An epidemiological investigation of health–related behaviours among male high School adolescents in Riyadh, Saudi Arabia

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Adolescents are valuable, creative, energetic, and challenging

All children and adolescents should know and feel that they are worthwhile, that there are governments, communities and people who care about them, and that there are resources available to meet their needs.

I hope that this thesis has made adolescents' behaviours and needs in Saudi Arabia more understandable and that this understanding will help family, community, professionals and policy makers in their work.

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Abstract

Objective: Little is known about health-related behaviours and their co-occurrence among male adolescents in Saudi Arabia. The main purpose of this study was to determine the prevalence of health related behaviours, and to investigate the associations between socio-demographic variables and health related behaviours and the clustering of health risk behaviours.

Research Methods: A cross-sectional study using a self-completion anonymous questionnaire was undertaken between February and April, 2008. A stratified random sample of 1501 male adolescents was recruited from one private and public high school in each of the five districts in the city of Riyadh, Saudi Arabia.

Main Outcome Measures: Prevalence and associations between health, social and demographic factors and health-related behaviours, including dietary behaviours, oral health, physical activity, smoking, violence, injuries and safety, and mental health factors.

Results: The results of this study showed that only 24.2% and 39.9% of the students consumed fruit and vegetables on a daily basis (at least once every day), and only 7% and 13.7% ate fruit and vegetables 3 times or more every day. Also, only 52.4% consumed dairy products at least once every day and only 18.3% of the students consumed dairy products 3 times or more every day. 48.1% reported to not consume any fish products on any day of the week. About 48.7%, 60.2% and 25.2% of the students consumed sweets, soft drinks, and energy drinks at least once every day. The results of this study also showed that only 36.7% of students eat breakfast regularly ($\geq$ 5 days per week). Eating breakfast regularly was positively associated with lower age, liking school, good academic performance, not eating high fat food every day, drinking soft drinks $\leq$ 1 time/day, drinking milk every day, low BMI, brushing teeth every day, physical activity $\geq$ 3 days/week, and not engaging in physical fights.

Around half (51.3%) participants reported good teeth health status, 22.6% brushed their teeth two times daily, 29.7% brushed their teeth once daily, whereas 47.7% of the subjects do not brush their teeth daily and 54.3% never visited the dentist during the past year. About 29.5% of participants suffered teeth pain sometimes or most of the time and 16.4% missed some school days for this reason. Brushing teeth every day was positively associated with higher standards of parental education, attending private school, living district, good academic performance, liking school, visiting dentist during the last year, good teeth status, and not suffering from teeth pain.

Only 18.4% of the students were physically active and only 65.2% participated in physical activity classes in schools. Regular physical activity was positively associated with younger age, liking school, good health status, lower BMI, father's, mother's, siblings' and peers' physical activity, not smoking, not fighting, not wanting to use drugs or alcohol, and not feeling lonely. Over a third (36.3%) of the participants were overweight or obese. A fifth (20.8%) of the adolescents were current smokers.

20.8% of the students were current smokers. Smoking among students was positively associated with higher age, studying in private school, poor health status, poor school performance, not liking school, father smoking, mother smoking, sibling smoking, peers smoking, low physical activity, wanting to use drugs and alcohol, carrying weapons, fighting, performing car drifting, and being abused by teachers.

Over half the sample (55.5%) reported an injury, 21.8% had been threatened or injured by weapons. Just under half (49%) of the adolescents reported they were involved in a physical fight. Moreover, fighting among students was positively associated with the interaction of low parental education, not liking school, poor academic performance, skipping breakfast, low physical activity, current smoking, being threatened or injured by weapons, carrying weapons, joining people performing car drifting, bullying others, being abused by teachers. Carrying weapons during the last 30 days was reported by 36.6% of the sample. Carrying weapons was positively associated with higher age, not liking school, poor academic performance, current smoking, fighting, being threatened or injured by weapons, performing car drifting, joining people performing car drifting, taking part in bullying others, and being abused by family. Some (26.1%) of participants reported having been bullied and 24.6% of the students reported bullying others. Many of the adolescents reported being abused by a family member (34.4%) or one of their school teachers (39.5%) during the past 12 months preceding the survey. During this time period, many of the students reported feeling lonely (22.8%), feeling very worried about something that they could not sleep at night sometimes or more (27.0%), and feeling very sad or hopeless almost every day for two weeks or more (40%). About 14% of the participants in this study reported that they had wanted to use alcohol or drugs. A small but notable proportion (13.9%) of the participants reported that they had thought of attempting suicide and 6.9% had actually attempted suicide. Over a third (36.1%) of adolescents had performed car drifting 12 months preceding the survey. However, car drifting was positively associated with higher age, attending a private school, not liking school, poor academic performance, not brushing teeth every day, current smoking, wanting to use drugs and alcohol, carrying weapons, joining people who performing car drifting, bullying others, and attempting suicide. The majority (78.7%) of participants drove vehicles and 96% and 97.7% reported that they did not use a seat belt when doing so and did not use a seat belt when riding in a car as a passenger, respectively. Only 2.1% and 1.4% of participants wore a helmet when used motorized vehicle or non-motorized.

Conclusions and implications: The results of this study reveal that the adolescents engage in multiple health-risk behaviours, and these risk behaviours are relatively common among adolescents and cluster together. Health related behaviours are associated with several socio-demographic variables (age, father's and mother's education, school factors, health status and living districts), although not necessarily in the same order. However, the data emphasized the need for further quantitative and in-depth qualitative research throughout Saudi Arabia, including other cities, rural communities, female adolescents, and other Middle Eastern countries. Cross-sectional research to gather evidence on youth health to collect population-based data on a range of health-related behaviours along with physical and social environments amongst school-age students and out-of-school youth facilities are important and highly needed to investigate health-related behaviours and associated risk factors and to measure change over time.

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1. Chapter One: Introduction

1.1 Background

People's health status and behaviours are linked inextricably. The concept of health behaviours and risk behaviours has emerged as a major issue in the population health, health promotion and epidemiology literature. Behaviours, knowledge, beliefs and attitudes may have a significant influence on physical, psychological and mental health status and well-being. Behaviour and lifestyle are crucial determinants of health, illness, disability, and premature mortality (Currie et al., 1998).

Generally, 'health behaviour' and 'health risk behaviour' are terms that are often used interchangeably. Health behaviour is a general term that describes actions people take which have positive influence upon their health and other aspects of lifestyle such as employment and living conditions such as healthy diet, exercise, oral hygiene behaviours, avoidance or sensible drinking, safe sexual behaviours. Conversely, the concept of health risk behaviour has been used to describe behaviours with potentially negative effects on health which contribute to the leading causes of morbidity and mortality such as substance use, early onset of sexual activity or unsafe sexual practices, risky driving, violent or suicidal behaviours, antisocial behaviours, disordered eating, sedentary life, and smoking among others (Shaw et al., 2010, Suris et al., 2008; Currie et al, 2000, 2004, 2008; Wang et al., 2009).

The World Health Report 2002, which was published under the title: *Reducing risks, Promoting life*, has acknowledged the crucial importance of health behaviours, and risk factors as causes of much of the world's burden of disease (WHO, 2002a). Indeed, the report states that the ten leading preventable risks to global health have behavioural underpinnings, such as unsafe sex, smoking, abusive alcohol consumption, physical inactivity, high blood pressure, hypercholesterolemia and other diet related problems. Until recently, all of these factors and the diseases linked to them had been thought to be common in industrialized countries. However, WHO demonstrates they are now becoming common in developing countries (WHO, 2002a),

where they create a double burden in addition to infectious diseases and poor – unhealthy- lifestyle.

Unfortunately, people from all age groups, especially adolescents adopt and practise some risk behaviours, even if they know they are unhealthy or harmful. Adolescence is a period of rapid physical and mental development when they are confronted with opportunities for risks (Fritch, 2004). Adolescents' behaviours and lifestyles may directly or indirectly impinge on their health both in the long term and the short term (Kumar et al., 2004). ''Many adolescents are exposed to health risks because of poverty, exploitation, gender discrimination, war, violence, change in social and economic situations as well as risky behaviour'' (Fritch, 2004). Moreover, some risk behaviours may primarily influence the individuals who practice them, such as drug user, injury related behaviours, whereas some behaviours affect others beyond the individual, for instance smoking tobacco has a direct and long term impact on people who smoke and an indirect impact on other people who inhale smoke passively, while others have a direct influence on individuals and their partners (e.g. unsafe sexual behaviour).

1.2 Adolescence

Adolescence is defined as the period from the onset of puberty to the termination of physical growth and attainment of final adult height and characteristics (Dorland's illustrated medical dictionary, 1974). It is "characterized by many rapid, interrelated changes of body, mind and social relationships" (WHO, 1997). It is the period of transition between childhood and adulthood, and it is marked by physical, emotional, and sexual maturation. It has been reported that "Adolescence itself is a period of profound cognitive, physical, social and moral development, none of which adheres to a perfectly predictable course" (SAM, 1999). The development of many aspects of adolescent life (e.g. familial, interpersonal and institutional relationships) at this critical stage of life may have lasting influences throughout the life-course (Wheaton and Clarke, 2003). Adolescents comprise a significant part of today's population, and are greater in number than any time (UNFPA, 2005). It has been stated that one fifth of the world's population – a total of 1.2 billion people – are adolescents, and 85% of them are in the developing world (WHO, 2007). Nearly half of the world's population (almost 3 billion people) is under the age of 25. Asia alone is home to 70 per cent of

the developing world's young people (UNFPA, 2005). In all countries, adolescents represent the future. Therefore, adolescence is an important time to implant healthy choices and effective interventions to prevent disease and enhance the potential for life-long behaviour that will contribute to the health. However, it has been reported that the huge rates of change and development in this life stage create additional complexity for those who deliver health care (Keeney et al., 2004).

The massive and numerous developmental changes in physical, emotional and psychological characteristics that start during puberty create new feelings and may naturally lead to different behaviours among adolescents. It is a critical period of discovery and development of behaviours that are important to health (Schulenberg et al., 1997). Adolescence is a key stage of social and biological development during which individuals develop their personal identities, partly through exploring and experiencing new roles, circumstances and events (Coleman and Hendry, 1990). Many adolescents experiment and engage in health damaging behaviours (Must et al, 1992). Health related behaviours and beliefs established during this period of development are firmly linked to patterns of behaviour in adulthood (Wadsworth, 1992).

In general, it has been reported that the main causes of adolescent morbidity and mortality are primarily due to preventable health risk behaviours (Rew et al., 2004; Grunbaum et al., 2004, Muscari, 1999, WHO, 2000; Brown, 2001, Ahmed and Andersson, 2002). Five leading causes of death (unintentional injuries, HIV/AIDS, other communicable diseases, violence, and suicide) have been reported in people aged 15–29 years (Blum and Nelson-Nmari, 2004). Moreover, in their systematic analysis study Patton and his colleagues analysed worldwide rates and patterns of mortality in people aged 10–24 years (Patton et al., 2009). The study described international rates and patterns of mortality between early adolescence and young adulthood. They found that traffic accidents were the largest cause and accounted for 14% of male and 5% of female deaths. Other prominent causes included violence (12% of male deaths) and suicide (6% of all deaths). Traffic accidents, violence, and suicide accounted for more than half of all-cause mortality in both sexes. Moreover, it has been found that in high-income countries including Saudi Arabia which is considered one of these high-income countries, traffic accidents caused 32% of deaths in males aged 10–24 years. Violence and suicide accounted for 10% and 15% of male mortality, respectively. On the other hand, in females, traffic accidents (27%) (Note

that Saudi Arabia did not contribute to this number since females are not permitted to drive) and suicide (12%) were the main causes of death. Therefore, improving the physical and mental health of young people in the present and future is important and has become a focus for health care providers, health policy makers and researchers of various disciplines in developed countries. Emphasizing health care services and health provision during adolescence and research targeting adolescents' health have become important for several reasons. Firstly, the period of adolescence is a transitional time when the developments of social and intellectual skills are of utmost importance for adult life. These transitions in biological, cognitive, and psychological domains provide many opportunities for adolescents to engage in risky health behaviours or to begin to develop a healthy lifestyle. Secondly, the factors which influence adolescents' morbidity and mortality are primarily preventable. Thirdly, preventing health risk behaviours among adolescents help to prevent disease, enhance health and improve life quality. Since risk factors may translate into disease, disability and death, therefore prevents diseases save health, lives, and money. In other words, promoting healthy behaviours and preventing risky behaviours can be a cost effectiveness strategy. For example, tobacco causes or contributes to lung cancer, ischemic heart disease and other diseases; as a result, smoking prevention would be cost effective and improve health.

1.3 Rationale for the study

Over the past decade there has been growing acceptance that young people between 10 and 24 years of age are a distinct population group with needs that differ from those of infants or adults (Coleman, 2001; WHO, 2002b), and youths may be especially vulnerable to risk since shifts in health take place around puberty as new health risks become prominent which have potential life-threatening risk (Resnick et al., 1997; Kelinert, 2007; Patton et al., 2007). Many behaviours that comprise young people's lifestyles may directly or indirectly infringe on their health in the short or long term; consequently, a wide range of behavioural variables should be measured (Currie et al, 2000). In line with that, taking a social as opposed to a purely biomedical research perspective means studying the social environmental and psychological influences or determinants of child and adolescent health and health behaviour (Currie et al, 2000). Therefore, individual psychological attributes, and family, school and

peer settings and relationships are important avenues to be explored. However, health behaviours may be seen as a pathway through which ecological, psychological and social factors interact and influence health (Currie et al., 2001).

The study covers a range of health indicators and outcomes (BMI, poor dental health status, self-rated health status, poor school performance, school satisfaction and mental health symptoms) and health-related behaviours (dietary behaviours, oral health hygiene behaviours, physical activity, smoking behaviours, injuries, violence, bullying and safety behaviours) as well as the life circumstances of adolescents (family behaviours, peers behaviours and socio-demographic variables).

The lifestyle choices that a person makes can have a direct and indirect impact on physical and mental well-being. Moreover, these choices and behaviours can be influenced by many factors such as sex, age, social class, income, family style, education, peer group pressure and living condition. Personal and socio-demographic backgrounds are associated with behaviours. For example, it has been found that risk behaviours increase with age (Currie et al., 2004, 2008; Shaw et al., 2010) and boys seem to have a higher number of concurrent risk behaviours (Chou et al., 2006; Brener and Collines, 1998; Currie et al., 2008; Shaw et al., 2010). Also, type of academic track can play a role with being more likely to engage in risk behaviours (Kohn et al., 2005; Rodondi et al., 2000). School performance has been identified as a statistically significant source of stress for adolescents. Poor school performance was related to interpersonal violence, suicidal tendencies, and the use of cigarettes and alcohol (Resnick et al. 1997). High and low socioeconomic status (SES) has also been linked to risk behaviours, although with differing conclusions (Currie et al., 2008; Santelli et al., 2000; Currie et al., 2004; Fothergil and Ensminger, 2006; Hanseon and chen, 2007; Hallfors et al., 2004; Bush et al., 2007). Moreover, peer, parental and family members risk-behaviours have been shown to strongly influence and be positively associated with risk behaviours among adolescents (Yen et al. 1998, DiIorio et al. 1999, Bearman and Moody 2004).

Adolescence is an important phase in the life cycle where critical development in different aspects occurs. It is a period that is characterized by the increasing importance of social contexts such as community, schools and peers beyond the home. Unlike children, adolescents are given more freedom of choices in their life and more likely to make their own decisions (Hoffman et al., 1994). Therefore, risk behaviours

can be considered a normal aspect of adolescent development (Steinberg and Morris, 2001). There is evidence that health risk behaviours tend to cluster together (Lindberg et al., 2000; Brener and Collins, 1998; Tubman et al., 1996; DuRant et al., 1999; Viner et al., 2006; Rhee et al., 2007). The development of chronic diseases is largely the result of behavioural factors, unlike many acute illnesses, and behaviour is the primary contributor to chronic disease for most people (GIH, 2004). Many of the most common causes of morbidity and mortality are influenced by health behaviours (Kann et al., 2000). It has been found that many risk behaviours, such as smoking, drinking alcohol and violence, appear to track from adolescence into adulthood (Grunbaum et al., 2004, Maggs et al., 1997, Kelder et al., 1994, Cox, 2001). Thus, the prevention of risk behaviours among children and adolescents is a high priority in public health. It is important to find early indications of health-risk behaviours, as established risky behaviour in young ages can be difficult to change later in life. Thus, childhood and adolescence might be the ideal time to motivate and promote healthy behaviours and healthy choices. Smoking, diet, exercise and sedentary life, oral health hygiene behaviours, injuries related behaviours, violence and safety may have much in common. They are lifestyle behaviours and associated with health. This begs the question, what is the prevalence of these behaviours and the nature of associations between each other among adolescents?

This research was inspired by the Health Behaviour in School-aged Children (HBSC), Global school-based student health survey (GSHS) project, which is a cross-national research study conducted in collaboration with the WHO Regional Office for Europe and the Youth Risk Behaviour Surveillance (YRBS) in the United States. HBSC and YRBS monitor priority health risk behaviours among adolescents including smoking and tobacco use, physical activity, dietary behaviours, oral hygiene behaviours, drug and alcohol, sexual behaviours, injuries and violence related behaviours. In my study, all these behaviours were investigated in this research except sexual, drugs and alcohol behaviours because of cultural and political issue (the researcher was asked by the Ministry of Education in Saudi Arabia to remove the questions regarding those behaviours and to focus on male behaviour rather than female behaviour for cultural issues too in order to have the ethical permission for the main study).

Despite the important connection between behaviour and overall health, many countries, especially developing countries, still lack basic prevalence estimates of youth risk behaviours. This may be due to either a lack of resources, a lack of research capacity, or both (Phongsavan et al., 2005). In Saudi Arabia, effective youth health promotion interventions might be hampered by the absence of up-to-date data on the incidence and prevalence of health problems.

To my knowledge, no comprehensive study of adolescent health-related behaviour in Saudi Arabia has been published to date. Moreover, research on health-related behaviours among adolescents is limited in Saudi Arabia.

My decision to explore these behaviours originated in their health promoting and disease preventative role. Moreover, due to the lack of research on health related behaviours and missing information in Saudi Arabia this study was conducted to fill the gap.

1.4 Importance of the Study

This study will contribute to the field of public health, epidemiology and health promotion, in particular by identifying important health related behaviours, protective and variable factors that influence adolescent's behaviours in Saudi Arabia. This is important in order to: (1) determine the reality of these behaviours among male adolescents; (2) determine the associated factors which may influence adolescents' behaviours; (3) help identify adolescents who are at greatest risk from risky behaviours, (4) provide information to help to design effective prevention programs. In addition, this study will be an important contribution to gaps in the literature in several areas, such as dietary and nutrition, oral health, smoking, physical activity, as well as violence, injuries, bullying, abuse, mental health, and safety behaviours in Saudi Arabia.

1.5 The Aims of the Study

This project focuses on the health-related behaviours found among high school students in Saudi Arabia and factors which are related to them. The main aims of this research are as follows:

1. To improve understanding by providing detailed information on adolescents' health related behaviours in Saudi Arabia for young people, educators, health professionals and policy makers
2. To provide a baseline against which change can be measured over time
3. To improve understanding of adolescents needs
4. To provide data to inform for the development of future health promotion interventions.

1.6 Research questions

The core questions in the survey are as follows:

1. What is the prevalence of smoking, physical activity behaviours, dietary behaviours, oral hygiene behaviours, violence, injuries, mental health factors and safety behaviours among male high school students in Riyadh?
2. What is the level of the students' knowledge and attitudes with regard to tobacco use, physical activity, dietary behaviours, and safety?
3. Is there any association between students' background characteristics such as age, students' level of education, father's and mother's level of education, type of school (private and public), and living district with regard to health-related behaviours?
4. What are the associations and the interactions between these behaviours?

1.7 Parameters of this thesis

Human behaviours are a very complex issue, and because of that this researcher recognises that many variables contribute to an adolescent's decisions regarding risk taking behaviours. It is therefore not possible to cover all health related behaviours and not possible to cover all associated variables in detail for the purpose of this thesis.

This thesis will specifically seek to examine the health related behaviours among male high school adolescents in Riyadh.

1.8 Organisation of this thesis

Chapter 2 presents general information of adolescent's health and behaviours. It also presents a literature review of adolescent's health issues, behaviours in general and previous studies on health related behaviours in Saudi Arabia. Chapter 3 presents

the pilot study procedures and outcomes. Chapter 4 presents the research protocol and methods for the main study. Chapter 5 presents the descriptive results and tests of the associations between behaviours and socio-demographic variables and between the behaviours with themselves. Chapter 6 presents multi-variable logistic regression analyses to explore independent associations between behaviours and other factors. Chapter 7 presents a detailed discussion of the study findings. Chapter 8 presents the study conclusions and recommendations for researchers, policy makers, families and communities. The appendices are attached at the end of the thesis.

2. Chapter Two: Literature review

2.1 Overview

Adolescents' health and their health service needs are important in order to build a safe and promising future for any country. As it has been mentioned, adolescence is a period of profound dynamic development during which many changes (biological, physiological, emotional, and psychosocial) occur. Adolescents are quite often engaged in high-risk behaviour at increasingly earlier ages, and most youths engage in some type of personal behaviour that threatens their health and well-being (Eman et al., 1998).

Despite the fact that adolescents engage in multiple risk behaviours that put their health in danger, health related behaviours have not attracted the attention they deserve in Saudi Arabia since there is no comprehensive research offered on the large or even small scale, nor probably in surrounding developing countries. Research, demographic and country-specific health data which provide evidence to support the need to improve adolescent health care with regard to policies, programmes and services, in Saudi Arabia have been always absent. Moreover, health related behaviour studies among adolescents in Saudi Arabia are scarce and several issues and many topics may have not been investigated, for example suicide, sexual behaviours, drugs and alcohol use among adolescents. This thesis contributes to investigate and understand several health-related behaviours of male adolescents in Riyadh, Saudi Arabia.

The study covers a range of health indicators and outcomes (BMI, poor dental health status, self-rated health status, poor school performance, school satisfaction and mental health symptoms) and health-related behaviours (dietary behaviours, oral health hygiene behaviours, physical activity, smoking behaviours, injuries, violence, bullying and safety behaviours) as well as the life circumstances of adolescents (family behaviours, peers behaviours and socio-demographic variables).

The literature review is presented under main headings as follows:

- Background on health
- Adolescent growth and development

- Adolescent health related behaviours
- Smoking among adolescents
- Physical activity among adolescents
- Dietary patterns and nutritional behaviours
- Violence, injuries, safety and mental health related issues;
- Important factors associated with health related behaviours, which have influence over adolescents' behaviours.

2.2 Definition of Health and related concepts

Health has many components although it is commonly referred to in the context of disease and illness. Yet, health is, in fact, much more than this. The most commonly quoted definition of health is that presented in the Constitution of the World Health Organisation (WHO) (1946):

''Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity''.

This definition goes beyond the common preoccupation with disease, and emphasises the positive (well-being) as well as the negative (ill-health) dimensions of health. Moreover, three inextricably interlinked facets of health - physical, mental and social - are identified. However, this WHO definition of health is not entirely satisfactory in practice. It defines health as an absolute state - one to be attained 'completely' - and leaves no room for a variety or range of healthy states.

Many factors can affect the health of individuals and communities. Factors such as living place, the state of the environment, genetics, income and education level, and public policy all have considerable impacts on health. Also, schools are a very important environment and perfect place to equip adolescents with knowledge and implant a healthy behaviour. According to WHO, the general determinants of health include:

- the social and economic environment,
- the physical environment, and
- the person's individual characteristics and behaviours

The Public Health Agency of Canada cites on their web site that they have learned a lot in the past several decades about what determines health. At every stage of life, health is determined by complex interactions between social and economic factors, the physical environment, and individual behaviour. These factors are referred to as "determinants of health". They do not exist in isolation from each other. It is the combined influence of the determinants of health that determines health status. Health Canada has identified twelve key determinants of health, as follows (Public Health Agency of Canada, 2001: http://www.phac-aspc.gc.ca/ph-sp/determinants/index-eng.php):

- Income and Social Status
- Social Support Networks
- Education and Literacy
- Employment/Working Conditions
- Social Environments
- Physical Environments
- Personal Health Practices and Coping Skills
- Healthy Child Development
- Biology and Genetic Endowment
- Health Services
- Gender
- Culture

WHO highlights the importance of parents in preventing adolescent health risk behaviours, the ways in which parents influence these behaviours, and their implications for programmes aiming to improve adolescent health. Parents' roles can be organized into five dimensions, each of which has specific influences on adolescent health outcomes (WHO, 2007):

- connection – *love*
- behaviour control – *limit*
- respect for individuality – *respect*
- modelling of appropriate behaviour – *model*
- Provision and protection – *provide*.

In general, there are many factors that can influence and determine health, whether at an individual or population level. In fact, the achievement of physical and mental well-being may be not the responsibility of the individual alone. Health is somehow everyone's business. People's ability to pursue good health is limited by many factors such as varying degrees of life skills, facilities, services, information, knowledge, culture and economic means. As it can be seen in real life these determinants are interrelated and this interrelatedness of factors may often impact the ability to arrive at a clear causation for many health conditions and behaviours. However, also, the way these determinants of health interact and the linkages between them can be of major importance for health promotion and public health in general.

The World Health Organisation held its first International Conference on Health Promotion in Ottawa, Canada in 1986 and produced the Ottawa Charter for Health Promotion (WHO, 1996a). The charter built on the Declaration of Alma Ata. The Declaration of Alma Ata in 1978 was an important milestone in the promotion of world health which provided the blueprint for Primary Health Care and the Health for All by the year 2000 and calls for action on five fronts; namely,

- Building healthy public policy
- Re-orienting the health services
- Creating supportive environments
- Strengthening community action
- Developing personal skills

2.3 Why Adolescents?

Adolescents comprise a significant part of today's population; one in five persons in the world is an adolescent aged 10–19 years, with 85% of adolescents living in developing countries and in some developing countries, adolescents constitute over half of the population (WHO, 2007). The international community has made a commitment to foster an enabling environment that best secures the enjoyment of the highest attainable standard of health by all (WHO, 2002). But, unfortunately, ''Adolescence is frequently portrayed as a negative stage of life - a period of storm and stress to be survived or endured'' (Arnett, 1999). However, this view diminishes

the importance of adolescence which can be a time of great energy, creativity, health, education and experience.

Throughout the world, adolescence is considered to be a time of relatively good health; therefore they may not be viewed as a priority. It was stated that “Too often in the past, public policy has either ignored adolescents or focused on them only when they behave in ways that trouble their elders” (PAHO, 1998). In recent years, especially in developed countries, increasing attention has been paid to the health situation and health-related behaviours of adolescents.

Much previous research has shown that the greatest health threats for adolescents are behavioural. Therefore, as a result of adolescents’ development, the changes in how adolescents think, reason, and understand can lead to wrong choices and risk behaviours. Just as other people such as parents, adults or elderly sometimes make poor decisions, so do adolescents. This can especially be a problem when some influences such as peer pressure, family problem or low economic status lead to poor decisions which lead adolescents to engage in risky behaviours, such as use of drugs or alcohol, violence, suicide or unsafe sex. However, children and adolescents issues have been neglected or not well addressed in Saudi Arabia. Many kinds of expertise are needed to fully address health, education and human rights issues of children and adolescents in Saudi Arabia.

2.4 Adolescent growth and development

Adolescence is “characterized by many rapid, interrelated changes of body, mind and social relationships” (WHO, 1997). It is a period when a person's biological, cognitive, psychological and social characteristics change from what is typically considered child like to what is considered adult like. It is being distinctly different from both groups. Adolescence is a period of rapid physical transitions. It is associated with puberty, which is a time when the reproductive capacity is established. However, the timing of these events can show variation from one individual to another.

Adolescents developing brains bring new cognitive skills that enhance their ability to reason and to think abstractly. They develop emotionally, establishing a new sense of who they are and who they want to become, no adolescent can truly be understood in separate parts; an adolescent is a “package deal” (American

Psychological Association, 2002). Cognitive development is occurring in this stage of life. Integrated, multi-level changes in thinking have been correlated to cognitive development during adolescence (Lerner and Galambos, 1998). Change in one area of development typically leads to, or occurs in conjunction with, changes in other areas.

Entering puberty heralds the physical changes of adolescence: a growth spurt and sexual maturation. Although it sometimes seems that adolescents' bodies change overnight, the process of sexual maturation actually occurs over a period of several years. For most adolescents, sexual maturation involves achieving fertility and the physical changes that support fertility; for boys the onset of puberty involves enlargement of the testes at around age 11 or 12 and first ejaculation, which typically occurs between the ages of 12 and 14 (American Psychological Association, 2002).

During adolescence, the young person's thinking moves from concrete to abstract, and language is increasingly used to manipulate ideas (Kail, 1991). There are many factors that affect the onset and progression of puberty, including genetic and biological influences, stressful life events, socioeconomic status, nutrition and diet, amount of body fat, and the presence of a chronic illness (American Psychological Association, 2002).

One of the basic challenges for policy makers, health practitioners and families is to understand the developmental processes of adolescence. "Adolescence itself is a period of profound cognitive, physical, social and moral development, none of which adheres to a perfectly predictable course" (SAM, 1999). The unpredictable rate of change for all aspects of development related to adolescence creates additional complexity for those who are responsible for and interested in adolescent health status and care.

Adolescents' need people who listen to them, understand and appreciate their perspective (Hamburg, 1997). There are a number of ways that adults can help adolescents to make better decisions. Professionals who work with adolescents need to know what is normative and what represents early or late physical development in order to help prepare the adolescent for the myriad changes that take place during this time of life (American Psychological Association, 2002). Furthermore, no adolescent can be fully understood outside the context of his or her family, neighbourhood,

school, workplace, or community or without considering such factors as gender, race, sexual orientation, disability or chronic illness, and religious beliefs.

Policy makers, parents and teachers should have a sound background in adolescent growth and development and the competencies necessary to assess health, given the wide range of physical, emotional and psychosocial skills that an adolescent might possess at a given age. Parental supervision is also important until the adolescent achieves self-reliance in order to adopt healthy and safe choices. Moreover, it is important to consider the necessary education that students must possess regarding the nature of adolescents, their stage of development, health issues and the barriers and challenges to health within their environments.

Additionally, adolescents should have a greater opportunity to express their thoughts and voices in explaining their choices in an atmosphere that encourages dialogue to understand their views, attitude and needs. Adolescents' developments (cognitively, physically, socially, emotionally) influence them to try engaging in new behaviours as they transition from childhood to adulthood, exploratory behaviours are natural in adolescence (Hamburg, 1997). Provision of appropriate and effective adolescent health care necessitates a wide range of policy, knowledge, skills and attitudes going beyond traditional approaches.

The social development of adolescents is best considered in the contexts in which it occurs; that is, relating to peers, family, school, work, and community. A strong sense of bonding, closeness, and attachment to family have been found to be associated with better emotional development, better school performance, and engagement in fewer high-risk activities, such as drug use (Resnick et al., 1997; Klein, 1997). During adolescence, parent and adolescent conflict may appear and increase. This conflict appears to be a necessary part of gaining independence from parents (Steinberg, 2001).

2.5 Adolescents in Saudi Arabia

Saudi Arabia occupies the majority of the Arabic Peninsula with the area of about 2,250,000 square kilometres (868,730 square miles). The capital city is Riyadh (population in 2006: 5.8 million) (SAMIRAD, 2010). It comprises 13 administrative provinces. The population of Saudi Arabia was estimated at 25,795 in July 2004, and

around five and a half million of the people living in Saudi Arabia are non-nationals (Saudi national statistic department, national census report, 2004). Saudi is a young nation; perhaps as much as half of the population is under twenty four years of age.

Saudi Arabia occupies most of the Arabian Peninsula, occupying almost 80 percent of the Arabian Peninsula (Saudi Arabia-Ministry of foreign affairs, 2010) with the Red Sea and the Gulf of Aqaba to the west and the Persian Gulf to the east. Neighbouring countries are Kuwait, Qatar, the United Arab Emirates, Oman, Yemen, Bahrain, Jordan and Iraq. Its oil region lies primarily in the eastern province along the Persian Gulf (See Figure 2.1) (CIA-The World Factbook, 2010).

Figure 2-1. Saudi Arabia Map

Saudi Arabia is not only one of the homelands for the Arabs, but also the birthplace of Islam, the world's second-largest religion. Islam was founded by Prophet Muhammad, and it is the location of the two holy Muslims pilgrimage cities of Mecca and Medina. Saudi Arabia is the most conservative country in the Middle East and most (if not all) people are Muslim (Saudi Arabia-Ministry of foreign affairs, 2010).

Religion plays a significant role in the life of Saudi people. The majority of Saudi laws and policies are based on Islam. To understand the history of the Kingdom and its political, economic and social development, it is necessary to realize that Islam, which permeates every aspect of a Muslim's life, also permeates every aspect of the Saudi Arabian state (SAMIRAD, 2010). Islam as a religion has rules that influence people behaviours, attitude and life in Saudi Arabia. For example, sexual intercourse out of marriage and drinking alcohol are strictly forbidden. Furthermore, if something like that happens and is discovered, there will be religiously based punishments, so people tend not to practice prohibited behaviours even if they want to. However, due to the stigma associated with some behaviour, when people practise some prohibited behaviours they tend to hide them to avoid being penalized, which might prevent them from seeking help. However, people in Saudi Arabia believe that Islam is the perfect guidance and therefore limit prohibited activities and encourage behaving according to the law.

The Arab name is a categorization based mainly on Arabic languages and a shared sense of geographic, historical and cultural identity. Arabs may be different and diverse according to religious belief type and level, nationality and culture. The huge majority of Arabs are Muslim; however, Christian and Jewish Arabs make up most of the none Muslim Arab population. Islam is strongly associated with Arab identity because of the origins of Islam in the Arabian land.

Saudi Arabia has an oil-based economy with strong government controls over major economic activities. It possesses about 20% of the world's proven petroleum reserves, ranks as the largest exporter of petroleum, and plays a leading role in OPEC. The petroleum sector accounts for roughly 80% of budget revenues, 45% of GDP, and 90% of export earnings (CIA-The World Factbook, 2010).

There is a paucity of research and field studies in many areas, particularly on risky behaviours in Gulf Cooperation Council (GCC) countries and other Arabic

countries. Health related behaviour studies constitute a fundamental step in the strategic planning of adolescent health programs as well as in identifying priority health problems. This is also a crucial step for any successful health promotion program and public health in general.

As a result of general development and global changes in many different aspects around the world such as in technology, media, social context, and beliefs which all may have influences on adolescents' attitudes, knowledge and behaviours, adolescents and youth face great challenges, especially in such a conservative country like Saudi Arabia. However, during the past 3-4 decades, rapid developments in standards of living in the Kingdom of Saudi Arabia and increased mechanization have touched all aspects of people's lives. As a consequence, great changes in diet and nutrition habits and physical activity have occurred in Saudi society and low levels of physical activity and sedentary living are becoming increasingly prevalent among the Saudi population (Al-hazzaa, 2002; Al-Rukban, 2003). Furthermore, it is assumed that changes have also happened to other risk behaviours (e.g. smoking, violence, injuries and accidents). Moreover, with massive urbanization and increased reliance on computers and technology, further reductions in physical activity and increase in obesity are projected for the coming years. Moreover, as a result of global changes and development in technology, media, social context, and beliefs which all may have influence on adolescents' behaviours, adolescents and youths face great challenges especially in a conservative country like Saudi Arabia. There are many conflicts between what the Saudi adolescents are told to do regarding their culture and religion and what they notice that other adolescents in different countries are enjoying doing. As a result of the stigma around some behaviour, for instance smoking and sexual activity out of marriage, Saudi adolescents may tend to conceal their risk behaviours, which prevent them from seeking help until the situation has become complicated or dangerous.

While the majority of adolescent morbidity and mortality is preventable, health providers, communities and policy-makers have not given adequate attention to opportunities for health promotion and prevention activities in Saudi Arabia.

Unfortunately, Saudi Arabia suffers from a lack of emphasis on important public health topics, especially with regard to adolescent health and risk behaviours. Moreover, it seems that children and adolescents are not viewed as a priority. As a

result, a wide range of adolescent health issues are being neglected and health promotion initiatives have been sorely inadequate, never attracting the attention they deserve in Saudi Arabia and may be in other Arabic countries in the region. Hence, the present study will investigate adolescents' health behaviours and factors associated with them. This study will add to existing knowledge, and not replicate what already exists.

2.6 Background on Adolescent Health and behaviours

Adolescence has long been studied; Litt (1999) mentioned that adolescence studies began in 1904 with the work of G. Stanley Hall (Litt, 1999). Adolescent health programs are only well established in the Western world. The Centre for Disease Control and Prevention in the United States (CDC) serves adolescents through a unique public institution. In 1998, CDC established the National Centre for Chronic Disease Prevention and Health Promotion (NCCDPHP), including the Division of Adolescent and School Health (DASH). DASH's mission is to prevent serious health risk behaviours among children and adolescents. The Youth Risk Behaviours Surveillance System (YRBSS) monitors priority health-risk behaviours and the prevalence of obesity and asthma among youth and young adults. The YRBSS includes a national school-based survey conducted by the Centres for Disease Control and Prevention (CDC). The Youth Risk Behaviour Surveillance System (YRBSS) monitors six categories of priority health-risk behaviours among youth and young adults including:

- smoking and tobacco use;
- alcohol and other drug use;
- sexual behaviours that contribute to unintended pregnancy and sexually transmitted diseases (STDs), including human immunodeficiency virus (HIV) infection;
- unhealthy dietary behaviours;
- physical inactivity; and
- behaviours that contribute to unintentional injuries and violence

The World Health Organization (WHO) also has a strong interest in the health of young people and adopts a comprehensive approach to promote adolescent health. Health problems of adolescent were first discussed during a WHO technical expert committee meeting in 1965. In Europe, Health Behaviour in School-aged Children (HBSC) is a cross-national research study conducted in collaboration with the WHO Regional Office for Europe. The study aims to increase understanding of young people's health and well-being, health behaviours and their social context. HBSC was initiated in 1982 by researchers from three countries and shortly afterwards the project was adopted by the World Health Organization as a WHO collaborative study. There are now over forty participating countries and regions. The survey is carried out on a nationally representative sample in each participating country. The sample consists of approximately 1500 from each age group (i.e. a total of 4500 adolescents from each participating country).

2.7 Searching literatures

In this study, a manual and an electronic literature review were conducted, and four well known search engines in this topic were used (MEDLINE 1966-2007, EMBASE 1988-2007, Web of Science 1970-2007 and CINHAL 1982-2007) to develop the background for this study. I did the initial searches to 2007 then I did ‘top up’ searches to ensure that I did not miss more recent materials. The majority of studies were found to be in MEDLINE and EMBASE data bases. The keywords which were used in searching the literatures were very few. I only start searching literatures by using few words (e.g., Saudi, behaviour, lifestyle, habit) in order to obtain as many relevant studies as possible, with the assumption that studies on health related behaviours in Saudi Arabia are scarce. So, any study on health related behaviours in Saudi were first included by titles; then abstracts were reviewed for either to be included or excluded in this research project and all studies had the same chance to be included if the participants of the study were students or adolescents and answer any question of my research questions such as student’s knowledge, attitudes and behaviours regarding smoking, physical activity, dietary patterns, oral hygiene, mental health related behaviours and symptoms, violent behaviours, injuries and safety behaviours among male adolescents in Riyadh, Saudi Arabia.

2.8 Health-related behaviour

As it has been explained earlier in this thesis (Chapter 1), “Health related behaviour” is used to express any behaviour that influences health in either a negative or a positive way. It includes health risk behaviours and healthy behaviours. Healthy behaviour is any behaviour that enhances health such as eating a healthy diet, physical activity and safe sex, etc. Health risk behaviour means any behaviour that increases the likelihood of harmful health outcomes such as smoking, violence alcohol drinking, etc. The behaviours of today’s adolescents, in any country, affect the country’s future and may also affect everyone's future in the next generation. Adolescent health attitudes and practices not only impact on the immediate health status but have long-term consequences.

2.9 Smoking Behaviour

2.9.1 History of Smoking

Tobacco has been used in various forms throughout the ages. Since the discovery of tobacco, the epidemic of smoking has continued to spread all over the world in modern times. Smoking is defined as the action of lighting a cigarette, a pipe, a cigar, a water pipe, or any other objects made from tobacco or materials of similar effects. The object is sucked on with lips to extract smoke and this smoke is inhaled into the chest and exhaled from the nose and mouth as a white smoke. However, cigarette appears to be the most common way of tobacco use.

Tobacco is the most widely distributed and commonly used drug in the world today and smoking among young people is widely spread in all parts of the world and is increasing in the developing countries (Peto et al., 1992). Globally, the use of tobacco is increasing, although the epidemic is shifting to the developing world (WHO, 2010). Tobacco use is growing in developing countries. Currently, 50% of men and 9% of women in developing countries smoke, as compared with 35% of men and 22% of women in industrialized/developed countries (WHO-EMRO, 2005). It has been reported that tobacco consumption increased by 24% in the Middle East from 1990 to 1997 (WHO-EMRO, 2005). In fact, the Middle East and Asia are the only two regions in the world where cigarette sales increased during that time period. Also, it has been reported that half of adult males in the Middle East are smokers (WHO-EMRO, 2005).

Although the effects of tobacco on the probability of developing serious pathologies have been well known since the 18th century (Grzybowski, 2005), the evidence of tobacco damage was ignored until the publication in 1950 of five case-control studies that linked smoking to the development of lung cancer (Doll, 1998). During the following two decades the association between smoking and other illnesses, such as cardiovascular and respiratory illness, was generally accepted (Vineis et al., 2004). It has been estimated that 100 million deaths were caused by tobacco in the 20th century (WHO, 2010), and if current trends continue, there will be up to one billion deaths in the 21st century. Moreover, unchecked, tobacco-related deaths will increase to more than eight million a year by 2030, and 80% of those deaths will occur in the developing world (WHO, 2010).

However, It has been noted that the increase in smoking prevalence in Saudi Arabia has been extremely rapid (Al-Lehiany and Stanley, 2009).The increase of smoking prevalence in Saudi Arabia might be due to many differing factors such as cheap price, ineffective policy, legislations and preventive programmes. Over the last few years the issue of a smoking ban has been widely discussed after officials expressed greater concern for public health. Following Saudi Arabia's signing of the FCTC (Framework Convention on Tobacco Control) in 2004, the Saudi government decided to impose a law banning smoking in public places (Euromonitor International, 2009). Although the law is in place, it is not fully enforced by the authorities. Thus, sales of tobacco in the country remained unharmed by the new law (Euromonitor International, 2009).

2.9.2 Cigarette smoking and economic burden

The tobacco industry appears to target young people by using advertising campaigns and sponsoring sporting events. Many estimates have been made of the economic cost of smoking in terms of health resources. Parrott and Godfrey (2004) in their clinical review pointed some numbers. In the United Kingdom, the treatment of smoking related disease has been estimated to cost the NHS £1.4bn-£1.5bn a year (about 0.16% of the gross domestic product)-including £127m to treat lung cancer alone. Also, an estimated £410m a year is spent treating childhood illness related to

passive smoking; in adults, passive smoking accounts for at least 1000 deaths in non-smokers, at an estimated cost of about £12.8m a year at 2002 prices.

For the United States the economic cost of smoking range from about 0.6% to 0.85% of gross domestic product. The US public health service estimates a total cost of $50bn (£29bn; €42bn) a year for the treatment of smoking related diseases, in addition to an annual $47bn in lost earnings and productivity. Moreover, estimated total costs in Australia and Canada, as a proportion of their gross domestic product, are 0.4% and 0.56% respectively (Parrott and Godfrey, 2004).

In the United Kingdom an estimated £410m a year is spent treating childhood illness related to passive smoking; in adults, passive smoking accounts for at least 1000 deaths in non-smokers, at an estimated cost of about £12.8m a year at 2002 prices. Yearly, cigarette production has reached four thousand billion, costing 100 billion US dollars. Tobacco imports into Saudi Arabia in the form of manufactured cigarettes have increased dramatically over the years. Dr. Bedidah, supervisor general of Saudi tobacco control announced that Saudi Arabia imported 41,000 tons costing 1.45 $ billion; besides around $1 billion has been spent on treatment for disease brought about by tobacco smoking in 2004 (The Saudi Gazette, 2005, Issue No. 10178).

2.9.3 The serious effects of smoking

Smoking is the single most important preventable cause of premature death in developed countries (McGinnis and Foege, 1993). Data suggest the etiological role of smoking in physical and neuropsychiatric disorders (Dirker et al., 2002). Additionally, it has been officially recognized that tobacco smoking is a substance use disorder that has epidemiological, etiological, phenomenological, pathophysiological, co-morbid, diagnostic, therapeutic, and prognostic and outcome domains (American Psychiatric Association, 1996). In the industrialized world, cigarette smoking is considered the largest preventable cause of death (Jacobson, 1983, Jacobsen, 2005). The considerable morbidity and mortality that occurs in the global population, as a direct result of cigarette smoking, is indisputable. It is one of a major public health problem that causes millions of premature deaths, responsible for a wide range of preventable health problems throughout the world and vast economic losses. US Surgeon General

(2002) estimated that more than 400,000 Americans die each year due to smoking, a greater number than the deaths attributed to AIDS, alcohol, cocaine, heroin, homicide, suicide, motor vehicle crashes, and fire combined.

In Saudi Arabia, Al Tamimi et al. (1996) stated that lung cancer and smoking-related diseases are the greatest cause of deaths among Saudi males suggesting that cigarette smoking is becoming an important public health problem among men in Saudi Arabia. The situation is likely to be worse, particularly where the economic situation is improving and knowledge about the harmful effects of tobacco among the general population and preventive policies are lacking. As adolescents are considered the most vulnerable and receive unclear messages about smoking (Crawford, 2001), effective efforts to fight smoking is crucial to defeat smoking among adolescents in particular. Unfortunately, tobacco control activities in Saudi Arabia are not effective. These include lack of health education for the community, lack of preventive programme in the media; lack of smoking cessation clinics, absence of laws to prohibit smoking in public places, and inactivated legislation prohibiting smoking on government premises. Moreover, there is no law to prevent selling cigarettes to teenagers or from smoking.

2.9.4 Adolescents smoking behaviour

The Global Youth Tobacco Survey (GYTS) showed that the percentage of young people using any tobacco product ranges from 10 to 33%, and often high among boys (Warrnen et al., 2000). Cigarette smoking among adolescents is one of the 10 leading health indicators that reflect the major health concerns in the United States (Rowe and Clark, 2000). Worldwide, people are engaged in smoking behaviour at an early age (Faeh et al., 2006). One of the special concerns regarding youth risk behaviours is the increase in rates for smoking among adolescents. First-time tobacco use is usually initiated before graduation from high school (US Department of Health and Human Services, 1994). Many of the most common causes of morbidity and mortality are influenced by health behaviours, such as tobacco use, physical activity, and diet (Kann et al., 2000). Because these behaviours appear to track from adolescence into adulthood (Kelder et al., 1994), promotion of good health behaviours in adolescence may have positive effects on future health behaviours and disease risks.

2.9.5 Smoking in Saudi Arabia

There is no official clear data on smoking prevalence in Saudi Arabia. Moreover, no single national survey has been done and investigating the prevalence of smoking among students at any age. Few studies have been performed on smoking behaviour among adolescents' students, (Table 2.1) below shows details.

Siddigui et al. (2001) determined the prevalence of smoking in central Saudi for males above 12 years old, finding 34.4% were current smokers, 16.4% were ex-smokers, and 49.2% were non-smokers. This work had several limitations for instance, the sample size was small. In addition, the development and the validity of the questionnaire and sampling procedure were not explained and the statistical analysis was descriptive only. Also, the study took place in primary health centres and might have potential bias of not including general population (Siddigui et al. 2001). Saeed et al (1996) estimated smoking among Saudi males and females over 15 years old in Riyadh. They reported that 25.3% of the samples were current smokers. The study took place in primary health centres and might have potential bias of not including general population. Also, in this study, the researchers did not present the difference in smoking behaviours between different age groups or the association between smoking behaviours and other variables (Saeed et al., 1996). Jarallah et al (1999) conducted a study between 1990 and 1993 to identify smoking behaviours in three regions in Saudi Arabia. They reported that about 21.1% of the males age 15 years old and above were current smokers, whereas it has been found to be only 6.7 % among the group of male and female aged between 15-20 years old. Moreover, in this study the result did not show the difference in prevalence between male and female aged between 15-20 years old (Jarallah et al., 1999). Al-Yousaf and Karim (2001) carried out a study to ascertain the prevalence of smoking among school students in Alkharj, Saudi Arabia. It found that out of 819 students, 166 (20%) were current smokers, one hundred and thirty four (16%) were ex-smokers and 519 (64%) were non-smokers. In the smokers' group, (25%) were in the age group of 12 and below (average age 10.5 years), (49%) were in the age group of 13-15 years (average age 14 years) and (26%) were in the age group of 16 years and above (average age 16.6 years). The average starting age for current smokers was 13.8 years. The study was purely descriptive and the questionnaire development, validity and reliability of the questionnaire were not explained (Al-

Yousaf and Karim, 2001). In addition, a cross-sectional study among small sample of adolescents in western city of Saudi Arabia. The study found that 21.3% of the males and 4.9% of the females were smokers, respectively (Abou-Zeid et al., 2009). Their study recruited a small sample size (N=284), from a small number of schools, applied superficial analyses and the reliability and validity of the study were not explained. Abolfotouh et al. (1997) assessed the pattern of smoking behaviour among adolescents in one south city of Saudi Arabia. They found that the prevalence rate of regular smoking was 14.5% (Abolfotouh et al. 1997). The finding was from a small sample size (N=289), public school, lack of sampling, questions and variables details. Table 2.1 below shows the summary of the papers that were reviewed. Also, it shows more study and details.

Table 2-1. Smoking behaviours in Saudi Arabia

Study	Setting/date	Aims	Method/tools	Outcomes
Saeed et al., 1996	Primary health care centres in Riyadh, Saudi Arabia between January –April,1994	To measure the smoking behaviour and attitude	Cross-sectional Interview survey N=1534 male Age 15 years and above	25.3% were current smokers, 10.2% were ex-smokers, and 64.5% had never smoked. Among all smokers 79% started smoking between the ages of 15 and 30 years old, whereas 19.5% before 15 years old.
Siddiqui et al.,2001	Primary care clinics in Al-kharj city, Saudi Arabia between 1-30 November, 1999	To determine the prevalence of and major factors influencing smoking	Cross-sectional survey Questionnaire N= 634 male and female Age 12 years and above	Of 634 subjects, 34.4% were current smokers, 16.4% (104) were ex-smokers, and 49.2% (312) were non-smokers. The most common (66%) reason for starting smoking was friends' influence.
Jarallah et al .,1999	Saudi Arabia, between 1990 and 1993.	To determine the prevalence of smoking	Cross-sectional Interview and a predesigned Questionnaire were used N=8310 male and female Age 15 years and above	21.1% were male smokers and 6.7% of male and female aged 15-20 was current smokers. Most smokers (59%) smoked 20 or more cigarettes per day Current smoking was significantly associated with level of education, and smoking was higher among those who had lower and technical education.

Al-Damegh et al.,2004	Male High school in Al-Qassim, Kingdom of Saudi Arabia March 2003.	To study the smoking habits	Cross-sectional Survey Questionnaire N=2203 male Age 15-25 years	29.8% were current smokers and among these 83.7% started smoking at the age of 15 years or less. The most common reason given for smoking was the influence of friends (63.5%).
Al-Yousaf and Karim, 2001	High school students in Alkharj City, Saudi Arabia Date of conducting the study is not known.	To ascertain the prevalence and the influencing factors for smoking	Cross-sectional survey Questionnaire N=819 male students Age 15 years and above	20% were current smokers. The average starting age for current smokers was 13.8 years. The influence of friends, (58%) and the presence of smoking in the family (32%) were the most factors, for smoking.
Jarallah et al .,1996	Male Intermediate school, Riyadh, Saudi Arabia Date of conducting the study is not known.	To determined the prevalence and determinants of smoking	Cross-sectional survey Questionnaire N=1382 male Age 12-19 years	Among 222 students of 12-13 years old (3.2%) were smokers, among 645 students who are between 14-15 years old (8.5%) were smokers, among 368 students between age 16-17 years old (20.4%) were smokers, and for students who their age range between 18-19 years old (31.1%). Smoking associated with family smoking history and knowledge.
Abolfotouh et al.,1997	High-school adolescents in Asir province of south-western Saudi Arabia between 1994-1995	To assess the pattern of smoking behaviour, attitudes towards smoking	Cross-sectional survey Questionnaire was used N=289 male Aged 14-19 years	The prevalence rate of regular smoking was 14.5%. Generally, more than 50% responded correctly to the different statements.
Al-Faris, 1995	Rural High school in Saudi Arabia during May and June 1993	To estimate the prevalence of smoking	Cross-sectional survey Questionnaire was used N=358 male Aged 16-20 years	17% were regular smoking. The most common reason for smoking were desire (32%), idleness (28%). The majority know about the hazard of smoking.
Almase et al.,2002	High school in Riyadh, Saudi Arabia Date of the study	To estimate the prevalence of smoking	Cross-sectional survey Questionnaire was used	15% were current smokers.

	is not known.		N=290 Age16-17years	
Saeed et al.,1993	Secondary health institute in Riyadh September-December 1990	To determine the smoking habits	Cross-sectional survey Questionnaire N=407 male and female Aged 15-20 years	13% of male students were current smokers and 6% of female students were smokers. The majority of smokers started their habit between16-20years old.

In conclusion, cigarette smoking is an important public health problem among men in Saudi Arabia (Al-Turki, 2006; Rowland et al., 1987; Al-Dawood and El-Zubair, 1995; Saeed, 1987; Saeed et al.,1996; Saeed et al., 1993; Siddiqui et al., 2001). The smoking behaviours studies in Saudi Arabia are relatively scarce, and not well designed. Almost, all of the studies which were reviewed on smoking behaviours were focusing on prevalence of smoking behaviour and weak in methodology and statistical analysis.

In my study I will investigate beyond the prevalence of smoking. It is original since it looks at smoking behaviour and its association with student's several socio-demographic variables and family and peer smoking behaviours, also the association between smoking behaviours with school factors and general health status, and with other health-related behaviours. Moreover, the statistical analysis approach will be more advanced than all previous studies in Saudi Arabia (Al-Faris, 1995; Saeed et al., 1993; Abolfotouh et al.,1997; Al-Damegh et al.,2004; Al-Yousaf and Karim, 2001), since I will use univariate analysis (descriptive analysis and Chi-square test), and logistic regression analyses using binary regression to investigating the association between current smoking status as an outcome and several predictors. Also the regression analyses is done in several stages following an analytical approach (Figure 4.2). Moreover, my study will investigate and include a number of important determinants of adolescents smoking such as parents, siblings and peers smoking behaviours. These variables were not collected in the international surveys such as HBSC and YRBS, and a consequence might be that my study findings are less biased by some residual confounding factors (For details please see Chapter 4).

2.10 Physical activity behaviours

2.10.1 The importance of physical activity

Physical activity in childhood is beneficial in terms of increasing social interaction and well-being. Also, it is important for healthy growth and development and maintaining energy balance (Department of Health UK, 2004). Physical inactivity is considered a contributing factor in all causes of mortality (Blair et al., 1995, Blair et al., 1999). Research has indicated that physical activity can decrease the risk for a number of chronic diseases such as coronary heart disease, hypertension, non-insulin dependent diabetes mellitus, osteoporosis, colon cancer and anxiety and depression (Pate et al., 1995). Inactivity is established as a risk factor for coronary heart disease, colon cancer, diabetes, high blood pressure and breast cancer (US Department of Health and Human Services, 1996). Short-term positive effects of activity in youth include improved blood pressure, body weight, lipid and lipoprotein levels, psychological health, and development of bones, muscles and joints (US Department of Health and Human Services, 1996).

Inactivity in youth clusters and is associated with other unhealthy behaviours (Raitakari et al., 1994, Pate et al., 1996), and several outcomes. The clustering of inactivity and other risk behaviours may likely exist among different groups and in different countries, although it may differ in the type of risk behaviours or outcomes. For example, in a representative sample of US adolescents, it has been reported that low activity was associated with cigarette smoking, marijuana use, lower fruit and vegetable consumption, greater television watching, failure to wear a seat belt, and low perception of academic performance (Pate et al., 1996). Also, study among Finnish adolescents indicates that in both sexes, smoking, irregular breakfast eating, attending vocational school, and poor self perceived current health were significantly associated with inactivity (Aarnio et al., 2002).

McGinnes and Foege (1993) estimated that of all deaths occurring in the United States each year, approximately 250,000 youths (12%) of total population could be attributed to lack of physical activity. Several previous studies have demonstrated that the risk of all causes of mortality is significantly lower in physically

active and/or fit adults relative to sedentary others (Blair et al., 2001). Physical activity is protective for coronary heart disease and there is a significant inverse relation between physical activity and coronary heart disease (Kohl, 2001). The benefits of physically activity in include weight control, lower blood pressure, improved psychological wellbeing and a predisposition to increased physical activity in adulthood (Williams et al., 2002). Evidence from meta-analysis of 23 cohort studies of physical activity and cardiovascular disease showed that combined coronary heart disease and cardiovascular disease risk decreased linearly with increasing percentiles of physical activity (Williams, 2001).

Ness and colleagues demonstrated a strong inverse association between moderate and vigorous physical activity and fat mass among adolescents' boys (Ness et al., 2007). Also, it has been reported that physical activity was independently inversely associated with fat mass, percentage fat mass and body mass index (BMI) in male adolescents (Ekelund et al., 2005). It has been shown that 12 weeks of both resistance and endurance training can produce significant decreases in fat mass and percentage body fat (Broeder et al., 1997). Physical activity can also modify body composition favourably by reducing fat mass (Miles, 2007). However, it has been reported that 30 minutes of moderate physical activity per day is equivalent to approximately 1500 kcal/week, which translates to a loss of 2.1% or 1.8% body fat for men and women respectively (Elder and Roberts, 2007).

Inactivity in youth clusters with other unhealthy behaviours such as smoking, unhealthy dietary behaviours, and more TV viewing (Raitakari et al., 1994, Pate et al., 1996). The economic cost of physical inactivity is huge. In UK, the estimated direct cost of physical inactivity to the National Health Service is £1.06 billion (Allender et al., 2007). The indirect costs of physical inactivity increases these estimates further. It has been reported that the estimates total (direct and indirect) cost of physical inactivity in England to be £8.2 billion a year (Department of Health UK, 2004).

The World Health Organization has a global strategy on physical activity (WHO, 2004), and in England the Department of Health has a 'Choosing Activity' physical activity action plan (Department of Health, 2005). However, in Saudi Arabia there is no action plan or national agenda aiming to promote physical activity or tackling sedentary life. In addition, there is a huge lack of physical activity research and there is no comprehensive information on this behaviour in Saudi Arabia.

In general, data from the UK, demonstrate that children below 16 years of age are clearly more active than adults: 70% of boys and 61% of girls achieve the recommended 60 minutes of physical activity almost every day (Department of Health, 2004). It has been reported that physical activity decline as children reach adolescence (Brodersen et al., 2006; Biddle et al., 2004; Riddoch et al., 2007). Brodersen et al. (2006) have examined the physical activity patterns of adolescents in terms of ethnic and socioeconomic differences. It has been found that Asian adolescents were less physically active than white adolescents and it has been found that sedentary behaviour was greater in the low socioeconomic-status groups (Brodersen et al., 2006).

Delahunty and colleagues investigated the psychological predictors of physical activity. They found that male gender, lower BMI, higher exercise self-efficacy, lower perceived stress, and lower depression and anxiety scores were found to correlate with higher baseline levels of physical activity (Delahunty et al., 2006).

Physical inactivity is a major public health problem and is linked to a huge burden of chronic disease. Hills and Byrne (2006) summarised the environmental factors contributing to low levels of physical activity as:

- a declining need for physical activity in the home, workplace and community;
- a lack of physical education in schools, reduced time for play, active transport uncommon;
- neighbourhood design that is not conducive to physical activity;
- transport systems dominated by cars;
- use of lifts and escalators and inaccessible stairs;
- TV, computer games, internet and other sedentary entertainment;
- household appliances and labour-saving devices.

Increasing physical activity levels among population will need a concerted effort, involving national strategies, local authorities, schools, health professionals, and families. Fox and Riddoch (2000) have summarised the recommendations for 5–18 year-olds as follows:

- All children and adolescents should participate in physical activity daily of at least moderate intensity for
- 1 h each day;
- Children and adolescents who currently do little activity should participate in physical activity of at least moderate intensity for at least 0.5 h daily;
- At least twice weekly some of these activities should help to enhance and maintain muscular strength and flexibility and bone health.

Local community, authorities and town and community planners have an important role to play in helping people to be more active, both in terms of providing appropriate sport and leisure facilities. Tackling this issue may bring many benefits to the community, particularly saving lives and reducing healthcare costs throughout preventing risk factors. In addition, physical activity also provides opportunities for social interaction which can lead to a better quality of life. It has been reported that well designed environment has the potential to encourage physical activity, and can be closely related to health (Lake and Townshend, 2006). Encouraging participation in physical activity among children and adolescents should influence many chronic diseases among adulthood in the future (Trost et al., 1999). The benefits of physical activity are numerous and include not only health benefits but also psychological, mental and social benefits as well.

2.10.2 Physical activity among adolescents in Saudi

However, although there are studies that have focused on obesity in Saudi Arabia and other Arab countries, research on physical behaviours, sport and exercise among male, female, children, adolescents, and adults received no attention (Moussa et al., 1999). Al-Refaee and Al-Hazzaa (2001) identified physical activity prevalence among male adults in Riyadh. The findings of the study demonstrated a high prevalence of inactivity among Saudi males 19 years and older. Nearly 81% of the sample in this study did not exercise on a regular basis (53% were totally inactive and 27.5% were irregularly active). However, the study has several weaknesses. First, the study aimed to identify prevalence of physical activity only and knowledge, attitudes and factors associated with physical activity were not investigated. Moreover, the

study did not investigate school students. In addition, the study was based on self-completed questionnaires and the validity and reliability were not explained or confirmed (Al-Refaee and Al-Hazzaa, 2001). Furthermore, a study of Saudi children has demonstrated that considerable proportions were not active enough to maintain proper cardiovascular fitness, and that they exhibit one or more Coronary Artery Disease risk factors (Al-Hazzaa et al., 1994). Al-Rukban (2003) stated that in Riyadh, 48% of students aged 12-20 years old were totally inactive. In Al-Rukban's study, although, the study estimated physical activity among male students, the study was primarily focused on obesity and not physical activity behaviours. Also, the study was lacking many details regarding the validity and reliability of the study. Moreover, the sample size was relatively small (about 800 students), and restricted to those only from public school, and not representing different districts. Also, Al-Rukban study was lacking the inclusion of many factors such as family and peers physical activity.

Unfortunately, physical activities attract little attraction from authorities, researchers, communities and individuals in Saudi Arabia. Published studies on the physical activity patterns of the Saudi population are lacking, despite the fact that such data represents an important public health concern. To my knowledge no study has investigated the physical behaviours among adolescents in Riyadh, Saudi Arabia in details. Thus my study is original in Saudi Arabia. I will investigate the physical activity behaviours among a large sample using well designed protocol. This study will investigate students' physical activity behaviours in relation to students' background, students' family and peer physical activity behaviours. Also, it will investigate the association between physical activity and school performance, students' general health status and body mass index. In addition, it will investigate student's physical activity with other health-related behaviours.

In Saudi Arabia, unfortunately, there is no national agenda, comprehensive research or public policy regarding physical activity. Research is needed urgently into the factors that influence adolescents' activity behaviours. Therefore, there is an urgent need to establish physical behaviours research group to evaluate physical activity behaviours through a large-scale surveillance system, and to develop a national policy to tackle the low level of physical activity in Saudi Arabia, particularly among adolescents. I found it is wise and useful to use the information from western developed countries experience in improving public health among their population.

2.11 Dietary behaviours

2.11.1 Importance of healthy diet

Good nutrition is a major factor affecting an individual's health. Long-term benefits of healthy eating include reduced risk of coronary heart disease, some cancers, stroke, diabetes, high blood pressure, and osteoporosis (US Department of Health and Human Services, 2000), and short-term benefits among youth include optimization of growth, health, and intellectual development, and prevention of under-nutrition, iron deficiency anaemia, obesity, eating disorders, dental caries, and unsafe weight loss methods (CDC, 1996). On the other hand, eating patterns such as eating frequency, skipping of breakfast, and frequency of meals eaten away from home might influence school-going children's nutritional status, which then influences their health and academic performance (Shaw, 1998). Increasing awareness of the importance of diet for health promotion and disease prevention has led to a greater concern about the diet and eating patterns of school children and adolescents (Ming et al., 2006).

As adolescence is a transitional life-stage food habits may be likely to change, since it is a time of new independence and diminished family influence, especially over food intake (NHMRC, 2003). One of the important dietary behaviours is eating variety of food groups. Eating a variety of nutritious foods means consuming different food types in appropriate amounts to obtain all the required nutrients without excess energy intake (DHFS, 1998). Variety refers to choosing a range of items from within each food group, particularly from the food groups such as vegetables, fruits, cereals, milk products, and meat.

In Saudi Arabia there are no national diet guidelines. But, for example, in Australia, a healthy diet for children and adolescents is defined by nutrition guidelines established by the National Health and Medical Research Council. These guidelines advise that children and adolescents should consume: sufficient nutritious foods to grow and develop normally (in combination with physical activity); a variety of healthy foods; plenty of vegetables, legumes, fruits and cereals (such as breads, rice, pasta and noodles); lean meat, fish, poultry or alternatives; reduced fat dairy foods (but full fat for children under 2 years), limited saturated fat; low salt foods; moderate total fat and sugars; and no alcohol (NHMRC, 2003). The Australian Guide to Healthy Eating defines appropriate quantities of foods for different age groups (DHFS, 1998).

The recommended daily consumption for adolescents is 3-4 servings of fruit and 3-4 vegetables. It is recommended that adolescents consume 750 ml of milk daily or equivalent of other high calcium foods (DHFS, 1998).

Also, breakfast eating behaviour is one of the important dietary behaviours. Eating breakfast is important for the health and development of children and adolescents (Ming et al., 2006). Evidence suggests that breakfast is a central component of nutritional well-being, contributing to total daily energy and nutrient requirements (Nicklas et al., 1993, Ruxton et al., 1996). Breakfast consumers tend to have higher daily energy intake compared with non-consumers (Sjoberg et al., 2003; William, 2007; Nicklas et al., 2000). However, young people are more likely to miss breakfast than any other meal (Dwyer et al., 2001a, Ming et al., 2006). Eating patterns established during adolescence shape the diet later in life (Dwyer et al., 2001a), therefore it is important to motivate and help children and adolescents to adopt this important eating behaviour.

It has long been recognised that good nutrition is of crucial importance for the well-being. Food patterns in childhood, particularly adolescence, can set the scene for future dietary preferences and eating behaviour in adult life. Improving the health and nutrition of children should remain a priority for the government, health professionals, the food industry and teachers alike. Moving forward in adolescent nutrition will involve multiple partnerships, and key tasks will be to (Adams, 1997):

- Define healthy eating and fitness for adolescents realistically;
- Simplify and clarify the healthy eating message;
- Reframe the message to fit adolescent audiences;
- Promote skills-based interventions to accompany the message;
- Strengthen environmental support for youth fitness and nutrition

It is clear that in recent years there is a great freedom in food selection. There is a wide and complex range of social and cultural influence food preferences and eating patterns among children and adolescence (Story et al., 2002). It has been reported that parents play a key role (Koivisto Hursti, 1999, Patrick and Nicklas, 2005), as they can influence food choice by making specific foods available and by acting as models for dietary behaviours. Programmes that promote familiarity with foods (e.g. fruit and

vegetable tasting sessions at school) can increase the variety of foods selected. Studies suggest that restricting children's access to particular foods may even promote their over-consumption (Birch, 1998).

2.11.2 The state of nutrition in Saudi Arabia

Most of the Gulf countries in the Middle East have faced marked changes in demographic, socio-economic and health situations during the last four decades. These changes have made great alterations in the dietary habits and lifestyle of the population.

In general, the food situation in the Middle East has improved during the last four decades as many aspects in Saudi Arabia, after the oil discovery. However, the change in food habits is not the same in the three groups of Middle Eastern countries. In the high-income countries, the traditional diet, which consisted of milk, fresh vegetables and fruits, whole wheat bread and fish, has changed to a more diversified diet, with an excess intake of energy-dense foods rich in fat and free sugars and deficient in complex carbohydrates (Musaiger,1994) with the daily energy intake exceeding 3,000 kcal/per capita. Although sugar consumption is already very high (30-40 kg/per capita/annum), it continues to rise and its contribution to the total energy intake ranges from 10 to 15%. The same trend is applicable to fat consumption (both vegetables and animal) that is now estimated at approximately 20 kg/per capita/annum, contributing over 30% to the total energy intake (FOA, 2000).

During my search I found that the majority of the literature regarding diet and nutrition focus on obesity and overweight, and very few studies address dietary behaviours and knowledge (Table 2.2).

However, in Jeddah city, Saudi Arabia, skipping breakfast was reported by 14.9%, whereas regular daily breakfast intake was reported by 85.1% of students and eating breakfast did not differ by age, sex, body mass index or social class. Skipping breakfast was more marked among students with poor school performance as compared to those with very good or excellent results (Abalkhail and Shawky, 2002). Unfortunately, their published study failed to report many important details. First, there was no definition given to 'regular breakfast intake' and that made it unclear and

difficult to make comparison with other studies. Second, the study was quite descriptive and failed to include many variables such as living districts or condition, fathers education level, and students several dietary behaviours. Third, the statistical methods were not clearly discussed.

Al-Rukban investigated obesity and its association with other dietary behaviours among male adolescents in Riyadh. He found that 33.4% consume soft drink daily, 7.6% eat fast food daily, 18.2% eat sweets daily (Al-Rukban, 2003). Al-Rukban's study was conducted in public schools only and did not include students from private schools or different areas of Riyadh city. His study also did not collect information regarding many students' background variables and did not adjust for socio-economic factors.

Al-Almaie (2005a) conducted a study among adolescents from third grade, intermediate and all three grades of secondary school students in the Al-Khobar Area, eastern province of Saudi Arabia. He found that approximately 51% of the male and 65% of the female students recognized unsaturated fats as healthy foods. However, 10% of the males and 8% of females reported saturated fats as healthy food items, 49% of the males and 66% of the females correctly defined cholesterol, and the main sources of knowledge about health and disease reported by the male and female respondents were television (58% and 61%, respectively), magazines (31% and 39%) and daily newspaper (33% and 34%). Primary health care centres (PHCCs) staff were the least source of knowledge (17% and 16%). He concluded that dietary knowledge of both male and female students on the dangers of unhealthy foods and the benefits of fibre-rich diets was found to be unsatisfactory (Al-Almaie, 2005a). The study was purely descriptive and lacked many details and discussion. The validity and reliability of the questionnaire items were not discussed in this study. Also, the statistical method was only percentage and chi-square test. Moreover, his study did not establish the link between the students knowledge and their dietary behaviours.

Table 2-2. Dietary and obesity literature

Study	Setting and date	Aims	Methods and tools	Outcomes
El-Hazmi and Warsy, 2002	Conducted in different areas of Saudi Arabia from 1994 to 1998. Age between 1 - 18 years old	To review the prevalence of overweight and obesity in children and adolescents	A cross-sectional survey. N=1207 (boys 6281; girls 6420). Anthropometric measurement and BMI were calculated	The overall prevalence of overweight was 10.7% and 12.7% in the boys and girls, respectively, and obesity was 6.0% and 6.74% in the two groups, respectively.
Al-Almaie, 2005b	Intermediate and secondary school of both genders in Al-Khobar area, Eastern Saudi, in 2001 Age between 14-19 years old	To determine the prevalence of obesity and overweight	A cross-sectional study N= 1766 (boys 675 ; girls 1091) Anthropometric measurement and BMI were calculated	The prevalence of obesity was higher in male than female students (19.3% versus 11.8%) while a higher proportion of female students than males were overweight (17.2% versus 10.2%)
Al-Almaie, 2005a	Third grade, intermediate and all three grades of secondary school students in the Al-Khobar Area, eastern province of Saudi Arabia. Date of conducting the study is not known Age between 14-19 years old	To determine the level and sources of knowledge about foods and healthy diets among male and female adolescents.	This was a cross-sectional A self administrated questionnaire were used N= 1240 male and 1331 female	51% of the male and 65% of the female students recognized unsaturated fats as healthy foods. Dietary knowledge of both male and female students on the dangers of unhealthy foods and the benefits of fibre-rich diets was found to be unsatisfactory. The main sources of dietary knowledge by the male and female respondents were television (58% and 61%, respectively)
Abalkhail, 2000	Schools in Jeddah using data from 1994 and 2000 Age between 10-20 years old	To investigate overweight and obesity children and adolescents	Data were collected by in-person interviews using a structured questionnaire and Anthropometric measurement and BMI were calculated N=5250	The increase in body weight and BMI were marked for all age groups; however boys showed the largest increase aged 10–16 years, whereas girls showed the lowest at 14–16 years.
Al-Rukban, 2003	Intermediate and secondary schools in Riyadh, Saudi Arabia, September 2001 – January 2002	To determine the prevalence of overweight and obesity and its correlates	A cross-sectional study. N= Self- administrated questionnaire was used and Anthropometric measurement and BMI were calculated N=894 male	The prevalence of overweight was 13.8% and obesity was 20.5%. Family history and lack of physical activity were associated with adolescent obesity.

El-Hazmi and Warsy, 1997	35 areas of Saudi Arabia, Age range from 14 and above	To determine the prevalence of overweight and obesity	National household survey Anthropometric measurement were calculated N=6162 males, 8498 females	The prevalence of overweight was 27.23% and 25.20% in the males and females respectively, while the prevalence of obesity was 13.05% and 20.26% in the males and females respectively.
Al-Nuaim et al.,1996	Male schools in Saudi Arabia Between septmber,1994 and march,1995 Aged between 6-18 years old	To determined the prevalence of overweight and obesity	A national survey project N=9,061 schoolboys Anthropometric measurement and BMI were calculated	The overall prevalence of overweight was 11.7% and obesity 15.8%. The highest prevalence 18.0% was in Riyadh. The obesity among adolescents between 13-14 years old in Riyadh was 17.5%, obesity for adolescents 15-16 years old was 20.9% and among 17-18 years old was 13.4%.
Al-Sudairy and Howard, 1992	Technical and vocational schools in Riyadh between January,1989 and May,1989 Aged between 16-25 years old	To investigate the habit of meal skipping of young male	Cross sectional survey In-person interview were used N= 452 male students	Meal-skipping is a common habit among technical and vocational young students in Riyadh. The majority (289 students, 64%) missed one or more of their daily meals. Dinner (evening meal) was the most often skipped meal.
Abalkhail and Shawky, 2002	School students in Jeddah in April 2000 Age ranged between 9-21 years old	To identify the nutritional habits and the prevalence of anaemic nutritional status	Cross sectional survey In-person interview were used N=800 students(376 male and 424 female)	31.4 % were overweight of which 54.6% were obese. (85.2%) of all students were having their breakfast regularly. No association were found between breakfast intake and BMI, gender and social class.
Madani et al., 2000	Saudi Arabia	To identify the state of nutritional status in Saudi Arabia	Review study of nutritional studies in Saudi	Rapid socio-economic development has occurred, with attendant changes in life style and food consumption patterns. Affluent dietary diseases are becoming major health problem in Saudi and theses diseases are increasing dramatically.
Al-Nuaim et al., 1996	Different region(south, west, north, east	To determined the prevalence of overweight	Cross-sectional survey Questionnaire, anthropometric	The total prevalence of overweight for male and female subjects was 29%

	and central) in Saudi Arabia Age over 15 Date of conducting the study is not known	and obesity	measurement and BMI were calculated N=13,177 male and female	and 27%, respectively. The prevalence of obesity for male and female subjects were 16.7% and 26.2%, respectively. The prevalence of overweight and obesity among 15-20 years old subjects were 12% and 7%, respectively. The prevalence of overweight and obesity increase with age.
Al-Sudairy and Howard, 1992	Technical and vocational schools in Riyadh between January,1989 and May,1989 Aged between 16-25 years old	To investigate the habit of eating between meal young male	Cross sectional survey In-person interview were used N= 452 male students	The eating between meals habit was found to be common among the majority (72.3%) of those students.Youngest group ate between meals more often than older students

In general, few studies on dietary intake of nutrients in Saudi Arabia have been carried out and even fewer on dietary behaviours targeting male adolescents, (Table 2.2) shows details. Therefore, my study will investigate several aspects of adolescent's dietary behaviours. Moreover, I believe that my study is original in many ways. First, it was based on very well designed standardized questionnaires. Second, the sample size and sampling strategy is superior to any study in Saudi Arabia (See Research Protocol, Chapter 4). Third, I investigate the association of dietary behaviours with student's background variables, school factors variables, BMI, and other health related behaviours. Finally, and as I mentioned earlier, the sampling and statistical method that will be used in my study are more advanced than previous studies in Saudi Arabia (for details see Chapter 4).

2.12 Obesity

2.12.1 Obesity worldwide

Obesity has reached an alarming level across the world. For example, the UK is one of the most obese countries in Europe (IASO, 2007). There are long-term health risks in terms of chronic disease in adulthood, including cardiovascular disease; type 2 (noninsulin dependent) diabetes, total blood cholesterol and raised diastolic blood pressure which is already now being seen in obese children (Dietz, 2000, Dietz, 2001; Ehtisham et al., 2000; Friedman et al., 1999). In addition, there are a social and psychological problems experienced by overweight and obese children (Buttriss, 2002). The main ill-effects of obesity during childhood are social and emotional (Mossberg, 1989).

One of the major problems of overweight and obesity in childhood is that it may be associated with obesity in adulthood. There is a widespread belief that adult fatness begins in childhood (Buttriss, 2002). It has been reported that overweight children are twice as likely as normal weight children to be obese as adults (Whitaker et al., 1997). Data from the one thousand families, birth cohort (1142 children recruited at birth in 1947 in Newcastle upon Tyne) revealed an association between childhood BMI (at age 9) and adult BMI (at age 50) but found little evidence of tracking from childhood overweight to adult obesity when using a measure of fatness that was independent of build (percentage of body fat rather than BMI) (Wright et al., 2001).

Obesity and overweight are major problems among both adults and children in the UK and elsewhere (National Audit Office, 2001). In the UK the prevalence of obesity among children of all ages is increasing (Chinn and Rona, 2001; Reilly and Dorosty, 1999; Reilly et al., 1999; Rudolf et al., 2001). The National Diet and Nutrition Survey (NDNS) revealed that, for boys aged 15–18 years in particular, BMI was significantly associated with geographical region, percentage energy from total fat, percentage energy from total sugars and gross weekly household income (Gregory et al., 2000). In addition, there have also been general increases in children's weight and skin fold thickness across the whole population, and the NDNS indicates that there has been an increase since the last national survey was conducted in the mid 1980s (Gregory et al., 2000).

Childhood obesity is an important public health issues. Because obesity in childhood tracks into adulthood, increases in childhood overweight and obesity are contributors to the adult obesity epidemic (Dietz and Gortmaker, 2001). Moreover, it has been found that obese children and adolescents are more likely to become obese in adulthood with all the associated risk outcomes (Odgen et al., 2002; Whitaker et al., 1997). It has been reported that children express the same co morbidities that are associated with being overweight and obese as adults (Dietz and Gortmaker, 2001; Williams, 2001). Therefore, being overweight during childhood brings with it co morbidities that will increase the duration of co morbidities in an individual by one to two decades, a factor that can increase the impact of a number of risk factors on adult diseases (Deckelbum and Williams, 2001).

A review summarizing data from many studies evaluating the impact of obesity on mortality and morbidity reported that obesity is linked with a large range of medical complications (Malnick and Knobler, 2006). They concluded that there is evidence that obesity is not only related to conditions such as diabetes, hypertension, heart disease, obstructive sleep apnoea, asthma, non-alcoholic fatty liver disease, osteoarthritis and polycystic ovary syndrome, but also that weight reduction has beneficial effects and therefore is an integral part of treating these morbidities (Malnick and Knobler, 2006).

In a review study, it has been revealed that the prevalence of obesity among adolescents is increasing worldwide, and was explained by widespread nutrition transitions to fat diets and a decrease in physical activity (Schneider, 2000). Therefore, it has been reported that ‘‘Shaping the environment to better support healthful decision has the potential to be a key aspect of a successful obesity prevention intervention’’ (Lake and Townshend, 2006). A Cochrane review on the prevention of childhood obesity concluded that the majority of studies were short-term (Campbell et al., 2002). Better understanding of how individual interact with their environment in relation of diet and physical activity would help to develop effective obesity intervention (Lake and Townshend, 2006).

2.12.2 Obesity in Saudi Arabia

Al-Nuaim et al. (1996) determined the prevalence of overweight and obesity among 9,061 male school children aged 6-18 years old in Saudi Arabia. The results showed that the overall prevalence of overweight and obesity was 11.7% - 15.8%. Although, the study included large sample size, the study might not be representative for children or adolescents in Saudi Arabia since it was based on hospital patient data and not population based study. In addition, the study was descriptive and no important associations or explanations were established (Al-Nuaim et al., 1996).

El-Hazmi and Warsy (1997) determined the prevalence of overweight (BMI 25-29.9) and obesity (BMI $\geq$ 30) in a total of 14,660 adult Saudi males and females over 14 years of age in 35 areas within the five Saudi provinces the kingdom. The prevalence of overweight in the total population was 27.2% and 25.2% in males and females, respectively, while the prevalence of obesity was 13.1% and 20.3% in male and females, respectively. Their study was descriptive and no important associations were investigated or established. However, in this study, adolescents and children were not included (El-Hazmi and Warsy, 1997). On the other hand, the high prevalence of obesity is a cause for concern, since obesity is associated with several complications which increase both morbidity and mortality. The attitude towards obesity is another important factor. In Saudi Arabia, the traditional, long comfortable, and loose clothes worn by men may have prevented them from noticing the gradual gain in weight. The modernization and affluence in Saudi Arabia over the last three decades, which have led to a sedentary lifestyle are also associated with obesity (Khashoggi et al., 1994). Some might even consider obesity as a sign of affluence (Hamilton et al., 1995), since affluent people tend to use cars, modern technology and have office job.

In summary, it is important to emphasise the importance of good eating and exercise habits from an early age, with the focus being on general health and wellbeing. Healthy schools programmes and health education programmes for individuals and families in the community, together with other government and non-government initiatives should be established to contribute towards empowering children with knowledge and opportunities to make informed choices for their future health. Schools have an important role to play here.

2.13 Oral hygiene Behaviours

The most obvious oral hygiene behaviours' include tooth brushing, flossing, fluoride use, and seeking care and preventive care at the dentist. Tooth brushing and flossing help to prevent periodontal disease by disrupting and removing accumulating plaque, and tooth brushing with fluoride toothpaste delivers a small dose of fluoride to the teeth (DHHS, 2000). Regular dental visits have been associated with fewer untreated caries, at least among younger children (Ismail and Sohn, 2001).

On the other hand, other health behaviours that affect dental health are nutrition including sugar intake (Szpunar, et al., 1995), use of smokeless tobacco (DHHS, 2000) and cigarettes (Ojima et al., 2007; Ylostalo et al., 2004). The importance of dental health care may be more obvious than other aspect, as dental caries is one of common diseases among adolescents and children. In the United States, among 5 to 17 year olds, dental caries are five times as common as asthma, and seven times as common as hay fever (DHHS, 2000). According to national surveys, more than three-quarters of 17-year-olds have at least one cavity or filling (DHHS, 2000), and about one in every five adolescents has at least one untreated caries lesion or active tooth infection (MacKay et al., 2000). Untreated dental caries have a number of consequences, including pain, which can interfere with diet, nutrition, sleep, learning, and other daily functions (DHHS, 2000), and an increased risk of periodontal diseases (Albandar et al., 1995). Untreated caries are also associated with tooth loss; by age 17, more than 7% of adolescents in the U.S. have lost at least one permanent tooth to caries (DHHS, 2000).

The research on dental behaviours in Saudi Arabia is limited and there is no national data regarding the prevalence of dental behaviours in children and adolescents. It has been reported that teeth caries prevalence among small primary school sample (n=272) was high and only 30.5% of the children brush their teeth daily (Al-Banyan et al., 2000). This, study can be criticised in many ways. First, it recruited a small number of participants. Second, it was not a population based study, since it was conducted in one dental clinic. Third, it did not include students over 12 years old. Fourth, it was purely descriptive and did not collect information regarding students socio-demographic background. Finally, statistical method was simple and the study

did not investigate any association between brushing teeth and students background variables or other oral health behaviours.

Another study revealed that 42% male and 27.6% female students (age 12 -15 years) brush their teeth daily, whereas brushing teeth daily was 61.4% among male and 26.8% among female students in high schools (Almas et al., 2003). In this study, students were not allocated from different area of Riyadh, and private school students were not included in the sample frame. Also, several students background variables were not reported. The statistical methods used in this study were only percentage and chi-square test.

The scarcity and the weak design of publications regarding dental health behaviours among adolescents may seem surprising given priority for specific research investments in dental and oral health in Saudi Arabia.

In this thesis, I will investigate oral hygiene behaviours, while acknowledging the key contributions to dental health behaviours. Also, my study is very original since it will investigate the association between oral health behaviours and student's background, school variable, general health status and the association between oral hygiene behaviours and teeth status and pain. Also, it investigates the association between oral health behaviour and other risk behaviours.

2.14 Violence, injury, mental health related factors and safety

Violence by young people is one of the most visible forms of risk behaviours in society, and participating in physical fights, bullying and carrying of weapons are important risk behaviours for youth violence (Krug et al., 2002). There are many possible ways to define violence. The World Health Organization defines violence as: "The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation". This definition covers a broad range of outcomes including psychological harm, deprivation and maldevelopment. It has been noted that this reflects a growing recognition among researchers and practitioners of the need to include violence that does not necessarily result in injury or death (Krug et al., 2002). Violent behaviour in children and adolescents can include a wide range of behaviours: physical aggression, fighting, threats or attempts to hurt others (including homicidal thoughts), use of weapons, fire setting, cruelty toward animals, intentional destruction of property and vandalism.

Although violence has probably always been part of the human experience, it should not be acceptable or underestimated. Its impact can be seen, in various forms, in all parts of the world. It has been reported that each year, more than a million people lose their lives, and many more suffer non-fatal injuries, as a result of self-inflicted, interpersonal or collective violence (Krug et al., 2002). In addition, overall, violence is among the leading causes of death worldwide for people aged 15–44 years.

Violence is widespread among adolescents. In a cross-national study among adolescent boys and girls in North American and European countries, it has been found that involvement in fighting varied across countries, ranging from 37% to 69% of the boys and 13% to 32% of the girls. In addition, involvement in weapon carrying ranged from 10% to 21% of the boys and 2% to 5% of the girls (Pickette et al., 2005). In the United States, a national survey of students in grades 9–12 found that 28.5% male adolescents had carried a weapon in the previous 30 days and 44.4% had been in a physical fight one or more times during the 12 months before the survey (CDC, 2008).

The main victims and perpetrators of such violence, almost everywhere, are adolescents themselves and young adults (Reza et al., 2001). Violence may have direct and indirect effects. It may harm not only its victims, but also their families, friends and communities. Violence as a risk behaviour cannot be viewed in isolation from other risk behaviours. Violent behaviours are associated with each other and associated with other risk behaviours. For example, in cross-national study among adolescent in North American and European countries, in nearly all reporting countries, both physical fighting and weapon carrying were significantly associated with elevated risks for medically treated, multiple, and hospitalized injury events (Pickett et al., 2005). In addition, violent was associated with substance abuse (Kuntsche and Gmel, 2004; Molcho et al., 2004), children who bully others have been found to report elevated rates of weapon-carrying, fighting and being injured through fighting (Nansel et al., 2003). Some forms of violence are strongly associated to psychological consequences such as cognitive impairment, depression, anxiety, phobias, panic disorders, and psychosomatic disorders (Butchart et al., 2008). A WHO study estimated that sexual abuse experienced during childhood accounts for serious health problems in the general population including 27% of post-traumatic stress disorders, 10% of panic disorders, 8% of suicide attempts, 6% of cases of depression, alcohol misuse, and illicit drug abuse (Andrews et al., 2004).

The importance of injury among adolescents may lie in the contribution of injury to adolescent mortality, disability and health care cost. However, many injuries are likely preventable. Motor vehicle-related death rates in particular, rise dramatically with age among adolescents (MacKay, et al., 2000). Motor vehicle-related injuries are the most common cause of unintentional and total injury deaths among adolescents, and the rate of death due to motor vehicle-related injuries is higher among adolescent males than among adolescent females (MacKay, et al., 2000). In Saudi Arabia a law to enforce people to use seat belt was made compulsory on December 5, 2000 (Al-Naami et al., 2010), but as a developing country there is a poor enforcement of existing law and low use of seatbelts seems widespread.

In addition, recreational activities contribute heavily to adolescent injury. According to the 1999 YRBS, about 38% of high school students reported that they had incurred an injury, requiring treatment by a doctor or nurse, while engaging in physical activity at some point over the prior year (Kann et al., 2000).

It should be reiterated that injuries associated with motor vehicle crashes, bicycling, and work do not by any means encompass all types of injuries, which can occur in a tremendously wide variety of settings, such as in the home, on sports teams, and in the context of water activities. Additional important types of injury include sports injuries, burns, falls, and poisonings, among others.

At the individual level, factors that affect the potential for violent behaviour include biological, psychological and behavioural characteristics (Krug et al., 2002). Also, it has been noted that these factors may appear in childhood or adolescence, and they may be influenced by the person's family and peers and by other social and cultural factors (Krug et al., 2002).

Parental behaviour, family environment and family structure are central factors in the development of violent behaviour in young people (Krug et al., 2002). For example, it has been reported that children growing up in single-parent households are at greater risk for violence (Henry et al., 1996), and to poor attachment between parents and children (McCord, 1996). In general, low socioeconomic status of the family is associated with future violence (Krug et al., 2002). Health behaviours in almost all countries are associated with family affluence, but the patterns emerging for some behaviour are varying (Currie et al., 2008).

Family and peer factors may also be associated with safety behaviours. In the cross-sectional study of a diverse sample of inner-city and suburban adolescents, adolescent students were more likely to report wearing their seatbelts if their parents used seatbelts and directed their adolescent children to use seatbelts (Shin et al., 1999).

According to American Academy of Child and Adolescents Psychiatry (2001), numerous research studies have concluded that a complex interaction or combination of factors leads to an increased risk of violent behaviour in children and adolescents. These factors include:

- Previous aggressive or violent behaviour
- Being the victim of physical abuse and/or sexual abuse
- Exposure to violence in the home and/or community
- Genetic (family heredity) factors

- Exposure to violence in media (TV, movies, etc.)
- Use of drugs and/or alcohol
- Presence of firearms in home
- Combination of stressful family socioeconomic factors (poverty, severe deprivation, marital breakup, single parenting, unemployment, loss of support from extended family)
- Brain damage from head injury

Bullying behaviours are manifested in many different ways. Bullying occurs in a physical form through hitting and kicking, in verbal form through teasing, name-calling, and threatening, or in psychological form through rumours and intentional social exclusion (Espelage et al., 2000; Nansel et al., 2001). A person may be a bully, a victim, or both. Dr. Dan Olweus in his book Bullying at School, gives general characteristics of both victims and bullies. Victims, generally, are physically weaker than peers, may have "body anxiety," are often quiet, shy, withdrawn, anxious, unassertive in peer groups, and closer to adults than to peers (Olweus, 1993). Generally, bullies are seen to have the following characteristics: greater physical strength than classmates, the need to dominate others, hot-tempered, impulsive, "tough," low empathy, and are often oppositional, defiant, and aggressive toward adults (Olweus, 1993). According to Cohn and Canter "bullying is the most common form of violence in our society" (Cohn and Canter, 2003). In the same article, it is stated that in the United States, "approximately 3.7 million youths engage in, and more than 3.2 million are victims of, moderate to serious bullying each year" (Cohn and Canter, 2003).

In 1997 suicide was the third leading cause of injury death among adolescents 13–19 years of age in US (MacKay et al., 2000). However, many teens seriously consider suicide without attempting, or attempt without completing suicide. Among those adolescents seriously considering suicide, factors influencing suicidal thoughts may include depression, feelings of hopelessness or worthlessness, and a preoccupation with death, but may not be related to risk factors associated with actually attempting suicide (Behrman et al., 1996). It has been noted that about 60 to 90 percent of all suicidal behaviours are associated with some form of mental illness and/or substance use disorder (Harris and Barraclough, 1997). Despite the fact that

effective treatments exist for these disorders and conditions, the stigma of mental illness and substance abuse prevents many persons from seeking assistance; they fear prejudice and discrimination. About two thirds of people with mental disorders do not seek treatment (Kessler et al., 1996). The stigma of suicide, while deterring some from attempting suicide, is also a barrier to treatment for many persons who have suicidal thoughts or who have attempted suicide (US DHHS, 2001). Substance abuse or dependence can be an important contributor in the escalation from suicidal thoughts to suicide attempts (Gould et al., 1998).

As many other behaviours violence is, largely, preventable. The question therefore arises: why are there not more efforts to prevent it. Krug and colleges gave three possible reasons (Krug et al., 2002): A major obstacle is simply an absence of knowledge. A second problem relates to the feasibility of policy options to tackle the problem. Not enough decision-makers have seen the evidence that many forms of violence are preventable. A third problem is one of determination.

A large fraction of the disability and death that occur during adolescence could be alleviated through effective safety intervention and injury prevention. There is a dire need for research to guide and inform health behaviour promotion and injury prevention during the critical period of adolescent development.

Dangerous driving is an important issue in Saudi Arabia. In this study, I investigated a specific form of dangerous driving which can be referred to as car drifting. In my investigation, car drifting is a form of entertainment activity among Saudi adolescents. It is a process in which cars are driven at high speeds at various angles, often producing circular motions or snake-like movements of the car. People start the drift at high speeds, the point of Saudi drift is to spin as many times as possible but yet still maintain control and keep the car moving. I could not find any published studies that investigated card drifting in the literature, although there might be gray literature of which I am not aware.

There is no existing published research investigating violent, safety behaviours, dangerous driving or suicide among adolescents in Saudi Arabia, and only very few studies regarding psychological related factors (Asal and Abdel-Fattah, 2007**;** Al-Gelban, 2007; Abdel-Fatah et al., 2004). On the other hand, there are few but important data from surrounding Arab countries about suicide, violence and mental health. For example from Jordan, Lebanon and United Arab Emirates (UAE) since they took part in Global School-based Students Health Survey (GSHS), which investigate mental health-related symptoms, suicide and violence as many other behaviours, but among students between 13-15 years old. The GSHS website (http://www.who.int/chp/gshs/factsheets/en/index.html accessed August 1st 2010) provides fact sheets for all countries who have implemented the GSHS. Male students who always or most of the time felt lonely during the past 12 months preceding the survey were 13.1% in UAE, 7.7% in Lebanon and 12.2% in Jordan. The prevalence of feeling so worried about something that they could not sleep at night was 10.6% in UAE, 9.3% in Lebanon and 13.5% in Jordan among male students. Feeling so sad or hopeless almost every day for two weeks was 32% in UAE, and 31.6% in Lebanon. Students who seriously considered attempting suicide were 13.4% in UAE, 14.5% in Lebanon and 16.8% in Jordan. In UAE 56.9%, in Lebanon 64.6% and 63.9% in Jordan of the male students engaged in physical fighting at least once in the past 12 months preceding the survey (UAE-Global School-Based Students Health Survey 2005; Lebanon-Global School-Based Students Health Survey 2005; Jordan-Global School-Based Students Health Survey 2007).

Based on my knowledge, observation and experience, I find that violence, bullying and abuse, psychological related factors, and safety related behaviours are serious topics in Saudi Arabia and among adolescents. As a result, it is necessary to address the problem at an early age and therefore and research to discover such issues is needed. As well as with other behaviours, my study is original since it is one of the first to investigate suicide and mental health related symptoms among high school adolescents in Riyadh, Saudi Arabia. Also, it is original in term of investigating violent, bullying, family and teacher abuse, mental health issues, suicide, safety and injuries with relation to student's socio-demographic variables, school factors, and

their relation to other health-related behaviours and as well as between these behaviours.

2.15 Behaviours prevalence summery

Table 2.3 below summarises some of risk behaviours prevalence that this study will investigate. The table shows data from Saudi Arabia, England, Europe countries and USA .

Table 2-3. Behaviours Summary table:

Behaviours	**Saudi Arabia Male 15-18 years old**	**USA Male 15-18 years old (YRBS, 2009)**	**England and Europe Male 15 years old (HBSC, 2006)**
Eating breakfast regularly	49.7% (Al-Rukban, 2004). 81% (Abalkhail and Shawky, 2002)	70% (Siega-Riz et al., 1998)	In England 65%, and the range is between 42% (Slovenia) to 79% (Portugal)
Having eaten fruit every day	Consuming fruit and vegetables every day, 28.8% (Al-Rukban, 2004)	Two or more times per day is 35.3%	In England 33%, and the range is between 12% (Greenland) to 40% (Belgium (French))
Having eaten vegetables every day		Three or more times per day is 14.5%	-
Having drunk soft drink at least one time per day	33.4% (Al-Rukban, 2004)	34.6%	In England 28%, and the range is between 9% (Finland) to 52% (Belgium (French))
Brushing teeth more than once a day	(12-18 years old), 24.7% (Farsi et al., 2004)		In England 67%, and the range is between 20% (Malta) to 76% (Switzerland)
Physically active at least 60 minutes every days	>30 minutes/ 3 times and more, 27.7% (Al-Rukban, 2003)	24.18 %	In England 18%, and the range is 11% (Sweden) to 46% (Slovakia)
Attended physical education at least 1 day	NA	57.7%	-

Overweight or obesity	34.3% (Al-Rukban, 2003),	31 %	In England 9%, and the range is 8% (Latvia, Lithuania) to 32% Malta
Current tobacco use	15% (Almas et al.,2002)	29.8%	In England 13%, and the range is 7% (Canada) to 37% (Greenland)
Having been in a physical fight during the last 12 months	NA	(39.3%)	In England 51%. And the range is 32% (Finland) to 60% (Belgium (French), Ukraine, Malta)
Being Bullied	NA	18.7%	In England 22%, and the range is 12% (Iceland) to 56% (Belgium (French))
Bullying others	NA	-	In England 35%, and the range is 22% (Czech Republic) to 69% (Greece)
Having carried a weapon during the the30 days before the survey	NA	27.1%	Belgium (French) 10.5%, Estonia 17%, Latvia 14.2%, Portugal 17.7% (Pickett et al.,2005)
Having attempted suicide	NA	(4.6%)	In Lithuania 1.0% in 1994 to 1.8% in the year 1998 and to 1,7% in the year 2002 (Zemaitiene and Zaborskis, 2005)
Not using Seatbelt	NA	11.5%	-
Rarely or never worn a bicycle helmet	NA	88.3%	England 86.7%, Sweden 91.8%, Germany 80.4% (Klein et al., 2005)

Rarely or never worn a motorcycle helmet	NA	36.8%	NA
Having been threatened or injured by weapon	NA	9.8%	NA
Did not go to school because they felt unsafe	NA	4.6%	NA

All England and Europe data from HBSC (Curries et al., 2008), unless if it is stated something else.
All US data from YRBS (Eaton et al., 2010), unless if it is stated something else.

2.16 Understanding behaviours

Several theories have been proposed as to why people engage in risky behaviours. In considering these theories, it is important to think that adolescents are not all similar and that they may have different reasons for engaging in the same or different risk behaviour. Adolescents may also have multiple reasons for engaging in particular risk behaviour.

Clear understandings of health behaviour and health behaviour theory are important to the design of effective health promotion and prevention programmes. In fact, health behaviour theory can play a critical role throughout the programme planning process (Rimer and Glanz, 2005). Glanz and Rimer define a theory as:

"a systematic way of understanding events or situations. It is a set of concepts, definitions and propositions that explains or predicts these events or situations by illustrating the relationships between variables". They also noted that most health behaviour and health promotion theories were adapted from social and behavioural sciences, and health behaviours and health promotion theories draw upon various disciplines, such as psychology, sociology, anthropology, consumer behaviour, and marketing (Glanz and Rimer, 2005).

Table 2.4 is taken from the National Cancer Institute publication titled "Theories at a Glance: A Guide for Health Promotion Practice" written by Glanz and Rimer (Glanz and Rimer, 2005), it summarizes the focus and key concepts of each of the eight theories described in this guide.

Table 2-4. Summary of Theories: Focus and Key Concept

Level of Action	Theory	Focus	Key Concept
Individual Level	Health Belief Model	Individuals' perceptions of the threat posed by a health problem, the benefits of avoiding the threat, and factors influencing the decision to act	Perceived susceptibility Perceived severity Perceived benefits Perceived barriers Cues to action Self-efficacy
	Stages of Change Model	Individuals' motivation and readiness to change a problem behaviour	Precontemplation Contemplation Decision Action Maintenance
	Theory of Planned Behaviour	Individuals' attitudes toward a behaviour,	Behavioural intention Attitude Subjective

		perceptions of norms, and beliefs about changing	norm Perceived behavioural control
	Precaution Adoption Process Model	Individuals' journey from lack of awareness to action and maintenance	Unaware of issue Unengaged by issue Deciding about acting Deciding not to act Deciding to act Acting Maintenance
Interpersonal Level	Social Cognitive Theory	Personal factors, environmental factors, and human behaviour exert influence on each other	Reciprocal determinism Behavioural capability Expectations Self-efficacy Observational learning Reinforcements
Community level	Community Organization	Community-driven approaches to assessing and solving health and social problems	Empowerment Community capacity Participation Relevance Issue selection Critical consciousness
	Diffusion of Innovations	How new ideas, products, and practices spread within a society or from one society to another	Relative advantage Compatibility Complexity Trial ability Observability
	Communication Theory	How different types of communication affect health behaviour	Example: *Agenda Setting* Media agenda setting Public agenda setting Policy agenda setting Problem identification, definition Framing

In general, theories help in the stages of planning, implementing, and evaluating an intervention (Breinbauer and Maddaleno, 2005). Theories help to identify what the program designer needs to know before developing and implementing an intervention program. They also help to pinpoint what should be monitored, measured, or compared in a programme evaluation (Glanz et al., 2002; Glanze and Rimer, 1995). The theoretical framework is the basic foundation upon which evidence-based interventions are built in order to achieve successful programs for adolescents (Breinbauer and Maddaleno, 2005). However, the importance of theories to successful adolescents programs has been described by different authors (for example Kirby, 2001; Jemmot and Jemmot, 2000).

2.17 Health Promotion

As stated in the historic Ottawa Charter at the International Conference on Health Promotion on 21 November 1996:

'Health promotion is the process of enabling people to increase control over, and to improve, their health…. Good health is a major resource for social, economic, and personal development and an important dimension of quality of life. Political, economic, social, cultural, environmental, behavioural, and biological factors can all favour health or be harmful to it'

Health education is a fundamental part of health promotion. There are many definitions of health education. It is helpful to look first at some broad definitions, as an examination of these reminds us of the multiplicity of people, agencies and institutions which affect our health-related behaviour, and the multitude of ways in which the influence of health educators may be exerted. Such definitions include the following:

''In its broadest interpretation, health education concerns all those experiences of an individual, group or community that influence beliefs, attitudes and behaviour with respect to health as well as the processes and efforts of producing change when this is necessary for optimum health. This all-inclusive concept of health education recognises that many experiences, both positive and negative, have an impact on what an individual, group or community thinks, feels and does about health, and it does not restrict health education to those situations in which health activities are planned and formal'' (WHO, 1969).

Health education should be relevant to the levels of awareness and understanding of health-related issues held by the 'target' population, such as children, adolescents, elderly etc. Adolescents form an important target group for health education not only in their own right, but also because the occurrence and development of health-related beliefs, attitudes, skills and behaviours influence health problems of their health in later life. Health-related beliefs, attitudes and behaviours which develop in early life can thus contribute directly or indirectly to an individual's state of health in adulthood. The establishment of healthful outlooks and behaviour patterns among children should be, therefore, an essential goal for policy makers, public health researcher and health promotion professional should not aim only to

prevent ill-health and promote well-being, but also to enhance health in adulthood and community. However, as adolescents grow up these attitudes and beliefs may change and vary from year to year as they develop and as general social attitudes change. Thus, an information base is needed to illustrate the situation within each age group and to yield a picture of trends. Health education founded on an information base of this sort can then address those factors which have been shown to affect the adolescents' health-related behaviour, and can provide the information and foster the development of skills appropriate to each stage of development. The data for such an information base should include standard statistics such as prevalence rates for various health-related behaviours, the proportions of children adopting behaviour patterns at different ages, and the relative importance of different risk factors in each age group. Data of this sort have been collected in several national and regional studies of young people and health, mostly using 'closed' questions in self completion questionnaires such as YRBS project in the United States, HBSC project in Europe and North America countries and GSHS world wide.

However, it has been reported that translating knowledge about health issues into healthy behaviours is a challenging task in health promotion (Rimal, 2000; Merson et al., 2000). But, persuading people to cease smoking, to take exercise, to eat a healthy diet, to avoid unprotected sexual intercourse, injuries and violence has the potential to improve the health of a population (Michie and Abraham, 2004). On the other hand, adolescents may have access to information and may even know certain behaviours are harmful, this is not sufficient to persuade them to change their action (Breinbauer and Maddaleno, 2005), or to prevent them from risky behaviours. Although, it has been reported that the literature suggests that the link between knowledge and education is only moderate (Rimal, 2000), it is unlikely that individuals will continue engaging in healthy behaviours if they do not possess an adequate knowledge base (Rimal, 2000). Thus, providing factual information about risky health behaviours and thereby enhancing knowledge may be necessary to the extent that they can lead to subsequent behavioural modification (Breinbauer and Maddaleno, 2005; Rimal, 2000).

There is evidence that while public health interventions can successfully increase adolescents and youths' knowledge about issues (Egglestone et la., 2000, Cunha et al., 1998; Rimal and Flora, 1998), but cognitive knowledge may not be

enough for a sustained change in behaviours (Merson et al., 2000; Leyval et al., 1995).

The factors that influence adolescents to engage in health risk behaviours can be quite complex (Breinbauer and Maddaleno, 2005). The levels of influence for health-related behaviours have been identified as follows (McLeroy et al., 1988); (1) individual factors, (2) interpersonal factors, (3) organizational or institutional factors, (4) community factors and (5) public policy factors.

Therefore, programme developers are encouraged to see these various level as embedded systems, in which higher-order level or systems (e.g., society) set constrains and provide input to lower- order levels (e.g., individuals), and the lower-order levels in turns provide input back to systems at higher level (Bartholomew et al., 2001).

The cornerstones of health promotion strategy - building healthy public policy, creating supportive environments, strengthening community action and developing personal skills - are particularly relevant in addressing the challenges of improving and protecting the health and well-being of adolescents (Breinbauer and Maddaleno, 2005).

Social norms, regulation and policies are key factors to support the adoption of health promoting behaviours and to reduce or eliminate health-compromising reinforcements in the social and physical environments (Breinbauer and Maddaleno, 2005). As Green and Kreuter note, "health education provides the consciousness-raising, concern-arousing, action stimulating impetus for public movement and commitment to social reform essential to its success in democracy. Without health education, health promotion would be a manipulative social engineering enterprise. Without the policy support for social change, on the other hand, health education is often powerless to help people reach their health goals even with successful individual efforts" (Green and Kreuter, 1999). Therefore, health services, schools, recreational and sport facilities, community institutions, government agencies, businesses and political leaders are all part of the community where the adolescents grow, develops, studies, and play (Breinbauer and Maddaleno, 2005). Moreover, these initiatives and individuals are essential stakeholders that can play a pivotal role in promoting healthy lifestyles among adolescents. Urging changes in community social norms requires a comprehensive and multi-faceted approach comprising policy and programme

interventions in schools and other places frequented by adolescents, and are reinforced by public service campaigns and advocacy in the media, as well as by legislative and fiscal measures (Breinbauer and Maddaleno, 2005).

Programme designers are confronted with the challenge of how to address the multi-level determinants of youth violence, involving individual characteristics, family variables and societal factors (Breinbauer and Maddaleno, 2005), which contribute to this problem. In the design of programmes, early intervention and prevention are keys. Bartholomew and his colleagues proposed using a social ecological approach in designing promotion and intervention programmes (Bartholomew et al., 2001). In this approach, health is viewed as a function of individuals and the environments in which the individuals are embedded, including the family, social networks, organizations, communities and society as a whole.

According to the WHO report, ‘‘no single policy or program measure will be effective. Rather, a broad mix of initiatives is required, with the interventions varying according to the circumstances of each country’’ (WHO, 1999). The central element of all successful health promotion and prevention programs is the underlying theoretical framework (DiClemente et al., 2002; Glanz et al., 2002). Moreover, there has been a growing effort to identify, describe, analyze, and replicate those evidence-based intervention models which have produced the most positive results in enabling adolescents to adopt and maintain health-promoting lifestyles and /or change health-compromising behaviours (Breinbauer and Maddaleno, 2005).

2.18 Summary

In conducting this research review, I found a limited amount of research within the field of public health, health promotion or epidemiology, which explore smoking, physical activity, dietary, oral heath, violence, injuries, mental health related factors, suicide, safety and car accidents in Saudi Arabia. Children and adolescents’ conceptions of health-related behaviours are largely unexplored in Saudi Arabia.

This study covers a range of sociodemographic variables (age, school type, fathers education, mother educations, living and school districts), health indicators and outcomes (BMI, self-rated dental health status, self-rated health status, poor school performance, school satisfaction and mental health symptoms) and health-related behaviours which are; dietary behaviours (skipping breakfast, fast food consumption, food consumptions), oral health hygiene behaviours (brushing teeth, visiting dentist), physical activity (students physical activity in general, students' physical activity in school, student's family physical activities, student's peer physical activities), smoking behaviours (student's smoking, student's family smoking behaviours, and student's peers smoking behaviours) injuries (being injured or causing injuries), violence (fighting and carrying weapons), bullying (bullying others and being bullied, abuse behaviours (being abused by teachers and by family members) and safety behaviours (using seat belt and helmet); as well as adolescents' knowledge and attitudes regarding these behaviours. Therefore, the present research project aims partly to fills a gap in the scientific literature in Saudi Arabia.

3. Chapter Three: Pilot Study

3.1 Background

In recent years, there have been a large number of school-based epidemiological studies of self-reported health risk behaviours in adolescents. In Europe and Canada, the Health Behaviour among School- Aged Children (HBSC) Study has had six components: dietary behaviours, smoking behaviours, physical behaviours, sexual behaviours, substance use, violence, and injuries- of data collection since its inception in 1982, the most recent of which was in 2008 and involved 40 countries. In the USA, the Youth Risk Behaviour Surveillance (YRBS) System has been used extensively at national, state and local levels to monitor adolescent risk behaviours in US (Kann et al., 1998). In Africa, school-based risk behaviour surveys have been conducted in several countries, including Tanzania, South Africa and Zimbabwe (Flisher et al., 2003; Kaaya et al., 2002). The biggest comprehensive survey is the Global School-based Student Health Survey (GSHS) since it has been conducted in several countries around the world and covers behaviours, knowledge and attitudes. Therefore, the majority of the questionnaire questions in this study were obtained from Global School-based Student Health Survey (GSHS).

Unfortunately, although the vast majority of the Gulf population lives in Saudi Arabia, with a child population of 9.6 million (UNICEF, 2003), there is no country representative sample survey on any risk behaviours. Thus, conducting a well designed questionnaire survey based on international questionnaires to investigate adolescents health risk behaviours could be a valuable contribution to the Saudi adolescents' health literature and may help to inform and influence health promotion and health education policy and practice at local and national level in Saudi Arabia. Due to limited time and limited resources, the common health risk behaviours– dietary behaviours, oral health behaviours, physical activity, smoking, violent, injuries, safety and factors associated to mental health which may lead or cause morbidity or mortality among adolescents were selected to be investigated in my study. Although, some other risk behaviours such as illicit drugs use and alcohol drinking may occur among Saudi students, it may not be politically or culturally

appropriate to investigate among adolescents for instance alcohol sale and consumption is banned and illegal in Saudi Arabia. Moreover, students may feel uncomfortable to be asked about this kind of behaviours.

The pilot study was conducted to examine the reliability, feasibility and validity of the study questionnaire to be used for the main study. In the pilot study, sexual behaviour was initially included in the questionnaire, but was removed after permission was refused by the Ministry of Education. The sexual behaviour part of the study was replaced by several behaviours, such as violent, injuries and safety behaviours. The pilot study was conducted for a range of objectives (Teijlingen and Hundley, 2001):

- Developing the research questions and research plan
- Ensuring the acceptability and clarity of the questionnaire
- Ensuring that the questionnaire measures the research objectives
- Measuring the response rate and the quality of the responses
- Guaranteeing the cooperation of the participants to provide an honest reply
- Assessing the time required by the adolescent high school students to complete the questionnaire
- Improve the investigator's skills in as many elements of the research process as possible.
- Collect data to inform sample size of the main study.

3.2 Methodology

A good research strategy requires careful planning and a pilot study will often be a part of this strategy. A pilot or feasibility study is a small scale study designed to test and gather information prior to a main study, in order to improve the latter's quality and efficiency. A pilot study can reveal deficiencies in the design of a proposed procedure and tools, and can then be addressed before time and resources are expended on large scale studies. Generally, the term pilot study can refer to so-called feasibility studies which are "small scale versions, or trial runs, done in preparation for the major study" (Polit et al., 2001). However, a pilot study can also be the pre- testing or 'trying out' of a particular research instrument (Baker, 1994). One important objective of conducting a pilot study is that it might give advanced

warning about where the main research project could fail (Teijlingen and Hundley, 2001).

A pilot study is critical for identifying problems for respondents, researchers, research tools and methods. Pilot studies are a crucial element of a good study design and tools. Pilot studies fulfil a range of important functions and can provide valuable insights for researchers. Moreover, a pilot study is a study usually conducted to test validity and reliability before main study. Generally speaking, researchers should give great attention to reliability and validity. Whatever procedure for collecting data is selected, it should always be tested critically to assess to what extent it is likely to be valid and reliable.

Validity and reliability are important concepts in social research. Joppe (2000) provides the following explanation of what validity is in quantitative research: ‘‘Validity determines whether the research [instrument, tools, questions] truly measures that which it was intended to measure or how truthful the research results are’’. Validity is the extent to which a questionnaire or tool measures what it claims to measure. It is vital for a questionnaire to be valid in order for the results to be accurately applied and interpreted. Validity is not determined by a single statistic, but by a set of research tools.

There are number of types of validity and it can be defined in a number of ways. However, content validity, construct validity, and criterion-related validity are the three major types (Sekaran, 2003). Other type of validity is called face validity which refers to researchers’ subjective assessments of the presentation and relevance of the questionnaire: do the questions appear to be relevant, reasonable, unambiguous and clear? (Bowling, 2002). It has been noted that ‘‘Content validity should not be confused with face validity. The latter is not validity in the technical sense; it refers, not to what the test actually measures, but to what it appears superficially to measure. Face validity pertains to whether the test “looks valid” to the examinees who take it, the administrative personnel who decide on its use and other technically untrained observers’’ (Anastasi, 1988).

Face validity can be established by the investigators or other people, just by asking if they think the survey could adequately and completely assess what it is aimed to assess, such as behaviours or attitudes. If the intended participants state that

the questionnaire is measuring what it is intended to measure, then the survey can be said to have face validity. However, further steps may be taken to ask individuals similar to those who will be studied to see if they feel the same way about the survey items.

Content validity is also a theoretical concept, but is more systematic than face validity (Bowling, 2002). It is concerned with ensuring that the measure contains a sufficient and representative set of the topic under study. The researcher may determine content validity via careful definition of the research topic, the items to be scaled, and the scale to be used. When a test has content validity, the items on the test represent the entire range of possible items the test should cover. It could be met by searching the relevant literature or seeking advice from professional or experienced people in the field of the research to comprehensively include the full range of the domain it is intended to measure. Generally, content validity and face validity, are together simply a demonstration that the items of a test are drawn from the domain being measured.

Criterion validity is to correlate measures with a criterion measure known to be valid. Criterion-related validity is estimated empirically and quantitatively through a statistical correlation (such as Kappa test of agreement) between the set of scores obtained from a measurement procedure with those obtained from an alternative method of measuring the criterion

Pilot studies are also important to demonstrate instrument reliability. Joppe (2000) defines reliability as:

‘‘The extent to which results are consistent over time. An accurate representation of the total population under study is referred to as reliability. If the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable’’. Kirk and Miller (1986) identify three types of reliability referred to in quantitative research, which relate to: (1) the degree to which a measurement, given repeatedly, remains the same (2) the stability of a measurement over time; and (3) the similarity of measurements within a given time period. The consistency with which questionnaire [test] items are answered or individual’s scores remain relatively the same can be determined through the test-retest method at two different times (Charles, 1995). This attribute of the instrument is

actually referred to as stability. If we are dealing with a stable measure, then the results should be similar. A high degree of stability indicates a high degree of reliability, which means the results are repeatable.

On the other hand, reliability refers to consistency: Does a measure produce the same results with repeated trails? For example a scale that indicates that a person weights 130 pounds at one moment and 160 pounds one hour later is not considered reliable. For reliability, test-retest reliability refers to the extent to which a measurement produces systematic or reproducible variation when administered on separate occasions (Shrout, 1995). Joppe (2000) detects a problem with the test-retest method which can make the instrument, to a certain degree, unreliable. She explains that the test-retest method may sensitize the respondent to the subject matter, and hence influence the responses given. This could lead to a difference in the responses provided. While reliability is a necessary condition for validity, it is not sufficient to ensure validity. However, it seems impossible to address validity issues in the face of poor reliability.

Generally, there are many threats to validity and reliability and might be influenced by many factors, apart from the questionnaire design and scale construction. These are known as biases and errors in many aspects such as in research idea, design, sampling and process of the study.

A dictionary definition of bias is “a one-sided inclination of the mind”. Bias could occur in any stage of any research. Bias in research could jeopardise the research results and reduce the credibility of the research finding and the researcher. Random errors, i.e., those due to sampling variability or measurement precision, occur in all quantitative studies and can be minimized but not avoided. Systematic errors, or biases, are reproducible inaccuracies that produce a consistently false pattern of differences between observed and true values. Both random and systematic errors can threaten the validity of any research study. Research projects that rely on self-report questionnaires; depend on participants truthfully and accurate reporting of their attitudes and characteristics. This does not always happen. For example, some respondents may deliberately answer questions incorrectly and thus introduce bias. A much greater concern is that subjects may simply commit “honest” errors of omission, confusion, or false memory. Survey studies are subject to well-known types of bias.

For example, since respondents know they are being studied, and have at least some idea why, they may change their answers, either consciously or unconsciously, to show themselves in a better light or to conform to the expectations of those who are studying them. Thus, it is important that the questionnaire itself is written in such a way that the questions are valid, reliable and unbiased (i.e. the questions are written in such a way that people are willing and able to provide accurate answers).

Bias can emerge for a number of reasons and can depend on the way of developing or administering the questionnaire. People may sometimes tend to respond in the socially desirable direction when it comes to health behaviours such as smoking, drinking, or sexual behaviours.

There are ways to prevent response bias in surveys in order to achieve acceptable level of validity and reliability for any survey, and it should be considered when developing survey questions. Every question is measuring something. Therefore, it is important for each to be clear, understandable and precise. It is important to keep questions short; long questions can be confusing and stressful for respondents. Moreover, a leading question may affect the response given by the participant. A leading question is phrased in such a way that suggests to the respondent that the researcher expects a certain answer. Equally, it may be important to avoid double questions. A double question combines two or more issues in a single question. Having two statements in one question or combining the two questions into one question makes it unclear which issue is being measured, as each question may elicit a different issue. The questions' wordings are fundamental to both the validity and reliability of any study. It is important to make sure that questions are clear, unambiguous, useful and well designed. Avoiding response bias is important to the success of any survey project. Implementing the above strategies may ensure that the questionnaire survey delivers valid data that could be able to effectively apply to the survey problem. Thus, good study design and procedure can be helpful in increasing study response rate, minimise bias, increase validity and reliability. Explaining the purpose of the study is fundamental and ethical for the quality of any research. Assuring a guarantee of confidentiality and/or anonymity and informing the respondents how and why they were selected is essential and could be helpful methods.

3.3 Questionnaire preparation

Questionnaire tools are highly used in research fields for collecting primary data. A questionnaire survey is helpful for collecting moderate amounts of information from large samples of people. Moreover, questionnaires are suitable for collecting information about attitudes, motivation, accounts of behaviour, opinions, and events.

Since a questionnaire is a powerful research tool, it demands careful attention to achieve valid results. Questionnaire design begins with an understanding of the capabilities of a questionnaire and how it can help the research. The development of the questionnaire was conducted in phases. First, I searched the literature for instruments measuring adolescent risk-taking behaviours. From searching the literature review, three key instruments were identified: CDC Youth Risk Behaviour Survey (YRBS) used in United States, WHO/Health Behaviour in School-aged Children (HBSC) in used Europe and Canada, and the Global School-based Student Health Survey (GSHS) used in several countries around the world. The GSHS was developed by the World Health Organization (WHO) in collaboration with United Nations' UNICEF, UNESCO, and UNAIDS; and with technical assistance from CDC. The methodology for these three surveys is almost the same. For example, the YRBS, HSBS and GSHS surveys are administered in schools setting, using self reported questionnaire, investigating the same health risk behaviours, asking the same core health risk questions, and allows for voluntary and anonymous participation. Through a review process (first by the researcher and followed by two public health professors, it has been observed that the GSHS questionnaire was more comprehensive since it has the core questions of both YRBS and HBSC; the GSHS questionnaire also investigates adolescents' knowledge and attitudes. However, none of these instruments has been used in large population scale in Saudi Arabia. It was found that it would be useful to conduct such a study based on an international widely used tools across countries.

3.4 Questionnaire items

The purpose of the pilot study questionnaire is to collect data on adolescents' health risk behaviours and associated factors. The questionnaire covers socio-demographic information, dietary behaviours, physical activity behaviours, smoking behaviours, sexual behaviours. The questionnaire items were mainly based on previous international questionnaires (HSBS, GSHS and YRBS). Some new items were added to the questionnaire in order to gather more information to meet the main research project aims and objectives. For example, Do you think that students need health education programme about health diet and nutrition?; Do you think that students need health education programme about smoking behaviour?; Do you think that students need health education programme about physical activity?; Do you think that students need health education programme about sexual behaviour and related health issues?; family and peers smoking behaviours and family and peers physical activity behaviours, parents' level of education. Ethical approval was obtained from the Ministry of Education in Riyadh for the pilot study after reviewing the research proposal. In Saudi Arabia, parents consent is not necessary for research based questionnaire when it is approved by Ministry of Education. However, students totally have the choice to participate or not.

3.5 Social and demographic items

Data describing how health risk behaviours and protective factors vary by demographic characteristics can help guide policy and program planning and implementation. Therefore, the questions in this survey instrument measure the age, school grade, nationality, type of school, family style and father's and mother's educational level of the respondents. These socio-demographic variables can have an important influence upon adolescents' behaviours.

3.6 Dietary behaviour items

The questionnaire covers many aspects of dietary behaviours. The questions in this module measure dietary behaviours, knowledge and attitudes. It investigates breakfast, lunch and dinner consumption among students. Moreover, it investigates the role of school with regard to student's dietary behaviours and knowledge. These

questions also measure food choices. The questionnaire items also measure students' consumption of many different types of food for instance, fruits, vegetables, fish and sea products, milk products, sweets, carbonated drinks, caffeinated drinks and energy drinks.

3.7 Physical activity items

The questions in this module measure participation in physical activity and sedentary leisure behaviour. It investigates physical activity in school. Also, it investigates student's family and peer physical activity. Moreover, it investigates some factors that influence adolescents' decision toward practicing physical activity and knowledge and school role in providing information regarding physical activity issues.

3.8 Smoking items

These questions measure lifetime and current smoking patterns, knowledge and attitudes toward smoking behaviours, age of starting smoking, family and friends smoking behaviours, attempts to smoke or quit smoking, and place of smoking.

3.9 Sexual behaviours items and rational

The questions in this module measure the prevalence of lifetime and current sexual intercourse, age at first intercourse, sexual knowledge and attitude and the sources of the knowledge. Moreover, it investigates the role of school and teacher regarding sexual behaviours (Note that sexual behaviours items were included in the pilot study before it has been asked to be removed from the main study questionnaire).

3.10 Questionnaire development and design

The pilot study self-report questionnaire consisted of 85 multiple-choice questions which were translated into Arabic. The instrument consisted of an introductory section in which demographic data were elicited in eight questions, followed by questions addressing the following domains of risk behaviour: dietary behaviours; tobacco smoking; physical activity behaviours; and sexual behaviour. No

skip patterns were included on the questionnaire. Skip patterns are the sequence of questions asked and skipped. Skip patterns, normally used to jump questions not relevant or applicable to individuals were not included in the questionnaire. For instance, if a respondent answers a question that indicates he does not smoke, you can opt to "skip" items regarding what kind of smoking he use. Not including skip patterns helped to ensure that students read and answered every question. This technique also prevented students from detecting a pattern of blank responses that might identify the risk behaviours of other students, allowing some degree of privacy because equivalent amounts of time are needed to complete the survey despite the number of risk behaviours a student engages in and because individual students cannot be identified based on skip patterns.

An English version of the questionnaire was initially developed based on international standardized questionnaires. The researcher contacted some experienced professionals in the field in Saudi to seek feedback on the first draft of the questionnaire which was prepared by the researcher. A family and community medicine consultant and associate professor at the Medical School, King Saud University, Dr Mohamed Al-Rukban, agreed to help in reviewing the questionnaire. Three meetings were held to discuss drafts. The last questionnaire draft was reviewed by a native English speaker. After that, the questionnaire was translated into Arabic language by the researcher. The questionnaire was validated by translating it back into English by an Arabic-English translator who had Arabic language as his first language. This back-translated version was compared with the original version. A small number of differences were resolved by discussion between the researcher and translator. Moreover, the Arabic version of the questionnaire was revised by Dr Mohamed Al-Rukban, associate professor at the Medical School, King Saud University and by Professor Mohamed Khfajy, a public health consultant at the School Health Services Department in the Saudi Ministry of Education. Very little change occurred based on their comments, mainly words ordering and editing.

After wording changes, I met those again to keep them informed about the final version. They all agreed that the purpose, the contents of the questionnaire, and the format were ready to use, but stated that it might be too long for the students. Moreover, one colleague was not sure about the possibility of getting the permission to investigate sexual behaviours. It was considered to be hard for any researcher to

investigate this issue because of its cultural sensitivity and it might imply political problem and consequences. Beyond this issue, the reviewers felt confident that the questionnaire through being based on an international standard questionnaire and used worldwide had sufficient validity and reliability to be used in the Saudi context.

Validity and reliability may be reduced because of factors such as problems with question content and formatting, which could lead to confusion with the overall meaning of the question as well as misinterpretation of individual terms or concepts. I tried to overcome this by pre-piloting the questionnaire to identify any ambiguities in the questions and to ensure the accessibility of the questionnaire before the pilot study. To work on or with adolescents, it is important to have them involved in the work and participate in designing the questionnaire. Thus, twelve adolescents were interviewed in different public settings (e.g. coffee shops and sport club) before the pilot study took place. The students helped the researcher to revise rewording and modify the Arabic version of the questionnaire and to change the layout font from 14 to 16. They also recommended printing the questionnaire on double sided papers to minimise the number of questionnaire papers in order for the questionnaire to look smaller. Students ensured the acceptability and the clarity of the questionnaire before the test-retest pilot study. Discussing the questionnaire with the students provided useful experience for the researcher about how to talk and deal with the students in classrooms.

3.11 Study design

The pilot study was conducted using a cross-sectional test/re-test design and was carried out in one high school in Riyadh city. The first and second administrations of the survey were 3-4 weeks apart. This time frame decreased the likelihood that an actual change in behaviour might occur between administrations. At the same time, the length and complexity of the survey made it unlikely that students would remember their exact answers from the first session to the second session. During the second phase of the study and after the students had completed the questionnaire, a discussion took place regarding the language used in the questionnaire, the format, their emotional reactions on answering the questions, and any other technical aspects of the questionnaire.

3.12 Sample population

The school was chosen on a convenience basis. An attempt was made to ensure that the school was not exceptional in any obvious way. The researcher contacted the headmaster of the school and set an appointment with him. The research aims and process were explained. The headmaster and some teachers looked at the questionnaire, and no comments or complaints were made. The selected school will not be included in the main study sample. The sample population of the study was adolescents from six classes, two classes from each level which were selected randomly from 1st, 2nd and 3rd level of one high school. The sample included all the students in two classes of all the three grades in one male high school in Riyadh city. The grade corresponded to an age of 15 years to 19 years old. Students who participated in the pilot study were similar to the target population who are intended to be the subjects of the main study.

3.13 Data collection

The questionnaire was administered in a regular classroom setting in a regular class period. The survey was conducted by the researcher. The data collector explained the survey procedures. Students were informed during the first session that they would be asked to complete a similar survey in the second session after 3-4 weeks. Questionnaires were distributed during class period. Students were informed that participation was voluntary and anonymous, and that responses would be treated confidentially. Because some risk behaviours are socially unacceptable, consistency of responses may be affected by a fear of the consequences of admitting having engaged in risk behaviours. To avoid this problem, the researcher gave introduction and general instructions for a few minutes before starting the survey, helpful methods to increase the response rate and the quality of adolescents' response. The general instructions covered the following points:

- What the study is about and why it is important
- The organisation responsible for conducting the study
- Emphasis that there are no right or wrong answers; requesting honest answers and trying to elicit integrity in general
- Promising confidentiality

- Saying thank you

Also, consistency may be affected by a desire to conform to perceived norms among a peer group. This factor may likely to be operating in adolescence students, when peer influence is at a peak. I was aware of this issue, so it was very important to ask the teachers to leave the classes, students to be independent, not to open discussion and be apart enough from each other and I explained to students that there is no right or wrong answer. The data were collected during December 2006 and January 2007.

3.14 Data entry, coding and analysis

Excel was first used for data entry. SPSS [Statistical Package for Social Science, Version 14.0] was used for analysis. All the data were entered in a personal computer. Assurance of completeness and accuracy was made through double-checking records upon data entry completion. Statistical advice was obtained from qualified statistician (Dr Tom Chadwick, Research Fellow at Institute of Health and Society at Newcastle University). Descriptive statistics were calculated and compared for the first and second phase of the study. Test-retest reliability was examined by comparing prevalence rates of the main question for each risk behaviour in both phases. The chi-square test was used to examine the consistency of the main health risk behaviours questions by comparing first phase with the second phase to investigate any differences in the participants' responses.

I re-coded the main research questions in both study phases based on their final outcomes to be compared for test-retest reliability. The dietary behaviour module of the questionnaire asked students: ''How often do you eat breakfast after you wake up every morning?'' The response alternative answers were: ''Never'', ''One day'', ''Two days'', ''Three days'', ''Four days'' and ''Five days and more'' Those who reported eating breakfast two days or less a week were grouped together and considered as one group. Those who reported having breakfast three and four days were grouped together. Moreover, those who reported eating breakfast ''Five days and more'' remain the same.

For physical activity behaviours, physical activity questionnaire asked students to report the frequency of days spent exercising for at least 60 minutes. The question asked students: ‘‘during the usual week, how many days are you physically active for at least 60 minutes per day?’’ The response alternative answers were: ‘‘Never’’, ‘‘One day’’, ‘‘Two days’’, ‘‘Three days’’, ‘‘Four days’’ and ‘‘Five days and more’’. Those who reported being active for once a week or less were grouped together and considered inadequately active, and those who reported being active between 2–3 times per week were considered moderate active, and those who reported being active four times a week and more were considered highly active.

For smoking behaviour, students were asked: ‘‘What best describes you?’’ The response alternative answers were: ‘‘I have never smoked’’, ‘’I have tried it only’’, ‘’I used to smoke in the past’’, ‘‘I smoke some days during the week’’ and ‘‘I smoke every day’’. Those who reported ‘‘I have never smoked’’, ‘‘I have tried it only’’, ‘‘I used to smoke in the past’’ were considered non- smokers, while those who reported ‘‘I smoke some days during the week’’ and ‘‘I smoke every day’’ were considered as smokers.

On sexual behaviours module, students were asked: ‘‘Have you ever had any sexual experience?’’ “The response alternative answers were: ‘‘Yes, I had sexual experience’’ and ‘‘No, I had no sexual experience’’.

3.15 Pilot study results

One dozen students were interviewed before the pilot study was conducted to ensure the language, accessibility, and the meaning of the questionnaire items. This process helped to improve the quality of the Arabic questionnaire version in terms of question content, order/context effects, add instructions, and formatting before the pilot study. It was clear to the researchers that the interviewed students did not know their height and weight, so self-reported weight and height questions were useless and might be not valid among Saudi adolescents. Thus, it was removed and it was decided to use anthropometric measurements to record students’ height and weight in the main study for accurate data.

In the first phase of the study 73 students were attending on the day of data collection, and a total of 72 students participated (response rate 99%) and in the

second phase of the pilot study, 70 participated in both phases of the study (response rate 96%). Students who did not participated in the first study were asked not to participate in the second phase of the study. It was observed that students required no more than 45 minutes to complete the questionnaires. Only one student refused to complete the questionnaire, and he did not give any reason. The prevalence rates at time 1 and time 2 for each risk behaviour showed no significant differences between the two administrations. Students' responses were very similar in both phases of the study. The chi-square test was applied to the main research questions to identify the reliability of the questionnaire.

The students' responses to the main dietary behaviour questions were consistent. P-value was not statistically significant (P= 0.92). Table 3.1 below shows details.

Table 3-1. Eating breakfast

Having Breakfast	First Phase		Second Phase		*P*-Value
	N	(%)	N	(%)	
Eat for 2 days or less a week	29	(41)	29	(41)	*0.92*
3-4 days	12	(17)	12	(17)	
Five days and more	30	(42)	29	(41)	
Total	71	(100)	70	(100)	

Similarly, no significant difference was found in responses to physical activity question among students in both two phases of the pilot study since p-value was not statistically significant p= 0.87. Table 3.2 below shows details.

Table 3-2. Physical activity

Physical activity	First Phase		Second Phase		*P*-Value
	N	(%)	N	(%)	
≤ 1 day a week	51	(71)	48	(69)	*0.87*
2-3 days a week	13	(18)	13	(18)	
≥ 4 days a week	8	(11)	8	(11)	
Total	72	(100)	69	(100)	

The students' responses to smoking behaviours questions did not change either. No significant difference in response to smoking item among the students and p-value was not significant p= 0.60. Table 3 below shows details.

Table 3-3. Smoking behaviour

Smoking	First Phase		Second Phase		
	N	(%)	N	(%)	*P*-Value
Non-smoker	53	(75)	50	(72.5)	*0.60*
Current smoker	18	(25)	19	(27.5)	
Total	71	(100)	69	(100)	

Similarly, the participants' sexual behaviour responses were consistent since no p-value was not statistically significant p= 0.87. This means there was no significant difference in response to this item among the students. Table 3-4 below shows details.

Table 3-4. Sexual health behaviour

Sexual behaviour	First Phase		Second Phase		
	N	(%)	N	(%)	P-Value
Have had sexual experiences	34	(47)	34	(48)	*0.87*
No sexual experiences	38	(53)	36	(52)	
Total	72	(100)	70	(100)	

In general, students' impressions about the questionnaire were positive and encouraging. They stated some issues about some other related risk behaviours, such as drug use and fast and careless driving. Although, some students stated that the questionnaire was long, they confirmed it was easy to read, understand and to complete. Adolescents stated that sexual health behaviour is the topic they want to study and get information about more. They raised a lot of questions regarding sexual health and STI/STD, such as the forms of disease transmissions, effective use of condoms etc. In addition, great agreements were found when comparing students' responses in phase one and two.

3.16 Pilot study discussion and conclusion

The questionnaire was developed for use in high-school students in Riyadh, Saudi Arabia. This survey assessed several health risk behaviours, knowledge and attitudes. The response rate was very high, 99% on the first phase of the pilot study, and 96% in the second phase. It was observed that the students required no more than forty five minutes to complete the questionnaires. In general, the findings of this study suggest that the questionnaire items were appropriate to use among high school students in Riyadh. Similarly, it has been documented that self-reported health behaviour survey is widely used among adolescents and has adequate reliability

(Nancy et al., 1995). It was clear after the first and second study that explaining confidentiality, data entry process, using an anonymous questionnaire, encourage students to participate (by demonstrating the aims and objectives of the study) were useful approach to enhance students' reliability and their motivation to participate.

The pilot study has achieved its objectives through establishing that the questionnaire can be effectively used in the field survey and for the main study. The format and content of the questionnaire were clearly acceptable to the population sampled. The high degree of compliance recorded. The pilot study in both two phases showed high level of response rate; however, it may have been biased by small sample size. It also demonstrated the feasibility of achieving the predefined sample size for the main study (N=1496, See Main Study Methodology in Chapter 4), and provided preliminary indications of knowledge, attitude, beliefs and practices concerning health behaviours. It also proved that the study can be conducted within the defined time. The results of this study indicate that, at least among adolescent high school students in Riyadh, the questions had acceptable test-retest reliability among year high school students. From the pre-pilot study, I found that the interviewed students were not aware of their heights and weights. So, self-reported height and weight may give invalid data among Saudi students. Therefore, students' heights and weights were decided be measured in order to calculate their body mass index (BMI).

This instrument contributes to the current national and international literature. This study could prove useful in program development and evaluation because it is based on a holistic approach to youth programming. Specifically, the tool examines individual factors such as knowledge, and environmental factors such as peer norms, family, and schools' role regarding health risk behaviours. All of these factors reciprocally affect the health of youth and thus serve as important intervention points.

The strengths of the study included the very high participation rate the detailed history of dietary behaviours, smoking behaviours, physical behaviours and sexual behaviours. This is, to my knowledge, the first study of test-retest study verifying health risk behaviours self-administered questionnaire among Saudi adolescents. Language and cultural factors that could affect the validity of the data could be addressed. Special care was given to translating and back-translating the questionnaire to ensure that the meaning of the questions was accurately portrayed in the local

vernacular. The relatively high student response rates confirm the applicability of the health risk behaviours models in the Saudi context. For regional consistency, the students completed the questionnaire in their classrooms under the supervision of the survey investigator. To ensure students' privacy and to allow for anonymous participation, teachers or any authoritative figures were not present during the survey. Ministry and school permissions for the pilot study were gained prior to the survey.

Some limitations of this study are in need of discussion. First, the reliance upon self-completion of the questionnaire has the potential for bias as adolescents may not recall their behaviour accurately. All information collected in this study is self-reported and although multiple procedures were used to ensure confidentiality, it is possible that the bias of providing socially desirable answers is present. These instruments need to be tested in other age groups and among females to ensure that the findings are not specific to Saudi male high school students. It could be tested and modified appropriately to fit the needs of other populations as well.

I concluded that the questionnaire could be safely used for the main study. Since the validity and reliability of this study has been accomplished (Table 3.5), because of using several techniques. These techniques were:

- The questions in the questionnaire, was based on international standardized questionnaire, which has been used in different countries around the world.
- The questionnaire was translated first from English to Arabic, and then translated back to English.
- Interviewing twelve students
- The Questionnaire was revised and improved based on the opinions of twelve high school students and three experienced researchers.
- The questionnaire was as clear and simple as it could be.
- Discussion took a place with students regarding the questionnaire items, and the students were asked to give their comments
- Test re-test pilot study participants responses rate was high.
- Test re-retest chi-square test showed no significant differences in participant responses.

Table 3-5. Pilot study check list

Task	Comments
Acceptability of the questions	12 students have been interviewed and they all agreed that the questionnaire items are clear, appropriate to be addressed and easy to be answered. The students give some comments regarding the language and layout then the questionnaire was modified before the pilot.
Clarity of the language used	
Clarity of the layout	
Questionnaire and question format	
Visibility of sample size needed	From the pilot study the response rate was very high.
Questionnaire items	It was stated by many students that the questionnaire is quite long, but easy to read, understand and to complete.
Validity: whether the questionnaire answer the research questions	The questionnaire items were based on valid and reliable international questionnaires. Experienced researchers advices were obtained and considered. The Qs. was translated from English to Arabic and back to English. The Qs was pre-tested by interviewing 12 students then by pilot study.
Reliability (consistency)	Test-retest study was applied and no significant differences were found in participants responses.

4. Chapter Four: Main Study Methodology

4.1 Introduction

This chapter deals with the research methodology and the aim of the chapter is to discuss the practical approaches that were used in this study. So, this section introduces and covers study type, study design, sampling, pilot study, data collection instrument, data collection processing, the statistical analyses proposed, and the limitations of the study.

4.2 Study Setting

The study took place in Riyadh, Saudi Arabia. The population of Riyadh is estimated to be about five million. The city is the capital city of Saudi Arabia and it has a fast rate of growth. Gathering comprehensive data about health related behaviours of adolescents in Riyadh will attract more attention than data from any city and therefore will have major implication on the society.

4.3 Study Population

The specific population selected for sampling in this study survey is male adolescents attending public and private high schools in Riyadh. Due to political, religious and cultural reasons, female adolescent students are separated in schools from male students; therefore, female students cannot be reached by the researcher and will not be included in this study, although there is no doubt that their future role in community and family health is fundamental. The majority of the students are usually aged between 15, and 18 years, in their tenth, eleventh and twelfth grade of their school years in Riyadh City, Saudi Arabia. The reasons for selecting this age group are as follows:

- Adolescents are highly exposed to risky behaviours that may influence their health directly or in the future.
- The behaviour changes during adolescence often determine the lifestyle and health habits of adulthood, creating long-term health implications.

- The majority of health risk behaviours, which contribute to the leading cause of mortality and morbidity, often can be prevented by adopting healthy behaviours and effective prevention.
- Many high-risk behaviours among adult first began during adolescents and become well-established patterns of behaviour by young adulthood (Park et al., 2006).

4.4 Study Design

This study employed a cross-sectional design to investigate adolescent health-related behaviours. This type of research was appropriate to answer the research questions. The data collection took place between February and April 2008.

4.5 Study Tool

The method to collect the data was a self-completion questionnaire. The questionnaire approach is a very common technique used for collecting and one of the major approaches to collect primary data. Questionnaire is usually distributed by one or more of variety of methods which include posting, by hand, phone or internet. The survey questionnaire is useful in the process of collecting data from a large number of people and this is useful especially when resources and time scale are limited.

Although, questionnaires are widely used to measure health-related behaviours, it is important here to mention that there is potential for bias using self-reported questionnaire to assess behaviours such as physical activity. It has been reported that an accurate assessment of physical activity in epidemiological studies is critical to the evaluations not only of health outcomes of physical activity but also of potential confounding effects by this complex behaviour (Orsini et al., 2008). Physical activity dimensions include intensity, frequency, and duration, which together make up the total volume of activity. Another important dimension of physical activity is type or mode, e.g., walking and cycling (Corder et al., 2008). There are measures that the researcher uses to validate and measures physical activity. Accelerometers and machines/equipment records are used to validate physical activity (Orsini et al., 2008). There is evidence, however, that the validity of shorter physical activity questionnaires can be acceptable to classify persons according to physical activity levels (Mader et al., 2006). Self-report instruments and movement sensing are

currently the most commonly used methods for the assessment of physical activity in epidemiological research (Corder et al., 2008).

4.6 Questionnaire Items

The questionnaire aimed to collect comprehensive data from school students regarding behaviours, knowledge and attitude. The questionnaire items (105 items) were based on international validated questionnaires which have been used worldwide (See Appendix C for the items sources). The questionnaire include students' personal characteristics (age, school grade level, type of school, home district, family structure, fathers' and mothers' level of education), self-reported health and school performance and school satisfaction, dietary behaviours and height and weight, oral health hygiene, physical activity behaviours, smoking behaviours, injuries and violence, bullying and abuse, factors associated to psychological health, and driving and safety behaviours (See Appendix A: 1 for English version and Appendix A: 2 for Arabic version).

4.7 Sampling Strategy

In this study I applied multi-stage, stratified sampling among 10^{th} to 12^{th} grade high school students in Riyadh Capital city, Saudi Arabia in 2008. Stratified sampling by school type, school district, and class level of high schools, to yield a representative sample of students to make sure that I have recruited representative sample size from the whole of Riyadh city. Schools were divided into two types: those in the private sector (about 44%) and those in the public sector (about 56%), but 72 % of the total high school students belong to the public schools, whereas 28% of them in private schools (see Table 4.3 below). Moreover, in order for this study to be relatively representative Riyadh was divided to five districts (north, south, east, west and central), so as to ensure a distribution of adolescents and schools from all areas of the city. Also, to avoid any potential bias by not including students from different areas. However, no previous study has investigated the difference between these districts and there is not enough information about any cultural or socio-demographic status differences. Two schools (one public and one private) were selected, using random numbers from each district, providing 10 schools in total from which to

sample classes and pupils. After selecting the schools from each district, they were contacted and informed about the study and procedure and they were asked to participate. From previous experience with the permission from the Ministry of Education, schools usually tend to participate.(See table 4.1).

Table 4-1. Number of schools in each district

District	Number of public schools	Number of Private schools	Total
North	1	1	2
South	1	1	2
East	1	1	2
West	1	1	2
Central	1	1	2
Total	5	5	10

4.8 Sample Size

Statistical advice was obtained before collecting data. Based on the pilot study, the numbers in Table 4.2 are the overall sample sizes required to estimate a prevalence of 20% to the stated precision or accuracy (i.e. precision of 2% would translate to 95% confidence values for the prevalence estimate of between 18% and 22%, precision of 3% to prevalence between 17% and 23% and accuracy of 5% would change this range to 15% to 25%). Table 4.2 below shows that when the level of accuracy increases, the sample size required is much greater.

Table 4-2. Sample size needed for different levels of precision

Precision	Sample Size
2%	1,494
3%	464
5%	245

I decided on a sample size of over 1,494, which provides 2% precision, offered a reasonably high level of precision for prevalence estimates and provided reasonable power for subsequent multivariable analysis. The aim was to sample from schools in line with the population proportions and average class sizes (Table 4.3); taking approximately 72% of the sample of adolescents from public schools and 28%

from private schools. This means that the sample would be approximately 1080 students from public and 420 from private schools.

Table 4-3. Distribution of Public and Private Schools in districts of Riyadh, and numbers of classes' students within them (Sampling Frame)

Type of Schools	Schools		Classes		Students	
	N.	%	N.	%	N.	%
Public School	95	56	1477	64	38604	72
Private School	75	44	834	36	15337	28
Total	170	100	2311	100	53941	100

(Numbers obtained from Ministry of Education in Riyadh)

An equal number of schools and class were sampled from each type of schools and districts as I do not have the detailed population information available about the number of students in each district, table 4.4 shows all the details.

Table 4-4. Structure of study sample by District, school type, classes and number of students

District	Class level	Type of School				Students	
		Public School		Private School			
		Classes No.	Students No.	Classes No.	Students No.	No	(%)
North	**10th grade**	3	78	2-3	36	114	
	11th grade	3	78	2-3	36	114	
	12th grade	3	78	2-3	36	114	
	Total	**9**	**234**	**6-9**	**108**	**342**	**(20)**
South	**10th grade**	3	78	2	36	114	
	11th grade	3	78	2	36	114	
	12th grade	3	78	2	36	114	
	Total	**9**	**234**	**6-9**	**108**	**342**	**(20)**
East	**10th grade**	3	78	2	36	114	
	11th grade	3	78	2	36	114	
	12th grade	3	78	2	36	114	
	Total	**9**	**234**	**6-9**	**108**	**342**	**(20)**
West	**10th grade**	3	78	2	36	114	
	11th grade	3	78	2	36	114	
	12th grade	3	78	2	36	114	
	Total	**9**	**234**	**6-9**	**108**	**342**	**(20)**
Centre	**10th grade**	3	78	2	36	114	
	11th grade	3	78	2	36	114	
	12th grade	3	78	2	36	114	
	Total	**9**	**234**	**6-9**	**108**	**342**	**(20)**
Total		**45**	**(68)**	**30-45**	**(32)**	**1710**	**(100)**

At the outset, although I knew that 56% of schools are public and 44% private. I also knew that class numbers, size and number of students in classes were different in the two types of school, students in public school classes range from 25-35 (in some school 50 students in one class) and around 15 in private schools. Given the different class sizes, randomly sampling nine classes from each public school (three from each grade, 10-12) and six to nine classes from each private school (2-3 from each grade, 10-12), resulted in approximately 1170 students from the five public schools and 540 from the five private schools. This provided approximately 68% public and 32% private pupils, 45 (60%) public school classes (of approximately 25 pupils each) and 30 (40%) private school classes (of approximately 15 pupils each) and five each of public and private schools (50% each). These proportions compared reasonably well with the proportions of pupils, classes and schools in the public and private sectors in Riyadh (see Table 4.4), although there was a slight over-representation of the private sector (these figures are only estimates and it was possible to add more classes and student if needed. This sampling strategy gave an expected sample size of 1710, allowing for about 12% non-response to the survey. However, based on the pilot study it was assumed that the response rate would be high since it was 99% and 96% in the first and second phase of the pilot study. In general, the sample size was large enough to enable acceptable precision of prevalence.

4.9 Survey Procedures

The survey procedures were designed to protect student privacy and allow for anonymous participation. I distributed and collected the questionnaire after completed by the students in classes and under my supervision. The aim and the objectives of the study were explained to the students and for high response participation and accurate results. I explained and ensured confidentiality and motivated students to participate. Students were assured that the survey was anonymous and that no-one at their school would see their questionnaire. Students were instructed not to talk to anyone or look onto anyone else work-everyone is entitled to their privacy, and to think about each question and answer it as it applies to you. They were also told that there was no right or wrong answer, and not to answers any question in a way which they think they should answer it to impress other. To insure the privacy, students were separated in

the class. Teachers were asked to leave the class and the researcher was present in the room at all times to answer any questions and to ensure that the instructions were followed. Anyone who did not participated in completing the questionnaire was asked to remain silent and sit quietly. Students recorded responses on the questionnaire booklet. When the students complete their questionnaire they handed it to the researcher. Then, their height and weight was measured in private and recorded on the back of each student questionnaire respectively.

4.10 Height and Weight protocol

Students' height and weight were only measured by the researcher using validated international standardised protocol (See below).

4.10.1 Height and Weight issues

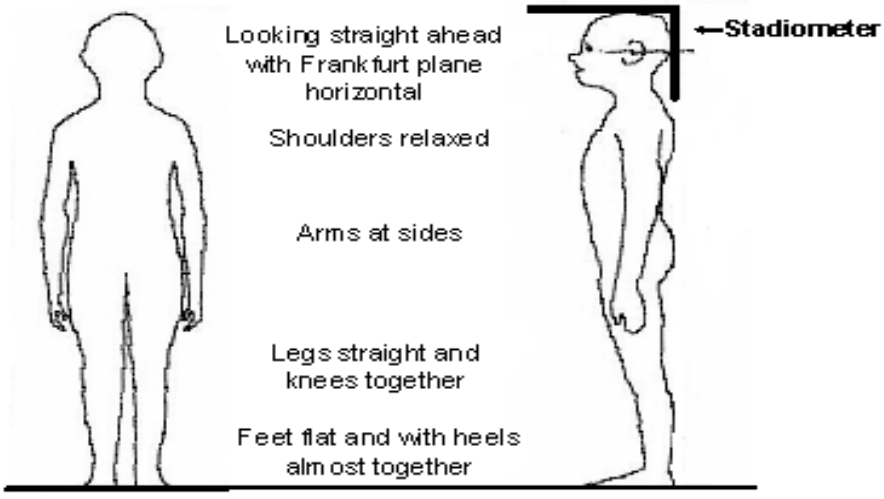
1. Height and weight are used to calculate Ideal Body Weight (IBW) and Body Mass Index (BMI).
2. An inaccurate height and weight results in an inaccurate IBW and BMI
3. The same scale was used for all students. After students completed the questionnaire, their height and weight were measured and recorded.

4.10.2 Obtaining Height measurement

1. Make sure the student on the middle of the firm surface.
2. Students will be measured in the standing position using portable stadiometer.
3. Clothing should be minimal when measuring height so that posture of the students can clearly be seen.
4. Students will be asked to remove shoes AND socks (thick socks can make a difference) and any heavy clothes and to stand with heels together, arms by their sides and eyes looking straight ahead.

5. Students should stand with the back and head straight so that the Frankfurt plane is horizontal and the eyes are focused forward (see Figure 4.1). Back of the heels, buttocks, shoulder blades and back of the head. However if the participant is overweight it may only be possible to obtain contact at the buttocks and shoulder blades as it is important for the participant to stand straight.
6. Feet, knees, buttocks and shoulder blades should be in contact with the vertical surface of the stadiometer.
7. Arms should be hanging loosely at the sides with palms facing the thighs; the head is not necessarily in contact with the wall.
8. Students will be asked to take a deep breath and stand tall to aid in straightening of the spine. Shoulders should be relaxed.
9. The moveable headboard should be gently lowered until it touches the crown of the head.
10. Record the measurement to the nearest 0.1cm on the back of the last page of the student Questionnaire.

Figure 4-1: Height Measurement.



4.10.3 Obtaining Weight measurements

1. Ensure balance is on a firm, flat surface.
2. The scale will be balanced to zero before weighing.

3. The student will be asked to remove heavy outer clothing (such as coats, jackets, and vests), purses, shoes, and any heavy accessories such as belts with heavy belt buckles. The student should also remove everything from their pockets including money (coins), pens, pencils, wallets, and papers.
4. Students stand on the centre of scales, without support and with their weight distributed evenly on both feet with feet close together, arms at sides and eyes looking forwards, record body mass to nearest 0.1 kg.
5. Make sure the scale is zero-balanced before each student is weighed.
6. It is strictly important not to react to the student's weight. While the weight measurement is being taken, it is important not to be judgmental. Any communication about the weight should be neutral (neither positive nor negative) and professional.

4.10.4 Calculating BMI

Student's weight and height were measured and body mass index was calculated. Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m2). Anthropometry, based on weight and height measures, is one of the methods used most frequently to identify people at higher risk of overweight and obesity, and body mass index (BMI) is the index used most often.

Cole et al. Proposed BMI cut-off values for children and adolescents (Cole et al., 2000). The use of Cole et al. Criteria (BMI cut-off values) is widely accepted and used (Fletcher et al., 2004, Andersen et al., 2005). However, It has been reported that Cole et al. Values have a low sensitivity when compared with weight-for height, which makes their use to screen obesity in children less useful since they could not detect more than 80% of those classified as obese by WHO (Abrantes et al., 2003). Also, it has been found that the sensitivity, specificity and agreement of BMI values proposed by Cole et al. With weight-for-height index are better for pre-school children than for schoolchildren (Abrantes et al., 2003). However, the ideal gold standard method to diagnose overweight and obesity is a more direct measure of body fat such as dual-energy X-ray absorptiometry (DEXA), which is clearly more

difficult to obtain (Abrantes et al., 2003). In my study BMI cut off for adults was used, but only for the chi-square test to investigate overweight differences among group (BMI was used as a continuous variable in linear regression analyses). First because the majority (45%) of the participants were aged 18 or older, and BMI cut-offs of 25 and 30 are used to classify individuals as overweight and obese for this age, respectively, whereas the remaining students were 15 years old (3.4%), 16 years old (20.1%) and 17 years old (30.7%). However, the average BMI cut off for adolescents between 15-17 years old (based on Cole et al., criteria) is 24%, and it was presumed that it will not affect the results.

4.11 Data collection

Data collection was by means of a self-completion questionnaire, completed in a class setting and administered by the researcher. The questionnaire aims and objectives were explained for students to encourage them to participate in this study. The questionnaires were distributed in classes and collected by the researcher during class session which is about 45 minutes. Confidentiality was of utmost importance and a procedure that ensures pupils' anonymity. The confidentiality issues and process were explained to students and taken in account by the researcher to enhance authenticity of the student responds. The project questionnaire is based on Health Behaviour in School-aged Children survey (HBSC), Global school-based student health survey (GSHS) and Youth Risk behaviours Surveillance (YRBS), surveys among school-aged children and adolescents carried in many European countries and Youth Risk Behaviour Surveillance (YRBS) in United States.

4.12 Ethics and official approval

An official letter from the Supervisors to the Ministry of Education Director's in Saudi stating the importance of the study and asking for permission to conduct this study was obtained and submitted to the ministry of Education. The Research Committee at the Ministry of Education was authorized to discuss the questionnaire items. The committee approved the questionnaire but asked the researcher to exclude the sexual behaviour items. The researcher met some of the committee members and discussed the importance and the benefit of addressing sexual behaviours items to students. On Monday 5th November 2007 the researcher met the head of research

committee and it is the second meeting after the previous meeting which was held last December 2006 during the Pilot study. The researcher emphasized the importance of the survey and the confidentiality of the information. The head of the committee confirmed his permission regarding the other part of the survey except the sexual health items. Therefore, the sexual health part was excluded, and then the approval was obtained (See Appendix B).

4.13 Reliability and validity:

Although this study's research questionnaire was based on previously validated and reliable questionnaires, test-retest pilot study was conducted in Riyadh during December 2006 and January 2007 before the main study take place to evaluate the questionnaire and the ability of adolescents to answer it. The questionnaire was found to be valid and reliable within Saudi context (See Chapter 3).

4.14 Planning data entry

Computers are valuable for improving the accuracy and speed of data collection and analysis, making it easy to check for errors, producing numbers and graphical summaries of the data and generation new variables. For these data, an SPSS spreadsheet was designed by the study statistician and then reviewed by the researcher himself through comparing the SPSS spreadsheet variables and responses items with the original questionnaire. Age, weight and height were entered as continuous variables while the rest of the items of the questionnaire were coded as categorical variables. The data were either coded as single-coded variable where there is only one possible answer to a question such as 'During the past 12 months, have you been weighed and measured?' It is not possible to answer both 'yes' and 'no' to this question, or a multi- coded variable which more than one answer is possible for each respondent such as 'From the resources below, who has taught you about healthy diet (you can tick more than one if you want)?' In this case, a student may have been taught by a number of resources. On the other hand numerical data like weight and height were entered with the same precision as they are measured by the researcher, and the type and the unit of the measurement were consistent. For example, the same measurement tool was used and weight was recorded in kilograms and height was recorded in centimetres for all the participants' students.

4.15 Data cleaning

In any study there is always the potential for errors to occur in a data set, either at the outset when taking measurements or when collecting and entering the data onto computer. It is hard to eliminate all of these errors. However, there is almost always a way to reduce the number of typing errors by checking the data carefully once they have been entered. It is relatively easy to check categorical data, as the responses for each variable can only take one of a number of limited values. A table of descriptive statistics containing the range, minimum and maximum values of each variable was obtained for the all variables, and then all data items were checked against the original questionnaire for the all variables to see whether there are any strange values and typing mistakes. Therefore, values that are not allowable must be errors. Three items out of 108 items (105 items in the study questionnaire plus items regarding weight, height, BMI, and school districts) have been found to be having some responses out of acceptable range, so these four items have been checked and the mistakes have been corrected. On the other hand, numerical data are often difficult to check. However, numerical data can be ranged checked that is, upper and lower limits can be specified for each variable. If a value lies outside this range then it is flagged up for further investigation. In my data, first I obtained the minimum and the maximum value of the students' age, height and weight and the histogram were viewed to detect any strange values. There were only three unacceptable variables values were found which were students age (2 cases), weight (five cases) and height (3 cases) wrong values were detected and checked. Moreover, and for more accuracy I have re-checked the data entry (about half of the questionnaires were selected randomly and re-checked and it was found that the data were entered carefully).

4.16 Statistical analysis

Statistics encompasses the methods of collecting, summarizing, analysing and drawing conclusions from the data; researchers may use several statistical techniques to achieve their study aims. Additionally, as the data may take many different forms, different statistical tests are required. Thus, it is important to know what form every variable takes before we can make decisions regarding the most appropriate statistical methods to use. Each variable and the resulting data were one of two types: categorical or continuous. In this study the age and BMI were used as continuous-

numerical variables and recoded and used as categorical variables in Chi-square test (Chapter 5) and as a continuous variable in the regression analyses and the other items were all analysed as categorical variables.

After the data were entered and cleaned, Chi-square analyses was used to investigate health-related behaviours among students with student's background (age, class level, type of school, home districts, fathers and mothers educational level), academic performance and liking school and examine the interrelation between different risk behaviours. In the majority of social and medical studies extensive use is made of significance tests. Study reports are often full of the resultant 'p-values'. The way in which significance tests have gained their important role and the problems involved in their use are considered by, amongst others, Atkins and Jarrett cited by Jones and Rushton (1982):

''Significance tests perform a vital function in the social sciences because they appear to supply an objective method of drawing conclusions from quantitative data. Sometimes they are used mechanically, with little comment, and with even less regard for whether or not the required assumptions are satisfied''. However, there is no clear agreement about the cut-off value for significance, although, critics of p-values point out that the criterion used to decide "statistical significance" is based on the somewhat arbitrary personal choice of level which is often set at 0.05. It been argued that studies that generate a large number of measures of association have a probability of generating some false-positive results due to random error through comparisons. Statistically significant results could be found by chance in many epidemiological studies even if there are no real correlations between factors. Thus researcher should be aware and look behind numbers. A variety of procedures addressed to tackle such a problem and one of well known and debatable is Bonferroni adjustment. Bonferroni adjustment or correction, require the establishment of a smaller critical *p* value for rejecting the null hypothesis on each individual test in light of the multiple tests to "preserve" the stated alpha level for the entire study. Epidemiologists have expressed little enthusiasm for such formal correction methods, that Bonferroni correction adjustments are, at best, unnecessary and, at worst, deleterious to sound statistical inference (Rothman, 1990, Savitz and Olshan, 1995). Medical epidemiologist Thomas V Perneger stated:

‘‘What would happen to biomedical research if Bonferroni adjustments became routine? Cynical researchers would slice their results like salami, publishing one P value at a time to escape the wrath of the statistical reviewer. Idealists would conduct studies to examine only one association at a time-wasting time, energy, and public money. Meta-analysts would go out of business, since a pooled analysis would invalidate retrospectively all original findings by adding more tests to be adjusted for. Journals would have to create a new section entitled “P value updates,” in which P values of previously published papers would be corrected for newly published tests based on the same study. And so on ...’’ (Perneger, 1998).

However, in this study a P-value at 0.05 was considered statistically significant. This level of significant was used because it is widely used in literature and most importantly to be consistent with the majority of the studies in Saudi Arabia (e.g. for accurate compatibility).

Multivariable logistic regression analyses were performed for binary outcomes to examine the nature of the association between risk behaviours as outcomes and explanatory factors. For example, smoking behaviour (e.g. current smoker or non smoker as an outcome) and socio-demographic or family and peer smoking status variables as explanatory or independent factors. Moreover, I used linear regression for BMI (BMI was skewed therefore Log BMI was used) because It was used in the regression analyses as a continuous variable. The construction of the analysis plan was based on the findings of studies from different fields (e.g., public health, epidemiology, sociology psychology).

Several hypotheses were made and guided the analysis. First, it was hypothesized that socio-demographic/background characteristics influence adolescent’s behaviours. Therefore, their relation to the risk behaviours will be examined first and then controlled for in the other models. Second, it was hypothesized that school has an important role and influence on many aspects of adolescent’s life, and liking school and school achievement/performance are associated with adolescents’ behaviours.

Third, health risk behaviours are interrelated and tend to be inter-associated. Typically, involvement in one risk behaviour is found to be positively associated with involvement in other risk behaviours. Therefore, logistic analyses were used to investigate the independent co-occurrence of behaviours.

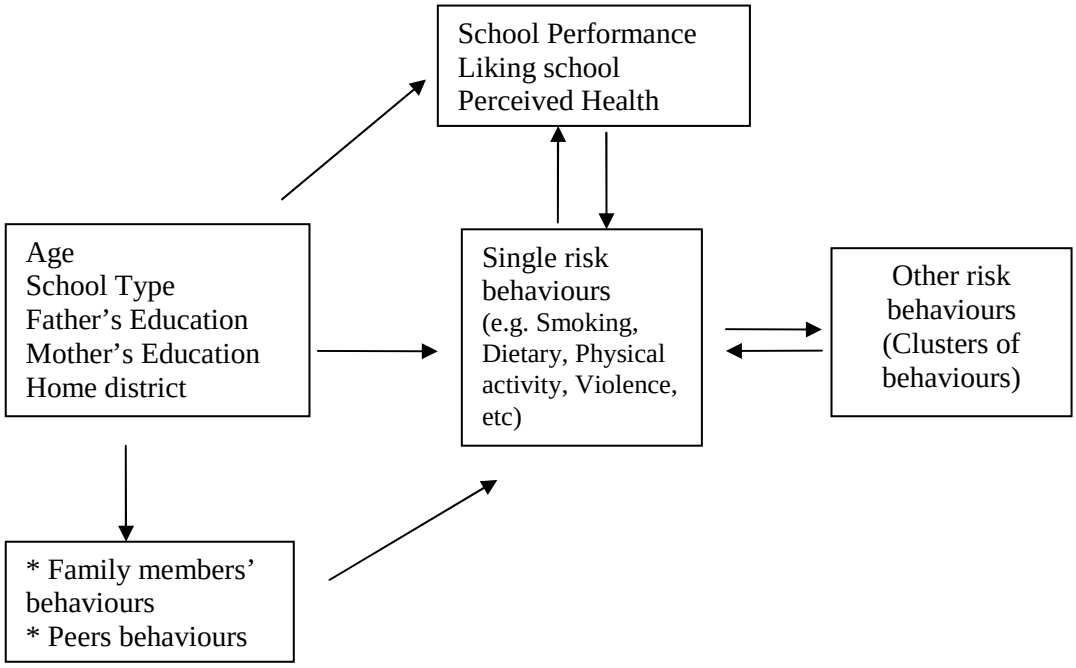
P-values from likelihood ratio test for all variables in all results tables from logistic regression (F-tests for linear regression models) were reported. Likelihood ratio or F-tests were used to determine if there was an overall significant association for each variable. Where there were more than 2 levels of variable Wald or t-test for binary logistic or linear regression models respectively, were used to test for difference between different levels of these variables. The odds ratios (OR) with a 95% confident interval (CI) from logistic regression was reported for related risk factors of each health risk behaviours. I tried not to force the models, although I included several risk behaviour variables in one model. The purpose of entering variables within different domains simultaneously was to reduce the number of models computed, and to identify the variables independently associated statistically. Automatic removal techniques (backwards or forward removal) were not applied since several variables from different domains were entered in one model and because it was recognised that risk behaviours tend to cluster. Alternatively, the non significant variables were removed one by one in a time starting with highest non significant value.

However, there were several stages have been followed for all behaviours. Stage one; aim to investigate the association between the behaviour and the socio-demographic variables. I start the regression analyses by using simple regression where I investigate the association between single behaviour, for example smoking behaviour and the all the socio-demographic variables (e.g. first model). Personal and socio-demographic backgrounds are associated with behaviours. For example, it has been found that risk behaviours increase with age (Currie et al., 2004, 2008; Shaw et al., 2010) and boys seem to have a higher number of concurrent risk behaviours (Chou et al., 2006; Brener and Collines, 1998; Currie et al., 2008; Shaw et al., 2010). In the second model, I investigate the interaction of parental education when I include the father and mother education interaction in the regression model since in the preliminary analysis I found that father's and mother's education were highly correlated. In model 3, I start to remove the non significant variable one every time.

Stage two; aim to investigate the association between single behaviour and school variables (school performance and school satisfaction) and general perceived health status. I start the analyses by using simple regression where I investigated the association between single behaviour and school performance, school satisfaction and

perceived health status while controlling for socio-demographic variables (e.g. first model). Studies have reported that students' perceptions of school are related to academic achievement (Kristjansson et al., 2009), socioeconomic position (Koivusilta et al., 2006; Koivusilta et al., 2003). Also, self reported academic achievement has been shown to be associated with multiple risk behaviours and may play a role in the adoption of risk behaviours (Kristjansson et al, 2010; Martins and Alexandre, 2009; Lynskey and Hall, 2000; Patterson et al, 2004; Schnohr et al., 2009). In model two, because liking school and school satisfactions were highly correlated in the preliminary analysis, I included the interaction of school performance and school satisfaction to the model and in model 3, I removed the non significant variables one every time. In the third stage the aim is to investigate the co-occurrence (clustering) of health risk behaviours. There is evidence that health risk behaviours tend to cluster together, with similar risk factors for many different risk behaviours (Lindberg et al., 2000; Brener and Collins, 1998; DuRant et al., 1999; Viner et al., 2006; Rhee et al., 2007). In model 1, I investigated the association between single behaviour and several health related behaviours while adjusting for socio-demographic status. Then, I start to remove the non significant variable from the model. (See figure 4.2 below). Finally, all significant variables in the final model of each stage were included in one final regression model, which allowed identification of whether variables are truly independently associated with outcomes, rather than due to confounding by unanalysed variables in the separate models. Moreover, all the final models were re-run excluding the non-significant variables.

Figure 4-2.Analytical approach



Family and peers behaviours were only investigated with regard to students smoking and physical activity behaviours.

In each model, I tested and reported the goodness-of-fit test (Hosmer and Lemeshow Test and Omnibus Test). Non-significant Hosmer and Lemeshow test means the model fit the data well and explains the most variables and the higher the value of Hosmer and Lemeshow, the better model is. On the other hand Omnibus Test shows whether the explained variance in a set of data is significantly greater than the unexplained variance, overall, and has to be significant for best fit model. In SPSS if there are missing values in at least one variable the entire observation is not included in the analysis, and SPSS automatically do so by default.

There has been growing interest in considering factors defined at multiple levels in public health research. Over the past few years multilevel analysis has emerged as one analytical strategy that may partly address this need. In the context of my study there is chance for significant clustering of behaviours among pupils amongst specific class or school and that because adolescents students are clustered within classes and within schools and these might influence adolescents behaviours due to peer pressure or significant impacts of individual teachers. I acknowledge that this is a limitation of my analysis, but multi-level analysis could be the subject of further research.

However, in my study there all the students were from Riyadh, all the students were male (e.g. no gender differences), no race differences (e.g. all Arab and Muslim) and all students were from high schools. Moreover, there were no previous social, psychological, economical research data suggesting differences among adolescents in different districts in Riyadh.

4.17 Limitations of the study

- Adolescent middle school students were not included in this study. Although health risk behaviour may start at early ages
- Due to political, religion and cultural reasons, female adolescent students are separated in schools from male students; therefore, female students could not be reached by the researcher and will not be included in this study, although there is no doubt that their future role in community and family health is fundamental.
- This study is based on self-reported questionnaire, and the extent of underreporting or over reporting of behaviours cannot be determined. Yet, the pilot study was conducted and validity was satisfying.
- The study includes only adolescents who attend male high schools; therefore, the study is not representative for all male adolescents.

  The study took place in Riyadh city; therefore, the study is not representative for all adolescents in Saudi Arabia.

4.18 Summary

This study will advance the methods used in previous studies in Saudi Arabia. First, it has used multi-stage stratified sampling. Second, quite large sample size was recruited from public and private school, using proportionate rate. Third, the questionnaires were distributed and collected by one researcher, which yield for more accurate process and eliminating ‘interviewer biases. Fourth, I used univariate analysis (descriptive analyses and Chi-square test), and regression analyses using binary regression and linear regression to investigating the association between outcome and several predictors. Also, the regression analyses take several stages following analytical approaches.

5. Chapter Five: Results 1, Descriptive Analyses

5.1 Introduction

The results of this study reflect the health-risk behaviours among male adolescents in high school students in the capital city of Riyadh, Central Province, Kingdom of Saudi Arabia. The results are presented as follows:

- Response rate.
- Participants' personal and background characteristic.
- Dietary behaviours and oral health related behaviours
- Physical behaviours.
- Tobacco smoking.
- Injuries, violence, safety related behaviours and mental health.

5.2 Response Rate

The required sample size was a total of 1,494 students (for details see chapter 4). Ten male private and public high schools were visited in five districts of Riyadh city. 1560 questionnaires were distributed, and 1546 questionnaires were collected from students. The collected questionnaires were reviewed and checked by the researcher. 45 questionnaires were excluded for different reasons such as, left fully or partially not completed, have some papers missing or found not completed seriously. A total of 1501 questionnaires were found to be appropriate to be entered into the SPSS programme. The students who participated in this study were obtained from all high school levels 1st, 2nd and 3rd grade. Furthermore, the response rates for the items of the questionnaire were 100% for the most of the questionnaire items, and only a few items show some low missing answers up to 2%.

5.3 Adolescent Students' Background Characteristics:

5.3.1 Age

Table 5.1 shows that the age of the students in this study ranged between 15 to 20 years old, with mean age of 17.4 years and standard deviation (SD) of ±1.18 and the modal and median age was 17 years. 354 (23.5 %) of the students were between the age of 15 and 16 years old, and 891 (59.3%) of the students were between 17 and 18 years, whereas 356 (17.1%) of the students were 19 years of age or older.

Table 5-1. Social and demographic characteristics:

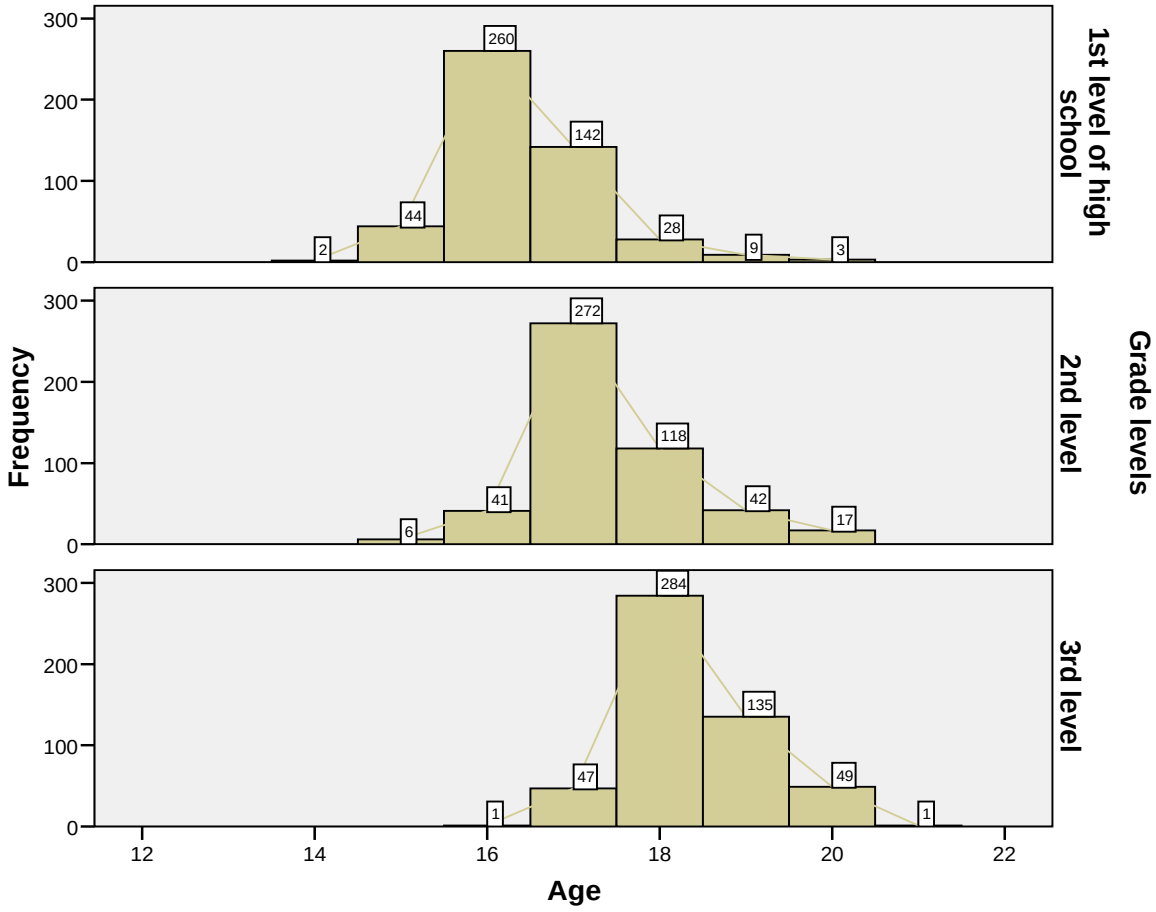
Variable	No.	%
Age		
15	52	3.4
16	302	20.1
17	461	30.7
18	430	28.6
19	186	12.4
20	70	4.7
Total	1501	100
Age (grouped)		
⩽16	354	23.6
17-18	891	59.4
⩾19	256	17.1
Total	1501	100
School class level		
1st grade	488	32.5
2nd grade	496	33.0
3rd grade	517	34.4
Total	1501	100
Home location (district)		
North	301	20.1
South	296	19.7
Central	318	21.2
West	279	18.6
East	305	20.3
Total	1499	100
School location (district)		
North	292	19.5
South	300	20.0

Central	300	20.0
West	298	19.9
East	311	20.7
Total	1501	100
Father's educational Level		
⩽12 years of education	949	63.9
> 12 years of education	536	36.1
Total	1485	100
Mother's educational Level		
⩽12 years of education	1197	80.9
>12 years of education	283	19.1
Total	1480	100
Nationality		
Saudi	1338	89.6
Non-Saudi	155	10.4
Total	1493	100
Perceived school Performance		
Good	1099	74.1
Poor	385	25.9
Total	1484	100
Liking school		
I like it	879	58.8
I do not like it	615	41.2
Total	1494	100
Perceived health		
Good	1442	96.1
poor	52	3.5
Total	1494	100
Disease type		
Respiratory disease	229	15.3
Blood disease	162	10.8
Musculoskeletal disorder	53	3.5
Hypertension	32	2.1
Cardiovascular disease	21	1.4
Diabetes	17	1.1
Kidney disease	15	1
Liver disease	7	0.5
Cancer	1	0.1

5.3.2 Class level

The educational level of the students ranged from 1st-3rd level of high school (equal to 10th, 11th, and 12th grades). 488 (32.5%) were in the 1st level of their high school, 224 (33%) were in the 2nd level of high school, whereas 517 (34%) of the students were in the 3rd level. The mean age for the students in the 1st level was 16.4 years old with standard deviation of ± 0.8, while the mean age of the student in 2nd level was 17.4 years and standard deviation of ± 0.9, whereas the mean age of the 3rd level students was 18.4 years old (See Table 5.1).

Figure 5-1. Age range among different school levels



5.3.3 School type

In this study, the majority of students were selected from public school in contrast to private school. A total of 1032 (69%) of the students were studying in public schools, whereas 469 (31%) of the students were studying in private schools (See Table 5.1).

5.3.4 Location of schools

Schools were meant to be sampled equally from five different parts of Riyadh city; north, south, central, east, west districts of the city with two different types of schools in each area, public and private (See Table 5.1). Students' school district and their home district were strongly associated ($p < 0.001$) (See Table 5.2).

Table 5-2. The association between school district and home district

Variable	School district											
	North		South		Central		West		East		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Home												
North	274	91.0	0.0	0.0	12	4.0	13	4.3	2.0	0.7	301	20.1
South	0.0	0.0	292	98.6	2.0	0.7	2	0.7	0.0	0.0	296	19.7
Central	9	2.8	3	0.9	278	87.4	19	6.0	9	2.8	318	21.2
West	7	2.5	5	1.8	4	1.4	263	94.3	0	0.0	279	18.6
East	2	0.7	0	0.0	2	0.7	1	0.3	300	98.4	305	20.3
Total	292	19.5	300	20	298	19.9	298	19.9	311	20.7	1499	100
(χ^2=5128.187, d.f.=16, p <0.001)												

5.3.5 Student's father's educational level

A total of 536 (36.1%) of the students fathers in this study were well educated, having ≥ 12 years of education, whereas 410 (27.6%) of the fathers had a diploma or high school degree, 451 (30%) had intermediate school or primary school certificate, and the minority (n=88, 5.9%) were illiterate (See Table 5.1). There is a significant association between father's educational status and district of home living in Riyadh. The north district of Riyadh has the most fathers highly educated; whereas the least educated (≤ 12 years) fathers were in the east district of Riyadh (Table 5.3).

Table 5-3. The association between father's educational level and home districts

	Father's educational level					
	≤12 years of education		>12 years of education		Total	
	No.	%	No.	%	No.	%
Home						
North	108	36.2	190	63.8	298	20.1
South	228	78.6	62	21.4	290	19.6
Central	174	55.1	142	44.9	316	21.3
West	196	71.5	78	28.5	274	18.5

East	241	79	64	21	305	20.6
Total	947	63.9	536	36.1	1483	100

(χ^2 =173.805, d.f.= 4, p <0.001)

5.3.6 Students' mothers' educational level

A total of 220 (14.9%) of the students' mothers' were illiterate whereas 541 (36.6%) of the students' mothers had either primary or intermediate education degrees. Students' mothers who had high schools /diploma or a bachelor degree were 29.5% and 19.3% respectively (See Table 5.1). Also, there is a significant association between mother's educational level and district of home living in Riyadh. The north district of Riyadh has the most mothers' highly educated, whereas the least educated mothers belong to the east district of Riyadh (Table 5.4).

Table 5-4. The association between a mother's educational level and distinct of student's home

	Mother's educational level					
	≤12 years of education		>12 years of education		Total	
	No.	%	No.	%	No.	%
Home						
North	200	67.8	95	32.2	295	20.0
South	255	87.9	35	12.1	290	19.6
Central	239	75.2	79	24.8	318	21.5
West	235	85.1	41	14.9	276	18.7
East	266	89	33	11.0	299	20.2
Total	1196	80.9	283	19.1	1478	100

(χ^2 =64.52, d.f.= 4, p<0.001)

5.3.7 The association between father's and mother's education:

Father's education and mother's education were positively associated. The majority (92.2%) of students' fathers who have ≤ 12 years of education, their wife also has ≤ 12 years of education (Table 5.5).

Table 5-5. Association between mother's and father's educational level

Father's Educational level	Mother's educational level					
	≤12 years of education		>12 years of education		Total	
	No.	%	No.	%	No.	%
≤12 year's edu.	864	92.2	73	7.8	937	63.9
>12 year's edu.	321	60.6	209	39.4	530	36.1
Total	1185	80.8	282	19.2	1467	100

(χ^2=218.14, d.f.= 1, p<0.001)

5.3.8 Academic performance:

A total of 601 (40.5%) of the study sample stated their school performance as Very good or more, and 497 (33.5%) stated their performance at Good level. 320 (21.6%) of the students consider their school performance at Average, whereas 65 (4.4%) of the students stated their performance as poor (See Table 5.1).

5.3.9 Liking School:

A total of 142 (9.5%) of the students stated they like school a lot and 737 (49.3%) of the students like school a bit. A number of 252 (16.9%) of the students do not like schools, whereas 363 (24.3%) of the students hate their schools (See Table 5.1).

5.3.10 The association between student's academic performance and school satisfaction:

The data show a significant positive association between good academic performance and liking school (Table 5.6). As the data are cross-sectional, it is not possible to infer the direction of this relation: that is, whether reported students academic performance affect liking school or vice versa. There are arguments for both views. It seems reasonable that young people who do well in school tend to like school, but other can argue that young people who like school are more interested and could be motivated to do well in school more than who do not like school.

Table 5-6. The association between liking school and school performance

School performance	Liking School					
	Like School		Dislike school		Total	
	No.	%	No.	%	No.	%
Good	701	64.0	394	36.0	1095	74.1
Poor	166	43.3	217	56.7	383	25.9
Total	867	58.7	611	41.3	1478	100

(χ^2=49.989, d.f. = 1, p<0.001)

5.3.11 The association of father's education with student's school performance and liking school:

Students' school performance and liking school were positively statistically associated with father's education level (See Table 5.7). The majority of students who reported performing well in school and liking school had highly educated fathers.

Table 5-7. The associations between father's educational and student's school's performance and liking schools

	Father's educational level					
	≤12 years of education		>12 years of education		Total	
	No.	%	No.	%	No.	%
School performance						
Good	655	60.0	436	40.0	1091	74.2
Poor	283	74.7	96	25.3	379	25.8
Total	938	63.8	532	36.2	1470	100
χ^2	χ^2 =26.066, d.f.= 1, p<0.001					
Liking School						
Like School	526	60.7	340	39.3	866	58.6
Do not like school	418	68.3	190	31.7	612	41.4
Total	944	63.9	534	36.1	1478	100
χ^2	χ^2 =8.879, d.f.= 1, p=0.003					

5.3.12 The association of mother's education and students' school performance and liking school:

Students' school performance was positively statistically associated with mother's education level, whereas liking school was not associated with mother's education level (See Table 5.8).

Table 5-8. Associations between mother's educational level and students' school performance and liking schools

	Mother's educational level					
	≤12 years of education		>12 years of education		Total	
	No.	%	No.	%	No.	%
School performance						
Good	843	77.6	243	22.4	1086	74.2
Poor	337	89.4	40	10.6	377	25.8
Total	1180	80.7	283	19.3	1463	100
χ^2 =24.813, d.f.= 1, p<0.001						
Liking School						
Like School	695	80.3	170	19.7	865	58.7
Do not like school	495	81.4	113	18.6	608	41.3
Total	1190	80.8	283	19.2	1473	100
χ^2 =0.262, d.f.= 1, p=0.61						

5.3.13 Health status:

The majority 96.1% of the students reported their health as Good, whereas only 3.5% of the students perceived themselves as having poor health (See Table 5.1). Self reported health status was statistically associated with reported school performance level since 74.5% of the students who perceived themselves at Good health reported performing Good at school (See Table 5.9).

Table 5-9. The Association between students health status and school performance

	School Performance					
	Good		Poor		Total	
Health Status	No.	%	No.	%	No.	%
Good	1062	74.5	363	25.5	1425	96.5
poor	31	59.6	21	40.4	52	3.5
Total	1093	74.0	384	26.0	1477	100

(χ^2=5.794, d.f.= 1, p=0.01)

5.4 Dietary behaviours:

5.4.1 Eating breakfast:

A total of 550 (36.7%) students in this study ate breakfast almost every day (five or more days per week), on the other hand 431 (28.8%) of the total students do not eat a breakfast meal. 4.7% and 10.8% of the students ate breakfast one day or two days respectively, whereas 10.1 % and 8.9% of the students ate breakfast between three to four days respectively (Table 5.10).

5.4.2 Eating breakfast and students' age, class level, school type, and nationality:

Only students' age was associated with breakfast eating behaviour. ANOVA statistical test was applied and a significant difference was found (F=2.3, df =5, p value= 0.04). Also, cross-tabulation showed that eating breakfast regularly is associated with younger age. There were no significant associations between breakfast eating and student's type of school and nationality.

Table 5-10. The association between eating breakfast and students' class level, type of school and students nationality.

Variables	Eating breakfast						
	Skipping breakfast		≥5 days/week		Total		
	N	%	N	%	N	%	χ^2 Test
Age							
≤16	169	55.5	157	44.5	353	23.6	
17-18							
≥19	582	65.5	307	34.5	889	59.4	χ^2= 12.232
Total	170	66.7	85	33.3	255	17.0	d.f.= 2
	948	63.3	549	36.7	1497	100	*p*= 0.002
Class level							
1st	286	58.8	200	41.2	486	32.5	χ^2= 6.557
2nd	319	64.6	175	35.4	494	33	d.f.= 2
3rd	343	66.3	174	33.7	517	34.5	*p*= 0.014
Total	948	63.3	549	36.7	1497	100	
School type							
Public	661	64.2	369	35.8	1030	68.8	χ^2=1.023
Private	287	61.5	180	38.5	467	31.2	d.f.= 1
Total	948	63.3	549	36.7	1497	100	*p*= 0.312
Nationality							
Saudi	851	63.8	483	36.2	1334	89.6	χ^2= 1.959
Non-Saudi	90	58.1	65	41.9	155	10.4	d.f.= 1
Total	941	63.2	548	36.8	1489	100	*p*=0.162

5.4.3 The association between eating breakfast and fathers' and mothers' educational level and home district:

There was no association between student's breakfast eating and parents' education or living district (Table 5.11).

Table 5-11. The association between eating breakfast and fathers' and mothers' educational level and home district.

Variables	Eating breakfast						
	≤ 5 days/week		≥ 5 days/week		Total		χ^2 Test
	N	%	N	%	N	%	
Fathers' edu.							
≤12 years	612	64.7	334	35.3	946	63.9	χ^2= 2.508
> 12 years	324	60.6	211	39.4	535	36.1	d.f.= 1
Total	936	63.2	545	36.8	1481	100	*p*= 0.113
Mothers' edu.							
≤12 years	762	63.9	431	36.1	1193	80.8	χ^2= 0.942
> 12 years	172	60.8	111	39.2	283	19.2	d.f.= 1
Total	934	63.3	542	36.7	1476	100	*p*= 0.332
Home District							
North	180	59.8	121	40.2	301	20.1	χ^2= 8.522
South	198	66.9	98	33.1	296	19.8	d.f.= 4
Central	217	68.2	101	31.8	318	21.3	*p*= 0.074
West	171	61.7	106	38.3	277	8.5	
East	181	59.7	122	40.3	303	20.3	
Total	947	63.3	548	36.7	1495	100	

5.4.4 Reasons for not eating breakfast among students:

The survey showed that 387 high school students (40.8%) reported they dislike to eat early in the morning, whereas 383 (40.5%) reported they do not usually have time for breakfast. 96 (10.8%) of the participants reported that no prepared food for breakfast as the main reasons for not having breakfast. 8.5% of the students reported other reasons. There was no significant difference for reasons of not eating breakfast among students and their socio-demographic characteristics (Table 5.12).

Table 5-12. Reasons for not eating breakfast among students

Reasons for not eating Breakfast	N	%
I dislike to eat early in the morning	386	40.8
I do not have time for breakfast	383	40.5
There is no prepared food for breakfast in the home	96	10.2
Other reason	80	8.5
Total	945	100

5.4.5 Eating lunch and dinner

Lunch and evening meal (dinner) were eaten almost every day by the majority of the students. A total of 75.6% and 71% of the students ate lunch and evening meal respectively five days or more during usual weeks. Unlike breakfast eating behaviour, there were not any significant differences regarding eating lunch and dinner in relation with students' socio-demographic variables (Table 5.13).

Table 5-13. Eating lunch and dinner

Number of days	Lunch		Dinner	
	N	%	N	%
Never	71	4.8	59	4.0
One day	25	1.7	19	1.3
Two days	58	3.9	50	3.4
Three days	66	4.4	120	8.1
Four days	143	9.6	183	12.3
Five days and more	1125	75.6	1055	71.0
Total	1488	100	1486	100

5.4.6 Student's body weight

5.4.6.1 Perception of body weight

More than one third (32%) of high school students describe themselves as overweight and 25.3% described their weight as underweight, whereas 42.8% think that they are among the normal weight.

5.4.6.2 Student's actual weight:

A total of 287 students (19.3%) were underweight, whereas less than the half of the total students, 661 (44.4%) were among normal weight range. On the other hand, 279 (18.7%) of the students were overweight and 262 (17.5%) were obese.

5.4.6.3 The association between student's self described weight and actual BMI:

Students self-described weight were compared to the students actual BMI category. Spearman correlation test show good correlation between the two variables r= 0.686 and p<0.001. Also, Chi-square for trend was applied and positive significant association was found between students self described weight and actual BMI (Table 5.14).

Table 5-14. The association between actual BMI category and student's weight perception:

Weight perception	Actual BMI category							
	Underweight		Normal weight		Over weight		Total	
	N	%	N	%	N	%	N	%
Underweight	188	50.1	178	47.5	9	2.4	375	25.3
Normal weight	90	14.1	408	63.9	140	21.9	638	43.1
Over weight	8	1.7	69	14.7	391	83.5	468	31.6
Total	286	19.3	655	44.2	540	36.5	1481	100

(χ^2=858.268, d.f.= 4, p<0.001)

5.4.6.4 Students measuring their weight during the last 12 months

Self weighted measurement is not a common behaviour among adolescents in Saudi. Only about 57% of the total students reported measuring their weight in the last 12 months.

5.4.6.5 Methods of losing weight:

A total of 37.3% of the students in this study practised physical activity to lose weight. Also, a total of 28.1% of the students tried to eat less food or fewer calories to lose weight. Although, a total of 36.3% of the students were found to be overweight or obese, only 53.7% of them practised sport exercise and 61.4% have tried to eat less calories or food to lose weight. There were a significant correlation between student's BMI and practicing physical exercise as a methods of weight control, overweight students were more likely to report having exercise during the past 30 days to control weight (53.7%), χ^2=131.304, d.f.= 2, p< 0.001. Also, overweight students were more likely to report eating less food or less high fat food in the past 30 days to control weight (61.4%), χ^2=167.680, d.f.= 2, p< 0.001. Surprisingly, although practicing sport exercise is most common used methods to lose weight or keeping from gaining weight among high school students', eating less food or fewer calories is most common methods to lose weight among overweight or obese. (Table 5.15).

Table 5-15. The association between losing weight methods and BMI category:

Methods of weight control	BMI category							
	Underweight (< 18.50)		Normal weight (18.50- 24.99)		Over weight (≥ 25)		Total	
	No.	%	No.	%	No.	%	No.	%
Exercising in the past 30days								
Yes	50	9.0	207	37.3	298	53.7	555	37.3
No	236	25.3	454	48.7	243	26.0	933	62.7
Total	286	19.2	661	44.4	541	36.4	1488	100
χ^2=131.304, d.f.= 2, p< 0.001								
Eating less food /less fat								
Yes	25	6.0	135	32.6	254	61.4	414	28.1
No	256	24.2	521	49.2	283	26.7	1060	71.9
Total	281	19.1	656	44.5	537	36.4	1474	100
χ^2=167.680, d.f.= 2, p< 0.001								

5.4.6.6 The association between student's BMI category and students' age, school class, type of school and students nationality

There was a significant positive association between overweight and student's older age. Older students and students in higher level were found to be overweight compare to younger student. Also, Saudi students were found to be significantly overweight than non-Saudi students (Table 5.16).

Table 5-16. The association between students' BMI category and students' age, school class, type of school and students nationality

Variables	Underweight (< 18.50)		Normal weight (18.50- 24.99)		Over weight (≥ 25)		Total	
	No.	%	No.	%	No.	%	No.	%
Age								
≤16	96	27.5	151	44.5	102	23.6	349	23.4
17-18	156	17.6	388	43.7	343	38.7	887	59.6
≥19	35	13.8	122	48.2	96	38.0	253	17.0
Total	287	19.3	661	44.4	541	36.3	1489	100
χ^2= 19.517, d.f.=4, p< 0.001								
Class level								
1st	113	23.4	213	44.2	156	32.4	482	32.4
2nd	99	20.0	215	43.4	181	36.6	495	33.2
3rd	75	14.6	233	45.5	204	39.8	512	34.4
Total	287	19.3	661	44.4	541	36.3	1489	100
χ^2= 12.488, d.f.=4, p< 0.001								
School type								
Public	194	18.9	448	43.8	382	37.3	1024	68.8
Private	93	20.0	213	45.8	159	34.2	465	31.2
Total	287	19.3	661	44.4	541	36.3	1489	100
χ^2=1.052, d.f.=2, p= 0.305								
Nationality								
Saudi	266	20	573	43.1	489	36.8	1328	89.7
Non-Saudi	20	13.1	84	54.9	49	32.0	153	10.3
Total	286	19.3	657	44.4	538	36.3	1481	100
χ^2=8.581, d.f.=2, p= 0.014								

5.4.6.7 The association between students' BMI category and fathers' and mothers' education and living district:

There was a significant association between students' BMI and fathers' and mothers' education. Students whose fathers' and mothers' were highly educated, were more among the overweight. Also, there is a significant difference among groups in

relation to students' BMI. It showed that students living in the west were less likely to report being overweight, followed by students live in the east district. On the other hand, students who live in the central district of the city were more to report overweight, followed by students live in the south and north district.

Table 5-17. The association between student's BMI category and fathers' and mothers' education:

Variables	Underweight N	%	Normal weight N	%	Over weight N	%	Total N	%
Fathers' edu.								
≤ 12 years	197	20.9	425	45.2	319	33.9	941	63.9
> 12 years	85	16.0	229	43.0	218	41.0	532	36.1
Total	282	19.1	654	44.4	537	36.5	1473	100
χ^2= 9.352, d.f.= 2, *p*= 0.002								
Mothers' edu.								
≤ 12 years	237	19.9	36	45.1	415	34.9	1188	80.9
> 12 years	41	14.6	119	42.5	120	42.9	280	19.1
Total	278	18.9	655	44.6	535	36.4	1468	100
χ^2= 7.577, d.f.= 2, *p*=0.006								
Home district								
North	41	13.8	141	47.3	116	38.9	298	20.0
South	52	17.7	126	42.9	116	39.5	294	19.8
Central	62	19.6	125	39.6	129	40.8	316	21.3
West	59	21.5	132	48.0	84	30.5	275	18.5
East	73	24.0	135	44.4	96	31.6	304	20.4
Total	287	19.3	659	44.3	541	36.4	1487	100
(χ^2= 20.028, d.f.= 8, *p*= 0.01)								

5.4.6.8 Students' BMI category and eating food high in fat, eating at fast food restaurant, and eating between meals

There was no association between students' BMI category and eating high fat food or eating in restaurant. There is a significant difference among weight groups with regard to eating between meals. Overweight students reported less to eat ≥ 2 times between meals compare to other groups (Table 5.18).

Table 5-18. The association between student's BMI category and eating food high in fat and at fast food restaurant

Variables	Underweight No.	%	Normal weight No.	%	Overweight N0.	%	Total No.	%
Eating food high in fat								
≤ 0 time every day	182	19.8	406	44.1	333	36.2	921	62.0
≥ 1 time everyday	105	18.6	251	44.5	208	36.9	564	38.0
Total	287	19.3	657	44.2	541	36.4	1485	100

χ^2= 0.231, d.f.= 2, p= 0.631								
Eating at restaurant								
I don't usually eat	216	20.0	475	43.9	391	36.1	1082	72.9
≥ 1 time everyday	71	17.7	183	45.5	148	36.8	402	27.1
Total	287	19.3	658	44.3	539	36.3	1484	100
χ^2= 0.493, d.f.= 2, p= 0.483								
Eating between meal								
≤1 time	165	16.3	429	42.3	419	41.4	1013	68.2
≥2 times	121	25.6	231	48.9	120	25.4	472	31.8
Total	286	19.3	660	44.4	539	36.3	1485	100
χ^2= 39.072, d.f.= 2, p< 0.001								

5.4.6.9 Students' BMI category and consuming vegetables and fruit, drinking soft drink and energy drink.

Eating fruit and vegetables and drinking soft drink were not associated with students' BMI. On the other hand, not eating sweets and not drinking energy drink were positively associated with overweight, and more prevalent among overweight students (Table 5.19).

Table 5-19. The association between BMI category and dietary behaviours

Items	Underweight		Normal weight		Overweight		Total	
	No.	%	No.	%	No.	%	No.	%
Fruit								
≤ 0 time a day	218	19.4	484	43.1	421	37.5	1123	75.8
≥ 1 time a day	67	18.7	174	48.5	118	32.9	359	24.2
Total	282	19.2	658	44.4	539	36.4	1482	100
χ^2= 3.44, d.f.= 2, p= 0.179								
Vegetables								
≤ 0 time a day	170	19.1	389	43.7	332	37.3	891	60.1
≥ 1 time a day	116	19.6	269	45.5	206	34.9	591	39.9
Total	286	19.3	658	44.4	538	36.4	1482	100
χ^2=0.898, d.f.= 2, *p= 0.638*								
Sweets								
≤ 0 time a day	127	16.7	330	43.4	304	39.9	761	51.3
≥ 1 time a day	158	21.9	328	45.5	235	32.6	721	48.7
Total	285	19.2	658	44.4	539	36.4	1482	100
χ^2=11.140, d.f.= 2, p= 0.004								
Soft Drink								
≤ 0 time a day	76	17.2	200	45.1	167	37.7	443	29.9

≥ 1 time a day	210	20.3	456	44.0	371	35.8	1037	70.1
Total	286	19.3	656	44.3	538	36.4	1480	100
χ^2=1.959, d.f.= 2, *p*= 0.377								
Energy Drink								
≤ 0 time a day	204	18.4	477	43.1	427	38.5	1108	74.8
≥ 1 time a day	80	21.4	181	48.5	112	30.0	373	25.2
Total	284	19.2	658	44.4	539	36.4	1481	100
χ^2= 8.778, d.f.= 2, *p= 0.012*								

5.4.7 Type of Food:

Results showed that students in this study consumed sweets and carbonated drinks-fizzy drinks much more than vegetables and fruits. A total of 70.1% and 48.7% of the students reported drinking soft drinks and eating sweets respectively more than four times per day, whereas only 24.2% and 40% eat fruits and vegetables every day, respectively. Only 18.3% of the total students consumed milk and milk products at least three times per day (Table 5.20).

Table 5-20. Food Frequencies

Items	Never/Not daily		1-2 times		3-4 times		≥ 5 times		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Fruit	1132	75.8	257	17.2	68	4.6	37	2.5	1494	100
Vegetables	898	60.1	391	26.2	91	6.1	114	7.6	1494	100
Milk	710	47.6	510	34.2	109	7.3	164	10.9	1493	100
Fish prod.	1353	90.7	110	7.4	23	1.5	6	0.4	1492	100
Sweets	767	51.3	431	28.8	143	9.5	153	10.2	1494	100
Soft drinks	446	29.9	446	29.9	235	15.8	365	24.5	1492	100
Energy drinks	1117	74.8	204	13.7	72	4.8	100	6.7	1493	100

5.4.8 School role in students' nutritional behaviours:

Only 57.6% of the total students stated that they have been taught during any time of their school years about the importance and the benefit of eating healthy diets. Only 57.7% of the students stated they have been taught about the benefits of eating more fruits and vegetables. 66.7% of the students in this study stated they have been

taught about the benefit of consuming milk and milk products. The majority of the students are not aware of different and healthy methods of gaining weight or losing weight since only 16.1% and 18.9% of the total students stated that they have been taught about how to gain or lose weight respectively (Table 5.21).

Table 5-21. School role in students' nutritional behaviours

Variables	No.	%.
Taught about the benefit of healthy eating	863	57.6
Taught about the benefit of eating fruits and vegetables	862	57.7
Taught about the benefit of drinking Milk	999	66.7
Taught about the healthy way to gain weight	242	16.1
Taught about the healthy way to lose weight	283	18.9
Taught about how to safely prepare and store food	538	36.0
Taught about how to make healthy meals and snacks	543	36.4

5.4.9 Sources of nutritional information and knowledge:

Among the different sources of knowledge, family and media were the most common sources of information regarding nutrition and diet, 70% and 49.9% respectively. Friends and internet were considered as source of information for about 25.5% and 25% of the students respectively. Unfortunately, school comes as the fifth sources of information since only 18.3% of the students reported school as source of knowledge.

5.4.10 The need for nutritional health education:

From all above data and, it is clearly that nutritional behaviours, overweight and obesity status, nutritional knowledge are in need for improvement and critical work to tackle the serious problems that may occur in future. Out of 1501 students 90% stated that they need a health education programme regarding diet and nutrition.

5.5 Oral health and hygiene behaviours

5.5.1 Teeth health status and oral hygiene behaviours

Only 18.15% of the students describe their health of their teeth as very good, whereas 33.2% described their teeth as good. 35.8% of the students stated their teeth health status at average level. Students who describe their teeth as poor or very poor were about 12.9% (Table 5.22).

About 47.7% of the students do not usually brush teeth. Only about 29.7% and 22.6% brush their teeth once every day or more than once every day, respectively (Table 5.22).

Of the total students, only 29% stated never suffer from teeth pain. 41.3% stated suffer from teeth pain but rarely, 24.3% of the students suffer from tooth pain sometimes, and about 5.2% most of the time suffer from tooth pain during the last 12 months (Table 5.22).

A total of 16.4% of the students have missed some school days because of tooth pain. Only less than half of the students in this study (45.7%) visited the dentist in the last 12 months. Table below shows details (Table 5.22).

Table 5-22. Distribution of oral health hygiene variables:

Variable	No.	%
How would you describe the health of your teeth?		
Very Good	271	18.1
Good	496	33.2
Average	536	35.8
Poor	148	9.9
Very Poor	45	3.0
Total	1496	100
How often do you brush teeth?		
Never	500	33.4
Not every day	214	14.3
Once a day	445	29.7
Twice a day	247	16.5
3 or more a day	91	6.1
Total	1497	100
During the past 12 months, how often did you have a tooth ache?		
Never	437	29.2
Rarely	618	41.3
Sometimes	364	24.3
Most of the times	78	5.2
Total	1497	100
During the past 12 months, did a tooth pain cause you to miss school?		
Yes	245	16.4
No	1248	83.6
Total	1493	100
When was the last time you visit a dentist?		
During the past 12 months	681	45.7
Between 12-24 months	220	14.8
More than 24 months ago	588	39.5
Total	1489	100

5.5.1.1 Students' teeth health status and students' class level, type of school and nationality

Age has no significant association with perceived teeth health status. Students' study in private school or non-Saudi students were significantly different from public school students and Saudi students in relation to perceived good teeth status. Non-Saudi students and students in private school significantly reported good teeth health status (Table 5.23).

Table 5-23. The association between a student's teeth health status and student's class level, type of school and nationality

Variables	Teeth health status						
	Good		Poor		Total		χ^2 Test
	N	%	N	%	N	%	
Age							
≤16	190	24.8	164	22.5	354	23.7	χ^2= 5.873
17-18	464	60.5	424	58.2	888	59.4	d.f.= 2
≥19	113	14.7	141	19.3	254	17.0	*p*= 0.054
Total	767	51.3	729	48.7	1496	100	
Class level							
1st grade	265	54.4	222	45.6	487	32.6	χ^2= 4.209
2nd grade	255	51.6	239	48.4	494	33.0	d.f.= 2
3rd grade	247	48.0	268	52.0	515	34.4	*p*= 0.122
Total	767	51.3	729	48.7	1496	100	
School type							
Public school	498	48.5	529	51.5	1027	68.6	χ^2= 10.128
Private school	269	57.4	200	42.6	469	31.4	d.f.= 1
Total	767	51.3	729	48.7	1496	100	*P*<0.001
Nationality							
Saudi	663	49.7	670	50.3	1333	89.6	χ^2= 9.166
Non-Saudi	97	62.6	58	37.4	155	10.4	d.f.= 1
Total	760	51.1	728	48.9	1488	100	*p*= 0.002

5.5.1.2 Student's teeth health status and student's father's and mother's education, and living district:

Students whose father and mother were highly educated were more likely to report good teeth health status and the associations were significant. Also, there was a significant difference among different district groups in relation to teeth health status. Students who live in the central district, followed by students who live in the north district, were more likely to report good teeth health, whereas students' who were living in the west district, were more likely to report poor teeth (Table 5.24).

Table 5-24. The association between teeth health status and father's and mother's education:

Variables	Teeth health status						
	Good		Poor		Total		χ^2 Test
	N	%	N	%	N	%	
Father education							
≤12 years	450	47.7	494	52.3	944	63.8	χ^2= 13.629
> 12 years	309	57.6	227	42.4	536	36.2	d.f.= 2
Total	759	51.3	721	48.7	1480	100	*P*< 0.001
Mother education							
≤12 years	585	49.0	608	51.0	1193	80.9	χ^2= 12.289
> 12 years	171	60.6	111	39.4	282	19.1	d.f.= 2
Total	756	51.3	719	48.7	1475	100	*P*< 0.001
Home district							
North	162	54.0	138	46.0	300	20.1	
South	148	50.2	147	49.8	295	19.7	χ^2= 15.231
Central	186	58.5	132	41.5	318	21.3	d.f.= 4
West	120	43.2	158	56.8	278	18.6	*P*= 0.004
East	151	49.8	152	50.2	303	20.3	
Total	767	51.3	727	48.7	1494	100	

5.5.1.3 Students' brushing teeth among different students' class, school type and nationality:

The majority of students studying in private school (52.2%) and non-Saudi students (66.5 %) brush their teeth once or more daily. Age has no positive or negative significant association with brushing teeth, where as students studying in private school and non-Saudi were significantly more likely to brush their teeth daily (Table 5.25).

Table 5-25. The association between students brushing teeth among different students' class, school type and nationality

Variables	Brushing teeth						
	0 time/day		≥ 1 time a day		Total		χ^2 Test
	N	%	N	%	N	%	
Age							
≤16	162	45.8	192	54.2	354	23.6	χ^2= 2.657
17-18	419	47.2	469	52.8	888	59.3	d.f.= 2
≥19	133	52.2	122	47.8	255	17.0	*p*=0.265
Total	714	47.7	783	52.3	1497	100	
Class level							
1st grade	227	46.6	260	53.4	487	32.5	χ^2= 0.127
2nd grade	241	48.7	254	51.3	495	33.1	d.f.= 2
3rd grade	246	47.8	269	52.2	515	34.4	*p*= 0.721
Total	714	47.7	783	52.3	1497	100	
School type							
Public school	543	52.7	487	47.3	1030	68.8	χ^2= 33.393
Private school	171	36.6	296	63.4	467	31.2	d.f.= 1
Total	714	47.7	783	52.3	1497	100	*p*<0.001
Nationality							
Saudi	660	49.5	674	50.5	1334	89.6	χ^2= 14.117
Non-Saudi	52	33.5	103	66.5	155	10.4	d.f.= 1
Total	712	47.8	777	52.2	1489	100	*p*<0.001

Note: Brushing teeth behaviour was dichotomised to not brushing teeth daily vs. Brushing teeth at least once every day

5.5.1.4 Student's brushing teeth and fathers' and mothers' educational level, and living district:

Students whose father and mother were highly educated were more likely to brush their teeth once or more every day. There were significant differences among district groups and brushing teeth behaviours. Students who live in the north district followed by students live in the north district were more likely to report brushing teeth daily, whereas students who were living in the south and east district, followed by the west district were less to brush teeth daily (Table 5.26).

Table 5-26. The association between students brushing teeth and fathers' and mothers' educational level

Variables	Brushing teeth						
	0 time/day		≥ 1 time a day		Total		χ^2 Test
	N	%	N	%	N	%	
Fathers' edu.							
≤ 12 years	499	52.7	447	47.3	946	63.9	χ^2= 25.642
> 12 years	209	39.1	326	60.9	535	36.1	d.f.= 1
Total	708	47.8	773	52.2	1481	100	*p*<0.001
Mothers' edu.							
≤ 12 years	600	50.3	593	49.7	1193	80.8	χ^2= 17.712
> 12 years	103	36.4	180	63.6	283	19.2	d.f.= 1
Total	703	47.6	773	52.4	1476	100	*p*<0.001
Home district							
North	110	36.7	190	63.3	300	20.1	
South	159	53.7	137	46.3	296	19.8	χ^2= 24.824
Central	142	44.8	175	55.2	317	21.2	d.f.= 4
West	141	50.7	137	49.3	278	18.6	*p*<0.001
East	162	53.3	142	46.7	304	20.3	
Total	714	47.8	781	52.2	1495	100	

5.5.1.5 Students' brushing teeth behaviour and oral health status, having teeth pain and visiting dentist:

Brushing teeth behaviour was significantly associated with other oral hygiene factors. Brushing teeth daily was positively associated with good teeth status, not suffering from teeth pain and visiting a dentist during the past year (Table 5. 27).

Table 5-27. Association between brushing teeth and oral health status, having teeth pain and visiting dentist

Variables	Brushing teeth						
	0 time/day		≥1 time a day		Total		χ^2 Test
	N	%	N	%	N	%	
Oral health status							χ^2= 100.14
Good	269	35.1	497	64.9	766	51.3	d.f.= 1
Poor	444	61.0	284	39.0	728	48.7	*p*<0.001
Total	713	47.7	781	52.3	1494	100	
Teeth pain							χ^2= 18.789
Never/rarely	464	44.1	589	55.9	1053	70.4	d.f.= 1
Sometime/often	249	56.3	193	43.7	442	29.6	*p*<0.001
Total	713	47.7	782	52.3	1495	100	
Visiting dentist							
≤ 12 months	286	42.1	394	57.9	680	45.8	χ^2= 16.06
>12 months	423	52.5	383	47.5	806	54.2	d.f.= 1

Total	709	47.7	777	52.3	1486	100	$p<0.001$

5.5.2 Having teeth pain and consuming sweets, soft drinks and energy drink

Consuming sweets, soft drinks, and high energy drinks daily were all positively associated with suffering from teeth pain (Table 5.28).

Table 5-28. The association between having teeth pain and consuming sweets, soft drinks and energy drinks

Items	Teeth pain						
	Never		≥Sometimes		Total		χ^2 Test
	N	%	N	%	N	%	
Sweets							
Never/not daily	564	73.6	202	26.4	766	51.8	χ^2= 7.772
≥ 1 time a day	486	67.0	239	33.0	725	48.6	d.f.= 1
Total	1050	70.4	441	29.6	1491	100	p=0.005
Soft Drinks							
Never/not daily	345	77.5	100	22.5	445	29.9	χ^2=14.556
≥ 1 time a day	706	67.7	337	32.2	1043	70.1	d.f.= 1
Total	1051	70.6	437	29.4	1488	100	p<0.001
Energy Drink							
Never/ not daily	811	72.7	305	27.3	1116	74.9	χ^2=10.971
≥ 1 time a day	238	63.6	136	36.4	374	25.1	d.f.= 1
Total	1049	70.4	441	29.6	1490	100	p<0.001

5.5.3 Teeth pain and teeth health status and visiting dentist:

Good teeth health status was positively associated with not suffering from teeth pain ($p< 0.001$). Also, visiting dentist during the last 12 month preceding the survey was associated with not suffering from teeth pain ($p<0.001$) (Table 5.29).

Table 5-29. The association between teeth pain and health status and visiting dentist:

Variables	Teeth pain						
	Never		≥Sometimes		Total		χ2 Test
	N	%	N	%	N	%	
Teeth health status							χ2= 112.72
Good	633	82.6	133	17.4	766	51.3	d.f.= 1
Poor	419	57.6	309	42.4	728	48.7	
Total	1052	70.4	442	29.6	1494	100	p<0.001

Visiting dentist						
≤12 months	428	62.9	252	37.1	680	45.8	$\chi 2$= 37.39
>12 months	624	77.4	182	22.6	806	54.2	d.f.= 1
Total	1052	70.8	434	29.2	1486	100	p<0.001

5.6 Physical activity

5.6.1 Physical activity among adolescents:

Only 18.4% of the students meet the recommended guideline physical activity and practice physical activity ≥ 5 days per week. The majority of the students (31.1%) do not do any physical activity during the week. There is only one class a week of physical activity in schools, and about (34.8%) do not take part in this class.

13.5% of the students have no friends to practice physical activity. 46.5% and 40.0% of the students have some or most of their friends practice physical activity weekly, respectively. The majority of the students in our sample, their fathers (83.5%) and mothers (94.1%) do not practice physical activity at all, whereas 50.3% have one of their siblings who practice physical activity every week (Table 5.30).

Table 5-30. Distribution of physical activity behaviours:

Variable	**No.**	**%**
Physically active for at least 60 minutes per day		
Never	466	31.1
1 day	334	22.3
2 days	204	13.6
3 days	131	8.8
4 days	85	5.7
≥ 5 days	276	18.4
Total	1496	100
Participating in physical activity in school every week		
No	521	34.8
Yes	975	65.2
Total	1496	100
Father practice physical activity during the week		
Yes	247	16.5
No	1253	83.5
Total	1500	100
Mother practice physical activity during the week		
Yes	89	5.9
No	1411	94.1
Total	1500	100
Sibling practice physical activity during the week		
Yes	754	50.3
No	746	49.7
Total	1500	100
Friends practice physical activity every week		
None of them	202	13.5
Some of them	691	46.5
Most of them	594	40.0

Total	1501	100
How many hours in total do you usually watch television, or use computer daily?		
≤ 1 hour	321	21.5
2 hours	228	15.3
3 hours	256	17.1
≥ 4 hours	689	46.1
Total	1494	100
Do you think students need health education about physical health and sport?		
Yes	1323	88.6
No/ I do not know	170	11.4
Total	1493	100

5.6.1.1 Students' physical activity and students' class level, type of school and students nationality:

Age and class level were associated with physical activity behaviour. Younger students were more than any other age group to practice physical activity ≥ 3 days per week. School type and student's nationality were not associated with physical activity (Table 5.31).

Table 5-31. The association between students' physical activity and students' class level, type of school and students' nationality

Variables	Physical activity per week in the last 30 days						χ^2 Test
	Less active (< 3 day)		Active (≥ 3 days)		Total		
	N	%	N	%	N	%	
Age							
≤16	204	57.8	149	42.2	353	23.6	
17-18	626	70.5	262	29.5	888	59.4	χ2= 18.649
≥19	174	68.2	81	31.8	255	17.0	d.f.= 2
Total	1004	67.1	492	32.9	1496	100	p<0.001
Class level							
1st grade	286	58.8	200	41.2	486	32.5	χ2= 22.392
2nd grade	353	71.6	140	28.4	493	33.0	d.f.= 2
3rd grade	365	70.6	152	29.4	517	34.6	p<0.001
Total	1004	67.1	492	32.9	1496	100	
School type							
Public school	680	66.2	347	33.8	1027	68.6	χ2=1.202
Private school	324	69.1	145	30.9	469	31.4	d.f.= 1
Total	1004	67.1	492	32.9	1496	100	p=0.273
Nationality							
Saudi	900	67.5	433	32.5	1333	89.6	χ2= 0.837
Non-Saudi	99	63.9	56	36.1	155	10.4	d.f.= 1
Total	999	67.1	489	32.9	1488	100	p= 0.360

5.6.1.2 Student's physical activity and students' fathers' and mothers' education and living district:

There were no significant associations between students' physical activity and their fathers' and mothers' education and living district (Table 5.32).

Table 5-32. The association between student's physical activity and student's father's and mother's education and living district

Variables	Physical activity per week in the last 30 days						
	Less active (< 3 day)		Active (≥ 3 days)		Total		χ^2 Test
	N	%	N	%	N	%	
Fathers' edu.							
≤ 12 years	624	66.0	322	34.0	946	63.9	χ2= 1.713
> 12 years	370	69.3	164	30.7	534	36.1	d.f.= 1
Total	994	67.2	486	32.8	1480	100	p= 0.191
Mothers' edu.							
≤ 12 years	802	67.2	392	32.8	1194	80.9	χ2= 0.040
> 12 years	187	66.5	94	33.5	281	19.2	d.f.= 1
Total	989	47.6	486	32.9	1475	100	p= 0.842
Home district							
North	211	70.1	90	29.9	301	20.1	
South	198	67.6	95	32.4	293	19.8	χ2= 4.860
Central	215	67.8	102	32.2	317	21.2	d.f.= 4
West	172	61.9	106	38.1	278	18.6	p=0.302
East	207	67.9	98	32.1	305	20.4	
Total	1003	67.1	491	32.9	1494	100	

5.6.1.3 Students' physical activity in relation to fathers, mothers, siblings and peers' physical activity behaviours:

Students' physical activity behaviour was strongly associated positively with their fathers', mothers', siblings' and peers physical activities behaviours (Table 5.33).

Table 5-33. The association between students' physical activity and their father, mother, sibling and peers' physical activity.

Physical activity	Physical activity per week in the last 30 days						
	Inactive (< 3 day)		Active (≥ 3 days)		Total		χ2 Test
	N	%	N	%	N	%	
Fathers							
Yes	147	59.5	100	40.5	247	16.5	χ2= 7.836
No	857	68.7	391	31.3	1248	83.5	d.f.= 1
Total	1004	67.2	491	32.8	1495	100	p= 0.005

Mothers							
Yes	48	53.9	41	46.1	89	6.0	$\chi2$= 7.504
No	956	68.0	450	32.0	1406	94.0	d.f.= 1
Total	1004	67.2	491	32.8	1495	100	p= 0.006
Siblings							
Yes	444	59.1	307	40.9	751	50.2	$\chi2$= 44.183
No	560	75.3	184	24.7	744	49.8	d.f.= 1
Total	1004	67.2	491	32.8	1495	100	p< 0.001
Peers							
Yes	834	65.1	447	34.9	1281	86.4	$\chi2$= 16.532
No	160	79.6	41	20.4	201	13.6	d.f.= 1
Total	994	67.1	488	32.9	1482	100	p< 0.001

5.6.2 Fathers' and mothers' physical activity

5.6.2.1 Fathers' physical activity and their educational level and home district

Highly educated fathers were significantly more than less educated fathers to practice physical activity. Living in the north was also associated with fathers' physical activity among students' fathers (Table 5.34).

Table 5-34. The association between fathers' physical activity and their educational level and home district.

Variables	Father practice physical activity						$\chi2$ Test
	Yes		No		Total		
	N	%	N	%	N	%	
Father education							
≤12 years	108	11.4	840	88.6	948	63.9	$\chi2$= 52.179
> 12 years	139	25.9	397	74.1	536	36.1	d.f.= 1
Total	247	16.6	1237	83.4	1484	100	P<0.001
Home district							
North	78	25.9	223	74.1	301	20.1	$\chi2$= 31.387
South	31	10.5	264	89.5	295	19.7	
Central	57	17.9	261	82.1	318	21.2	d.f.= 1
West	43	15.4	236	84.6	279	18.6	P<0.001
East	38	12.5	267	87.5	305	20.4	
Total	247	16.5	1251	83.5	1498	100	

5.6.2.2 Mothers' physical activity and their educational level and home district

Mothers' physical activity behaviour was positively associated with mothers' level of education and living districts. Higher mothers' education was more likely to practise physical activity. A mother who's living in the north was more likely to practise physical activity (Table 5.35).

Table 5-35. The association between mothers' physical activity and their educational level and home district

Variables	Mother practice physical activity						$\chi 2$ Test
	Yes		No		Total		
	N	%	N	%	N	%	
Mothers' education							
≤ 12 years	50	4.2	1146	95.8	1196	80.9	$\chi 2$= 32.695
> 12 years	37	13.1	246	86.9	283	19.1	d.f.= 1
Total	87	5.9	1392	94.1	1479	100	p< 0.001
Home district							
North	40	13.3	261	86.7	301	20.1	
South	6	2.0	289	98	295	19.7	$\chi 2$= 41.401
Central	20	6.3	298	93.7	318	21.2	d.f.= 4
West	11	3.9	268	96.1	279	18.6	P< 0.001
East	12	3.9	293	96.1	305	20.4	
Total	89	5.9	1409	94.1	1498	100	

5.6.3 Reasons for practicing physical activity:

Among the several reasons that students were given to select from, the main important reasons to practice physical activity were: *For fun* (62.8%), *to be healthy and fit* (39.3%), *to improve appearance* (31.7%), *Medical purpose* (11.8%), whereas 9.7% have *other* reasons.

5.6.4 Reasons for not practicing physical activity:

The majority of the students (59.5%) agreed that *lack of sport facilities in the community* as a barrier for not practicing physical activity, followed by *lack of appropriate sport clubs suitable for youths* (30.1%). Moreover, 22.5% of the students reported *no spare time. Dislike physical activity* (20.3%), *shame of body image* (18.7%), *lack of money to join sport and fitness club* (17.1%), were also among the barriers.

5.6.5 Student's knowledge and school role in physical activity education

Only 681 (46.25), and 309 (20.6%) of the total sample reported being taught about the benefits of physical activity and being taught about preventing and avoiding injury during physical activity. The majority of students believed that physical activity has a role in promoting health (Table 5.36).

Table 5-36. Student's knowledge and school role in physical activity education

Variables	Frequency	Percentage
Taught about the benefit of physical activity		
Yes	681	46.2
No/I do not remember	792	53.8
Total	1473	100
Taught about preventing and avoiding injury during physical activity		
Yes	309	20.6
No/I do not remember	1188	79.4
Total	1497	100
Benefit of Physical Activity in promoting health		
Yes	1374	91.9
No	121	8.1
Total	1495	100

5.6.6 Students' knowledge and beliefs and physical activity behaviour

There were significant positive associations between not being active regularly with not being taught about the benefits of physical activity, and not being taught about how to avoid and prevent injuries during physical activity (Table 5.37).

Table 5-37. The association between student's physical activity and student's knowledge and belief

Variables	Physical activity per week in the last 30 days					
	Not active (< 3 day)		Active (≥ 3 days)		Total	
	N	%	N	%	N	%
Taught about the benefit of physical activity						
Yes	418	61.6	261	38.4	679	46.3
No/I do not remember	568	72.0	221	28.0	789	53.7
Total	986	67.2	482	32.8	1468	100
$\chi 2$= 17.998, d.f.=1, p<0.001						
Taught about preventing injury during physical activity						
Yes	179	58.1	129	41.9	308	20.6
No/I do not remember	822	69.4	369	30.6	1184	79.4
Total	1001	67.1	491	32.9	1492	100
$\chi 2$= 14.158, d.f.= 1, p<0.001						

Benefit of Physical Activity in promoting health						
Yes	909	66.4	460	33.6	1369	91.9
No	90	74.4	31	25.6	121	8.1
Total	999	67.0	491	33.0	1490	100
$\chi 2$= 3.205, d.f.=1, p= 0.073						

5.6.7 Student's physical activity and student's BMI category:

There was significant negative association between body weight and physical activity behaviour. Overweight students were significantly less active (Table 5.38).

Table 5-38. Association between students BMI category and physical activity

Students BMI	Physical activity per week in the last 30 days						$\chi 2$ Test
	Inactive (< 3 day)		Active (≥ 3 days)		Total		
	N	%	N	%	N	%	
Underweight	171	60.0	114	40.0	285	19.2	$\chi 2$= 30.99 d.f.= 2 p< 0.001
Normal weight	414	62.8	245	37.2	659	44.4	
Overweight	410	75.9	130	24.1	540	36.4	
Total	995	67.0	489	33.0	1484	100	

5.6.8 The need for physical activity health promotion:

From all above data it is clearly that physical activity behaviours and knowledge status among students need improvement to encourage physical activity and sports and to prevent the serious problems that may occur in future. A total of 88.6% of the students stated that students need health education regarding physical activity benefits and importance.

5.7 Smoking behaviours

5.7.1 Students Smoking behaviour

12% of the students live with at least one smoker in the family, 34% spend some of their day with smoker(s), whereas the majority have no regular contact with smoker(s). Also, 52.5% of the students reported they have never smoked, whereas 19.5% have tried smoking in their lives. 8.5% and 12.4% of the students reported they smoke every day and sometimes every week, respectively (Table 5.39).

Table 5-39. Students' smoking behaviour

Variables	No.	%
Spending time with smokers		
I live with smoker	179	12
I spend some of my time with smokers every day	511	34.2
I usually do not contact smokers	801	53.7
Total	1491	100
Student's smoking behaviours		
I have never smoked	788	52.5
I have tried only	292	19.5
I used to smoke	109	7.3
I smoke someday every week	127	8.5
I smoke every day	185	12.4
Total	1501	100

5.7.2 Student's smoking behaviour and contact smokers:

Current smokers are students who smoke every day and students who smoke some day during the week (20.8%). On the other hand, non-smokers are students who have never smoked or tried smoking before or ex-smokers (79.2%)**.** There was a positive significant association between having regular contact with smokers and current smoking behaviours. Students who live or spend some of their day with smokers were found to be among the current smokers group (Table 5.40).

Table 5-40. The association between students' smoking behaviours and spending time with smokers

Variable	Non smokers		Current smoker		Total	
	N	%	N	%	N	%
I live or spend some of my time with smokers every day	418	60.8	270	39.2	688	46.2
I usually do not spend time with smokers	762	95.3	38	4.8	800	53.8
Total	1180	79.3	308	20.7	1488	100

($\chi 2$ =268.127 d.f.= 1, p< 0.001)

5.7.2.1 Students' smoking behaviour and students' age, class level, school type and nationality:

Higher age and higher school level of students were positively associated with current smoking behaviours. Also, studying in private school was positively associated with being smoking. There was no difference in smoking with regard to students' nationality (Table 5.41).

Table 5-41. The association between students' smoking behaviours and students' educational class, type of school and nationality:

Variables	Student's smoking behaviours						$\chi 2$ Test
	Non smokers		Current smokers		Total		
	N	%	N	%	N	%	
Age							
≤16	321	90.7	33	9.3	354	23.6	$\chi 2$= 65.816
17-18	705	79.1	186	20.9	881	59.4	d.f.= 2
≥19	163	63.8	93	36.2	256	17.0	p< 0.001
Total	1189	79.2	312	20.8	1501	100	
Class level							
1st	419	85.9	69	14.1	488	32.5	$\chi 2$= 30.994
2nd	399	80.4	97	19.6	494	19.6	d.f.= 2
3rd	371	71.8	146	28.2	517	34.4	p< 0.001
Total	1189	79.2	312	20.8	1501	100	
School type							
Public school	832	80.6	200	19.4	1032	68.8	$\chi 2$= 3.967
Private school	357	76.1	112	23.9	469	31.2	d.f.= 1
Total	1189	79.2	312	20.8	1501	100	p=0.046
Nationality							
Saudi	1061	79.3	277	20.7	1338	89.6	$\chi 2$= 0.128
Non-Saudi	121	78.1	34	21.9	155	10.4	d.f.=1
Total	1182	79.2	311	20.8	1493	100	p=0.720

5.7.2.2 Students' smoking behaviour and fathers' education, mothers' education and living district:

Students' smoking behaviour was not significantly associated with fathers' education, mothers' education or living district (Table 5.42).

Table 5-42. Students smoking behaviours and fathers' and mothers' education

Variables	Student's smoking behaviours						$\chi 2$ Test
	Non smokers		Current smokers		Total		
	N	%	N	%	N	%	
Father's educ.							
≤ 12 years	737	77.7	212	22.3	949	63.9	$\chi 2$= 3.741
> 12 years	439	81.9	97	18.1	536	36.1	d.f.= 1
Total	1176	79.2	309	20.8	1485	100	p= 0.053
Mother's edu.							
≤ 12 years	953	79.6	244	20.4	1197	80.9	$\chi 2$= 0.094
> 12 years	223	78.8	60	21.2	283	19.1	d.f.=1
Total	1176	79.5	304	20.5	1480	100	p= 0.760
Home district							
North	237	78.8	64	21.3	301	20.1	
South	222	75.0	74	25.0	296	19.8	$\chi 2$= 7.203
Central	264	83.0	54	17.0	318	21.2	d.f.= 4
West	217	77.8	62	22.2	279	18.6	p= 0.126
East	248	81.3	57	18.7	305	20.3	
Total	1188	79.3	311	20.7	1499	100	

5.7.2.3 Smoking behaviour and school performance, liking school and general health status:

There was a strong positive association between current smoking and poor health, poor academic performance and disliking school (Table 5.43).

Table 5-43. The association between smoking and health, academic performance and school satisfaction

Variables	Student's smoking behaviours						$\chi 2$ Test
	Non smokers		Current smokers		Total		
	N	%	N	%	N	%	
General Health status							
Good	1150	80.0	287	20.0	1437	96.5	$\chi 2$= 12.745
Poor	31	59.6	21	40.4	52	3.5	d.f.=1
Total	1181	79.3	308	20.7	1489	100	p< 0.001
School performance							
Good	891	81.2	206	18.8	1097	74.2	$\chi 2$= 11.485
Poor	279	73.0	103	27.0	382	25.8	d.f.=1
Total	1170	79.1	309	20.9	1479	100	p< 0.001

Liking school							
Yes	747	85.1	131	14.9	878	59.0	$\chi 2$= 44.251
No	433	70.9	178	29.1	611	41.0	d.f.=1
Total	1180	79.2	309	20.8	1489	100	p< 0.001

5.7.2.4 Students' smoking and fathers', mothers', siblings and peer smoking behaviours:

There was a strong positive significant association between students' smoking behaviour and fathers', mothers', siblings' and peer smoking behaviours. Students' whose fathers', mothers', siblings' and peers smoke were significantly smoke (Table 5.44).

Table 5-44. The association between students' smoking behaviours and smoking of family members and friends

Variables	Students' smoking behaviours						$\chi 2$ Test
	Non smokers		Current smokers		Total		
	N o.	%	No.	%	No.	%	
No one smoke in the family							
Yes	716	87.7	100	12.3	816	54.4	$\chi 2$= 79.037
No	473	69.1	212	30.9	684	45.6	d.f.=1
Total	1189	79.2	312	20.8	1501	100	p< 0.001
Fathers' smoking							
Yes	241	71.3	98	28.9	339	22.6	$\chi 2$= 17.481
No	947	81.6	214	18.4	1161	77.4	d.f.=1
Total	1188	79.2	312	20.8	1500	100	p< 0.001
Mothers' smoking							
Yes	12	54.5	10	45.5	22	1.5	$\chi 2$= 8.238
No	1176	79.6	302	20.4	1478	98.5	d.f.=1
Total	1188	79.2	312	20.8	1500	100	p= 0.004
Sibling's smoking							
Yes	278	65.1	149	34.9	427	28.4	$\chi 2$= 72.142
No	911	84.8	163	15.2	1074	71.6	d.f.=1
Total	1189	79.2	312	20.8	1501	100	p< 0.001
Peers smoking							
Yes	659	70.0	282	30.0	941	63.4	$\chi 2$= 137.302
No	519	95.6	24	4.4	543	36.6	d.f.=1
Total	1178	79.4	306	20.6	1484	100	p< 0.001

5.7.3 Parents and school role regarding smoking:

Only 57.4% of students' parents have discussed smoking issue with their sons, and 83% of the students reported they have been taught in school about smoking (Table 5.45).

Table 5-45. The role of parents and school regarding anti-smoking education

Variables	N	%
Parent(s) discuss the harm effect of smoking with student		
Yes	839	57.4
No	622	42.6
Total	1461	100
Taught in schools about the harm effect of smoking		
Yes	1237	83.0
No	253	17.0
Total	1490	100

5.7.4 Students smoking behaviour and parents and school anti-smoking education:

Parents' and school advice regarding smoking were associated with smoking behaviours. Amongst students' who their parents discussed smoking issues were 23.3% current smokers vs. 17.4% of students smokers amongst students who their parents did not discussed smoking effects. On the other hand, 28.3% of students who stated they have not been taught in school about smoking were smokers whereas 19.2% were smokers amongst students who have been taught about the danger of smoking behaviour (Table 4.46).

Table 5-46. The associations between students smoking and parents and school role in informing students regarding smoking and students' smoking behaviours

Variable	Student's smoking behaviours					
	Non smokers		Current smokers		Total	
	N	%	N	%	N	%
Parent(s) discuss the harmful effects of smoking with student						
Yes	641	76.7	195	23.3	836	57.4
No	512	82.6	108	17.4	620	42.6
Total	1153	79.2	303	20.8	1456	100
$\chi 2$= 7.535,d.f.= 1, p= 0.006						
Taught in schools about the harmful effects of smoking						
Yes	997	80.8	237	19.2	1234	83.1
No	180	71.7	71	28.3	251	16.9
Total	1177	79.3	308	20.7	1485	100
$\chi 2$= 10.463, d.f.= 1, p= 0.001						

5.7.5 Students' smoking behaviour and students' attitudes:

There were significant associations between students' smoking behaviour and students' attitudes. Current smokers were significantly more to report that they would smoke if someone offered them a cigarette, more likely to disagree with the idea of banning smoking in public places, more likely to state that it is not easy to stop smoking, less to agree that adolescents who smoke has less friend and agree more that smoking make them loss weight (Table 5.47).

Table 5-47. The associations between students' smoking behaviours and attitudes:

Variable	Student's smoking behaviours						$\chi 2$ Test
	Non smokers		Current smokers		Total		
	N	%	N	%	N	%	
Smoke if someone offered you a cigarette							
Yes	122	39.0	191	61.0	313	21.0	$\chi 2$= 396.488
No	1063	90.2	116	9.8	1179	79.0	d.f.=1
Total	1185	79.4	307	20.6	1492	100	p< 0.001

Smoking is harmful for health							
Yes	1123	79.3	294	20.7	1417	95.6	$\chi 2$= 0.021
No	52.0	80.0	13.0	20.0	65.0	4.4	d.f.= 1
Total	1175	79.3	307	20.7	1482	100	p= 0.884
In a favour of banning smoking in public places							
Yes	1039	83.4	207	16.6	1246	83.7	$\chi 2$= 80.308
No	140	57.9	102	42.1	242	16.3	d.f.=1
Total	1179	79.2	309	20.8	1488	100	p< 0.001
Easy to stop smoking							
Yes	463	84.2	87	15.8	550	36.8	$\chi 2$= 13.122
No	721	76.3	224	23.7	945	63.2	d.f.=1
Total	1184	79.2	311	20.8	1459	100	p< 0.001
Boys who smoke have							
More Friends	448	79.6	115	20.4	563	37.8	$\chi 2$= 26.857
No difference	432	73.7	154	26.3	586	39.3	d.f.= 2
Less friends	301	88.0	41	12.0	342	22.9	p< 0.001
Total	1181	79.2	310	20.8	1491	100	
Smoking makes people							
Gain weight	129	91.5	12	8.5	141	9.8	$\chi 2$= 15.245
No difference	396	77.5	115	22.5	511	35.4	d.f.= 2
Lose weight	610	77.2	180	22.8	790	54.8	p< 0.001
Total	1135	78.7	307	21.3	1442	100	

5.7.6 Smokers' students' attitudes:

73.1% out of the current smokers reported that they want to stop smoking, but only 42.8% stated they would be able to stop smoking when they want to stop (Table 5.48).

Table 5-48. The attitudes among smokers

Variables	No.	%
Do you want to stop smoking now? (among current smokers)		
Yes	226	73.1
No	48	15.5
Total	274	100
Would be able to stop smoking if you wanted to? (among current smokers)		
Yes	133	42.8
No	90	28.9
I do not know	75	24.1
Total	298	100

5.7.7 Anti-smoking messages in media and community:

Only 11% of the students reported that they have seen anti-smoking media messages a lot during the last 30 days, and only 16.9% have seen anti smoking messages in public places during the last 30 days (Table 5.49).

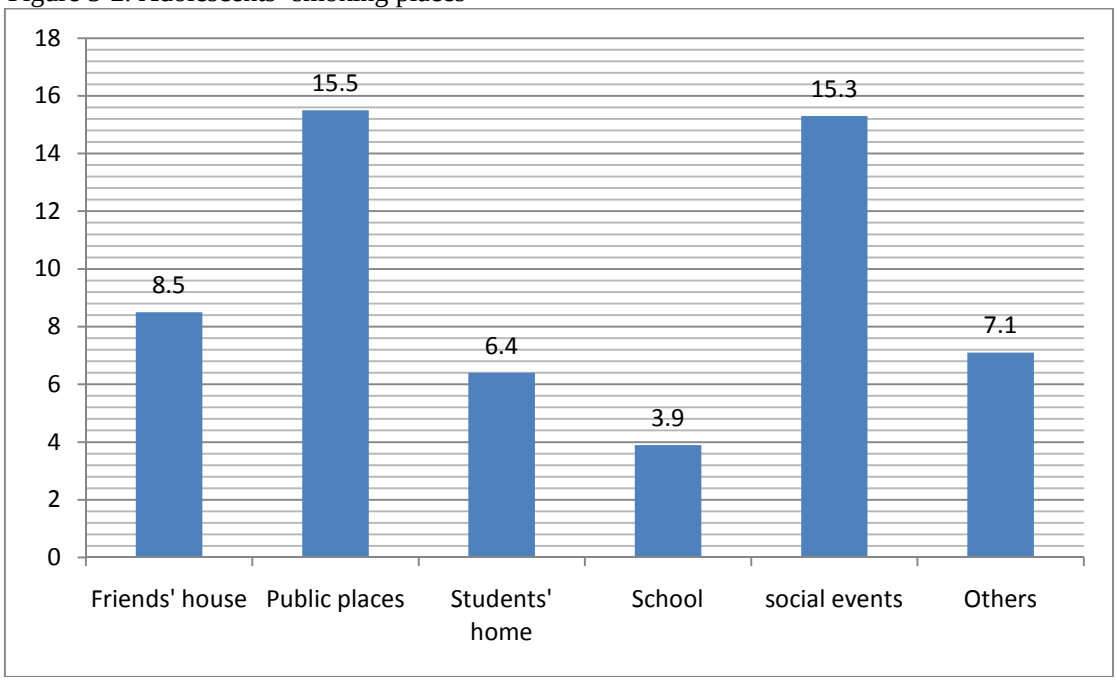
Table 5-49. Anti-smoking messages in media and community

Variable	Frequency	Percentage
How many anti-smoking media messages have you seen during the last 30 days?		
None	587	39.4
A few	739	49.6
A lot	165	11.0
Total	1491	100
How often do you see anti smoking messages in public places during the last 30 days?		
None	526	35.4
A few	709	47.7
A lot	251	16.9
Total	1486	100

5.7.8 Places of smoking

The most places or incidents where students smoke were public places (15.5%) and in social events (15.3%), followed by smoking at friend house (8.5%), other places (7.1%), student's home (6.4%) and school (3.9%) (Figure 5.2).

Figure 5-2. Adolescents' smoking places



5.7.9 Student's smoking behaviour, other behaviours and related factors:

Students' smoking behaviour was positively associated with skipping breakfast (< 5 day/week), not physically active (< 3 days/week) and suffering from teeth pain sometimes (Table 5.50).

Table 5-50. The association between smoking behaviour and eating breakfast, BMI, oral health status, brushing teeth and physical activity, school performance and health status

Variables	Student's smoking behaviours						$\chi 2$ Test
	Non smokers		Current smokers		Total		
	N	%	N	%	N	%	
Eating breakfast							
< 5 day/week	730	77.2	216	22.8	946	63.4	$\chi 2$= 6.635
≥ 5 days/ week	452	8.4	94	17.2	546	36.6	d.f.=1
Total	1182	79.2	310	20.8	1492	100	p= 0.01
Physical activity							
< 3 days/week	759	75.9	241	24.1	1000	67.1	$\chi 2$= 19.329
≥ 3 days/week	421	85.7	70	14.3	491	32.9	d.f.=1
Total	1180	79.1	311	20.9	1491	100	p< 0.001
Brushing teeth							
0 time	552	77.5	160	22.5	712	47.7	$\chi 2$= 2.573
≥ 1 times a day	631	80.9	149	19.1	780	52.3	d.f.=1
Total	1183	79.3	309	20.7	1492	100	p=0.109
Perceived teeth health status							
Good	617	80.9	146	19.1	763	51.2	$\chi 2$= 2.812
Poor	563	77.3	165	22.7	728	48.8	d.f.= 1
Total	1181	79.1	311	20.9	1491	100	p=0.094
Teeth pain							
No/rarely	849	80.8	202	19.2	1051	70.4	$\chi 2$= 5.689
Sometimes/usually	332	75.3	109	24.7	441	29.6	d.f.=1
Total	1181	79.2	311	20.8	1492	100	p= 0.017
BMI							
Underweight	233	81.5	53	18.5	286	19.3	
Normal weight	531	80.7	127	19.3	653	44.3	$\chi 2$= 3.89
Overweight	414	76.7	126	23.3	540	36.4	d.f.= 2
Total	1178	79.4	306	20.6	1484	100	p= 0.143

5.8 Injuries, violence, mental health and safety behaviours

5.8.1 Students' injuries

55.5% of the adolescents reported that they have being injured at least once in 12 month, preceding the survey.

5.8.1.1 Students' injuries in the last 12 months and students' age, school class, type of school and nationality:

There was no association between injuries and students' age, school classes, type of school and nationality (Table 5.51).

Table 5-51. The association between students' injuries in the last 12 months and students' age, school class, type of school and nationality.

Variables	Injuries during the past 12 months						
	0 time		≥1 times		Total		χ^2 Test
	N	%	N	%	N	%	
Age							
≤ 16	153	43.2	201	56.8	354	23.7	χ2= 0.886
17-18	404	45.5	483	54.5	887	59.3	d.f.= 2
≥ 19	109	42.9	145	57.1	254	17.0	p=0.642
Total	666	44.5	829	55.5	1495	100	
Class level							
1st	199	40.8	289	59.2	488	32.6	χ2= 4.329
2nd	225	45.7	267	54.3	492	32.9	d.f.= 2
3rd	242	47.0	273	53.0	515	34.4	p= 0.115
Total	666	44.5	829	55.5	1495	100	
Type of School							
Public	460	44.8	567	55.2	1027	68.7	χ2= 0.078
Private	206	44.0	262	56.0	468	31.3	d.f.= 1
Total	666	44.5	829	55.5	1495	100	p=0.780
Nationality							
Saudi	599	44.9	734	55.1	1333	89.6	χ2= 0.506
Non-Saudi	65	41.9	90	58.1	155	10.4	d.f.= 1
Total	664	44.6	824	55.4	1488	100	p=0.477

5.8.1.2 Students' injuries in the last 12 months and students' fathers' and mothers' education level and district of living

There was no association between students' injuries in the last 12 months and students' fathers' and mothers' education level and district of living (Table 5.52).

Table 5-52. The association between students' injuries in the last 12 months and students' fathers' and mothers' education level and district of living.

Variables	Injuries during the past 12 months						
	0 time		≥1 time		Total		χ2 Test
	N	%	N	%	N	%	
Fathers' edu.							
≤ 12 years	408	43.2	537	56.8	945	63.9	χ2= 2.227
> 12 years	252	47.2	282	52.8	534	36.1	d.f.= 1
Total	660	44.6	819	55.4	1479	100	p=0.136
Mothers' edu.							
≤ 12 years	531	44.5	662	55.5	1193	80.9	χ2= 0.026
> 12 years	127	45.0	155	55.0	282	19.1	d.f.= 1
Total	658	44.5	817	55.4	1475	100	p=0.873
Home district							
North	143	47.8	156	52.2	299	20.0	χ2= 4.319
South	122	41.2	174	58.8	296	19.8	d.f.= 4
Central	147	46.4	170	53.6	317	21.2	p=0.365
West	115	41.4	163	58.6	278	18.6	
East	138	45.5	165	54.5	303	20.3	
Total	665	44.5	828	55.5	1493	100	

5.8.2 Students' fighting behaviour

49% of the adolescents reported they were engaged in physical fights once or more in the past 12 months preceding the survey.

5.8.2.1 Students' fighting behaviour and in the past 12 months and students' age, class, type of school and nationality

There was no significant association between students fighting behaviour and students' age, class, type of school and nationality (Table 5.53).

Table 5-53. The association between students' physical fight in the past 12 months and students' age, class, type of school and nationality.

Variables	Physical fight in the past 12 months						
	0 time		≥1 times		Total		χ2 Test
	N	%	N	%	N	%	
Age							
≤ 16	185	52.3	169	47.7	354	23.6	χ2= 5.231
17-18	465	52.4	422	47.6	887	59.3	d.f.= 2
≥ 19	114	44.5	142	55.5	256	17.1	p= 0.073
Total	764	51.0	733	49.0	1497	100	
Class level							
1st grade	231	47.5	255	52.5	486	32.5	χ2= 3.635
2nd grade	259	52.2	237	47.8	496	33.1	d.f.= 2
3rd grade	274	53.2	241	46.8	515	34.4	p= 0.162
Total	764	51.0	733	49.0	1497	100	
Type of School							
Public	539	52.4	489	47.6	1028	68.7	χ2= 2.561
Private	225	48.0	244	52.0	469	31.3	d.f.= 1
Total	764	51.0	733	49.0	1497	100	p= 0.110
Nationality							χ2= 1.344
Saudi	690	51.7	645	48.3	1335	89.7	d.f.= 1
Non-Saudi	72	46.8	82	53.2	154	10.3	p=0.246
Total	762	51.2	727	48.8	1489	100	

5.8.2.2 Students' physical fight and fathers' and mothers' education level and district of living:

There was no significant association between students physical fighting and either father's education, mothers; education and living district (Table 5.54).

Table 5-54. The association between students' physical fight and fathers' and mothers' education level and district of living.

Variables	Physical fight in the past 12 months						
	0 time		≥1 times		Total		χ2 Test
	N	%	N	%	N	%	
Fathers' edu.							
≤ 12 years	479	50.6	468	49.4	947	63.9	χ2= 0.115
> 12 years	275	51.5	259	48.5	534	36.1	d.f.= 1
Total	754	50.9	727	49.1	1481	100	p= 0.735
Mothers' edu.							χ2= 0.415
≤ 12 years	614	51.4	580	48.6	1194	80.9	d.f.= 1
> 12 years	139	49.3	143	50.7	282	19.1	p= 0.519
Total	753	51.0	723	49.0	1476	100	
Home district							
North	156	51.8	145	48.2	301	20.1	χ2= 0.936
South	157	53.2	138	46.8	295	19.7	d.f.= 4
Central	158	50.2	157	49.8	315	21.1	p= 0.919
West	141	50.5	138	49.5	279	18.7	
East	152	49.8	153	50.2	305	20.4	
Total	764	51.1	731	48.9	1495	100	

5.8.3 Carrying weapons

36.6% of the adolescents reported they carried weapons in the past 30 days once or more in the past 30 days preceding the survey.

5.8.3.1 Carrying weapons in the past 30 days and students' age, class, type of school and nationality

Students' age and nationality were significantly associated with students' carrying weapons behaviour in the past 30 days preceding the survey. Older students and Saudi students were more likely to report carrying weapons (Table 5.55).

Table 5-55. The association between carrying weapons in the past 30 days and students' age, class, type of school and nationality.

Variables	Carrying weapons in the past 30 days						
	No		Yes		Total		$\chi 2$ Test
	N	%	N	%	N	%	
Age							
≤ 16	225	65.4	119	34.6	344	23.2	$\chi 2$= 12.686
17-18	579	65.6	304	34.4	883	59.6	d.f.= 2
≥ 19	137	53.7	118	46.3	255	17.1	p= 0.002
Total	941	63.5	541	36.5	1482	100	
Class level	291	60.9	187	39.1	478	32.3	$\chi 2$= 2.149
1st grade	314	64.3	174	35.7	488	32.9	d.f.= 2
2nd grade	336	65.1	180	34.9	516	34.8	p= 0.342
3rd grade	941	63.5	541	36.5	1482	100	
Total							
School type							
Public	663	64.9	358	35.1	1021	68.9	$\chi 2$= 2.941
Private	278	60.3	183	39.7	461	31.1	d.f.= 1
Total	941	63.5	541	36.5	1482	100	p= 0.086
Nationality							
Saudi	822	62.3	497	37.7	1319	89.7	$\chi 2$= 6.698
Non-Saudi	113	72.9	42	27.1	155	10.5	d.f.= 1
Total	935	63.4	539	36.6	1474	100	p= 0.010

5.8.3.2 Carrying weapons in the past 30 days and students' fathers' and mothers' education level and district of living

There was no significant association between carrying weapons in the past 30 days and students' fathers' and mothers' education level and district of living (Table 5.56).

Table 5-56. The association between carrying weapons in the past 30 days and students' fathers' and mothers' education level and district of living.

Variables	Carrying weapons in the past 30 days						
	No		Yes		Total		χ2 Test
	N	%	N	%	N	%	
Father edu.							
≤ 12 years	587	62.6	350	37.4	937	63.9	χ2= 0.827
> 12 years	344	65.0	185	35.0	529	36.1	d.f.= 1
Total	931	63.5	535	36.5	1466	100	p= 0.363
Mothers edu.							
≤ 12 years	754	63.8	428	36.2	1182	80.9	χ2= 0.446
> 12 years	172	61.6	107	38.4	279	19.1	d.f.= 1
Total	926	63.4	535	36.6	1461	100	p= 0.504
Home district							
North	193	65.0	104	35.0	297	20.1	χ2= 3.657
South	188	63.7	107	36.3	295	19.9	d.f.= 4
Central	199	63.7	117	37.0	316	21.4	p= 0.454
West	184	66.9	91	33.1	275	18.6	
East	177	59.6	120	40.4	297	20.1	
Total	941	63.6	539	36.4	1480	100	

5.8.4 Threatened or injured by weapons

21.9% of the adolescents reported they were threatened or injured at least once in the past 12 months preceding the survey.

5.8.4.1 Threatened or injured by weapons in the past 12 months and students' age, class, type of school and nationality:

Students' age was positively associated with being threatened or injuries by weapons. Older students were more likely to be threatened or injured. On the other hand, school class, type of school and nationality were not associated (Table 5.57).

Table 5-57. The association between ever been threatened or injured by weapons in the past 12 months and students' age, class, type of school and nationality.

Variables	Threatened or injured by weapons in the past 12 months						
	No		Yes		Total		χ2 Test
	N	%	N	%	N	%	
Age							
≤ 16	295	83.6	58	16.4	354	23.6	χ2= 14.643
17-18	695	78.3	193	21.7	888	59.3	d.f.= 2
≥ 19	180	70.6	75	29.4	255	17.0	p= 0.001
Total	1170	78.2	326	21.8	1496	100	
Class level							
1st grade	378	77.8	108	22.2	486	32.5	χ2= 0.384
2nd grade	391	79.1	103	20.9	494	33.0	d.f.= 2
3rd grade	401	77.7	115	22.3	516	34.5	p= 0.825
Total	1170	78.2	326	21.8	1496	100	
School type							χ2= 0.563
Public	800	77.7	230	22.3	1030	68.9	d.f.= 1
Private	370	79.4	96	20.6	466	31.1	p= 0.453
Total	1170	78.2	326	21.8	1496	100	
Nationality							
Saudi	1038	77.9	295	22.1	1333	89.6	χ2= 0.368
Non-Saudi	124	80.0	31	20.0	155	10.4	d.f.= 1
Total	1162	78.1	326	21.9	1488	100	p= 0.544

5.8.4.2 Threatened or injured by weapons in the past 12 months and students' fathers' and mothers' education level and district of living

Fathers' education and living district were associated with being threatened or injured by weapons in the past 12 months. Students' whose fathers' education was ≤ 12 years were more than other group to report being threatened or injured by weapons. Also, there was significant difference among students living in different district and being threatened or injured in the past 12 months (Table 5.58).

Table 5-58. The association between students being threatened or injured by weapons in the past 12 months and students' fathers' and mothers' education level and district of living.

Variables	Threatened or injured by weapons in the past 12 months						
	No		Yes		Total		χ2 Test
	N	%	N	%	N	%	
Fathers' edu.							χ2= 5.158
≤12 years	723	76.3	224	23.7	947	64.0	d.f.= 1
> 12 years	434	81.4	99	18.6	533	36.0	p= 0.023
Total	1157	78.2	323	21.8	1480	100	
Mothers' edu.							χ2= 0.123
≤12 years	932	78.1	261	21.9	1193	80.9	d.f.= 1
> 12 years	223	79.1	59	20.9	282	19.1	p= 0.726
Total	1155	78.3	320	21.7	1475	100	
Home district							
North	253	84.3	47	15.7	300	20.1	χ2= 16.817
South	225	76.5	69	23.5	294	19.7	d.f.= 4
Central	252	79.5	65	20.5	317	21.2	p= 0.002
West	222	79.6	57	20.4	279	18.7	
East	216	71.1	88	28.9	304	20.3	
Total	1168	78.2	326	21.8	1494	100	

5.8.5 Students' feeling unsafe

14.2% of the adolescents reported they did not feel safe going to school in the past 30 days preceding the survey.

5.8.5.1 Students' feeling unsafe going to school in the past 30 days and students' age, class, type of school and nationality:

Students' age, class level and nationality were not significantly associated with feeling unsafe going to school. On the other hand, studying in private school was associated with feeling unsafe going to school in the past 30 days (Table 5.59).

Table 5-59. The association between students feeling unsafe going to school in the past 30 days and students' age, class, type of school and nationality

Variables	Unsafe going to school in the past 30 days						
	0 day		≥1 day		Total		χ2 Test
	N	%	N	%	N	%	
Age							
≤ 16	305	86.9	46	13.1	351	23.6	χ2= 3.181
17-18	762	86.4	120	13.6	882	59.3	d.f.= 2
≥ 19	209	82.3	45	17.7	254	17.1	p= 0.204
Total	1276	85.8	211	14.2	1487	100	
Class level							
1st grade	405	83.9	78	16.1	483	32.5	χ2= 2.417
2nd grade	422	86.3	67	13.7	489	32.9	d.f.= 2
3rd grade	449	87.2	66	12.8	515	34.6	p = 0.299
Total	1276	85.8	211	14.2	1487	100	
School type							
Public	894	87.4	129	12.6	1023	68.8	χ2= 6.719
Private	382	82.3	82	17.7	464	31.2	d.f.= 2
Total	1276	85.8	211	14.2	1487	100	p =0.010
Nationality							
Saudi	1133	85.6	191	14.4	1324	89.5	χ2= 1.373
Non-Saudi	138	89.0	17	11.0	155	10.5	d.f.= 2
Total	1271	85.9	208	14.1	1479	100	p= 0.241

5.8.5.2 Students' feeling unsafe going to school in the past 30 days and their fathers' and mothers' education level and district of living:

Low fathers' education (≤ 12 years) was positively associated with feeling unsafe going to school in the past 30 days. Mothers' education and living district were not significantly associated with feeling unsafe going to school (Table 5.60).

Table 5-60. The association between students' feeling unsafe going to school in the past 30 days and their fathers' and mothers' education level and district of living

Variables			Unsafe going to school in the past 30 days				
	0 time		≥1 times		Total		χ2 Test
	N	%	N	%	N	%	
Fathers edu.							
≤ 12 years	789	84.2	148	15.8	937	63.7	χ2= 5.824
> 12 years	474	88.8	60	11.2	534	36.3	d.f.= 1
Total	1263	85.9	208	14.1	1471	100	p= 0.016
Mothers edu.							
≤ 12 years	1018	85.8	169	14.2	1187	80.9	χ2= 0.571
> 12 years	245	87.5	35	12.5	280	19.1	d.f.= 1
Total	1263	86.1	204	13.9	1467	100	p= 0.450
Home district							
North	265	88.3	35	11.7	300	20.2	χ2= 8.508
South	244	84.1	46	15.9	290	19.5	d.f.= 4
Central	284	89.3	34	10.7	318	20.2	p= 0.075
West	233	84.1	44	15.9	277	18.7	
East	248	82.7	52	17.3	300	20.2	
Total	1274	85.8	211	14.2	1485	100	

5.8.6 Being bullied

26.1% of the adolescents reported they were bullied in the past 12 months once or more preceding the survey.

5.8.6.1 Students' being bullied in the past 12 months and students' age, class, type of school and nationality:

Students' older age was negatively associated with reporting being bullied ≥1 times in the past 12 months, whereas, class level, type of school and nationality were not associated with being bullied (Table 5.61).

Table 5-61. The association between been bullied in the past 12 months and students' age, class, type of school and nationality.

Variables	Been bullied in the past 12 months						
	0 time		≥1 times		Total		χ2 Test
	N	%	N	%	N	%	
Age							
≤ 16	244	69.5	107	30.5	351	23.5	χ2= 6.241
17-18	674	76.2	211	23.8	885	59.4	d.f.= 2
≥ 19	184	72.2	71	27.8	255	17.1	p= 0.044
Total	1102	73.9	389	26.1	1491	100	
Class							
1st	342	70.8	141	29.2	483	32.4	χ2= 3.573
2nd	373	75.5	121	24.5	494	33.1	d.f.= 2
3rd	387	75.3	127	24.7	514	34.5	p= 0.168
Total	1102	73.9	389	26.1	1491	100	
School type							
Public	755	73.8	268	26.2	1023	68.6	χ2= 0.020
Private	347	74.1	121	25.9	468	31.4	d.f.= 1
Total	1102	73.5	389	12.5	1491	100	p= 0.889
Nationality							
Saudi	993	74.7	336	25.3	1329	89.6	χ2= 3.701
Non-Saudi	104	67.5	50	32.5	154	10.4	d.f.= 1
Total	1097	73.4	386	12.6	1483	100	p= 0.054

5.8.6.2 Students' being bullied in the past 12 months and students' fathers' and mothers' education level and district of living:

Students' fathers' and mothers' education were not significantly associated with being bullied. There was significant difference among students living in different district and being bullied in the past 12 months. Students' who live in south and east districts were more likely to be bullied, whereas students in the north district were less than any other students to report being bullied (Table 5.62).

Table 5-62. The Association between students been bullied in the past 12 months and students' fathers' and mothers' education level and district of living

Variables	Being bullied in the past 12 months						
	0 time		≥ 1 time		Total		χ2 Test
	N	%	N	%	N	%	
Fathers Edu.							
≤ 12 years	693	73.6	249	26.4	942	63.9	χ2= 0.216
> 12 years	398	74.7	135	25.3	533	36.1	d.f.= 1
Total	1091	74.0	384	26.0	1475	100	p= 0.642
Mothers Edu.							
≤ 12 years	884	74.3	306	25.7	1190	80.9	χ2= 0.677
> 12 years	202	71.9	79	28.1	281	19.1	d.f.= 1
Total	1086	73.8	385	26.2	1471	100	p= 0.410
Living district							
North	236	79.2	62	20.8	298	20.0	χ2= 14.808
South	200	68.3	93	31.7	293	19.7	d.f.= 4
Central	233	73.5	84	26.5	317	21.3	p= 0.005
West	195	69.9	84	30.1	279	18.7	
East	237	78.5	65	21.5	302	20.3	
Total	1101	73.9	388	26.1	1489	100	

5.8.7 Students' bullying others

24.6% of the adolescents reported they bullied other in the past 12 months preceding the survey.

5.8.7.1 Students' bullying others in the last 12 months and students' age, class, type of school and nationality:

Students' age, level of school class and nationality were not statistically associated with students' taking part in bullying others in the last 12 months (Table5.63).

Table 5-63. The association between taking part in bullying others in the last 12 months and students' age, class, type of school and nationality

Variables	Bulling others in the past 12 months						
	0 time		≥1 time		Total		χ2 Test
	N	%	N	%	N	%	
Age							
≤ 16	268	76.1	84	23.9	352	23.5	χ2= 3.015
17-18	678	76.3	211	23.7	889	59.4	d.f.= 2
≥ 19	182	71.1	74	28.9	256	17.1	p= 0.221
Total	1128	75.4	369	24.6	1497	100	
Class level							
1st	357	73.6	128	26.4	485	32.4	χ2= 1.731
2nd	372	75.2	123	24.8	495	33.1	d.f.= 2
3rd	399	77.2	118	22.8	517	34.5	p= 0.421
Total	1128	75.4	369	24.6	1497	100	
School type							
Public	779	75.7	250	24.3	1029	68.7	χ2= 0.222
Private	349	74.6	119	25.4	468	31.3	d.f.= 1
Total	1128	75.4	369	24.6	1497	100	p= 0.638
Nationality							
Saudi	1007	75.5	327	24.5	1334	89.6	χ2= 0.125
Non-Saudi	115	74.2	40	25.8	155	10.4	d.f.= 1
Total	1122	75.4	367	24.6	1489	100	p= 0.724

5.8.7.2 Students' bullying others in the past 12 months and students' fathers' and mothers' education level and district of living:

Students' fathers', mothers' and living district were not statistically associated with students bullying behaviour (Table 5.64).

Table 5-64. The association between taking part in bullying others in the past 12 months and students' fathers' and mothers' education level and district of living

Variables	Bullying others by in the past 12 months						
	0 time		≥1 time		Total		χ2 Test
	N	%	N	%	N	%	
Fathers' edu.							
≤ 12 years	707	74.7	240	25.3	947	63.9	χ2= 0.561
> 12 years	408	76.4	126	23.6	534	36.1	d.f.= 1
Total	1115	75.3	366	24.7	1481	100	p= 0.454
Mothers' edu.							
≤ 12 years	910	76.2	284	23.8	1194	80.9	χ2= 2.988
> 12 years	201	71.3	81	28.7	282	19.1	d.f.= 1
Total	1111	75.3	365	24.7	1476	100	p= 0.084
Living district							
North	231	76.7	70	23.3	301	20.1	χ2= 1.802
South	214	72.8	80	27.2	294	19.7	d.f.= 4
Central	241	76.0	76	24.0	317	21.2	p= 0.772
West	208	74.6	71	25.4	279	18.7	
East	233	76.6	71	23.4	304	20.3	
Total	1127	75.4	368	24.6	1495	100	

5.8.7.3 Students' bullies other and being bullied:

Bullying others and being bullied by others were positively associated, since about half of the students who being bullied take part in bullying others (Table 5.65).

Table 5-65. The association between been bullied and taking part in bullying others in the past 12 months

Being bullied	Bullying others in the past 12 months						
	0 time		≥1 time		Total		χ2 Test
	N	%	N	%	N	%	
0 time	919	83.5	183	16.5	1101	73.9	χ2= 15.266 d.f.= 1 p< 0.001
≥1 time	203	52.2	186	47.8	389	26.1	
Total	1122	75.3	368	24.7	1490	100	

5.8.8 Students' abuse

34.4%, 39.5% of the adolescents reported they were bullied once or more by teacher or family member in the past 12 months preceding the survey, respectively.

5.8.8.1 Abuse by a teacher in the past 12 months and students' age, class, type of school and nationality:

Students' age, school type and nationality were not associated with being abused by teacher. Students' in 1st grade were more than other group to report that they have being abused by teacher and the association was significant (Table 5.66).

Table 5-66. The association between been abused by a teacher in the past 12 months and students' age, class, type of school and nationality.

Variables	Abused by teacher in the past 12 months						
	0 time		≥1 times		Total		χ2 Test
	N	%	N	%	N	%	
Age							
≤ 16	215	60.7	139	39.3	354	23.7	χ2= 4.875 d.f.= 2 p= 0.087
17-18	596	67.0	292	33.0	885	59.2	
≥ 19	172	67.5	83	32.5	255	17.1	
Total	980	65.6	514	34.4	1494	100	
Class level							
1st grade	297	61.1	189	38.9	486	32.5	χ2= 8.566 d.f.= 2 p= 0.014
2nd grade	323	65.5	170	34.5	493	33.0	
3rd grade	360	69.9	155	30.1	515	34.5	
Total	980	65.6	514	34.4	1494	100	
School type							χ2= 0.224 d.f.= 1 p= 0.636
Public	679	66.0	350	34.0	1029	68.9	
Private	301	64.7	164	35.3	465	31.1	
Total	980	65.6	514	34.4	1494	100	
Nationality							
Saudi	872	65.5	460	34.5	1332	89.6	χ2= 0.262 d.f.= 1 p= 0.609
Non-Saudi	104	67.5	50	32.5	154	10.4	
Total	976	65.7	510	34.3	1486	100	

5.8.8.2 Students' abuse by a teacher in the past 12 months and students' fathers' and mothers' education level and district of living:

There was no significant association between being abuse by teacher and students' fathers' and mothers' education and students' living district (Table 5.67)

Table 5-67. The association between been abused by a teacher and students' background

Variables	Abused by teacher in the past 12 months						
	0 time		≥1 times		Total		χ2 Test
	N	%	N	%	N	%	
Fathers' edu.							
≤ 12 years	604	64.0	340	36.0	944	63.9	χ2= 3.683
> 12 years	368	68.9	166	31.1	534	36.1	d.f.= 1
Total	972	65.8	506	34.2	1478	100	p= 0.055
Mothers' edu.							
≤ 12 years	771	64.7	421	35.3	1192	80.9	χ2= 3.809
> 12 years	199	70.8	82	29.2	281	19.1	d.f.= 1
Total	970	65.9	503	34.1	1473	100	p= 0.051
Living district							
North	192	64.0	108	36.0	300	20.1	χ2= 9.091
South	178	60.3	117	39.7	295	19.8	d.f.= 4
Central	220	69.4	97	30.6	317	21.2	p= 0.059
West	178	63.8	101	36.2	279	18.7	
East	211	70.1	90	29.9	301	20.2	
Total	979	65.6	513	34.4	1492	100	

5.8.8.3 Students' abuse by the family in the past 12 months and students' age, class, type of school:

Students' age, class level, type of school and nationality were not significantly associated with being abused by family member in the past 12 months (Table 5.68).

Table 5-68. The association between been abused by the family in the past 12 months and students' age, class, type of school.

Variables	Abused by family in the past 12 months						
	0 time		≥1 times		Total		χ2 Test
	N	%	N	%	N	%	
Age							
≤ 16	215	61.3	136	38.7	351	23.5	χ2= 1.856
17-18	540	61.3	341	38.7	881	59.3	d.f.= 2
≥ 19	144	56.7	110	43.3	254	17.1	p= 0.395
Total	899	60.5	587	39.5	1486	100	
Class level							
1st grade	295	61.1	188	38.9	483	32.5	χ2= 1.745
2nd grade	305	62.2	185	37.8	490	33.0	d.f.= 2
3rd grade	299	58.3	214	41.7	513	34.5	p= 0.418
Total	899	60.5	587	39.5	1486	100	

School type							
Public	609	59.6	412	40.4	1021	68.7	$\chi2$= 0.988
Private	290	62.4	175	37.6	465	31.3	d.f.= 1
Total	899	60.5	587	39.5	1486	100	p= 0.320
Nationality							
Saudi	813	61.4	511	38.6	1324	89.6	$\chi2$= 2.721
Non-Saudi	84	54.5	70	45.5	154	10.4	d.f.= 1
Total	897	60.7	581	39.3	1478	100	p= 0.099

5.8.8.4 Students' abuse by the family in the past 12 months and fathers' and mothers' education level and district of living:

Students' fathers' and mothers' education were associated with being abused by family. Low fathers' and mothers' level of education were positively statistically associated with being bullied by family in the past 12 months. There was no difference among students' living in different district with regards to being abuse by family (Table 5.69).

Table 5-69. The association between students been abused by the family in the past 12 months and fathers' and mothers' education level and district of living.

Items	Abused by family in the past 12 months						
	0 time		≥1 time		Total		$\chi2$ Test
	N	%	N	%	N	%	
Fathers' edu.							
≤ 12 years	544	57.9	395	42.1	939	63.9	$\chi2$= 7.029
> 12 years	345	65.0	186	35.0	531	36.1	d.f.= 1
Total	889	60.5	581	39.5	1470	100	p= 0.008
Mothers' edu.							
≤ 12 years	696	58.7	489	41.3	1185	80.8	$\chi2$= 8.111
> 12 years	191	68.0	90	32.0	281	19.2	d.f.= 1
Total	887	60.5	579	39.5	1466	100	p= 0.004
Home district							
North	192	64.6	105	35.4	297	20.0	
South	172	58.7	121	41.3	293	19.7	$\chi2$= 7.366
Central	192	60.8	124	39.2	316	21.3	d.f.= 4
West	151	54.7	125	45.3	276	18.6	p= 0.118
East	191	63.2	111	36.8	302	20.4	
Total	898	60.5	586	39.5	1484	100	

5.8.9 Feeling lonely

22.8% of the adolescents were felt very lonely in the past 12 months preceding the survey.

5.8.9.1 Students' age, class, type of school and nationality and students feeling lonely in the past 12 months:

Students' age and class level were positively significantly associated with feeling lonely (≥ sometimes). Type of school and nationality were not associated with feeling lonely in the past 12 months (Table 5.70).

Table 5-70. The association between students' class, type of school and nationality and students feeling lonely in the past 12 months

Variables	Feeling lonely in the past 12 months						
	Never/rarely		≥ Sometimes		Total		χ2 Test
	N	%	N	%	N	%	
Age							
≤ 16	294	84.2	55	15.8	349	23.6	χ2= 8.111
17-18	673	76.3	209	23.7	882	59.3	d.f.= 2
≥ 19	181	70.7	75	29.3	256	17.2	p< 0.001
Total	1148	77.2	339	22.8	1487	100	
Class level							
1st grade	386	80.8	92	19.2	478	32.1	χ2= 7.055
2nd grade	381	77.4	111	22.6	492	33.1	d.f.= 2
3rd grade	381	73.7	136	26.3	517	34.8	p= 0.029
Total	1148	77.2	339	22.8	1487	100	
School type							
Public	787	77.0	235	23.0	1022	68.7	χ2= 0.072
Private	361	77.6	104	22.4	468	31.2	d.f.= 1
Total	1148	77.2	339	22.8	1487	100	p=0.789
Nationality							
Saudi	1032	77.9	293	22.1	1325	89.6	χ2= 1.605
Non-Saudi	113	73.4	41	26.6	154	10.4	d.f.= 1
Total	1145	77.4	334	22.6	1479	100	p= 0.205

5.8.9.2 Students' feeling lonely in the past 12 months and students' fathers' and mothers' education level and home district:

There were no significant association between students' fathers' and mothers' education and home district with regard to feeling lonely in the past 12 months (Table 5.71).

Table 5-71. The association between students' fathers' and mothers' education and home district

Variables	Feeling lonely in the past 12 months						
	Never/rarely		≥ Sometimes		Total		$\chi 2$ Test
	N	%	N	%	N	%	
Fathers' edu.							$\chi 2$= 0.616
≤ 12 years	724	76.9	218	23.1	942	64.0	d.f.= 1
> 12 years	416	78.6	113	21.4	529	36.0	p= 0.432
Total	1140	77.5	331	22.5	1471	100	
Mothers' edu.							$\chi 2$= 0.001
≤ 12 years	924	77.7	265	22.3	1189	81.1	d.f.= 1
> 12 years	215	77.6	62	22.4	277	18.9	p= 0.973
Total	1139	77.7	327	22.3	1466	100	
Home district							
North	239	80.2	59	19.8	398	20.1	$\chi 2$= 2.654
South	229	77.9	65	22.1	294	19.8	d.f.= 4
Central	242	76.8	73	23.2	315	21.2	p= 0.617
West	208	74.8	70	25.2	278	18.7	
East	229	76.3	71	23.7	300	20.2	
Total	1147	77.2	338	22.8	1485	100	

5.8.10 Students' feeling very worried

27% of the adolescents reported they very worried in the past 12 months preceding the survey.

5.8.10.1 Students' being very worried in the past 12 months and students' age, class, type of school and nationality:

Student's older age and higher class level were positively statistically associated with being very worried sometimes and more in the past 12 months. Type of school and nationality were not associated with being very worried in the past 12 months (Table 5.72).

Table 5-72. The association between students being very worried and students' age, class, type of school and nationality.

Variables	Feeling very worried in the past 12 months						
	Never/rarely		≥ Sometimes		Total		χ^2 Test
	N	%	N	%	N	%	
Age							
≤ 16	280	79.1	74	20.9	354	23.7	χ^2= 16.698
17-18	647	73.0	239	27.0	886	59.3	d.f.= 2
≥ 19	163	82.3	91	35.8	254	17.0	*p*< 0.001
Total	1090	73.0	404	27.0	1494	100	
Class level							
1st grade	371	76.2	116	23.8	487	32.6	χ^2= 9.237
2nd grade	367	74.7	124	25.3	491	32.9	d.f.= 2
3rd grade	352	68.2	164	31.8	516	34.5	*p*= 0.010
Total	1090	73.0	404	27.0	1494	100	
School type							χ^2= 0.487
Public	743	72.4	283	27.6	1026	68.7	d.f.= 1
Private	347	74.1	121	25.9	468	31.3	*p*=0.485
Total	1090	73.0	404	27.0	1494	100	
Nationality							χ^2= 0.344
Saudi	974	73.2	357	26.8	1331	89.6	d.f.= 1
Non-Saudi	110	71.0	45	29.0	155	10.4	*p*=0.485
Total	1084	72.9	402	27.1	1486	100	

5.8.10.2 Students' being very worried in the past 12 months and their fathers', mothers' education and living district:

Low fathers' education was significantly associated with being very worried in the past 12 months. Mothers' education and living district were found not to have a significant association (Table 5.73).

Table 5-73. The association between students being very worried in the past 12 months and their fathers', mothers' education and living district.

Variables	Feeling very worried in the past 12 months						
	Never/rarely		≥ Sometimes		Total		χ2 Test
	N	%	N	%	N	%	
Father edu.							χ2= 5.312
≤ 12 years	671	71.0	274	29.0	945	63.9	d.f.= 1
> 12 years	408	76.5	125	23.5	533	36.1	p= 0.021
Total	1079	73.0	399	27.0	1478	100	
Mother edu.							χ2= 0.660
≤ 12 years	867	72.8	324	27.2	1191	80.9	d.f.= 1
> 12 years	212	75.2	70	24.8	282	19.1	p= 0.417
Total	1079	73.3	394	26.7	1473	100	
School district							
North	226	75.6	73	24.4	299	20.0	χ2= 3.022
South	216	73.2	79	26.8	295	19.8	d.f.= 4
Central	235	74.4	81	25.6	316	21.2	p= 0.554
West	196	70.3	83	29.7	279	18.7	
East	215	71.0	88	29.0	303	20.3	
Total	1088	72.9	404	27.1	1492	100	

5.8.10.3 Students' feeling very worried and feeling lonely in the past 12 months:

There was a strong positive association between feeling very lonely and being so worried in the past 12 months preceding the survey (Table 5.74).

Table 5-74. The association between feeling very worried and feeling lonely in the past 12 months

Feeling very lonely	Feeling very worried in the past 12 months						
	Never/rarely		≥ Sometimes		Total		χ2 Test
	N	%	N	%	N	%	
Never/rarely	951	83.1	193	16.9	1144	77.1	χ2= 268.494 d.f.= 1 p< 0.001
≥ Sometimes	129	38.1	210	61.9	339	22.9	
Total	1080	72.8	403	27.2	1483	100	

5.8.11 Feeling very sad or hopeless

40% of the students reported feeling very sad or hopeless for two weeks or more in row in the past 12 months.

5.8.11.1 Students' feeling very sad or hopeless almost every day for two weeks or more in row in the past 12 months and students' age, class, type of school and nationality:

Students' age was significantly associated with students feeling very sad or hopeless for two weeks or more in row. There were no significant differences among students in different school classes, school type and nationality (Table 5.75).

Table 5-75. The association between feeling very sad or hopeless almost every day for two weeks or more in row

Variables	Feeling very sad or hopeless for two weeks or more in row						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Age							
≤ 16	232	66.3	118	33.7	350	23.6	$\chi 2$= 15.908
17-18	529	60.3	349	39.7	878	59.3	d.f.= 2
≥ 19	127	50.2	126	49.8	253	17.1	p< 0.001
Total	888	60.0	593	40.0	1481	100	
Class level							
1st grade	302	63.3	175	36.7	477	32.2	$\chi 2$= 4.149
2nd grade	292	59.8	196	40.2	488	33.0	d.f.= 2
3rd grade	294	57.0	222	43.0	516	34.8	p= 0.124
Total	888	60.0	593	40.0	1481	100	
School type							
Public	609	59.7	411	40.3	1020	68.9	$\chi 2$= 0.088
Private	279	60.5	182	39.5	461	31.1	d.f.= 1
Total	888	60.0	593	40.0	1481	100	p= 0.767
Nationality							$\chi 2$= 0.783
Saudi	788	59.7	532	40.3	1320	89.6	d.f.= 1
Non-Saudi	97	63.4	56	36.6	153	10.4	p=0.376
Total	885	60.1	588	39.9	1473	100	

5.8.11.2 Students feeling sad or hopeless almost every day for two weeks or more in row and fathers' and mothers' education and living district:

There were no associations between fathers' and mothers' education and living district with students' feeling sad or hopeless almost every day for two weeks or more in row (Table 5.76).

Table 5-76. The association between students feeling sad or hopeless almost every day for two weeks or more in row and fathers' and mothers' education and living district.

Variables	Feeling very sad or hopeless for two weeks or more in row						
	No		Yes		Total		χ2 Test
	N.	%	N.	%	N.	%	
Fathers' edu.							χ2= 0.023
≤ 12 years	559	59.8	376	40.2	935	63.8	d.f.= 1
> 12 years	319	60.2	211	39.8	530	36.2	p= 0.880
Total	878	59.9	587	40.1	1465	100	
Mothers' edu.							
≤ 12 years	696	59.0	484	41.0	1180	80.8	χ2= 2.305
> 12 years	179	63.9	101	36.1	280	19.2	d.f.= 1
Total	875	59.9	585	40.1	1460	100	p= 0.129
Home district							
North	185	61.9	114	38.1	299	20.2	χ2= 2.202
South	178	61.2	113	38.8	291	19.7	d.f.= 4
Central	190	60.5	124	39.5	314	21.2	p= 0.699
West	156	56.3	121	43.7	277	18.7	
East	179	60.1	119	39.9	298	20.1	
Total	888	60.0	591	40.0	1479	100	

5.8.12 Students' suicide

5.8.12.1 Students' thoughts of suicide and students' age, class, type of school and nationality

There were no associations between students' age, school class, type of school and nationality with thinking of suicide (Table 5.77).

Table 5-77. The association between thought of suicide and students' age, class, type of school and nationality

Variables	Thought of attempting suicide						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Age							
≤ 16	307	89.2	37	10.8	344	23.5	$\chi 2$= 5.674 d.f.= 2 p= 0.059
17-18	731	84.3	136	15.7	867	59.3	
≥ 19	221	87.7	31	12.3	252	17.2	
Total	1259	86.1	204	13.9	1463	100	
Class level							
1st grade	410	86.5	64	13.5	474	32.4	$\chi 2$= 0.708 d.f.= 2 p= 0.702
2nd grade	407	85.0	72	15.0	479	32.7	
3rd grade	442	86.7	68	13.3	510	34.9	
Total	1259	86.1	204	13.9	1463	100	
Type of School							
Public	873	86.8	133	13.2	1006	68.8	$\chi 2$= 1.404 d.f.= 1 p= 0.236
Private	386	84.5	71	15.5	457	31.2	
Total	1259	86.1	204	13.9	1463	100	
Nationality							
Saudi	1127	86.6	175	13.4	1302	89.5	$\chi 2$= 3.452 d.f.= 1 p= 0.063
Non-Saudi	124	81.0	29	19.0	153	10.5	
Total	1251	86.0	204	14.0	1455	100	

5.8.12.2 Students' thoughts of suicide and fathers' and mothers' education and living district:

There were no associations between students' fathers' and mothers' education and living district with thinking of suicide (Table 5.78).

Table 5-78. The association between students' thoughts and students' fathers' and mothers' education and living district with thinking of suicide

Variables	Thought of attempting suicide						
	No		Yes		Total		χ2 Test
	N.	%	N.	%	N.	%	
Fathers' edu.							χ2= 0.012
≤ 12 years	793	86.2	127	13.8	920	63.5	d.f.= 1
> 12 years	454	86.0	74	14.0	528	36.5	p = 0.911
Total	1247	86.1	201	13.9	1448	100	
Mothers' edu.							χ2= 0.078
≤ 12 years	1004	86.3	160	13.7	1164	80.7	d.f.= 1
> 12 years	238	85.6	40	14.4	278	19.3	p = 0.781
Total	1242	86.1	200	13.9	1442	100	
Home district							
North	251	85.1	44	14.9	295	20.2	χ2= 2.405
South	253	86.9	38	13.1	291	19.9	d.f.= 4
Central	273	88.1	37	11.9	310	21.2	p= 0.662
West	233	86.3	37	13.7	270	18.5	
East	249	84.1	47	15.9	296	20.2	
Total	1259	86.1	203	13.9	1462	100	

5.8.12.3 Students' thinking of attempting suicide and feeling very lonely, being very worried and very sad or hopeless for two weeks or more in row:

Thinking of suicide among adolescents was positively associated with feeling very lonely, being very worried and very sad or hopeless for two weeks or more in row or more in the past 12 months (Table 5.79).

Table 5-79. The association between thinking of attempting suicide and feeling very lonely, being very worried and very sad or hopeless for two weeks or more in row

Variables	Thought of attempting suicide						
	No		Yes		Total		χ2 Test
	N.	%	N.	%	N.	%	
Feeling very lonely							χ2= 65.94
Never/rarely	1007	90.1	111	9.9	1118	76.9	d.f.= 1
≥ Sometimes	243	72.5	92	27.5	335	23.1	p < 0.001
Total	1250	86.0	203	14.0	1453	100	
Being very worried							χ2= 41.65
Never/rarely	955	89.6	111	10.4	1066	73.0	d.f.= 1
≥ Sometimes	301	76.4	93	23.6	394	27.0	p < 0.001
Total	1256	86.0	204	14.0	1460	100	

Very sad or hopeless							$\chi 2$= 73.36
No	805	92.5	65	7.5	870	60.0	d.f.= 1
Yes	444	76.7	135	23.3	579	40.0	p < 0.001
Total	1249	86.2	200	13.8	1449	100	

5.8.12.4 Students' actual attempting suicide in the past 12 months and students' age, class, school type and nationality:

There were no associations between students' age, class, school type and nationality with students' actual attempting suicide in the past 12 months (Table 5.80).

Table 5-80. The association of actual attempting suicide in the past 12 months and students' age, class, school type and nationality.

Variables	Attempting suicide in the past 12 months						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Age							
≤ 16	330	94.8	18	5.2	348	23.5	$\chi 2$= 2.357
17-18	812	92.4	67	7.6	867	59.3	d.f.= 2
≥ 19	238	93.3	17	6.7	255	17.2	p= 0.308
Total	1380	93.1	102	6.9	1482	100	
Class level							
1st grade	447	93.5	31	6.5	478	32.3	$\chi 2$= 0.312
2nd grade	452	92.6	36	7.4	488	32.9	d.f.= 2
3rd grade	481	93.2	35	6.8	516	34.8	p= 0.865
Total	1380	93.1	102	6.9	1482	100	
Type of School							$\chi 2$= 0.001
Public	946	93.1	70	6.9	1016	68.8	d.f.= 1
Private	434	93.1	32	6.9	466	31.4	p= 0.987
Total	1380	93.1	102	6.9	1482	100	
Nationality							
Saudi	1235	93.5	86	6.5	1321	89.6	$\chi 2$= 3.317
Non-Saudi	137	89.5	16	10.5	153	10.4	d.f.= 1
Total	1372	93.1	102	6.9	1474	100	p=0.069

5.8.12.5 Students' actual attempting suicide in the past 12 months and students' and students' fathers' and mothers' education and living district:

There were no associations between students' fathers' and mothers' education and living district with students' actual attempting suicide in the past 12 months (Table 5.81).

Table 5-81. The association of students' actual attempting suicide in the past 12 months and students' fathers' and mothers' education and living district

Variables	Attempting suicide in the past 12 months						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Fathers' edu.							$\chi 2$= 0.352
≤ 12 years	870	92.8	68	7.2	938	63.9	d.f.= 1
> 12 years	495	93.6	34	6.4	529	36.1	p= 0.552
Total	1365	93.0	102	7.0	1467	100	
Mothers' edu.							
≤ 12 years	1101	93.1	82	6.9	1183	81.0	$\chi 2$= 0.003
> 12 years	259	93.2	19	6.8	278	19.0	d.f.= 1
Total	1360	93.1	101	6.9	1461	100	p= 0.954
Home district							
North	283	94.6	16	5.4	299	20.2	$\chi 2$= 1.958
South	269	92.8	21	7.2	290	19.6	d.f.= 4
Central	288	92.0	25	8.0	313	21.1	p=0.744
West	257	92.8	20	7.2	270	18.7	
East	282	93.7	19	6.3	301	20.3	
Total	1379	93.2	101	6.8	1480	100	

5.8.12.6 Students' actual attempting suicide in the past 12 months and students' psychological variables in the past 12 months:

Students' attempting suicide was positively associated with thinking of suicide, feeling very sad or hopeless for two weeks or more in row or more, feeling very lonely and being very worried and in the past 12 months (Table 5.82).

Table 5-82. The association between actual attempting suicides with psychological variables in the past 12 months

Variables	Attempting suicide in the past 12 months						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Thinking of suicide							
No	1206	96.6	42	3.4	1248	86.1	$\chi 2$= 153.55
Yes	148	73.3	54	26.7	202	13.9	d.f.= 1
Total	1354	93.4	96	6.6	1450	100	p< 0.001

Very sad or hopeless							$\chi2$= 17.73
No	842	95.6	39	4.4	881	59.9	d.f.= 1
Yes	530	90.0	59	10.0	589	40.1	p< 0.001
Total	1372	93.3	98	6.7	1470	100	
Feeling very lonely							
Never/rarely	1079	95.0	57	5.0	1136	77.1	$\chi2$= 26.30
≥ Sometimes	293	86.9	44	13.1	337	22.9	d.f.= 1
Total	1372	93.1	101	6.9	1473	100	p< 0.001
Being very worried							
Never/rarely	1022	94.6	58	5.4	1080	73.0	$\chi2$= 14.52
≥ Sometimes	355	89.0	44	11.0	399	27.0	d.f.= 1
Total	1377	93.1	102	6.9	1479	100	p< 0.001

5.8.13 Students attitudes towards drugs and alcohol

About 13.8% of the adolescents in this study reported wanting to use drugs or alcohol in the past 12 months to feel good.

5.8.13.1 Students want to use drugs or alcohol in the past 12 months to feel good and students' age, class, type of school and nationality:

Students' age was found to be positively associated with being wanted to use drugs or alcohol to feel good. Older students were more likely to report wanting to use drugs or alcohol in the past 12 months to feel good. School class, type of school and nationality were not associated with being wanted to use drugs or alcohol in the past 12 months (Table 5.83).

Table 5-83. The association between students' want to use drugs or alcohol in the past 12 months to feel good and students' age, class, type of school and nationality.

Variables	Want to use drugs or alcohol in the past 12 months						
	No		Yes		Total		$\chi2$ Test
	N.	%	N.	%	N.	%	
Age							
≤ 16	326	92.4	27	7.6	353	23.7	$\chi2$= 19.80
17-18	756	85.5	128	14.5	884	59.2	d.f.= 2
≥ 19	204	80.0	51	20.0	255	17.1	p< 0.001
Total	1286	86.2	2.6	13.8	1492	100	
Class level							
1st grade	431	88.9	54	11.1	485	32.5	$\chi2$= 4.61
2nd grade	419	85.5	71	14.5	490	32.8	d.f.= 1
3rd grade	436	84.3	81	15.7	517	34.7	p= 0.100
Total	1286	86.2	206	13.8	1492	100	

Type of School							
Public	878	85.6	148	14.4	1026	68.8	$\chi 2$= 1.05
Private	408	87.6	58	12.4	466	31.2	d.f.= 1
Total	1286	86.2	206	13.8	1492	100	p= 0.305
Nationality							$\chi 2$= 0.21
Saudi	1149	86.4	181	13.6	1330	89.6	d.f.= 1
Non-Saudi	131	85.1	32	14.9	154	10.4	p= 0.651
Total	1280	86.3	204	13.7	1484	100	

5.8.13.2 Students want to use drugs or alcohol in the past 12 months to feel good and students' fathers' and mothers' education and living district:

There was no association between Students' want to use drugs or alcohol in the past 12 months and fathers' and mothers' education and living district (Table 5.84).

Table 5-84. The association between students' want to use drugs or alcohol in the past 12 months to feel good and fathers' and mothers' education and living district

Variables	Want to use drugs or alcohol in the past 12 months						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Fathers' edu.							
≤ 12 years	803	85.1	141	14.9	944	64	$\chi 2$= 2.735
> 12 years	469	88.2	63	11.8	532	36	d.f.= 1
Total	1272	86.2	204	13.8	1476	100	p=0.098
Mothers' edu.							$\chi 2$= 0.029
≤ 12 years	1029	86.4	162	13.6	1191	81	d.f.= 1
> 12 years	243	86.8	37	13.2	280	19	p= 0.864
Total	1272	86.5	199	13.5	1471	100	
Home district							
North	258	86.3	41	13.7	299	20.1	$\chi 2$= 3.215
South	249	84.7	45	15.3	294	19.7	d.f.= 4
Central	282	89.0	35	11.0	317	21.3	p= 0.523
West	236	84.6	43	15.4	279	18.7	
East	260	86.4	41	13.6	301	20.2	
Total	1285	86.2	205	13.8	1490	100	

5.8.13.3 Students' desire to use drugs or alcohol in the past 12 months and psychological variables and other risk behaviours:

13.8% of the adolescents wanted to use alcohol or drugs in the past 12 months preceding the survey. There was a highly significant association between wanting to use alcohol or drugs and feeling very sad or hopeless, feeling very lonely , being very worried, thought of suicide, actual attempting suicide, being bullied, being abused by family, being abused by teacher, physical fight, carrying weapons, smoking behaviour and car drifting (Table 5.85).

Table 5-85. The association between students' desire to use drugs or alcohol in the past 12 months and other risk behaviours.

Variables	Want to use drugs or alcohol in the past 12 months						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Feeling very sad or hopeless							$\chi 2$= 61.277
No	817	92.1	70	7.9	887	60	d.f.= 1
Yes	461	77.9	131	22.1	592	40	p< 0.001
Total	1278	86.4	201	13.6	1479	100	
Feeling very lonely							
Never/rarely	1038	90.6	108	9.4	1146	77.2	$\chi 2$= 80.961
≥ Sometimes	242	71.4	97	28.6	336	22.8	d.f.= 1
Total	1280	86.2	205	13.8	1484	100	p< 0.001
Being very worried							
Never/rarely	990	91.2	95	8.8	1085	72.9	$\chi 2$= 86.537
≥ Sometimes	293	72.5	111	27.5	404	27.1	d.f.= 1
Total	1377	86.2	206	13.8	1489	100	p< 0.001
Thought of suicide							
No	1124	89.5	132	10.5	1256	86.1	$\chi 2$= 75.076
Yes	136	67.0	67	33.0	203	13.9	d.f.= 1
Total	1260	86.5	199	13.5	1459	100	p< 0.001
Attempting suicide							
No	1221	88.6	157	11.4	1378	93.2	$\chi 2$= 102.893
Yes	53	52.5	48	47.5	101	6.8	d.f.= 1
Total	282	89.0	35	11.0	317	21.3	p< 0.001
Being bullied							
No	981	89.3	118	10.7	1099	74	$\chi 2$= 34.78
Yes	298	77.2	88	22.8	386	26	d.f.= 1
Total	1279	86.1	206	13.9	1485	100	p< 0.001
Abused by family							
No	817	91.3	78	8.7	895	60.4	$\chi 2$= 49.854
Yes	459	78.3	127	21.7	586	39.6	d.f.= 1
Total	1279	86.2	205	13.8	1481	100	p< 0.001

Abused by teacher							χ^2= 32.661
No	878	89.9	99	10.1	977	65.6	d.f.= 1
Yes	405	79.1	107	20.9	512	34.4	p< 0.001
Total	1283	86.2	206	13.8	1489	100	
Physical fight							
No	705	92.5	57	7.5	762	51.2	χ^2= 51.966
Yes	579	79.6	148	20.4	727	48.8	d.f.= 1
Total	1284	86.2	205	13.8	1489	100	p< 0.001
Carrying weapons							
No	861	91.7	78	8.3	939	63.6	χ^2= 63.215
Yes	413	76.9	124	23.1	537	36.4	d.f.= 1
Total	1274	86.3	202	13.7	1476	100	p< 0.001
Smoking status							
Non-smokers	1075	91.2	104	8.8	1179	79.3	χ^2= 115.359
Current smokers	208	67.5	100	32.5	308	20.7	d.f.= 1
Total	1283	86.3	204	13.7	1487	100	p< 0.001
Car drifting							
No	884	92.9	68	7.1	952	63.9	χ^2= 99.164
Yes	399	74.3	138	25.7	537	36.1	d.f.= 1
Total	1283	86.2	206	13.8	1489	100	p< 0.001

5.8.14 Driving and safety

5.8.14.1 Prevalence of driving and safety behaviours

78.7%, 96% and 97.7% of the students drive, not using seat belt when driving and not using seat belt when riding a vehicle, respectively. 36.1%, 46.7% and 42.9% of the students perform car drifting, join people while performing car drifting and attend car drifting events, respectively. Using a helmet and seat belt are very rare practices in Saudi Arabia. 37.1% use non-motorcycle and only 1.4% use helmet. 55.3% use motorcycle and only 2% use helmet when drive motorcycle (Table 5.86).

Table 5-86. Driving and using seat belt behaviours

Variables	No.	%
Driving a vehicle		
I do not drive	319	21.3
I drive	1180	78.7
Total	1499	100
Using seat belt when driving a vehicle		
No	1133	96
Yes	47	4
Total	1180	100
Using seat belt when riding a vehicle		
No	1465	97.7
Yes	34	2.3
Total	1499	100
Practicing car drifting		
No	956	63.9
Yes	539	36.1
Total	1495	100
Join people performing car drifting		
No	797	53.3
Yes	697	46.7
Total	1499	100
Attending car drifting events		
No	853	57.1
Yes	642	42.9
Total	1495	100
Using non-motorizes		
No	939	62.9
Yes	554	37.1
Total	1493	100
Wearing helmet when using non-motorized vehicle		
No	546	98.6
Yes	8554	1.4100
Total		

Using motorcycle		
No	667	44.7
Yes	826	55.3
Total	1493	100
Wearing helmet when using motorcycle		
No	809	97.9
Yes	17	2.1
Total	826	100

5.8.14.2 Students using seat belt behaviour when driving and when riding vehicle:

Using seat belt when riding the car was positively associated with using seat belt when driving car and the association was significant (Table 5.87).

Table 5-87. The association between using seat belt when driving and when riding a vehicle

Seat belt when riding car	Using seat belt when driving car						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
No	1123	97.5	29	2.5	1152	97.6	$\chi 2$= 272.707 d.f.= 1 p< 0.001
Yes	10	35.7	18	64.3	28	2.4	
Total	1133	96	47	4	1180	100	

5.8.15 Car drifting

5.8.15.1 Student' performing car drifting behaviour and students' age, class, type of school and nationality:

Students' age and type of school were associated with performing car drifting behaviour. Older students and studying in private school were positively associated with performing car drifting behaviour (Table 5.88).

Table 5-88. The association between Students performing car drifting behaviour and students' age, class, type of school and nationality

Variables	Performing car drifting						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Age							
≤ 16	250	71.0	102	29.0	352	23.5	$\chi 2$= 11.817
17-18	557	62.8	330	37.2	887	59.3	d.f.= 2
≥ 19	149	58.2	107	41.8	256	17.1	p< 0.001
Total	956	63.9	539	36.1	1495	100	
Class level							
1st grade	308	63.6	176	36.4	484	32.4	$\chi 2$= 0.058
2nd grade	316	63.8	179	36.2	495	33.1	d.f.= 2
3rd grade	332	64.3	184	35.7	516	34.5	p = 0.972
Total	956	63.9	539	36.1	1495	100	
Type of School							
Public	675	65.7	352	34.3	1027	68.7	$\chi 2$= 4.503
Private	281	60.0	187	40.0	468	31.3	d.f.= 2
Total	956	63.9	539	36.1	1495	100	p= 0.034
Nationality							
Saudi	841	63.1	491	36.9	1332	89.6	$\chi 2$= 3.692
Non-Saudi	110	71	45	29	155	10.4	d.f.= 1
Total	951	64	536	36	1487	100	p= 0.055

5.8.15.2 Students performing car drifting and fathers', mothers' education and home district:

Lower levels of fathers' education was positively associated with performing car drifting in the past 12 months. Mothers' education and home district were not associated with car drifting behaviour (Table 5.89).

Table 5-89. The association between Students' performing car drifting behaviour and students' fathers', mothers' education and home district

Variables	Performing car drifting in the past 12 months						
	No		Yes		Total		χ2 Test
	N.	%	N.	%	N.	%	
Fathers' edu.							
≤ 12 years	583	61.8	361	38.2	944	63.8	χ2= 5.161
> 12 years	362	67.7	173	32.2	535	36.2	d.f.= 1
Total	945	63.9	534	36.1	1479	100	p= 0.023
Mothers' edu.							
≤ 12 years	753	63.1	440	36.9	1193	80.9	χ2= 3.064
> 12 years	193	68.7	88	31.3	281	19.1	d.f.= 1
Total	946	64.2	528	35.8	1474	100	p= 0.080
Home district							
North	191	63.5	110	36.5	301	20.2	χ2= 1.189
South	181	61.8	112	38.2	293	19.6	d.f.= 4
Central	204	64.2	114	35.8	318	100	p= 0.880
West	182	65.7	95	34.3	277	18.6	
East	198	65.1	106	34.9	304	20.4	
Total	956	64	537	36	1493	100	

5.8.15.3 Join people in the same car as a passenger when performing car drifting and students' age, class type of school and nationality.

There was no association between join people who perform car drifting in the past 12 months and students' age, class level, type of school and nationality (Table 5.90).

Table 5-90. Joining people in the same car as a passenger when performing car drifting and students' age, class type of school and nationality.

Variables	Join car drifting in the past 12 months						
	No		Yes		Total		χ2 Test
	N.	%	N.	%	N.	%	
Age							
≤ 16	194	55.1	158	44.9	352	23.6	χ2= 0.578
17-18	468	52.8	418	47.2	886	59.3	d.f.= 2
≥ 19	135	52.7	121	47.3	256	17.1	p= 0.749
Total	797	53.3	697	46.7	1494	100	
Class level							
1st grade	258	53.3	226	46.7	484	32.4	χ2= 0.276
2nd grade	260	52.5	235	47.5	495	33.1	d.f.= 2
3rd grade	279	54.2	236	45.8	515	34.5	p= 0.871
Total	956	63.9	539	36.1	1494	100	
Type of School							χ2= 0.470
Public	554	53.9	473	46.1	1027	68.7	d.f.= 1
Private	243	52.0	224	48.0	467	31.3	p= 0.493

Total	797	53.3	697	46.7	1494	100	
Nationality							$\chi 2$= 0.213
Saudi	713	53.6	618	46.4	1331	89.6	d.f.= 1
Non-Saudi	80	51.6	75	48.4	155	10.4	p= 0.644
Total	793	53.4	693	46.6	1486	100	

5.8.15.4 Joining people in the same car as a passenger when performing car drifting

There was no association between join people who perform car drifting in the past 12 months and students' fathers', mothers' and living district (Table 5.91).

Table 5-91. Joining people in the same car as a passenger when performing car drifting

Variables	Join car drifting in the past 12 months						
	No		Yes		Total		$\chi 2$ Test
	N.	%	N.	%	N.	%	
Fathers' edu.							$\chi 2$= 1.122
12 years	493	52.3	450	47.7	943	63.8	d.f.= 1
> 12 years	295	55.1	240	44.9	535	36.2	p= 0.290
Total	788	53.3	690	36.1	1478	100	
Mothers' edu.							
12 years	639	53.6	553	46.4	1192	80.9	$\chi 2$= 0.005
> 12 years	150	53.4	131	46.6	281	19.1	d.f.= 1
Total	789	53.6	684	46.4	1473	100	p= 0.945
Home district							
North	168	55.8	133	44.2	301	20.2	$\chi 2$= 01.648
South	151	51.5	142	48.5	293	19.6	d.f.= 4
Central	171	53.8	147	46.2	318	21.3	p= 0.800
West	142	51.4	134	48.6	276	18.5	
East	156	54.3	139	45.7	304	20.4	
Total	797	53.4	695	46.6	1492	100	

5.8.16 The schools role in teaching students regarding violent, safety, mental health problem management, and students' knowledge:

42% of the students stated that they were taught about how to avoid and prevent vehicle accidents, 49.4% were taught how to avoid and prevent other type of accidents, 31.2% were taught how to avoid fighting, 25.1% were taught how to avoid being bullied, 38.3% were you taught about first aid skills, 20.7% were taught how to

handle stress in healthy way, 35.7% were taught how to manage anger in healthy way and 14.5% were taught what to do if a friend is thinking about suicide (Table 5.92).

Table 5-92. School role in safety and mental health:

Variables	Frequency	Percentage
Were you taught how to avoid and prevent vehicle accidents? Yes	627	42
Were you taught how to avoid and prevent other type of accidents?(such as fires, poison) Yes	737	49.4
Were you taught how to avoid fighting? Yes	466	31.2
Were you taught how to avoid being bullied? Yes	374	25.1
Were you taught about first aid skills? Yes	572	38.3
Were you taught how to handle stress in healthy way? Yes	309	20.7
Were you taught how to manage anger in healthy way? Yes	532	35.7
Were you taught what to do if a friend is thinking about suicide? Yes	216	14.5

5.8.17 The need for health education programmes regarding preventing injuries and violence and promoting safety

A total of 1189 (80%) of the students in this study agreed that students need health education programmes about how to prevent injuries and avoid violence.

6. Chapter Six: Results 2, Multivariable Analyses

6.1 Dietary behaviour

6.1.1 The Association between eating breakfast regularly and socio demographic characteristics:

The association between breakfast eating behaviour and students' background characteristics were tested using binary logistic regression. Model 1 (Table 6.1) show that only students' age is the variable that independently associated with eating breakfast regularly (≥ 5 days/week). School district, school type, fathers' and mothers' education were not associated with students' eating breakfast regularly. Also, when I checked for interaction between fathers' and mothers' education, there was no significant interaction and adding interaction to the model did not help to improve the model.

Table 6-1. Logistic regression model for eating breakfast with students' age, school type, fathers' and mothers' education and living district.

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9 [0.8 – 0.9]	0.012	0.9 [0.8 – 0.9]	0.013
School Type				
Private School (ref)	-	-	-	-
Public School	0.9 [0.7 – 1.2]	0.522	0.9 [0.7 – 1.2]	0.552
Living district	-	0.057		0.047
East (ref)	-	-	-	-
North	0.8 [0.6 – 1.2]	*0.367*	0.8 [0.6 – 1.2]	*0.336*
South	0.7 [0.5 – 1.0]	*0.076*	0.7 [0.5 – 1.0]	*0.064*
Central	0.6 [0.4 – 0.9]	*0.008*	0.6 [0.4 – 0.9]	*0.006*
West	0.9 [0.7 – 1.3]	*0.686*	0.9 [0.7 – 1.3]	*0.608*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽12 years	0.9 [0.7 – 1.1]	0.322	1.1 [0.7 – 2.0]	0.601
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽12 years	0.9 [0.7 – 1.3]	0.817	1.1 [0.7 – 1.5]	0.656
Father's by mother's education	-	-	0.7 [0.4 – 1.3]	0.272

Note: Breakfast was dichotomized to Skipping breakfast vs. Eating breakfast (⩾ 5 days/week)

Model without interaction: -2 Log likelihood = 1904.327, Hosmer and Lemeshow Test p-value= 0.518, and Omnibus Tests of Model Coefficients p= 0.027
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1903.128, Hosmer and Lemeshow Test p-value= 0.250, and Omnibus Tests of Model Coefficients p=0.030

The model was re-built (Table 6.2) without the non significant variables and parental education interaction. The variables were removed from the model one by one starting with the largest non significant p-value. The regression model shows that age was significantly associated negatively with eating breakfast regularly (OR= 0.90, 95% CI= 0.8–0.9, *P*= 0.010), which means that older adolescents were less likely to eat breakfast than younger students, or in other words, that younger adolescents eat breakfast more frequently than older students. School district became significant. Only students living in the central district show significant negative association with eating breakfast regularly compared with the reference level (OR= 0.6, 95%CI= 0.9 – 1.8, p= 0.012), (see table 6.2).

Table 6-2. Eating breakfast and student's age and living districts.

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9	0.8 – 0.9	0.010
Living district	-	-	0.049
East (ref)	-	-	-
North	0.9	1.3 – 2.6	*0.717*
South	0.7	0.7 – 1.4	*0.060*
Central	0.6	0.9 – 1.8	*0.012*
West	0.9	0.9 – 1.8	*0.659*

-2 Log likelihood = 1949.532, Hosmer and Lemeshow Test p-value =0.521, and Omnibus Tests of Model Coefficients p=0.010.

6.1.2 The association between breakfast eating with perceived health, liking school and school performance

I checked for the association between perceived health status, liking school and self-reported school performance with regard to students' breakfast eating behaviour adjusting for age, school type, fathers' and mothers' education and home district. Model 1 (Table 6.3) shows that not liking school and poor school performance were negatively significantly associated with eating breakfast regularly. Consistent with the Table 6.1, only age still significant among the socio-demographic variables. When I checked for the interaction between liking school and good school performance in

Model 2 (Table 6.3) there was no interaction between school performance and liking school, also, the interaction did not improve the model.

Table 6-3. Logistic regression for the relationship between eating breakfast to perceived health, liking school and school performance.

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9 [0.8 – 0.9]	0.037	0.9 [0.8 – 0.9]	0.036
School Type				
Private School (ref)	-	-	-	-
Public School	0.9 [0.7 – 1.1]	0.429	0.9 [0.7 – 1.1]	0.431
Living district		0.093		0.094
East (ref)	-	-	-	-
North	0.8 [0.6 – 1.2]	*0.360*	0.8 [0.6 – 1.2]	*0.359*
South	0.7 [0.5 – 1.0]	*0.081*	0.7 [0.5 – 1.0]	*0.081*
Central	0.6 [0.4 – 0.9]	*0.011*	0.6 [0.4 – 0.9]	*0.011*
West	0.9 [0.6 – 1.3]	*0.554*	0.9 [0.6 – 1.3]	*0.550*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽12 years	0.9 [0.7 – 1.2]	0.513	0.9 [0.7 – 1.2]	0.504
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽12 years	0.9 [0.7 – 1.3]	0.989	0.9 [0.7 – 1.3]	0.995
Perceived health status				
Good (ref)	-	-	-	-
Poor	1.1 [0.6 – 1.9]	0.846	1.1 [0.6 – 1.9]	0.845
Liking school				
Yes (ref)	-	-	-	-
No	0.7 [0.6 – 0.9]	0.004	0.7 [0.6 – 0.9]	0.018
Academic Performance				
Good	-	-	-	-
Poor	0.6 [0.5 – 0.8]	0.001	0.7 [0.5 – 0.9]	0.037
Liking school by academic performance	-------	----	0.9 [0.5 – 1.5]	0.713

Model without interaction: -2 Log likelihood = 1845.687, Hosmer and Lemeshow Test = 0.631, and Omnibus Tests of Model Coefficients p<0.001
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1845.552, Hosmer and Lemeshow Test =0.733, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-built again (Table 6.4) without the non significant variables and without the interaction. It shows that students who reported disliking school were significantly less likely to eat breakfast regularly (≥ 5 days/week), (OR= 0.7, 95%CI= 0.6–0.9, *p*= 0.003). As well, students who reported poor school performance were significantly less likely to eat breakfast regularly (OR= 0.6, 95%CI= 0.5–0.8, *p*= 0.001).

Table 6-4. Logistic regression for the relationship between eating breakfast and liking school and school performance

Variables	OR	[95% C.I.]	Likelihood ratio P value
Age (years)	0.9	0.8 – 0.9	0.036
Liking school			
Yes (ref)	-	-	-
No	0.7	0.6 – 0.9	0.003
Academic Performance			
Good (ref)	-	-	-
Poor	0.6	0.5 – 0.8	0.001

-2 Log likelihood = 1892.933, Hosmer and Lemeshow Test p-value = 0.716, and Omnibus Tests of Model Coefficients p< 0.001

6.1.3 The association between breakfast eating with dietary behaviours and student's BMI:

The association between eating breakfast regularly and several other dietary behaviours and students' BMI, adjusting for students' age, type of school fathers' and mothers' education was investigated. Table 6.5 shows that consuming high fat food every day, drinking carbonated drinks (≥ 2 times/day), not consuming milk and milk products daily and students' BMI, has significant negative associations with eating breakfast regularly among students. Whereas, eating at a fast food restaurant, eating sweets, drinking energy beverages and eating fruits were not independently associated with student's breakfast eating behaviour (Table 6.5).

Table 6-5. Logistic regression of the relationship between eating breakfast and other dietary behaviours and BMI among adolescents

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9	0.8 – 1.0	0.134
School Type			
Private School (ref)	-	-	-
Public School	0.8	0.6 – 1.1	0.160
Living district			0.073
East (ref)	-	-	-
North	0.9	0.6 – 1.3	*0.648*
South	0.8	0.5 – 1.1	*0.199*
Central	0.6	0.4 – 0.9	*0.015*
West	1.0	0.7 – 1.4	*0.985*
Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	0.9	0.7 – 1.2	0.546
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.9	0.7 – 1.3	0.926
Eating at fast food restaurants			
Every day (ref)	-	-	-
Not every day	0.9	0.7 – 1.3	0.826
Eating high fat Food			
Every day (ref)	-	-	-
Not every day	1.3	1.1 – 1.7	0.025
Drinking energy drinks			
Every day (ref)	-	-	-
Not every day	1.0	0.8 – 1.3	0.935
Eating sweet and candies			
⩾ 2 time/day (ref)	-	-	-
⩽1 time/day	1.1	0.9 – 1.5	0.332
Drinking Soft drinks			
⩾ 2 time/day (ref)	-	-	-
⩽1 time/day	1.5	1.1 -1.9	0.003
Eating vegetables			
Not every day (ref)	-	-	-
Every day	1.2	0.9 – 1.6	0.077
Eating Fruit			
Not every day (ref)	-	-	-
Every day	1.0	0.8 – 1.4	0.792
Milk and milk products			
Not every day (ref)	-	-	-
Every day	1.9	1.5 – 2.4	< 0.001
Log BMI	0.5	0.3 – 0.7	0.001

-2 Log likelihood = 1774.361, Hosmer and Lemeshow Test p-value = 0.314, and Omnibus Tests of Model Coefficients p< 0.001

I re-built the model by removing the non-significant variables one by one, starting with the largest non significant p- value (Table 6.6). The model shows quite similar results. Not eating high fat food every day was statistically higher among students eating breakfast regularly (≥ 5 day/week). Consuming milk and milk products every day was positively associated with eating breakfast regularly. Drinking less soft drink (≤ 1 time a day) was positively associated with eating breakfast regularly. Interestingly, students' BMI was negatively associated with eating breakfast regularly. Students with higher BMI were less likely to eat breakfast regularly.

Table 6-6. Eating breakfast with dietary behaviours and students' BMI

Variables	OR	[95% C.I.]	Likelihood ratio test P value
Eating high fat Food			
Every day (ref)	-	-	-
Not every day	1.5	1.1 – 1.6	0.023
Drinking Soft drinks			
⩾ 2 time/day (ref)	-	-	-
⩽1 time/day	1.5	1.2 -1.9	< 0.001
Milk and milk products			
Not every day (ref)	-	-	-
Every day	1.9	1.5 – 2.4	< 0.001
Log BMI	0.5	0.3 – 0.7	< 0.001

-2 Log likelihood = 1839.445, Hosmer and Lemeshow Test p-value= 0.656, and Omnibus Tests of Model Coefficients p< 0.001

6.1.4 The association between breakfast eating and other health-related behaviours

Among several health-related behaviours only brushing teeth, physical activity and physical fighting behaviours were independently positively associated with breakfast eating, while adjusting for students' age, school type, home districts, fathers' and mothers' education (Table 6.7). Brushing teeth every day, practicing physical activity for ≥3 times a week and not been engaged in physical fighting were positively associated with eating breakfast every day.

Table 6-7. Logistic regression of eating breakfast and other health related behaviours adjusting for students' background variables.

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9	0.8 – 0.9	0.050
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.8	0.7 – 1.1	0.291
Mother's Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.9	0.7 – 1.3	0.951
School type			
Private(ref)	-	-	-
Public	0.8	0.7 – 1.1	0.316
Living district			0.118
East (ref)	-	-	-
North	0.9	0.6 – 1.3	*0.456*
South	0.8	0.6 – 1.1	*0.170*
Central	0.6	0.5 – 0.9	*0.014*
West	0.9	0.6 – 1.3	*0.700*
Brushing teeth			
< 1 time a day/week	-	-	-
⩾ 1 time a day/week	1.4	1.1 – 1.7	0.009
Physical activity			
⩽ 2 times a week(ref)	-	-	-
⩾ 3 times a week	1.4	1.1 – 1.7	0.020
Smoking			
Current smoking(ref)	-	-	
Non-smoking	1.2	0.8 – 1.6	0.356
Want to use drugs or alcohol			
No (ref)	-	-	-
Yes	1.1	0.7 – 1.5	0.761
Carrying weapons			
No (ref)	-	-	-
Yes	0.9	0.7 – 1.7	0.491
Threaten or injured by weapons			
No (ref)	-	-	-
Yes	1.2	0.9 – 1.7	0.210
Physical fight			
No (ref)	-	-	-
Yes	0.7	0.6 – 0.9	0.022
Performing car drifting			
No (ref)	-	-	-
Yes	0.9	0.7 – 1.2	0.667

Join car drifting			
No (ref)	-	-	-
Yes	0.9	0.6 – 1.1	0.249
Been Bullied by other			
No (ref)	-	-	-
Yes	1.1	0.8 – 1.4	0.495
Bullies other			
No (ref)	-	-	-
Yes	1.0	0.7 – 1.4	0.760
Abused by teacher			
No (ref)	-	-	-
Yes	0.9	0.8 – 1.3	0.988
Abused by family			
No (ref)	-	-	-
Yes	1.1	0.8 – 1.4	0.547
Attempting suicide			
No (ref)	-	-	-
Yes	0.9	0.6 – 1.6	0.860

-2 Log likelihood = 1781.250, Hosmer and Lemeshow Test p-value = 0.208, and Omnibus Tests of Model Coefficients p= 0.007

The model was re-built (Table 6.8) without the non significant variables. The logistic regression model shows that brushing teeth every day and practicing physical activity ≥ 3 times a week were independently associated with eating breakfast regularly. Also, students who reported being involved in physical fight over the past 12 months were significantly less likely to eat breakfast regularly (Table 6.8).

Table 6-8. Eating breakfast with physical fighting and physical activity

Variables	OR	[95% C.I.]	Likelihood ratio test P value
Brushing teeth			
< 1 time a day/week	-	-	-
⩾ 1 time a day/week	1.4	1.1 – 1.7	0.002
Physical activity			
⩽ 2 times a week(ref)	-	-	-
⩾ 3 times a week	1.3	1.1 – 1.6	0.011
Physical fight			
No (ref)	-	-	-
Yes	0.9	0.6 – 0.9	0.003

2 Log likelihood = 1911.708, Hosmer and Lemeshow Test p-value = 0.873, and Omnibus Tests of Model Coefficients p< 0.001

6.1.5 The associations between eating breakfast and all the significant variables from several models

In the final stage all the significant variables were included in one final models. Final model (Table 6.9) shows that among all the significant variables from the separate model, student's age, not liking school, regular physical activity and brushing teeth every day become not significant.

Table 6-9. Final model of eating breakfast with the significant variables from previous model

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9	0.9 – 1.1	0.344
Living district			0.090
East (ref)	-	-	-
North	0.9	0.6 – 1.3	*0.538*
South	0.7	0.5 – 1.1	*0.119*
Central	0.6	0.5 – 0.9	*0.012*
West	0.9	0.6 – 1.3	*0.628*
Liking school			
Yes (ref)	-	-	-
No	0.7	0.6 – 1.0	0.105
Academic Performance			
Good (ref)	-	-	-
Poor	0.6	0.5 – 0.8	0.003
Eating high fat Food			
Every day (ref)	-	-	-
Not every day	1.3	1.1 – 1.7	0.040
Drinking Soft drinks			
⩾ 2 time/day (ref)	-	-	-
⩽1 time/day	1.4	1.1 -1.8	0.005
Milk and milk products			
Not every day (ref)	-	-	-
Every day	1.9	1.5 – 2.4	< 0.001
Log BMI	0.5	0.3 – 0.7	< 0.001
Brushing teeth			
< 1 time a day/week	-	-	-
⩾ 1 time a day/week	1.2	1.1 – 1.7	0.104
Physical activity			
⩽ 2 times a week(ref)	-	-	-
⩾ 3 times a week	1.1	0.9 – 1.4	0.389
Physical fight			
No (ref)	-	-	-
Yes	0.8	0.6 – 1.0	0.045

-2 Log likelihood = 1778.204, Hosmer and Lemeshow Test p-value= 0.824, and Omnibus Tests of Model Coefficients p< 0.001.

The model was re-performed without the non-significant variables (Table 6.10). Poor academic performance and being engaged in fighting were negatively associated with eating breakfast regularly. Not eating high fat food every day, not drinking soft drink for more than 1 time/day and consuming milk every day were positively associated with eating breakfast regularly. Also, eating breakfast was negatively associated with increase in BMI.

Table 6-10. Final model of eating breakfast with the significant variables only

Variables	OR	[95% C.I.]	Likelihood ratio test P value
Academic Performance			
Good (ref)	-	-	-
Poor	0.6	0.5 – 0.8	0.001
Eating high fat Food			
Every day (ref)	-	-	-
Not every day	1.3	1.1 – 1.7	0.040
Drinking Soft drinks			
⩾ 2 time/day (ref)	-	-	-
⩽1 time/day	1.4	1.1 -1.8	0.005
Milk and milk products			
Not every day (ref)	-	-	-
Every day	1.9	1.5 – 2.4	< 0.001
Log BMI	0.5	0.3 – 0.7	< 0.001
Physical fight			
No (ref)	-	-	-
Yes	0.8	0.6 – 1.0	0.027

- 2 Log likelihood = 1812.33, Hosmer and Lemeshow Test p-value= 0.251, and Omnibus Tests of Model Coefficients p< 0.001

6.2 Students' Body Mass Index

6.2.1 The association between BMI and student's socio-demographic variables:

In Model 1 (Table 6.11) it was found that students' age and living district were positively associated with BMI. Also, low fathers' and mothers' educations were associated with lower BMI. In Model 2, I checked for mothers' and fathers' education interaction with regards to students' BMI, and there was no interaction effect

Table 6-11. The linear regression association of BMI to students' age, school type, fathers' and mothers' education and living districts:

Variables	Model 1 without interaction		Model 2 with interaction	
	Coefficient [95%C.I.]	F-test/ *t-test* P value	Coefficient [95% C.I.]	F-test/ *t-test* P value
Intercept	15.63 [12.8–19.03]	< 0.001	15.5 [12.8 – 18.9]	< 0.001
Age (years)	1.02 [1.01 – 1.03]	< 0.001	1.02 [1.01 – 1.04]	< 0.001
School Type Private School(ref) Public School	- 1.02 [0.99 – 1.05]	- 0.209	- 1.08[0.99 - 1.05]	- 0.200
Living district East (ref) North South Central West	 - 1.05 [1.0 – 1.1] 1.06 [1.0 – 1.1] 1.05 [1.0 – 1.1] 1.00 [0.9 – 1.0]	0.007 - *0.019* *0.007* *0.023* *0.997*	 - 1.05 [1.0 – 1.1] 1.06 [1.0 – 1.1] 1.05 [1.0 – 1.1] 0.99 [0.9 – 1.1]	0.007 - *0.021* *0.008* *0.027* *0.960*
Fathers' Education >12 years (ref) ⩽ 12 years	- 0.95 [0.9 – 0.98]	- 0.003	- 0.97 [0.9 – 1.04]	- 0.414
Mother's Education > 12 years (ref) ⩽ 12 years	- 0.96 [0.9 – 0.99]	- 0.027	- 0.97 [0.9 – 1.0]	- 0.143
Father's by mother's education	-	-	0.99 [0.9 – 1.05]	0.565

Model without interaction: Goodness of Fit: Deviance=89.202, Pearson Chi-Square= 89.202, Log Likelihood= -33.954, F test=9.133, p<0.001
Model including interaction: Goodness of Fit: Deviance=89.181, Pearson Chi Square p-value= 89.181, Log Likelihood= -33.788

I re-built the model without school type and parental education interaction. Students' BMI was significantly increased with age by 1.02 Kg/m^2 for each year a studentcs age increased. For students living in the north, central, and south of the city, their BMI was significantly greater compared to reference group (East). Interestingly, low fathers' and mothers' education level (≤12 years) was associated with a lower BMI compared to a high parental level of education. This means that when students' fathers and mothers have higher education (>12 years), students would have greater BMI (Table 6.12).

Table 6-12. Multiple linear regression of students' BMI to students age, living districts fathers' and mothers' education

Variables	Coefficient	[95% C.I.]	F-test/ *t-test* P value
Intercept	15.7	12.9 – 19.1	< 0.001
Age (years)	1.02	1.0 – 1.03	< 0.001
Living district			0.007
East (ref)	-	-	-
North	1.05	1.0 – 1.1	*0.018*
South	1.05	1.0 – 1.1	*0.006*
Central	1.04	1.0 – 1.1	*0.021*
West	1.00	0.9 – 1.0	*0.953*
Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	0.95	0.9 – 0.98	0.005
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.96	0.9 – 0.99	0.033

Goodness of Fit: Deviance=89.299, Pearson Chi-Square p-value= 89.299, Log Likelihood= -34.744, F test=11.04, p<0.001

6.2.2 The association between students' BMI and students' perceived health status, liking school and school performance

The relationships between students' perceived health status, liking school and school performance and students' BMI, adjusting for socio-demographic variables were investigated. It was found that poor health status was independently associated with greater BMI (Table 6.13).

Table 6-13. Multiple linear regression of students' BMI and health status, liking school and school performance

Variables	Model 1 without interaction		Model 2 with interaction	
	Coefficient [95% C.I.]	F-test/ *t-test* P value	Coefficient [95% C.I.]	F-test/ *t-test* P value
Intercept	15.61 [12.8–19.1]	< 0.001	15.63 [12.8 – 18.1]	< 0.001
Age (years)	1.03 [1.01 – 1.03]	< 0.001	1.02 [1.01 – 1.04]	< 0.001
School Type				
Private School (ref)	-	-	-	-
Public School	1.02 [0.99 – 1.05]	0.165	1.02 [0.99 – 1.05]	0.163
Living district		0.007		0.006
East (ref)	-	-	-	-
North	1.05 [1.0 – 1.1]	*0.018*	1.05 [1.01 – 1.10]	*0.018*
South	1.06 [1.0 – 1.1]	*0.009*	1.06 [1.01 – 1.10]	*0.008*
Central	1.05 [1.0 – 1.1]	*0.030*	1.05 [1.00 – 1.09]	*0.030*
West	0.99 [0.9 – 1.0]	*0.912*	0.99 [0.96 – 1.04]	*0.900*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽12 years	0.96 [0.92 – 0.98]	0.006	0.96 [0.93 – 0.99]	0.006
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽12 years	0.96 [0.93 – 0.98]	0.046	0.97 [0.9 – 1.04]	0.046
Perceived health status				
Good (ref)	-	-	-	-
Poor	1.10 [0.9 – 0.99]	0.011	1.10 [1.02 – 1.17]	0.011
Liking school				
Yes (ref)	-	-	-	-
No	0.98 [0.9 – 1.01]	0.296	0.99 [0.96 – 1.02]	0.632
Academic Performance				
Good (ref)	-	-	-	-
Poor	0.97 [0.9 – 1.00]	0.062	0.98 [0.94 – 1.03]	0.460
Liking school by academic achievement	-	-	0.98 [0.92 – 1.04]	0.427

Model without interaction: Goodness of Fit: Deviance=87.304, Pearson Chi-Square= 87.304, Log Likelihood= -30.878, F=6.87, p<0.001
Model including interaction: Goodness of Fit: Deviance=87.266, Pearson Chi-Square p-value= 87.266, Log Likelihood= -30.562

The Model was re-built without non significant variables one by one at a time. In this regression model, poor health status and poor school performance were positively associated with greater BMI (Table 6.14).

Table 6-14. Multiple linear regression of students' BMI and health status, liking school and school performance

Variables	Coefficient	[95% C.I.]	F-test/ *t-test* P value
Intercept	15.58	12.69 – 18.91	< 0.001
Age (years)	1.03	1.01 – 1.04	< 0.001
Living district			0.010
East (ref)	-	-	-
North	1.05	1.01 – 1.10	*0.029*
South	0.05	1.01 – 1.10	*0.014*
Central	1.05	1.01 – 1.10	*0.022*
West	0.99	0.96 – 1.04	*0.915*
Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	0.96	0.93 – 0.99	< 0.001
Perceived health status			
Good (ref)	-	-	-
Poor	1.10	1.02 – 1.17	0.010
Academic Performance			
Good (ref)	-	-	-
Poor	0.97	0.94 – 0.99	0.027

Goodness of Fit: Deviance=87.830, Pearson Chi-Square= 87.830, Log Likelihood= -32.820, F=9.47, p<0.001

6.2.3 The association of student's BMI with other health–related behaviours:

Amongst several health-related behaviours reported in Table 6.13, only less physical activity (≤ 2 times a week) and not being threatened or injured by weapons were independently associated with BMI after adjusting for student's age, type of school, fathers' and mothers' education and home districts, which all were significantly associated with BMI except school type which was borderline significant. Being bullied by others was also of borderline significance (Table 6.15).

Table 6-15. Multiple linear regression of the relationship of student's BMI with other health–related behaviours

Variables	Coefficient	95% C.I.	P value
Intercept	14.48	11.7 – 17.9	< 0.001
Age (years)	1.02	1.01 – 1.03	< 0.001
School Type			
Private School (ref)	-	-	-
Public School	1.02	0.97 – 1.05	0.081
Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	0.96	0.93 – 0.98	0.007
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.96	0.92 – 0.99	0.023
Living district			0.036
East (ref)	-	-	-
North	1.04	1.002 – 1.09	*0.023*
South	1.06	1.01 – 1.10	*0.008*
Central	1.04	1.006 – 1.09	*0.025*
West	1.02	0.97 – 1.06	*0.287*
Physical activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.08	1.05 – 1.11	< 0.001
Smoking			
Current smoking	-	-	
Non-smoking	0.98	0.95 – 1.02	0.397
Want to use drugs			
Yes	-	-	-
No	1.02	0.98 – 1.07	0.216
Physical fight			
Yes	-	-	-
No	0.99	0.97 – 1.03	0.812
Threaten or injured by weapons			
Yes	-	-	-
No	1.04	1.004 – 1.08	0.030
Carry weapons			
Yes	-	-	-
No	0.99	0.96 – 1.02	0.700
Performing Car Drifting			
Yes	-	-	-
No	0.99	0.96 – 1.02	0.618

Join people performing car drifting			
Yes	-	-	-
No	1.02	0.99 – 1.05	0.156
Been Bullied by others			
Yes	-	-	-
No	1.03	0.99 – 1.06	0.067
Bullies others			
Yes	-	-	-
No	0.99	0.95 – 1.02	0.608
Abused by teacher			
Yes	-	-	-
No	1.00	0.97 – 1.03	0.797
Abused by family			
Yes	-	-	-
No	1.01	0.98 – 1.04	0.293
Attempting suicide			
Yes	-	-	-
No	0.98	0.96 – 1.03	0.634

Goodness of Fit**:** Deviance=82.567, Pearson Chi-Square= 82.567, Log Likelihood=-6.072, F=5.57, $p<0.001$.

The model was re-built without including the non significant variables (Table 6.16). The variables were omitted from the model one at a time starting with the higher p-values in order to detect any change in the model and to see if any other variable increased its association with BMI. Table 6.14, shows that low physical activity was associated with greater BMI (OR= 1.08, 95% CI= 1.05–1.11, *P*< 0.001), students who reported they have not been threatened or injured by weapons were significantly more likely to have higher BMI (OR= 1.04, 95% CI= 1.004–1.07, *P*= 0.026), and students who stated they not have not been bullied were more likely to have higher BMI (OR= 1.04, 95% CI= 1.007–1.07, *P*= 0.015) (Table 6.16).

Table 6-16. Multiple linear regression of the relationship of student's BMI with other health–related behaviours

Variables	OR	95% C.I.	F-test/ *t-test* P value
Intercept	14.47	11.8 – 17.8	< 0.001
Age (years)	1.02	1.01 – 1.03	< 0.001
Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	0.96	0.93 – 0.99	0.010

Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.96	0.92 – 0.99	0.023
Living district			0.037
East (ref)	-	-	-
North	1.04	1.001– 1.09	*0.045*
South	1.06	1.01 – 1.10	*0.006*
Central	1.04	1.005 – 1.09	*0.029*
West	1.01	0.97 – 1.05	*0.798*
Physical activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.08	1.05 – 1.11	< 0.001
Threaten or injured by weapons			
Yes	-	-	-
No	1.04	1.004 – 1.07	0.026
Been Bullied by others			
Yes	-	-	-
No	1.04	1.007 – 1.07	0.015

Goodness of Fit: Deviance=85.682, Pearson Chi-Square p-value= 85.682, Log Likelihood=-13.082, F=12.9, p<0.001

6.2.4 The association between BMI and Dietary behaviours:

Logistic regression was performed to investigate the relationship between dietary behaviours and students' BMI after adjusting for students' socio-demographic variables (Table 6.17). I found that skipping breakfast was associated with higher BMI among students. Also, not eating sweets every day was associated with higher BMI. Not drinking high energy beverage was of borderline significance.

Table 6-17. Multiple linear regression of students' BMI to dietary behaviours adjusted for students' socio-demographic variables:

Variables	Coefficient	[95% C.I.]	F-test/ *t-test* P value
Intercept	14.33	11.61 – 17.68	< 0.001
Age (years)	1.02	1.01 – 1.04	< 0.001
School Type			
Private School (ref)	-	-	-
Public School	1.01	0.98 – 1.04	0.316
Living district			0.005
East (ref)	-	-	-
North	1.05	1.01 – 1.10	*0.013*
South	1.05	1.01 – 1.10	*0.007*
Central	1.05	1.01 – 1.09	*0.016*
West	1.00	0.96 – 1.04	*0.982*

Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	0.96	0.93 – 0.99	0.006
Mother's Education			
> 12 years (ref)	-	-	-
⩽ 12 years	0.96	0.92 – 0.99	0.016
Eating breakfast			
⩾ 5 days a week	-	-	-
< 5 days a week	1.05	1.02 – 1.07	0.001
Eating high fat Food			
Every day (ref)	-	-	-
Not every day	1.01	0.98 – 1.04	0.304
Eating at restaurant			
Every day (ref)	-	-	-
Not every day	0.98	0.96 – 1.02	0.382
Drinking Soft drinks			0.546
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	1.02	0.98 – 1.05	*0.309*
Not every day	1.01	0.97 – 1.05	*0.443*
Drinking Energy drinks			0.070
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	1.01	0.96 – 1.07	*0.611*
Not every day	1.04	0.99 – 1.09	*0.062*
Eating sweet			0.040
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	1.02	0.98 – 1.06	*0.332*
Not every day	1.04	1.00 – 1.08	*0.019*
Eating vegetables			0.839
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	0.98	0.93 – 1.03	*0.543*
Not every day	0.99	0.95 – 1.03	*0.641*
Eating fruit			0.096
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	0.99	0.94 – 1.06	*0.954*
Not every day	1.00	0.95 – 1.06	*0.907*

Goodness of Fit: Deviance=85.062, Pearson Chi-Square p-value=85.062, Log Likelihood= -17.682, F=15.64, p<0.001

I re-built the model without the non significant variables. Students not eating breakfast regularly (< 5 days/week) have higher BMI than students eating breakfast regularly (≥ 5 days a week), (OR= 1.05, 95%CI= 1.02–1.07, *p*= 0.001). Students who do not consume high energy drinks every day have higher BMI than students who consume /week) have higher BMI than students eating breakf*p*= 0.018). Students who

eat sweets < 1 time a day/week have higher BMI than students who eat sweets ≥ 3 times a day/week (OR= 1.04, 95%CI= 1.01–1.08, *p*= 0.012). For details, see (Table 6.18).

Table 6-18. Logistic regression of the relationship between students' BMI and Dietary behaviours

Variables	Coefficient	[95% C.I.]	F-test/ *t-test* P value
Intercept	14.4	11.81 – 17.69	< 0.001
Age (years)	1.02	1.01 – 1.04	< 0.001
Living district			0.005
East (ref)	-	-	-
North	1.05	1.01 – 1.10	*0.012*
South	1.06	1.02 – 1.10	*0.006*
Central	1.05	1.01 – 1.09	*0.025*
West	1.00	0.96 – 1.04	*0.978*
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.96	0.93 – 0.99	0.006
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.96	0.92 – 0.99	0.024
Eating breakfast			
⩾ 5 days a week	-	-	-
< 5 days a week	1.05	1.02 – 1.07	0.001
Drinking Energy drinks			0.028
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	1.02	0.96 – 1.07	0.462
< 1 time a day	1.05	1.01 – 1.09	0.018
Eating sweet			0.030
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	1.02	0.98 – 1.06	0.312
< 1 time a day	1.04	1.001 – 1.08	0.012

Goodness of Fit: Deviance= 86.227, Pearson Chi-Square p-value= 86.227, Log Likelihood= -17.637, F=10.67, p<0.001

6.2.5 The association between BMI and the significant variables from several models

In this final model (Table 6.19) the majority of the significant variables remained significant. Higher age, living districts, high father's education, high mother's educations, poor health status, skipping breakfast, low physical activity, not being bullied and not eating sweet every day were all independently associated with higher BMI unit.

Table 6-19. Final model of the associations between students' BMI and the significant variables from previous models

Variables	Coefficient	[95% C.I.]	F-test/ *t-test* P value
Intercept	14.4	11.63 – 17.91	< 0.001
Age (years)	1.02	1.01 – 1.04	< 0.001
Living district			0.010
East (ref)	-	-	-
North	1.05	1.01 – 1.10	*0.034*
South	1.06	1.02 – 1.10	*0.008*
Central	1.05	1.01 – 1.09	*0.035*
West	1.00	0.96 – 1.04	*0.894*
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.96	0.93 – 0.99	0.022
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.96	0.92 – 0.99	0.036
Health status			
Good (ref)	-	-	-
Poor	1.8	1.0 – 1.2	0.025
Academic Performance			
Good (ref)	-	-	-
Poor	0.9	0.5 – 0.8	0.060
Eating breakfast			
⩾ 5 days a week	-	-	-
< 5 days a week	1.04	1.02 – 1.07	0.002
Drinking Energy drinks			0.157
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	1.01	0.96 – 1.07	*0.199*
< 1 time a day	1.03	1.01 – 1.09	*0.103*
Eating sweet			0.060
⩾ 3 times a day (ref)	-	-	-
1-2 times a day	1.02	0.98 – 1.06	*0.424*
< 1 time a day	1.04	1.001 – 1.08	*0.032*

Physical activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.07	1.05 – 1.11	< 0.001
Threaten or injured by weapons			
Yes	-	-	-
No	1.03	1.004 – 1.07	0.060
Been Bullied by others			
Yes	-	-	-
No	1.04	1.01 – 1.07	0.015

Goodness of Fit: Deviance=82.149, Pearson Chi-Square= 82.149, Log Likelihood=-0.027, F=9.97, p<0.001

The model was re-performed without the non-significant variables (Table 6.20).

Table 6-20. Final model of the association of students BMI with the significant variables only

Variables	Coefficient	[95% C.I.]	F-test/ *t-test* P value
Intercept	14.9	12.2 – 18.2	< 0.001
Age (years)	1.02	1.01 – 1.04	< 0.001
Living district			0.020
East (ref)	-	-	-
North	1.05	1.01 – 1.10	*0.026*
South	1.06	1.02 – 1.10	*0.006*
Central	1.05	1.01 – 1.09	*0.020*
West	1.00	0.96 – 1.04	*0.560*
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.96	0.93 – 0.99	0.007
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.96	0.92 – 0.99	0.026
Health status			
Good (ref)	-	-	-
Poor	1.8	1.0 – 1.2	0.045
Eating breakfast			
⩾ 5 days a week	-	-	-
< 5 days a week	1.04	1.02 – 1.07	0.008
Physical activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.07	1.05 – 1.11	< 0.001
Been Bullied by others			
Yes	-	-	-
No	1.04	1.01 – 1.07	0.001

Goodness of Fit: Deviance=84.93, Pearson Chi-Square= 84.93, Log Likelihood=-10.237, F=12.91, p<0.001

6.3 Oral health

6.3.1 The association between teeth brushing teeth behaviours and students' socio-demographic variables:

In Model 1 (Table 6.21), I found that students from public school, and whose their fathers had low level of education were independently associated negatively with brushing teeth every day. On the other hand, students who live in the north district were more likely to brush teeth daily. A student's age was not statistically associated with teeth brushing behaviours every day. A mother's education level was not associated significantly with brushing teeth behaviours but was nearly close to significant level. There was no significant interaction between fathers' and mothers' education with regard to brushing teeth.

Table 6-21. Logistic regression of brushing teeth every day to students' backgrounds variables:

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9 [0.9 – 1.0]	0.505	0.9 [0.9 – 1.0]	0.499
School Type				
Private School (ref)	-	-	-	-
Public School	0.6 [0.4 – 0.7]	< 0.001	0.6 [0.5 – 0.7]	< 0.001
Living district		0.026		0.025
East (ref)	-	-	-	-
North	1.7 [1.2 – 2.4]	*0.004*	1.7 [1.2 – 2.4]	*0.004*
South	1.0 [0.7 – 1.4]	*0.944*	1.0 [0.7 – 1.4]	*0.915*
Central	1.3 [0.9 – 1.8]	*0.120*	1.3 [0.9 – 1.8]	*0.112*
West	1.1 [0.8 – 1.5]	*0.569*	1.1 [0.8 – 1.6]	*0.537*
Fathers' Education				
>12 years (ref)	-	1	-	-
⩽ 12 years	0.8 [0.6 – 0.9]	0.036	0.7 [0.3 – 1.1]	0.160
Mother's Education				
> 12 years (ref)	-	1	-	-
⩽ 12 years	0.8 [0.6 – 1.0]	0.059	0.7 [0.5 – 1.0]	0.069
Fathers by mother education interaction	-------	----	1.2 [0.6 – 2.1]	0.604

Model without interaction: -2 Log likelihood = 1953.421, Hosmer and Lemeshow Test p-value = 0.385, and Omnibus Tests of Model Coefficients p< 0.001
Model including interaction between mothers and fathers education: -2 Log likelihood = 1953.152, Hosmer and Lemeshow Test p-value = 0.241, and Omnibus Tests of Model Coefficients p< 0.001

I re-run the model without students' age and the interaction. The model was improved (Table 6.22). In general, students in public schools were significantly less likely to brush their teeth every day. Students living in the north district brushed their teeth daily more than others. Students whose fathers or mothers have a lower educational level (≤ 12 years) were less likely to brush teeth daily (Table 6.22).

Table 6-22. Logistic regression of brushing teeth every day to students' backgrounds variables

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
School Type			
Private School (ref)	-	-	-
Public School	0.6	0.4 – 0.7	<0.001
Living district			0.020
East (ref)	-	-	-
North	1.7	1.2 – 2.4	*0.003*
South	1.0	0.7 – 1.4	*0.931*
Central	1.3	0.9 – 1.8	*0.103*
West	1.1	0.8 – 1.5	*0.583*
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.8	0.6 – 0.9	0.030
Mother's Education			
> 12 years (ref)	-	-	-
⩽ 12 years	0.7	0.5 – 1.0	0.050

-2 Log likelihood = 1953.866, Hosmer and Lemeshow Test p-value= 0.703, and Omnibus Tests of Model Coefficients p<0.001

6.3.2 The association of brushing teeth with health status, school performance and liking school

Disliking school and poor academic performance were independently and negatively associated with brushing teeth, after controlling for students' age, type of school, living district and fathers' and mothers' education. Perceived general health status was found not be associated with brushing teeth among this sample. Adding the interaction of liking school and school performance to the model helped to improve the goodness of fit (Table 6.23).

Table 6-23. Logistic regression for brushing teeth every day to perceived health, school performance and liking school

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age	0.99 [0.9 – 1.1]	0.923	0.99 [0.9 – 1.1]	0.939
School Type				
Private School (ref)	-	-	-	-
Public School	0.56 [0.4 – 0.7]	< 0.001	0.56 [0.4 – 0.7]	< 0.001
Living district		0.022		0.022
East (ref)	-	-	-	-
North	1.70 [1.2 – 2.4]	*0.004*	1.70[1.2 – 2.4]	*0.003*
South	1.01 [0.7 – 1.4]	*0.949*	1.01 [0.7 – 1.4]	*0.948*
Central	1.3 [0.9 – 1.8]	*0.161*	1.3 [0.9 – 1.8]	*0.158*
West	1.05 [0.7 – 1.5]	*0.748*	1.06[0.7 – 1.5]	*0.723*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	0.82 [0.6 – 1.0]	0.141	0.83 [0.6 – 1.1]	0.162
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	0.76 [0.6 – 1.0]	0.083	0.76 [0.5 – 1.0]	0.077
Perceived health status				
Good	-	-	-	-
Poor	0.99 [0.5 – 1.8]	0.980	0.99 [0.5 – 1.8]	0.977
Liking school				
Yes	-	-	-	-
No	0.64 [0.5 – 0.8]	< 0.001	0.57 [0.4 – 0.7]	< 0.001
Academic Performance				
Good	-	-	-	-
Poor	0.59 [0.5 – 0.8]	< 0.001	0.47 [0.3 – 0.7]	< 0.001
Liking school by academic achievement	-------	----	1.55 [0.9 – 2.5]	0.080

Model without interaction: -2 Log likelihood = 1880.983, Hosmer and Lemeshow Test p-value = 0.143, and Omnibus Tests of Model Coefficients p< 0.001
Model including interaction between mothers and fathers education: -2 Log likelihood = 1878.052, Hosmer and Lemeshow Test p-value =0.361, and Omnibus Tests of Model Coefficients p< 0.001

I ran the model again without the non-significant values one after another to detect the best fit model (Table 6.24). In general, the model shows similar results. Students who reported not liking school were significantly less likely to brush their teeth than students who reported that they liked school (OR= 0.58). Reporting poor academic performance was negatively associated with brushing teeth daily (OR= 0.47), (Table 6.24).

Table 6-24. Logistic regression for brushing teeth every day to, school performance and liking school

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
School Type			
Private School (ref)	-	-	-
Public School	0.55	0.4 – 0.7	< 0.001
Living district			0.003
East (ref)	-	-	-
North	1.83	1.3 – 2.6	*0.001*
South	0.99	0.7 – 1.4	*0.981*
Central	1.33	0.9 – 1.8	*0.091*
West	1.13	0.8 – 1.6	*0.477*
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.72	0.5 – 0.9	0.023
Liking school			
Yes	-	-	-
No	0.58	0.4 – 0.7	< 0.001
Academic Performance			
Good	-	-	-
Poor	0.47	0.3 – 0.7	< 0.001

-2 Log likelihood = 1906.984, Hosmer and Lemeshow Test p-value= 0.507, and Omnibus Tests of Model Coefficients p< 0.001

6.3.3 Brushing teeth and other oral health hygiene behaviours:

Students who reported having good teeth health, visiting a dentist during the past 12 months and never or rarely suffering from teeth pain were significantly more likely to report brushing their teeth daily. Among the variables that I adjusted for, only private school and north district were statistically associated with brushing teeth daily. Students' age and fathers' and mothers' education were not significantly associated with brushing teeth (Table 6.25).

Table 6-25. Multiple logistic regression of brushing teeth every day in relation to other oral health behaviours, adjusting for students' backgrounds

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9	0.9 – 1.0	0.689
School Type			
Private School (ref)	-	-	-
Public School	0.6	0.4 – 0.9	< 0.001
Living district			0.036
East (ref)	-	-	-
North	1.7	1.2 – 2.5	*0.004*
South	1.0	0.7 – 1.4	*0.853*
Central	1.2	0.9 – 1.8	*0.195*
West	1.2	0.8 – 1.7	*0.263*
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.8	0.6 – 1.1	0.200
Mother's Education			
> 12 years (ref)	-	-	-
⩽ 12 years	0.7	0.6 – 1.0	0.121
Perceived teeth health status			
Poor	-	-	-
Good	2.7	2.1 – 3.3	< 0.001
Visiting dentist during the past 12 months			
No (ref)	-	-	-
Yes	1.5	1.2 – 1.9	< 0.001
Suffering from teeth pain			
Sometimes/usually (ref)	-	-	-
Never/rarely	1.3	1.1 – 1.7	0.018

-2 Log likelihood = 1828.992.992, Hosmer and Lemeshow Test p-value = 0.434, and Omnibus Tests of Model Coefficients p< 0.001.

The model was re-built without the non-significant variables. Students who reported good oral health status were statistically more likely to brush their teeth every day (OR=2.7, 95% CI= 2.1-3.4, $p< 0.001$). Students who reported visiting a dentist for a check up during the past 12 months were more likely to brush their teeth daily (OR=1.5, 95%CI= 1.2-1.9, $p< 0.001$). Students who reported never or rarely suffering from teeth pain were significantly more likely to brush their teeth than students who sometimes or usually felt pain in their teeth (OR= 1.3, 95%CI= 1.1-1.7, $p=0.025$), (Table 6.26).

Table 6-26. Multiple logistic regression of brushing teeth every day in relation to other oral health behaviours

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
School Type			
Private School (ref)	-	-	-
Public School	0.6	0.4 – 0.7	< 0.001
Living district			0.002
East (ref)	-	-	-
North	1.9	1.3 – 2.6	*< 0.001*
South	1.0	0.7 – 1.4	*0.943*
Central	1.3	0.9 – 1.8	*0.111*
West	1.3	0.9 – 1.8	*0.179*
Perceived teeth health status			
Poor	-	-	-
Good	2.7	2.1 – 3.4	< 0.001
Visiting dentist during the past 12 months	-	-	-
No	1.5	1.2 -1.9	< 0.001
Yes			
Suffering from teeth pain			
Sometimes/usually	-	-	-
Never/rarely	1.3	1.1 – 1.7	0.025

-2 Log likelihood = 1893.089, Hosmer and Lemeshow Test p-value = 0.223, and Omnibus Tests of Model Coefficients $p < 0.001$

6.3.4 The association between brushing teeth every day and the significant variables from several models

The final model below (Table 6.27) showed that all the significant variables from the separate previous models remained significant associated with brushing teeth except father's and mother's education.

Table 6-27. The Final model of the association between brushing teeth and all significant variables

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.9	0.7 – 1.1	0.442
Mother's Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.9	0.7 – 1.1	0.137
School Type			
Private School (ref)	-	-	-
Public School	0.6	0.5 – 0.7	< 0.001
Living district			0.025
East (ref)	-	-	-
North	1.8	1.3 – 2.6	*0.003*
South	0.9	0.7 – 1.4	*0.885*
Central	1.3	0.9 – 1.8	*0.177*
West	1.2	0.9 – 1.8	*0.306*
Perceived teeth health status			
Poor	-	-	-
Good	2.6	2.1 – 3.3	< 0.001
Visiting dentist during the past 12 months			
No	-	-	-
Yes	1.5	1.2 -1.9	0.001
Suffering from teeth pain			
Sometimes/usually	-	-	-
Never/rarely	1.3	1.1 – 1.7	0.025
Liking school			
Yes	-	-	-
No	0.7	0.6 – 0.9	0.002
Academic Performance			
Good	-	-	-
Poor	0.7	0.5 – 0.9	0.001

-2 Log likelihood = 1829.852, Hosmer and Lemeshow Test p-value= 0.475, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-performed without the non-significant variables (Table 6.28). The significant variables remained the same.

Table 6-28. The final model of the association between brushing teeth every day and significant variables only

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
School Type			
Private School (ref)	-	-	-
Public School	0.6	0.5 – 0.7	< 0.001
Living district			0.003
East (ref)	-	-	-
North	1.8	1.3 – 2.6	*0.001*
South	0.9	0.7 – 1.4	*0.912*
Central	1.3	0.9 – 1.8	*0.143*
West	1.2	0.9 – 1.8	*0.228*
Perceived teeth health status			
Poor	-	-	-
Good	2.6	2.1 – 3.3	< 0.001
Visiting dentist during the past 12 months			
No	-	-	-
Yes	1.5	1.2 -1.9	0.001
Suffering from teeth pain			
Sometimes/usually	-	-	-
Never/rarely	1.5	1.1 – 1.7	0.025
Liking school			
Yes	-	-	-
No	0.7	0.6 – 0.9	0.006
Academic Performance			
Good	-	-	-
Poor	0.7	0.5 – 0.9	0.001

-2 Log likelihood = 1829.852, Hosmer and Lemeshow Test p-value= 0.475, and Omnibus Tests of Model Coefficients p< 0.001

6.3.5 The association between teeth health status and student's socio demographic variables:

Model 1 shows that only attending a public school was independently associated with poor teeth health status. Fathers' and mothers' low level of education were at borderline significance (Table 6.29).

Table 6-29. Multiple logistic regression of poor teeth health status to student's backgrounds

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.05 [0.9 – 1.2]	0.296	1.05 [0.9 – 1.2]	0.286
School Type				
Private School (ref)	-	-	-	-
Public School	1.36 [1.1 – 1.7]	0.007	1.37 [1.1 – 1.7]	0.006
Living district		0.054		0.055
East (ref)	-	-	-	-
North	1.05 [0.7 – 1.5]	*0.761*	1.04 [0.7 – 1.5]	*0.816*
South	1.00 [0.7 – 1.4]	*0.997*	0.99 [0.7 – 1.4]	*0.935*
Central	0.79 [0.6 – 1.1]	*0.164*	0.77 [0.6 – 1.1]	*0.135*
West	1.32 [0.9 – 1.8]	*0.098*	1.29 [0.9 – 1.8]	*0.129*
Fathers' Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	1.23 [0.9 – 1.8]	0.103	1.7 [0.9 – 3.0]	0.058
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	1.31 [0.9 – 1.7]	0.064	1.51 [1.1 – 2.2]	0.024
Fathers by mother education interaction			0.66 [0.4 – 1.2]	0.191

Note: teeth health status was dichotomised to good vs. Poor

Model without interaction: -2 Log likelihood = 1986.375, Hosmer and Lemeshow Test p-value = 0.815, and Omnibus Tests of Model Coefficients $p< 0.001$.

Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1984.663, Hosmer and Lemeshow Test p-value= 0.776, and Omnibus Tests of Model Coefficients $p< 0.001$

The model was re-run without the non-significant variables (Table 6.30). When I removed age and living district from the model, low father's education and low mother's education became positively associated with poor teeth health. Attending public school was positively associated with poor teeth health. Moreover, fathers' and mothers' low education were significantly associated with poor teeth health status (Table 6.30).

Table 6-30. Multiple logistic regression of poor teeth health status to student's backgrounds

Variables	OR	[95% C.I.]	Likelihood ratio P value
School Type			
Private School (ref)	-	-	-
Public School	1.4	1.1 – 1.7	0.005
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	1.3	1.1 – 3.1	0.040
Mother's Education			
> 12 years (ref)	-	-	-
⩽ 12 years	1.4	1.1 -2.2	0.037

-2 Log likelihood = 1999.041, Hosmer and Lemeshow Test p-value= 0.30, and Omnibus Tests of Model Coefficients $p< 0.001$

6.3.6 The association between teeth health status and students' perceived health, school performance and liking school:

In the adjusted logistic regression (Table 6.31), Model 1 showed that self-reported poor general health status, not liking school and poor academic performance were positively associated with poor teeth health status. Among the variables that I adjusted for, public school was associated with poor teeth health. I re-ran the regression again, (Model 2) and there was no significant interaction between liking school and school performance, but it improved the model slightly, (Table 6.31).

Table 6-31. Multiple logistic regression for poor teeth health to perceived health, school performance and liking school.

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.04 [0.9 – 1.1]	0.407	1.04 [0.9 – 1.1]	0.436
School Type				
Private School (ref)	-	-	-	-
Public School	1.39 [1.1 – 1.7]	0.006	1.39 [1.1 – 1.8]	0.006
Living district		0.065		0.065
East (ref)	-	-	-	-
North	1.06 [0.7 – 1.5]	*0.725*	1.05 [0.7 – 1.5]	*0.728*
South	0.95 [0.7 – 1.4]	*0.917*	0.98 [0.7 – 1.3]	*0.916*
Central	0.82 [0.6 – 1.1]	*0.264*	0.82 [0.6 – 1.1]	*0.262*
West	1.38 [0.9 – 1.9]	*0.069*	1.37 [0.9 – 1.9]	*0.072*

Fathers' Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.17 [0.9 – 1.5]	0.228	1.16 [0.9 – 1.5]	0.247
Mothers' Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	1.26 [0.9 – 1.7]	0.129	1.26 [.9 – 1.7]	0.123
Perceived health status				
Good	-	-	-	-
Poor	1.95 [1.1 – 3.6]	0.034	1.96 [1.1 – 3.6]	0.031
Liking school				
Yes	-	-	-	-
No	1.43 [1.1 – 1.8]	0.001	1.54 [1.2 – 2.0]	< 0.001
Academic Performance				
Good	-	-	-	-
Poor	1.69 [1.3 – 2.2]	< 0.001	1.95 [1.4 – 2.8]	< 0.001
Liking school by academic achievement	-------	----	0.64 [0.3 – 1.2]	0.257

Model without interaction: -2 Log likelihood = 1911.424, Hosmer and Lemeshow Test p-value = 0.761, and Omnibus Tests of Model Coefficients p< 0.001

Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1910.141, Hosmer and Lemeshow Test p-value =0.849, and Omnibus Tests of Model Coefficients p< 0.001

I re-run the model again without the non-significant variables one after another to detect the best fit model. Poor general health status was associated with poor teeth health status (OR= 2.02), not liking school and poor performance in school were associated with poor teeth health (OR= 1.56) and (OR= 2.01), respectively. Among the variables that I adjusted for, public school and low mother's education were also associated with poor teeth health (Table 6.32).

Table 6-32. Multiple logistic regression for poor teeth health to perceived health, school performance and liking school.

Variables	OR	[95% C.I.]	Likelihood ratio P value
School Type			
Private School (ref)	-	-	-
Public School	1.40	1.1 – 1.8	0.004
Mothers' Education			
> 12 years (ref)	-	-	-
⩽12 years	1.42	1.1 – 1.9	0.012
Perceived health status			
Good	-	-	-
Poor	2.02	1.1 – 3.8	0.020

Liking school			
Yes	-	-	-
No	1.56	1.2 – 2.0	< 0.001
Academic Performance			
Good	-	-	-
Poor	2.01	1.4 – 2.9	< 0.001

-2 Log likelihood = 1940.190, Hosmer and Lemeshow Test p-value = 0.975, and Omnibus Tests of Model Coefficients p< 0.001

6.3.7 The association between teeth health status and other oral hygiene behaviours:

The independent associations between teeth health status and brushing teeth, suffering from pain and visiting a dentist, while adjusting for students' socio-demographic variables was investigated. Table 6.33, shows that not brushing teeth daily and suffering from teeth pain were independently associated with poor teeth health.

Table 6-33. Multiple logistic regression of poor teeth health status and oral hygiene behaviours

Variables	OR	[95% C.I.]	Likelihood ratio P value
School Type			
Private School (ref)	-	-	-
Public School	1.24	0.9 – 1.6	0.090
Mothers' Education			
> 12 years (ref)	-	-	-
⩽ 12 years	1.27	0.9 – 1.7	0.132
Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	2.68	2.1 – 3.4	< 0.001
Suffering from teeth pain			
Never/rarely	-	-	-
Sometimes/usually	3.27	2.5 – 4.2	< 0.001
Visiting dentist for cheek up			
Yes	-	-	-
No	0.90	0.7 – 1.1	0.389

-2 Log likelihood = 1787.233, Hosmer and Lemeshow Test p-value= 0.885, and Omnibus Tests of Model Coefficients p< 0.001

I re-built the model without the non significant results, one at a time. Not brushing teeth every day was positively associated with poor health status (OR= 2.6, 95% CI= 2.1-3.3, $p< 0.001$), and experiencing teeth pain sometimes or often was also positively associated with poor teeth health (OR= 3.3, 95% CI= 2.6 – 4.3, $p< 0.001$). Non significant values were removed, a mother's low education (≤12 years) became significantly associated with poor teeth health (Table 6.34).

Table 6-34. Multiple logistic regression of poor teeth health status and brushing teeth and teeth pain

Variables	OR	[95% C.I.]	Likelihood ratio P value
Mothers' Education			
> 12 years (ref)	-	-	-
⩽ 12 years	1.4	1.1 – 1.8	0.016
Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	2.7	2.1 – 3.3	< 0.001
Suffering from teeth pain			
Never/rarely	-	-	-
Sometimes/usually	3.5	2.6 – 4.3	< 0.001

-2 Log likelihood = 1835.302, Hosmer and Lemeshow Test p-value= 0.802, and Omnibus Tests of Model Coefficients p< 0.001.

6.3.8 The association between poor teeth status and all the significant variables from several models

The final model below (Table 6.35) showed that poor academic performance, poor general health status, not brushing teeth every day and suffering from teeth pain frequently remained statistically associated with poor teeth health status.

Table 6-35. The final model of the association between poor teeth health and significant variables from previous models

Variables	OR	[95% C.I.]	Likelihood ratio P value
School Type			
Private School (ref)	-	-	-
Public School	1.2	0.9 – 1.6	0.091
Mothers' Education			
> 12 years (ref)	-	-	-
⩽ 12 years	1.3	0.9 – 1.7	0.075
Liking school			
Yes	-	-	-
No	1.2	0.9 – 1.6	0.068
Academic Performance			
Good	-	-	-
Poor	1.7	1.3 – 2.1	< 0.001
Perceived health status			
Good	-	-	-
Poor	2.0	1.1 – 3.8	0.038
Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	2.5	1.9 – 3.1	< 0.001
Suffering from teeth pain			
Never/rarely	-	-	-
Sometimes/usually	3.4	2.6 – 4.3	< 0.001

-2 Log likelihood = 1768.524, Hosmer and Lemeshow Test p-value= 0.673, and Omnibus Tests of Model Coefficients p< 0.001

The model was performed for the last time without the non-significant variables (Table 6.36).

Table 6-36. The final model of the associations between poor teeth and with the significant variables only

Variables	OR	[95% C.I.]	Likelihood ratio P value
Academic Performance			
Good	-	-	-
Poor	1.8	1.4 – 2.3	< 0.001
Perceived health status			
Good	-	-	-
Poor	2.0	1.1 – 3.8	0.034
Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	2.6	2.1 – 3.3	< 0.001
Suffering from teeth pain			
Never/rarely	-	-	-
Sometimes/usually	3.4	2.6 – 4.3	< 0.001

-2 Log likelihood = 1808.374, Hosmer and Lemeshow Test p-value= 0.795, and Omnibus Tests of Model Coefficients p< 0.001

6.4 Physical activity

6.4.1 The association between physical activity and student's socio-demographic variables:

Table 6.37 showed that only a student's age was independently associated with physical activity behaviours. When students' age increases they became less likely to engage in regular physical activity. School type, living district, fathers' and mothers' education were not significantly associated with students' physical activity in the model. The interaction between a father's and mother's education in Model 2 was not significant.

Table 6-37. Multiple logistic regressions for students' physical activity, according to age, school type, fathers' and mothers' education level and living districts

Variables	Model 1 without interaction		Model 2 with interaction	
	OR (95%C.I.)	Likelihood ratio/ *Wald test* P value	OR (95%C.I.)	Likelihood ratio/ *Wald test* P value
Age (years)	0.8 (0.7 – 0.9)	0.001	0.8 [0.7 – 0.9]	0.001
School Type				
Private School	-	-	-	-
Public School	1.1 (0.9 – 1.4)	0.351	1.1 [0.9 – 1.4]	0.349
Living district		0.134		0.136
East	-	-	-	-
North	0.8 [0.6 – 1.2]	*0.397*	0.8 [0.6 – 1.2]	*0.395*
South	0.9 [0.7 – 1.4]	*0.930*	0.9 [0.7 – 1.4]	*0.926*
Central	0.9 [0.7 – 1.3]	*0.737*	0.9 [0.7 – 1.3]	*0.733*
West	1.3 [0.9 – 1.9]	*0.089*	1.3 [0.9 – 1.9]	*0.093*
Fathers' Education				
>12 years	-	1	-	-
⩽12 years	1.2 [0.9 – 1.5]	0.163	1.2 [0.7 – 2.2]	0.471
Mother's Education				
>12 years	-	1	-	-
⩽12 years	0.9 (0.7 – 1.2)	0.620	0.9 [0.6 – 1.4]	0.728
Fathers by mothers education interaction	-----	-------	0.9 [0.5 – 1.8]	- 0.934

Notes: physical activity was dichotomised to < 2 time vs. ⩾ 3 or more times/week.
Model without interaction: -2 Log likelihood = 1830.589
Hosmer and Lemeshow Test p-value= 0.176, and Omnibus Tests of Model Coefficients p= 0.010
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1830.582, Hosmer and Lemeshow Test p-value= 0.015, and Omnibus Tests of Model Coefficients p= 0.017

So, from both models (Table 6.37) above it appears that only age is associated with practicing physical activity regularly. When students' age increases, they became less likely to engage in regular physical activity.

6.4.2 The association between physical activity and perceived health status, liking school and school performance:

Model 1 shows that a student's perceived health status and liking school were independently associated with physical activity behaviour. In Model 2 the interaction between school performance and liking school were tested. The model found no significant interaction, and show similar results for the other variables. Among the factors that I adjusted for, only age was associated with physical activity. Fathers' education was of borderline significance (Table 6.38).

Table 6-38. Logistic regression for students' physical activity to perceived health status, liking school and school performance adjusted for student's backgrounds

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.8 [0.7 – 0.9]	< 0.001	0.8 [0.7 – 0.9]	< 0.001
School Type				
Private School (ref)	-	-	-	-
Public School	1.0 [0.8 – 1.4]	0.485	1.0 [0.8 – 1.4]	0.485
Living district		0.111		0.111
East (ref)	-	-	-	-
North	0.8 [0.6 – 1.2]	*0.452*	0.8 [0.6 – 1.2]	*0.452*
South	1.0 [0.7 – 1.4]	*0.981*	1.0 [0.7 – 1.4]	*0.981*
Central	0.9 [0.7 – 1.3]	*0.706*	0.9 [0.7 – 1.3]	*0.706*
West	1.4 [0.9 – 1.9]	*0.067*	1.4 [0.9 – 1.9]	*0.067*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽12 years	1.2 [0.9 – 1.6]	0.090	1.2 [0.9 – 1.6]	0.091
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽12 years	0.9 [0.7 – 1.3]	0.718	0.9 [0.7 – 1.3]	0.718
Perceived health status				
Good	-	-	-	-
Poor	0.4 [0.2 – 0.9]	0.023	0.4 [0.2 – 0.9]	0.023

Liking school Yes No	- 0.7 [0.5 – 0.9]	- 0.004	- 0.7 [0.5 – 0.9]	- 0.016
Academic Performance Good Poor	- 1.0 [0.8 – 1.3]	- 0.748	- 1.0 [0.7 – 1.5]	- 0.805
Liking school by academic achievement	-------	----	1.0 [0.6 – 1.7]	0.983

Model without interaction: -2 Log likelihood = 1790.413
Hosmer and Lemeshow Test p-value= 0.945, and Omnibus Tests of Model Coefficients p< 0.001
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1790.412, Hosmer and Lemeshow Test p-value =0.931, and Omnibus Tests of Model Coefficients p< 0.001

I ran the model again without the non significant variables one at a time (Table 6.39). I found that poor health status and not liking school were negatively associated with physical activity; students who reported poor health status or not liking school were less likely to practice regular physical activity (≥ 3 times/week), (OR= 0.4) and (OR= 0.7), respectively.

Table 6-39. Logistic regression for students' physical activity to health status, and liking school.

Variables	OR	[95% C.I.]	Likelihood ratio P value
Age (years)	0.8	0.8 – 0.9	< 0.001
Fathers' Education >12 years (ref) ⩽12 years	- 1.3	- 1.1 – 0.6	- 0.020
Perceived health status Good Poor	- 0.4	- 0.2 – 0.9	- 0.030
Liking school Yes No	- 0.7	- 0.6 – 0.9	- 0.005

-2 Log likelihood = 1830.972, Hosmer and Lemeshow Test p-value = 0.797, and Omnibus Tests of Model Coefficients p< 0.001

6.4.3 The association between students' physical activity and fathers', mothers', siblings' and peers' physical activity:

Model 1 (Table 6.40) shows that fathers', siblings', and peers' physical activity were independently associated with students' physical activity, whereas mothers' physical behaviour shows a weak association with students' physical activity behaviour. I checked the interaction between family physical activity behaviours and students' physical activity behaviour. Model 2 shows that there was no interaction between fathers' and mothers' physical activity behaviours in relation to students' physical activity behaviours. Also, there was no interaction between fathers' and siblings' and mothers' and siblings' physical activity behaviours in relation to students' physical activity behaviours. Only students' age showed a significant reverse association with physical activity (Table 6.40).

Table 6-40. Logistic regression for students' physical activity and fathers', mothers', siblings' and peers' physical activity, adjusted for student's background.

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.85 [0.8 – 0.9]	0.002	0.85 [0.8 – 0.9]	0.002
School Type				
Private School (ref)	-	-	-	-
Public School	1.06 [0.8 – 1.4]	0.637	1.06 [0.8 – 1.4]	0.679
Living district		0.212		0.210
East (ref)	-	-	-	-
North	0.83 [0.6 – 1.2]	*0.354*	0.83 [0.6 – 1.2]	*0.359*
South	0.94 [0.6 – 1.4]	*0.749*	0.94 [0.6 – 1.4]	*0.759*
Central	0.98 [0.7 – 1.4]	*0.927*	0.98 [0.7 – 1.4]	*0.938*
West	1.31 [0.9 – 1.9]	*0.149*	1.33 [0.9 – 1.9]	*0.128*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.23 [0.9 – 1.6]	0.144	1.23 [0.9 – 1.6]	0.145
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	0.99 [0.7 – 1.4]	0.970	0.97 [0.7 – 1.3]	0.876
Peer physical activity		< 0.001-		< 0.001
None of them (ref)	-	*0.736*	-	-
Some of them	1.07 [0.7 – 1.6]	*< 0.001*	1.08 [0.7 – 1.6]	*0.702*
Most of them	3.02 [2.0 – 4.5]		3.07 [2.1– 4.6]	*< 0.001*
Fathers physical activity				
No	-	-	-	-
Yes	1.47 [1.1 – 2.0]	0.020	1.30 [0.8 – 2.0]	0.258

Mothers Physical activity				
No	-	-	-	-
Yes	1.64 [0.9 – 2.7]	0.053	0.98 [0.4 – 2.6]	0.973
Sibling physical activity				
No	-	-	-	-
Yes	1.81 [1.4 – 2.3]	< 0.001	1.75 [1.3 – 2.3]	< 0.001
Fathers by mothers physical activity interaction	---	---	2.05 [0.7 – 5.9]	0.185
Fathers by siblings physical activity interaction			1.1 [0.6 – 2.1]	0.825
Mothers by sibling physical activity interaction	----	---	1.1 [0.4 – 3.2]	0.795

Model without interaction: -2 Log likelihood = 1678.575, Hosmer and Lemeshow Test p-value = 0.876, and Omnibus Tests of Model Coefficients p< 0.001
Model including interaction between mothers and fathers education: -2 Log likelihood = 1676.402, Hosmer and Lemeshow Test p-value=0.790, and Omnibus Tests of Model Coefficients p< 0.001

I re-built the model without the non significant variables. Students who reported most of their friends practising physical activity regularly during the week were more likely to practise physical regularly. Students whose father and at least one of their siblings practised physical activity regularly were more likely to practise physical activity (≥ 3 or more times/week), (Table 6.41).

Table 6-41. The association between students physical activities and peers, fathers, and siblings physical activities

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.87	0.8 – 0.9	0.005
Peer physical behaviours			< 0.001
None of them (ref)	-	-	-
Some of them	1.07	0.7 – 1.6	*0.738*
Most of them	3.13	2.1 – 4.6	*< 0.001*
Fathers physical behaviours			
No	-	-	-
Yes	1.49	1.1 – 2.0	< 0.001
Sibling physical behaviours			
No	-	-	-
Yes	1.85	1.5 – 2.3	< 0.001

-2 Log likelihood = 1726.949, Hosmer and Lemeshow Test p = 0.912, and Omnibus Tests of Model Coefficients p<0.001

6.4.4 The association of student's physical activity and other health-related behaviours:

The association between students' physical activity and other health related behaviours, adjusting for students' background was investigated (Table 6.42). The model shows that students' BMI, not brushing teeth daily and did not fight during the last 12 months have inverse associations with practicing regular physical activity. It means that students whose had greater BMI, did not brush their teeth, and did not engage in physical fighting were more likely to not practise physical activity regularly (≥ 3 times/week). Students who were not smoking, never wanting to use drugs or alcohol, never/rarely feeling lonely and have been taught about the benefits of practising physical activity were more likely to practice physical activity regularly during the week (Table 6.42).

Table 6-42. Logistic regression for students' physical activity and other risk behaviours adjusted for students' background.

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.94	0.8 – 1.0	0.155
BMI	0.27	0.1 – 0.4	< 0.001
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	1.22	0.9 – 1.6	0.173
Mother's Education			
>12 years (ref)	-	-	-
⩽ 12 years	0.87	0.6 – 1.2	0.393
School type			
Private(ref)	-	-	-
Public	1.15	0.9 – 1.5	0.309
Living district			0.120
East (ref)	-	-	-
North	0.92	0.6 – 1.4	*0.681*
South	1.12	0.7 – 1.6	*0.577*
Central	1.07	0.7 – 1.5	*0.742*
West	1.54	1.1 – 2.2	*0.027*
Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	0.69	0.5 – 0.9	0.003

Eating breakfast			
⩾ 5 days/week	-	-	-
< 5 days/week	0.81	0.5 – 0.8	0.104
Smoking			
Current smoking (ref)	-	-	
Non-smoking	1.62	1.1 – 2.3	0.007
Want to use drugs or alcohol			
Yes (ref)	-	-	-
No	1.90	1.2 – 2.9	0.004
Physical fight			
Yes (ref)	-	-	-
No	0.71	0.5 – 0.9	0.014
Threaten or injured by weapons			
Yes (ref)	-	-	-
No	0.76	0.5 – 1.1	0.109
Carry weapons			
Yes (ref)	-	-	-
No	1.07	0.8 – 1.4	0.652
Performing Car Drifting			
Yes (ref)	-	-	-
No	1.18	0.9 – 1.6	0.277
Join people performing car drifting			
Yes (ref)			
No	-	-	-
	1.1	0.8 – 1.4	0.548
Been Bullied by others			
Yes (ref)	-	-	-
No	1.22	0.9 – 1.6	0.209
Bullies others			
Yes (ref)	-	-	-
No	0.95	0.7 – 1.3	0.737
Abused by teacher			
Yes (ref)	-	-	-
No	1.07	0.8 – 1.4	0.619
Abused by family			
Yes (ref)	-	-	-
No	0.83	0.6 – 1.1	0.193
Feeling lonely			
Sometime/most of the time (ref)	-	-	-
Never/ rarely	1.4	1.1– 2.0	0.024
Taught about the benefit of practicing physical activity			
No (ref)	-	-	-
Yes	1.48	1.2 – 1.9	< 0.001

-2 Log likelihood = 1603.633, Hosmer and Lemeshow Test p-value= 0.349, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-built removing non significant variables one-by one from the model (Table 6.43). It showed the same results, only the variables in the first model were independently associated with practising physical activity. Students with higher BMI were less likely to engage in physical activity regularly. Students who did not brush their teeth daily were less likely than students brushing their teeth daily to practise physical activity regularly. Non smoking students were significantly more likely than smokers to practise physical activity. Students who stated 'No' for wanting to use drugs or alcohol to feel good were more likely than students who stated 'Yes' to be engaged in regular physical activity. Students who did not engaged in physical fights were less likely to practise physical activity. Not feeling lonely was associated with regular physical activity. Students who reported being taught about the benefits of physical activity in school were more likely to report regular physical activity than students who do not know about the benefits of physical activity (Table 6.43).

Table 6-43. Logistic regression for students' physical activity and other risk behaviours adjusted for students' background

Variables	OR	[95% C.I.]	Likelihood ratio P value
BMI	0.27	0.2 – 0.4	< 0.001
Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	0.72	0.6 – 0.9	0.005
Smoking			
Current smoking (ref)	-	-	-
Non-smoking	1.72	1.2 – 2.3	0.001
Want to use drugs or alcohol			
Yes (ref)	-	-	-
No	1.77	1.2 – 2.6	0.005
Physical fight			
Yes (ref)	-	-	-
No	0.78	0.3 – 0.8	0.037
Feeling lonely			
Sometime/most of the time	-	-	-
Never/ rarely	1.46	1.1 – 1.9	0.012
Taught about the benefit of practising physical activity			
No (ref)	-	-	-
Yes	1.52	1.2 – 1.9	< 0.001

-2 Log likelihood = 1716.138, Hosmer and Lemeshow Test p-value= 0.692, and Omnibus Tests of Model Coefficients p< 0.001

6.4.5 The association between students' physical activity and all the significant variables from the previous models

The final model (Table 6.44) showed that being active for ≥3 days a week was positively associated with low BMI, not being a smoker, not wanting to use drugs or alcohol, brushing teeth daily, not feeling lonely, siblings, father and peers practicing physical activity every week.

Table 6-44. The Final model of the association between physical activity and the significant variables from previous model

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9	0.8 – 1.1	0.244
Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	1.2	0.9 – 1.6	0.116
Perceived health status			
Good	-	-	-
Poor	0.6	0.3 – 1.4	0.258
Liking school			
Yes	-	-	-
No	0.9	0.7 – 1.2	0.397
Peer physical behaviours			< 0.001
None of them (ref)	-	-	-
Some of them	1.0	0.7 – 1.6	*0.805*
Most of them	2.9	2.1 – 4.4	*< 0.001*
Fathers physical behaviours			
No	-	-	-
Yes	1.7	1.2 – 2.3	0.002
Sibling physical behaviours			
No	-	-	-
Yes	1.7	1.3 – 2.2	< 0.001
BMI	0.3	0.2 – 0.5	< 0.001
Smoking			
Current smoking (ref)	-	-	
Non-smoking	1.6	1.1 – 2.3	0.008
Want to use drugs or alcohol			
Yes (ref)	-	-	-
No	2.1	1.3 – 3.2	0.001
Physical fight			
Yes (ref)	-	-	-
No	0.8	0.6 – 1.0	0.133

Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	0.7	0.6 – 0.9	0.044
Feeling lonely			
Sometime/most of the time (ref)	-	-	-
Never/ rarely	1.4	1.1– 2.0	0.039
Taught about the benefit of practicing physical activity			
No (ref)	-	-	-
Yes	1.3	0.9 – 1.8	0.085

-2 Log likelihood = 1549.485, Hosmer and Lemeshow Test p-value= 0.222, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-built with the significant variables after removing the non-significant variables (Table 6.45).

Table 6-45. The final model of the association between physical activity and other significant variables

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Peer physical behaviours			< 0.001
None of them (ref)	-	-	-
Some of them	1.0	0.7 – 1.6	*0.823*
Most of them	3.0	2.0 – 4.5	*< 0.001*
Fathers physical behaviours			
No	-	-	-
Yes	1.6	1.2 – 2.2	0.004
Sibling physical behaviours			
No	-	-	-
Yes	1.7	1.3 – 2.2	< 0.001
BMI	0.3	0.2 – 0.5	< 0.001
Smoking			
Current smoking (ref)	-	-	
Non-smoking	1.5	1.1 – 2.1	0.010
Want to use drugs or alcohol			
Yes (ref)	-	-	-
No	1.8	1.3 – 3.2	0.005
Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	0.7	0.6 – 0.9	0.021
Feeling lonely			
Sometime/most of the time (ref)	-	-	-
Never/ rarely	1.4	1.1– 2.0	0.010

-2 Log likelihood = 1635.261, Hosmer and Lemeshow Test p-value= 0.419, and Omnibus Tests of Model Coefficients p< 0.001

6.4.6 The association between practising physical activity at school and students background

In Table 6.46, students' age was negatively associated with practising physical activity at school. When age increases, students become less likely to engage in sports classes at schools. Students living in the central district of the city were more likely to engage in sport class at school. This model showed a weak association between a father's education and a student's engagement in sports classes at school. Students whose father's education was ≤ 12 years were more likely to engage in sports classes at school. No interaction between a father's and mother's education was found in Model 2 (Table 6.46).

Table 6-46. Multiple logistic regression for students' physical activity behaviour in school and students' background

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.7 [0.7 – 0.9]	< 0.001	0.8 [0.7 – 0.8]	< 0.001
School Type				
Private School (ref)	-	-	-	-
Public School	0.8 [0.6 – 1.0]	0.159	0.8 [0.6 – 1.0]	0.162
Living district		0.005		0.006
East (ref)	-	-	-	-
North	1.3 [0.9 – 1.8]	*0.161*	1.3 [0.9 – 1.8]	*0.166*
South	0.9 [0.6 – 1.3]	*0.578*	0.9 [0.6 – 1.3]	*0.565*
Central	1.6 [1.1 – 2.3]	*0.005*	1.6 [1.1 – 2.3]	*0.006*
West	1.4 [0.9 – 2.0]	*0.057*	1.4 [0.9 – 2.0]	*0.063*
Fathers' Education				
> 12 years (ref)	-	1	-	-
⩽ 12 years	1.3 [1.0 – 1.7]	0.050	1.4 [0.7 – 2.6]	0.268
Mother's Education				
> 12 years (ref)	-	1	-	-
⩽ 12 years	0.9 [0.7 – 1.3]	0.724	0.9 [0.6 – 1.4]	0.898
Father's by mother's education interaction	--		0.9 [0.4 – 1.7]	0.776

Model without interaction: -2 Log likelihood = 1825.794, Hosmer and Lemeshow Test p-value= 0.090, and Omnibus Tests of Model Coefficients p< 0.001

Model including interaction between mothers' and fathers, education: -2 Log likelihood = 1825.713, Hosmer and Lemeshow Test p-value = 0.043, and Omnibus Tests of Model Coefficients p< 0.001

I re-built the model without non-significant variables. The model showed the same result for a student's age and living district, but the association between a father's education and physical activity in school changed slightly. I can conclude that younger adolescents students live in the central district of the city were more likely to take part in sports classes at school (Table 6.47).

Table 6-47. Physical activity behaviour in school and students' background

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.77	0.7 – 0.8	< 0.001
Living district			0.005
East (ref)	-	-	-
North	1.26	0.9 – 1.8	*0.194*
South	0.91	0.6 – 1.3	*0.600*
Central	1.67	1.2 – 2.4	*0.004*
West	1.35	0.9 – 1.9	*0.087*

2 Log likelihood = 1859.206, Hosmer and Lemeshow Test p-value = 0.700, and Omnibus Tests of Model Coefficients p<0.001

6.4.7 The association between physical activity in school and perceived health status, liking school and school performance:

Model 1 (Table 6.48) showed that poor health status, not liking school and poor academic performance were all independently associated with not practicing physical activity at school. Among the variables that I adjusted for, students' age, living in the central district and fathers' education were associated with practicing physical activity. In Model 2, it has been shown that there was no interaction between liking school and school performance in relation to practising physical activity in sports classes in school.

Table 6-48. Logistic regression of practising physical activity at school and students perceived health status, liking school and school performance

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.8 [0.7 – 0.9]	< 0.001	0.8 [0.7 – 0.9]	< 0.001
School Type				
Private School (ref)	-	-	-	-
Public School	0.8 [0.6 – 1.0]	0.065	0.7 [0.6 – 1.0]	0.066

Living district		0.004		0.005
East (ref)	-	-	-	-
North	1.2 [0.9 – 1.8]	*0.204*	1.3 [0.9 – 1.8]	*0.204*
South	0.9 [0.6 – 1.2]	*0.503*	0.9 [0.6 – 1.3]	*0.504*
Central	1.7 [1.1 – 2.4]	*0.005*	1.7 [1.2 – 2.4]	*0.005*
West	1.4 [0.9 – 1.9]	*0.089*	1.4 [0.9 – 1.9]	*0.091*
Fathers' Education				
>12 years (ref)	-	1	-	-
⩽12 years	1.4 [1.1 – 1.8]	0.010	1.4 [1.1 – 1.9]	0.012
Mother's Education				
> 12 years (ref)	-	1	-	-
⩽12 years	0.9 [0.7 – 1.3]	0.919	0.9 [0.7 – 1.3]	0.986
Perceived health status				
Good	-	-	-	-
Poor	0.5 [0.3 – 0.8]	0.014	0.5 [0.3 – 0.9]	0.021
Liking school				
Yes	-	1	-	-
No	0.6 [0.5 – 0.8]	< 0.001	0.6 [0.5 – 0.8]	0.002
Academic Performance				
Good	-	1	-	-
Poor	0.7 [0.5 – 0.9]	0.007	0.7 [0.5 – 1.1]	0.188
Liking school by academic achievement	-------	----	0.8 [0.5 – 1.4]	0.483

Model without interaction: -2 Log likelihood = 1750.842, Hosmer and Lemeshow Test p-value= 0.618, and Omnibus Tests of Model Coefficients p< 0.001
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1750.345, Hosmer and Lemeshow Test p-value= 0.963, and Omnibus Tests of Model Coefficients p< 0.001

I re-built the model again with only the significant variables. Students who reported poor health status were less likely to practise physical activity at school (OR=0.49). Also, students not liking school and who reported poor academic performance were less likely to practice physical activity at school (OR= 0.63) and (OR= 0.70) respectively. Among the variables that I adjusted for, school type became associated with physical activity in school. Students studying in public schools were less likely to participate in physical activity in school (Table 6.49).

Table 6-49. Physical activity at school and students perceived health status, liking school and school performance

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.78	0.7 – 0.9	< 0.001

School Type			
Private School (ref)	-	-	
Public School	0.77	0.6 – 0.9	0.038
Living district			0.004
East (ref)	-	-	-
North	1.24	0.8 – 1.8	*0.240*
South	0.90	0.6 – 1.3	*0.542*
Central	1.72	1.2 – 2.4	*0.003*
West	1.33	0.9 – 1.9	*0.112*
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	1.41	1.1 – 1.8	0.009
Perceived health status			
Good	-	-	-
Poor	0.49	0.3 – 0.9	0.010
Liking school			
Yes	-	-	-
No	0.63	0.5 – 0.8	< 0.001
Academic Performance			
Good	-	-	-
Poor	0.70	0.5 – 0.9	0.006

-2 Log likelihood = 1781.586, Hosmer and Lemeshow Test p-value= 0.398, and Omnibus Tests of Model Coefficients p< 0.001

Note that type of school improved when we removed mother's education from the model.

6.5 Current smoking

6.5.1 The association of current smoking status and students background:

In Model 1 (Table 6.50) students' age, school type, living district, and mothers' education were associated with smoking status. Higher age was associated with an increased odds of being current smoker, studying in private school increases the likelihood of being current smokers, students whose mothers were less educated were less likely to be smokers, and students' living in the north and in the south districts were more likely to smoke. In (Model 2), there was no interaction between father's and mother's education in relation to smoking behaviours.

Table 6-50. Multiple logistic regression for students' current smoking, according to students' background

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.68 [1.5 – 1.9]	<0.001	1.7 [1.5 -1.9]	< 0.001
School Type				
Private School (ref)	-	-	-	-
Public School	0.67 [0.5 – 0.9]	0.006	0.7 [0.5 – 0.9]	0.006
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.26 [0.9 – 1.7]	0.149	1.2 [0.6 – 2.3]	0.578
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	0.69 [0.5 – 0.9]	0.048	0.7 [0.4 -1.1]	0.098
Living district		0.139		0.137
East (ref)	-	-	-	-
North	1.61 [1.1 – 2.5]	*0.034*	1.6 [1.0 – 2.5]	*0.033*
South	1.60 [1.1 – 2.4]	*0.026*	1.6 [1.1 – 2.4]	*0.025*
Central	1.21 [0.8 – 1.9]	*0.375*	1.2 [0.8 – 1.9]	*0.370*
West	1.29 [0.8 – 2.0]	*0.238*	1.3 [0.8 – 2.0]	*0.233*
Fathers by mothers education	-------	-----	1.1 (0.5 – 2.2)	0.867

Notes: smoking behaviour dichotomised to Non smokers vs. Current smoking
Model without interaction: -2 Log likelihood = 1394.212, Hosmer and Lemeshow Test p-value= 0.098, and Omnibus Tests of Model Coefficients p< 0.001
Model including interaction between mothers and fathers education: -2 Log likelihood = 1394.184, Hosmer and Lemeshow Test p-value =0.044, and Omnibus Tests of Model Coefficients p < 0.001

The model was re-built again without fathers' education since it was non-significant in the first model (Table 6.51). Here, mothers' education and living in the north district became non significant in the model. I can conclude that higher age is associated with smoking behaviours. Public school students are less likely than private school to be smokers. Living in the south of the city was associated with smoking behaviours. Mothers' education and living in the north district had a weak association with smoking behaviours among the participants in this study (Table 6.51).

Table 6-51. Multiple logistic regression for students' smoking behaviours, according to students' background

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.69	1.5 – 1.9	< 0.001
School Type			
Private School (ref)	-	-	-
Public School	0.68	0.5 – 0.9	0.007
Mother's Education			
> 12 years (ref)	-	-	-
⩽ 12 years	0.76	0.5 – 1.1	0.112
Living district			0.137
East (ref)	-	-	-
North	1.50	0.9 – 2.3	*0.065*
South	1.57	1.1- 2.4	*0.032*
Central	1.17	0.8 – 2.8	*0.475*
West	1.29	0.8 – 2.0	*0.234*

-2 Log likelihood = 1405.913, Hosmer and Lemeshow Test p-value = 0.366, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-built again without mothers' education and living district (Table 6.52). I conclude that smoking behaviour increases as students' age increases. Students in public school were less likely than private schools students to be smokers.

Table 6-52. Multiple logistic regression for students' current smoking status, according to students' background

Variables	OR	[95% C.I.]	Likelihood ratio P value
Age (years)	1.66	1.5 – 1.9	< 0.001
School Type			
Private School (ref)	-	-	-
Public School	0.68	0.5 – 0.9	0.006

-2 Log likelihood = 1435.654, Hosmer and Lemeshow Test p-value = 0.314 and Omnibus Tests of Model Coefficients p< 0.001

6.5.2 The association between students' current smoking status and student's health status, liking school and school performance:

While adjusting for students' socio-demographic variables, perceived poor health status and not liking school were independently associated with smoking behaviours among students in our sample. Poor academic performance was of borderline significance (Table 6.53). I re-ran the model regression without the non significant variables. It showed similar results. I conclude that having a poor perceived health status and 'not liking school' are independently associated with smoking. There is weak evidence that academic performance is independently associated with smoking.

Table 6-53. Logistic regression analysis for students current smoking status in relation to students' academic performance, liking school and health status

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.70 [1.5 – 1.9]	<0.001	1.71 [1.5 -1.9]	< 0.001
School Type				
Private School (ref)	-	-	-	-
Public School	0.69 [0.5 – 0.9]	0.012	0.69 [0.5 – 0.9]	0.012
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.18 [0.8 – 1.6]	0.331	1.2 [0.8 – 1.6]	0.320
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	0.66 [0.5 – 0.9]	0.031	0.7 [0.5 -0.9]	0.031
Living district		0.215		0.218
East (ref)	-	-	-	-
North	1.58 [1.1 – 2.5]	*0.049*	1.58 [1.1 – 2.5]	*0.049*
South	1.50 [1.0 – 2.3]	*0.064*	1.50 [0.9 – 2.3]	*0.064*
Central	1.14 [0.7 – 1.8]	*0.563*	1.14 [0.7 -1.8]	*0.563*
West	1.33 [0.8 – 2.0]	*0.202*	1.33 [0.9 – 2.1]	*0.202*
Perceived health status				
Good	-	-	-	-
Poor	2.4 [1.3 – 4.4]	0.006	2.39 [1.3-4.5]	0.006
Liking school				
Yes	-	1	-	-
No	2.3 [1.7– 3.0]	<0.001	2.13 [1.5-3.0]	< 0.001
Academic Performance				
Good	-	1	-	-
Poor	1.3 [0.9 – 1.8]	0.069	1.15 [0.7-2.3]	0.559

Liking school by academic achievement	-------	----	1.25 [0.7-2.3]	0.473

Models without interaction: -2 Log likelihood = 1314.876, Hosmer and Lemeshow Test p-value= 0.886, and Omnibus Tests of Model Coefficients p< 0.001
Models with interaction between liking school and academic school performance was not significant in the logistic regression, the -2 Log likelihood = 1394.356, Hosmer and Lemeshow Test p-value= 0 .766 and Omnibus Tests of Model Coefficients p< 0.001

The model was re-built by removing the non significant variables eliminated one at a time sequentially. Mothers' education became non-significantly associated with smoking behaviours in this model (Table 6.54).

Table 6-54. Logistic regression analysis for students current smoking status in relation to students' academic performance, liking school and health status

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.7	1.5 – 1.9	< 0.001
School Type			
Private School (ref)	-	-	-
Public School	0.7	0.5 – 0.9	0.017
Perceived health status			
Good	-	-	-
Poor	2.6	1.4 – 4.8	0.002
Liking school			
Yes	-	-	-
No	2.3	1.8 – 3.0	< 0.001

-2 Log likelihood = 1377.471, Hosmer and Lemeshow Test p-value= 0.364, and Omnibus Tests of Model Coefficients p< 0.001

6.5.3 The association between students' current smoking status and their families' and peers' smoking status

Peers', fathers', mother's and siblings' smoking behaviours were all independently associated with students' smoking behaviour, while adjusting for students' socio-demographic background. If a father smokes, the student is more likely to smoke (OR= 1.70, 95% CI= 1.2 – 2.4, p=0.002), if a mother smokes, the student is more likely to smoke (OR= 3.19, 95% CI= 1.1 – 9.2, p=0.030), if a students' sibling smokes, the student is more likely to smoke (OR= 2.39, 95% IC = 1.8 – 3.3, p< 0.001) and , interestingly, if some of a student's friends smoke, he is 4.2 more likely to smoke

but if most of his friends smoke, he is 15 times more likely to smoke. Among the variables that have been adjusted for, age and living district were associated with smoking behaviours. Model 2, showed that there was an interaction between fathers' and mothers' smoking behaviours with regards to students' smoking behaviours. If both parents were not smokers, the student is significantly less likely to smoke (Table 6.55).

Table 6-55. Logistic regression analysis for students' smoking status to students' friends, father's, mother's, and sibling's smoking status

Variables	Model 1 without interaction		Model with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.50 [1.3 – 1.7]	<0.001	1.50 [1.3 -1.7]	< 0.001
School Type				
Private School (ref)	-	-	-	-
Public School	0.77 [0.6 – 1.1]	0.107	0.77 [0.6 – 1.1]	0.116
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.03 [0.7 – 1.5]	0.852	0.98 [0.7 – 1.4]	0.924
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	0.67 [0.4 – 1.0]	0.064	0.65 [0.4 -0.9]	0.042
Living district		0.123		0.073
East (ref)	-	-	-	-
North	1.70 [1.0 – 2.8]	*0.035*	1.80 [1.1 – 2.9]	*0.021*
South	1.82 [1.1 – 2.9]	*0.012*	1.91 [1.2 – 3.1]	*0.007*
Central	1.38 [0.8 – 2.2]	*0.194*	1.46 [0.7 – 2.3]	*0.132*
West	1.59 [1.0 – 2.6]	*0.060*	1.64 [1.0 – 2.6]	*0.048*
Friends smoking		< 0.001		< 0.001
None of them (ref)	-	-	-	-
Some of them	4.16 [2.6 – 6.7]	*<0.001*	4.0 [2.6 – 7.0]	*< 0.001*
Most of them	15.3 [9.4 -24.6]	*<0.001*	15.6 [9.4 -25.4]	*< 0.001*
Fathers smoking				
No (ref)	-	-	-	-
Yes	1.70 [1.2 – 2.4]	0.002	1.92 [1.3 – 2.9]	0.002
Mothers smoking				
No (ref)	-	-	-	-
Yes	3.19 [1.1 – 9.2]	0.031	65.0 [6.0 – 709]	0.001
⩾ 1 Sibling(s) smoking				
No (ref)	-	-	-	-
Yes	2.39 [1.8 – 3.3]	< 0.001	2.58 [1.9 – 3.5]	< 0.001

Father's by mother's smoking behaviours interaction	-------	-----	0.01 (0.0-0.3)	0.006
Father's by sibling's smoking Behaviour interaction	-------	-----	0.93 (0.5 – 2.0)	0.852
Mother's by sibling's smoking interaction	-------	-----	0.87 (0.7 -1.4)	0.919

Model without interaction: -2 Log likelihood = 1121.515, Hosmer and Lemeshow Test p-value= 0.671, and Omnibus Tests of Model Coefficients p< 0.001
Model with interaction between fathers', mothers' and siblings' smoking: -2 Log likelihood = 1114.494, Hosmer and Lemeshow Test p-value= 0.960, and Omnibus Tests of Model Coefficients p<0.001

The model was re-built by removing the non-significant variables eliminated one at a time sequentially. There was a significant interaction between a father's and mother's smoking behaviours and a student's smoking behaviour, and adding the interaction to the model and removing the non significant variables improved the goodness of fit (Table 6.56).

Table 6-56. Logistic regression analysis for students' smoking behaviour to students' friends, father's, mother's, and sibling's smoking behaviours.

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.5	1.3 – 1.7	< 0.001
Mother's Education			
> 12 years (ref)			
⩽12 years	0.7	0.4 – 0.9	0.034
Friends smoking			< 0.001
None of them (ref)	-	-	-
Some of them	4.3	2.7 – 7.1	*< 0.001*
Most of them	15.7	9.7 – 25 .6	*< 0.001*
Fathers smoking			
No (ref)	-	-	-
Yes	1.8	1.3 – 2.36	< 0.001
Mothers smoking			
No (ref)	-	-	-
Yes	62.5	6.0 – 643	< 0.001
⩾ 1 Sibling(s) smoking			
No (ref)	-	-	-
Yes	2.5	1.8 – 3.4	< 0.001
Fathers by mother smoking	0.013	0.0 – 1.92	0.002

Note: -2 Log likelihood= 1117, Hosmer and Lemeshow Test p-value= 0.986, and Omnibus Tests of Model Coefficients p< 0.001

6.5.4 Current smoking status and other health risk behaviours

Investigating the association between smoking behaviours and other risk behaviours was performed (Table 6.57). The model shows that several risk behaviours are significantly associated with smoking behaviours. Students who do not practise physical activity regularly (≤ 2 times a week), do not want to use drugs or alcohol, carry weapons, engage in physical fights, perform car drifting, permit being bullied or abused by their family were independently associated with smoking behaviour, adjusting for student age, type of school, living districts and fathers' and mothers' education. Among the variables that were adjusted for, it has been found that age, type of school, and living districts were still associated with smoking behaviours. Mothers' education had a weak association with smoking behaviour.

Table 6-57. Multiple logistic regression of students' current smoking status in relation to other risk behaviours, adjusted for students' background

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	1.6	1.4 – 1.9	< 0.001
School Type			
Private School (ref)	-	-	-
Public School	0.7	0.5 – 0.9	0.029
Fathers' Education			
> 12 years (ref)	-	-	-
⩽ 12 years	1.3	0.9 – 1.9	0.102
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.7	0.4 – 1.0	0.051
Living district			0.064
East (ref)	-	-	-
North	1.8	1.1 – 3.0	*0.017*
South	1.7	1.1 – 2.8	*0.024*
Central	1.2	0.7 – 2.0	*0.433*
West	1.6	0.9 – 2.5	*0.070*
Brushing teeth			
⩾ 1 time a day/week	-	-	-
< 1 time a day/week	0.69	0.5 – 0.9	0.863
Eating breakfast			
⩾ 5 days/week	-	-	-
< 5 days/week	1.0	0.7 – 1.4	0.262
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.6	1.2 – 2.3	0.003

Want to use drugs			
No	-	-	-
Yes	2.9	2.0 -4.2	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.5	1.1 – 2.1	0.012
Threaten or injured by weapons			
No	-	-	-
Yes	1.2	0.8 – 1.7	0.404
Physical fight			
No	-	-	-
Yes	2.4	1.7 – 3.4	< 0.001
Attempting suicide			
No	-	-	-
Yes	1.4	0.8 – 2.4	0.155
Performing Car Drifting			
No	1	-	-
Yes	1.6	1.1 – 2.2	0.005
Join people performing car drifting			
No	-	-	-
Yes	1.4	0.9 – 1.9	0.058
Being Bullied			
No	-	-	-
Yes	0.6	0.4 – 0.9	0.004
Bullies others			
No	-	-	-
Yes	0.9	0.6 – 1.3	0.617
Abused by teacher			
No	-	-	-
Yes	1.4	1.1 – 1.9	0.043
Abused by family			
No	-	-	-
Yes	1.0	0.8 – 1.4	0.798

-2 Log likelihood = 1151.518, Hosmer and Lemeshow Test p-value= 0.6442, and Omnibus Tests of Model Coefficients p< 0.001

The model was built again (Table 6.58) without non significant variables which were father's education, mother's education, living districts, threaten or injured by weapons, bullies others, and abused by family. The model showed that practising physical activity ≤ 2 times a week was significantly associated with smoking status. It means that students who were not smokers were more likely to practise physical activity regularly. Students who stated they want to use drugs or alcohol were more likely to be smokers. Carrying weapons and being involved in physical fights were associated with smoking behaviour. Performing car drifting was significantly associated with smoking. Students who were bullied were less likely to be smokers. Finally, being abused by teachers was associated with smoking behaviour.

Table 6-58. The association between current smoking status and other risk behaviours

Variables	OR	95% C.I.	Likelihood ratio P value
Age (years)	1.7	1.4 – 1.9	< 0.001
School Type			
Private School (ref)	-	-	-
Public School	0.7	0.5 – 0.9	0.046
Physical Activity			
⩾3 times a week	-	-	-
⩽2 times a week	1.6	1.1 – 2.3	0.004
Want to use drugs			
No	-	-	-
Yes	3.0	2.1 -4.3	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.6	1.2 – 2.2	0.003
Physical fight			
No	-	-	-
Yes	2.6	1.8 – 3.5	< 0.001
Performing Car Drifting			
No	1	-	-
Yes	1.8	1.4 – 2.5	< 0.001
Being Bullied			
No	-	-	-
Yes	0.6	0.4 – 0.9	0.007
Abused by teacher			
No	-	-	-
Yes	1.4	1.1 – 1.9	0.023

-2 Log likelihood = 1171.491, Hosmer and Lemeshow Test p-value= 0.735, and Omnibus Tests of Model Coefficients p< 0.001

6.5.5 The association between current smoking and the significant variables from several models

This final model (Table 6.59) showed that the majority of the significant variables from the previous models remained significant in this large final model. Only poor health status, studying in private school and being threatened by a teacher became not significantly associated with current smoking.

Table 6-59. The final regression model of the association between current smoking and all the significant variables in the previous models

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	1.6	1.3 – 1.8	< 0.001
School Type			
Private School (ref)	-	-	-
Public School	0.8	0.5 – 1.1	0.266
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.7	0.4 – 1.0	0.059
Living district			0.032
East (ref)	-	-	-
North	1.8	1.1 – 3.1	*0.019*
South	2.0	1.2 – 3.4	*0.008*
Central	1.2	0.7 – 2.3	*0.303*
West	2.0	1.1 – 3.5	*0.009*
Perceived health status			
Good	-	-	-
Poor	1.8	0.9 – 3.9	0.118
Liking school			
Yes	-	-	-
No	1.7	1.3 – 2.4	0.001
Friends smoking			< 0.001
None of them (ref)	-	-	-
Some of them	3.2	1.9 – 5.4	< *0.001*
Most of them	9.5	5.7 – 16.0	< *0.001*
Fathers smoking			
No (ref)	-	-	-
Yes	2.0	1.4 – 3.0	< 0.001
Mothers smoking			
No (ref)	-	-	-
Yes	5.7	1.5 – 18.0	0.003
⩾ 1 Sibling(s) smoking			
No (ref)	-	-	-
Yes	2.2	1.6 – 3.1	< 0.001

Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.7	1.1 – 2.3	0.010
Want to use drugs			
No	-	-	-
Yes	2.3	2.0 – 3.4	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.4	1.1 – 2.0	0.050
Physical fight			
No	-	-	-
Yes	2.4	1.7 – 3.4	< 0.001
Performing Car Drifting			
No	-	-	-
Yes	1.6	1.1 – 2.2	0.010
Being Bullied			
No	-	-	-
Yes	0.6	0.4 – 0.9	0.030
Abused by teacher			
No	-	-	-
Yes	1.3	0.9 – 1.8	0.185

-2 Log likelihood = 959.169, Hosmer and Lemeshow Test p-value= 0.262, and Omnibus Tests of Model Coefficients p< 0.001.

The model was built again (Table 6.60) without non-significant variables which were school type, mother's education, health status and being abused by teachers.

Table 6-60. The final model of the association between current smoking and all the significant variables only

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	1.5	1.3 – 1.7	< 0.001
Living district			0.026
East (ref)	-	-	-
North	1.8	1.1 – 3.1	*0.009*
South	2.0	1.2 – 3.4	*0.009*
Central	1.2	0.7 – 2.3	*0.298*
West	2.0	1.1 – 3.5	*0.012*
Liking school			
Yes	-	-	-
No	1.7	1.3 – 2.4	0.001

Friends smoking			< 0.001
None of them (ref)	-	-	-
Some of them	3.6	2.2 – 5.9	*< 0.001*
Most of them	10.6	6.3 – 17.6	*< 0.001*
Fathers smoking			
No (ref)	-	-	-
Yes	2.1	1.5 – 3.0	< 0.001
Mothers smoking			
No (ref)	-	-	-
Yes	4.6	1.5 – 14.1	0.007
⩾ 1 Sibling(s) smoking			
No (ref)	-	-	-
Yes	2.2	1.6 – 3.1	< 0.001
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.6	1.1 – 2.3	0.010
Want to use drugs			
No	-	-	-
Yes	2.5	1.8 – 3.7	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.5	1.1 – 2.1	0.032
Physical fight			
No	-	-	-
Yes	2.4	1.7 – 3.4	< 0.001
Performing Car Drifting			
No	-	-	-
Yes	1.5	1.1 – 2.1	0.020
Being Bullied			
No	-	-	-
Yes	0.7	0.5 – 0.9	0.040

-2 Log likelihood = 991.676, Hosmer and Lemeshow Test p-value= 0.123, and Omnibus Tests of Model Coefficients p< 0.001.

6.6 Violent Behaviours

6.6.1 The association between carrying weapons and students background:

Among the students' socio-demographic variables, students' age was positively associated with carrying weapons. Living in the west district was also associated with less carrying of weapons. Model 2 showed that there was no significant interaction between fathers' and mothers' education in relation to carrying weapons (Table 6.61).

Table 6-61. Logistic regression for students' carrying weapons behaviours in the past 30 days, according to age, school type, fathers' and mothers' education level and living districts.

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.13 [1.1 – 1.2]	0.013	1.13 [1.1 -1.2]	0.013
School Type				
Private School (ref)	-	-	-	-
Public School	0.82 [0.6 – 1.1	0.098	0.82 [0.6 – 1.0]	0.093
Father's Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.11 [0.9 – 1.4]	0.423	0.96 [0.5- 1.7]	0.881
Mother's Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	0.82 [0.9 – 1.4]	0.185	0.77 [0.5 -1.1]	0.157
Living district		0.386		0.416
East (ref)	-	-	-	-
North	0.87 [0.6 – 1.2]	*0.421*	0.87 [0.6 – 1.2]	*0.438*
South	0.88 [0.6 – 1.2]	*0.444*	0.88 [0.6 – 1.2]	*0.469*
Central	0.92 [0.7 – 1.3]	*0.608*	0.92 [0.7 -1.3]	*0.642*
West	0.70 [0.5 – 0.9]	*0.048*	0.71 [0.5 – 1.0]	*0.056*
Father's by mother's education interaction	-------	-----	1.2 (0.6 – 2.2)	0.560

Notes: Carrying weapons behaviour during the past 30 days was dichotomised to 0 day vs. 1 day or more.
Model without interaction: -2 Log likelihood = 1882.783, Hosmer and Lemeshow Test p-value= 0.734, and Omnibus Tests of Model Coefficients p= 0.077
Model including interaction between fathers' and mothers' education: -2 Log likelihood = 1882.442, Hosmer and Lemeshow Test p-value = 0.847, and Omnibus Tests of Model Coefficients p=0.105

I re-built the model without the non significant variables (Table 6.62). I conclude that increase in age is positively associated with carrying weapons in the last 30 days preceding the survey. The model shows a weak association between students who study in public schools or living in the west district with carrying weapons.

Table 6-62. Logistic regression for students' carrying weapons behaviours in the past 30 days, according to age, school type, and living districts

Variables	OR	[95% C.I.]	Likelihood ratio P value
Age (years)	1.12	1.0 – 1.2	0.011

-2 Log likelihood = 1928.802, Hosmer and Lemeshow Test p-value= 0.238, and Omnibus Tests of Model Coefficients p= 0.050

6.6.2 Carrying weapons behaviour and students health and school factors:

Not liking school and poor academic school performance were independently associated with students' carrying weapons, adjusting for students' socio-demographic variables. There was no significant interaction between liking school and academic performance in relation to carrying weapons (Table 6.63).

Table 6-63. Logistic regression for carrying weapons in relation to students' academic performance, liking school and perceived health status

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.12 [1.0 – 1.2]	0.029	1.12 [1.50 -1.2]	0.028
School Type				
Private School (ref)	-	-	-	-
Public School	0.81 [0.6 – 1.0]	0.088	0.81 [0.6 – 1.0]	0.087
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽12 years	1.05 [0.8 – 1.4]	0.715	1.06 [0.8 – 1.4]	0.694
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽12 years	0.77 [0.6 – 1.0]	0.098	0.77 [0.6 -1.0]	0.097
Living district		0.386		0.375
East (ref)	-	-	-	-
North	0.82 [0.6 – 1.2]	*0.280*	0.82 [0.6 – 1.2]	*0.280*
South	0.83 [0.6 – 1.2]	*0.302*	0.83 [0.6 – 1.2]	*0.301*
Central	0.90 [0.6 – 1.3]	*0.541*	0.90 [0.6 -1.3]	*0.542*
West	0.69 [0.5 – 0.9]	*0.046*	0.69 [0.5 – 0.9]	*0.048*

Perceived health status				
Good	-	-	-	-
Poor	1.13 [0.6 – 2.0]	0.677	1.14 [0.6 – 2.0]	0.674
Liking school				
Yes	-	1	-	-
No	1.82 [1.5 – 2.3]	< 0.001	1.73 [1.3 – 2.3]	< 0.001
Academic Performance				
Good	-	1	-	-
Poor	1.52 [1.2 – 2.0]	0.001	1.39 [0.9-2.0]	0.088
Liking school by academic achievement	-------	----	1.19 [0.7-2.0]	0.502

Models without interaction: -2 Log likelihood = 1802.890, Hosmer and Lemeshow Test p-value= 0.166, and Omnibus Tests of Model Coefficients p< 0.001
Models with interaction between liking school and academic school performance was not significant in the logistic regression, the -2 Log likelihood = 1802.438, Hosmer and Lemeshow Test p-value= 0 .195, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-run without non-significant variables eliminated one by one (Table 6.64). Students' not liking school and performing poorly in school were more likely to carry weapons. Also, in this model, students studying in public school were less likely to carry weapons.

Table 6-64. Logistic regression of carrying weapons and students school variables

Variables	OR	[95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.1	1.0 – 1.2	0.031
School Type			
Private School (ref)	-	-	-
Public School	0.8	0.6 – 1.0	0.037
Liking school			
Yes	-		-
No	1.9	1.5 – 2.3	< 0.001
Academic Performance			
Good	-	-	
Poor	1.5	1.2 – 1.9	0.001

-2 Log likelihood = 1858.564, Hosmer and Lemeshow Test p-value= 0.354, and Omnibus Tests of Model Coefficients p< 0.001.

6.6.3 The association between carrying weapons behaviours and other risk behaviours:

Current smoking, having been threatened or injured by weapons, being involved in physical fighting, joining car drifting, taking part in bullying others and having been abused by family were all independently associated with carrying weapons, controlling for students' socio-demographic variables (Table 6.65).

Table 6-65. Logistic regression of carrying weapons to others risk behaviours adjusted for students' background variables

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	1.0	1.4 – 1.9	0.672
School Type			
Private School (ref)	-	-	-
Public School	0.8	0.6 – 1.1	0.165
Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	1.0	0.8 – 1.4	0.928
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.9	0.6 – 1.2	0.378
Living district			0.507
East (ref)	-	-	-
North	0.9	0.6 – 1.3	*0.573*
South	0.8	0.5 – 1.2	*0.275*
Central	0.9	0.6 – 1.3	*0.501*
West	0.7	0.5 – 1.1	*0.086*
Eating breakfast			
Every day	-	-	
Not every day	1.1	0.9 – 1.5	0.426
Brushing teeth			
Every day	-	-	
Not every day	1.3	0.9 – 1.6	0.096
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.1	0.8 – 1.7	0.461
Smoking status			
Non-smoking	-	-	
Current smoking	1.5	1.1 – 2.1	0.017
Want to use drugs			
No	-	-	-
Yes	1.4	0.9 – 2.1	0.073

Threaten or injured by weapons			
No	-	-	-
Yes	3.0	2.2 – 4.2	< 0.001
Physical fight			
No	-	-	-
Yes	2.9	2.2 – 3.7	<0.001
Unsafe going to school			
No	-	-	-
Yes	1.5	1.2 – 2.0	0.563
Performing Car Drifting			
No	-	-	-
Yes	1.7	1.3 – 2.3	<0.001
Join people performing car drifting			
No	-	-	-
Yes	1.5	1.1 – 2.0	0.009
Attempting suicide			
No	-	-	-
Yes	1.2	0.6 – 2.1	0.522
Being Bullied			
No	-	-	-
Yes	0.8	0.6 – 1.2	0.279
Bullies others			
No	-	-	-
Yes	1.5	1.1 – 2.0	0.011
Abused by teacher			
No	-	-	-
Yes	0.9	0.7 – 1.3	0.828
Abused by family			
No	-	-	-
Yes	1.5	1.2 – 2.0	0.003

-2 Log likelihood = 1464.896, Hosmer and Lemeshow Test p-value= 0.043, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-ran without the non-significant variables (Table 6.56). Current smokers were more likely to carry weapons than non-smokers. Being threatened or injured by weapons and engaging in fighting were independently associated with carrying weapons in the past 30 days. Performing car drifting and joining people performing car drifting were also associated with carrying weapons. Taking part in bullying others and being abused by family were associated with carrying weapons (Table 6.66).

Table 6-66. Logistic regression of carrying weapons to others risk behaviours adjusted for students' background variables

Variables	OR	95% C.I.	Likelihood ratio P value
Smoking behaviours			
Non-smoking (ref)	-	-	
Current smoking	1.6	1.2 – 2.2	0.003
Threaten or injured by weapons			
No (ref)	-	-	-
Yes	3.0	2.2 – 4.0	< 0.001
Physical fight			
No (ref)	-	-	-
Yes	2.8	2.2 – 3.7	< 0.001
Performing Car Drifting			
No (ref)	-	-	-
Yes	1.8	1.4 – 2.4	< 0.001
Join people performing car drifting			
No (ref)	-	-	-
Yes	1.4	1.1 – 1.9	0.009
Bullies others			
No (ref)	-	-	-
Yes	1.4	1.1 – 2.0	0.015
Abused by family			
No (ref)	-	-	-
Yes	1.5	1.2 – 2.0	0.001

-2 Log likelihood = 1497.768, Hosmer and Lemeshow Test p-value= 0.894, and Omnibus Tests of Model Coefficients p< 0.001

6.6.4 The association between carrying weapons and all the significant variables from several models

The final model below (Table 6.67) showed that the majority of the significant variables from the previous models remained significant. Not liking school, current smoking, being threatened or injured by weapons, being in physical fights, performing car drifting, joining people who perform car drifting, bullying others and being abused by family were all independently associated with carrying weapons among adolescents in this study.

Table 6-67. The final model of the association between carrying weapons and all the significant variables from previous model

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	1.0	0.9 – 1.1	0.872
School Type			
Private School (ref)	-	-	-
Public School	0.8	0.6 – 1.1	0.158
Living district			0.464
East (ref)	-	-	-
North	0.9	0.6 – 1.3	*0.449*
South	0.7	0.5 – 1.1	*0.135*
Central	0.9	0.6 – 1.3	*0.460*
West	0.7	0.5 – 1.1	*0.096*
Liking school			
Yes	-	-	-
No	1.4	1.1 – 1.8	0.017
Academic Performance			
Good	-	-	-
Poor	1.2	0.9 – 1.6	0.264
Smoking status			
Non-smoking	-	-	
Current smoking	1.5	1.1 – 2.1	0.009
Threaten or injured by weapons			
No	-	-	-
Yes	3.0	2.2 – 4.1	< 0.001
Physical fight			
No	-	-	-
Yes	2.8	2.1 – 3.6	<0.001
Performing Car Drifting			
No	-	-	-
Yes	1.7	1.3 – 2.3	<0.001
Join people performing car drifting			
No	-	-	-
Yes	1.4	1.1 – 1.8	0.006
Bullies others			
No	-	-	-
Yes	1.4	1.1 – 1.8	0.030
Abused by family			
No	-	-	-
Yes	1.5	1.2 – 2.0	0.003

-2 Log likelihood = 1487.583, Hosmer and Lemeshow Test p-value= 0.199, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-run without the non-significant variables (Table 6.68). Not liking school, current smoking, being threatened or injured by weapons, fighting, performing car drifting, joining people while performing car drifting, bullying others and being abused by family were positively associated with carrying weapons.

Table 6-68. The final model of the association between carrying weapons and the significant variables only

Variables	OR	95% C.I.	Likelihood ratio P value
Liking school			
Yes	-	-	-
No	1.4	1.1 – 1.8	0.008
Smoking status			
Non-smoking	-	-	
Current smoking	1.5	1.1 – 2.1	0.008
Threaten or injured by weapons			
No	-	-	-
Yes	3.0	2.2 – 4.1	< 0.001
Physical fight			
No	-	-	-
Yes	2.8	2.1 – 3.6	<0.001
Performing Car Drifting			
No	-	-	-
Yes	1.7	1.3 – 2.3	<0.001
Join people performing car drifting			
No	-	-	-
Yes	1.4	1.1 – 1.8	0.010
Bullies others			
No	-	-	-
Yes	1.4	1.1 – 1.8	0.030
Abused by family			
No	-	-	-
Yes	1.5	1.2 – 2.0	0.003

-2 Log likelihood = 1509.886, Hosmer and Lemeshow Test p-value= 0.510, and Omnibus Tests of Model Coefficients p< 0.001

6.6.5 The association between physical fights and students' socio-demographic variables:

Investigation of the association between physical fights and students' background shows a weak association between students' age and physical fights, and there were no associations between other background variables and physical fights. In Model 2, when interaction between fathers' and mothers' education were added to the model, it showed a positive association between low parents' education and students fighting. Students from fathers and mothers with low education were more likely to be engaged in physical fighting (Table 6.69).

Table 6-69. Logistic regressions for students' physical fight behaviours in relation to student's socio-demographic variables

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.10 [1.0 – 1.2]	0.050	1.10 [1.0 -1.2]	0.057
School Type				
Private School (ref)	-	-	-	-
Public School	0.85 [0.7 – 1.1]	0.159	0.84 [0.7 – 1.0]	0.127
Living district		0.959		0.966
East (ref)	-	-	-	-
North	0.99 [0.7 – 1.4]	*0.939*	1.01 [0.7 – 1.4]	*0.946*
South	0.91 [0.6 – 1.3]	*0.586*	0.94 [0.7 – 1.3]	*0.722*
Central	1.03 [0.7 – 1.4]	*0.838*	1.07 [0.7 -1.4]	*0.683*
West	0.95 [0.7 – 1.3]	*0.785*	0.99 [0.7 – 1.4]	*0.993*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽12 years	1.04 [0.8 – 1.3]	0.768	0.53 [0.3- 0.9]	0.024
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽12 years	0.89 [0.7 – 1.2]	0.446	0.67 [0.5 -0.9]	0.029
Fathers by mothers education interaction	-------	-----	2.30 [1.2 – 4.]	0.008

Fighting in the past 12 months dichotomised to 0 time vs. ⩾ 1 time
Model without interaction: -2 Log likelihood = 2018.198, Hosmer and Lemeshow Test p-value = 0.950, and Omnibus Tests of Model Coefficients p= 0.589
Model including interaction between mothers and fathers education: -2 Log likelihood = 2010.921, Hosmer and Lemeshow Test p-value =0.533, and Omnibus Tests of Model Coefficients p=0.130

The model was re-run without the non-significant variables. Students from fathers and mothers with low education were more likely to be engaged in physical fighting (Table 6.70).

Table 6-70. Logistic regressions for students' physical fight behaviours in relation to student's socio-demographic variables.

Variables	OR	[95% C.I.]	P value
Fathers by mothers education interaction	2.26	1.2 – 4.1	0.008

-2 Log likelihood = 2019.815, Hosmer and Lemeshow Test p-value = 1, and Omnibus Tests of Model Coefficients p= 0.050.

6.6.6 Association between physical fights and perceived health status and school factors:

Adjusting for students' background, not liking schools and poor school performance were positively associated with being engaged in physical fights. Model 2, showed that there was no significant interaction between school performance, and liking school with regards to physical fights (Table 6.71).

Table 6-71. Multiple logistic regression for students' being engaged in physical fight behaviours in relation to perceived health status and school factors, adjusted for students' backgrounds

	Model 1 without interaction		Model 2 with interaction	
Variables	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.08 [0.9 – 1.2]	0.102	1.08 [0.9 -1.2]	0.099
School Type				
Private School (ref)		-		-
Public School	0.83 [0.7 – 1.1]	0.114	0.83 [0.7 – 1.0]	0.113
Living district		0.917		0.917
East (ref)		-		-
North	0.98 [0.7 – 1.4]	*0.908*	0.98 [0.7 – 1.4]	*0.909*
South	0.90 [0.6 – 1.2]	*0.500*	0.89 [0.6 – 1.2]	*0.500*
Central	1.04 [0.7 – 1.5]	*0.805*	1.04 [0.7 -1.5]	*0.803*
West	0.94 [0.7 – 1.3]	*0.745*	0.95 [0.7 – 1.3]	*0.751*
Fathers' Education				
>12 years (ref)		-	-	-
⩽ 12 years	0.99 [0.8 – 1.3]	0.949	0.99 [0.8- 1.3]	0.962

Mother's Education > 12 years (ref) ⩽ 12 years	 0.84 [0.6 – 1.2]	 - 0.243	 - 0.84 [0.6 – 1.1]	 - 0.240
Perceived health status Good Poor	 1.26 [0.7 – 2.2]	 - 0.423	 1.27 [0.7 – 2.3]	 - 0.422
Liking school Yes No	 1.39 [1.1 – 1.7]	 - 0.003	 - 1.35 [1.0 – 1.7]	 - 0.020
Academic Performance Good Poor	 - 1.68 [1.3 – 2.2]	 - < 0.001	 1.60 [1.1 – 2.3]	 0.010
Liking school by academic performance interaction	-------	----	1.11 [0.7 – 1.8]	0.683

Model without interaction: -2 Log likelihood = 1949.223, Hosmer and Lemeshow Test p-value = 0.650, and Omnibus Tests of Model Coefficients p<0.001
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1949.056, Hosmer and Lemeshow Test p-value = 0.246, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-built without the non significant variables (Table 6.72). Students reporting poor academic performance and not liking school were positively more likely to engage in physical fighting.

Table 6-72. Multiple logistic regression for students' physical fight behaviours in relation to school factors

Variables	OR	[95% C.I.]	P value
Liking school Yes No	 - 1.45	 - 1.1 – 1.7	 - 0.001
Academic Performance Good Poor	 - 1.64	 - 1.3 – 2.1	 - < 0.001

-2 Log likelihood = 2008.322, Hosmer and Lemeshow Test p-value= 0.984, and Omnibus Tests of Model Coefficients p< 0.001

6.6.7 The association between physical fighting and other risk behaviours:

Smoking behaviour, skipping breakfast, being threatened or injured by weapons, carrying weapons, joining people performing car drifting in the same car, taking part in bullying others and being abused by teacher were independently associated with physical fighting during the past 12 months, adjusting for socio-demographic variables. Also, inverse associations was found between low level of physical activity and fighting (Table 6.73).

Table 6-73. Multiple logistic regression of physical fighting and other risk behaviours

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	0.9	0.8 – 1.1	0.516
School Type			
Private School (ref)	-	-	-
Public School	0.9	0.7 – 1.2	0.626
Fathers' Education			
> 12 years (ref)	-	-	-
⩽ 12 years	0.9	0.7 – 1.2	0.506
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.9	0.7 – 1.4	0.978
Living district			0.787
East (ref)	-	-	-
North	1.0	0.7 – 1.5	*0.886*
South	0.8	0.6 – 1.3	*0.425*
Central	1.1	0.8 – 1.7	*0.638*
West	1.0	0.5 – 1.1	*0.941*
Eating breakfast			
Every day	-	-	
Not every day	1.4	1.1 – 1.7	0.023
Brushing teeth			
Every day	-	-	
Not every day	0.9	0.6 – 1.1	0.262
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	0.738	0.6 – 0.9	0.024
Smoking status			
Non-smoking (ref)	-	-	
Current smoking	2.3	1.6 – 3.2	< 0.001

Want to use drugs			
No (ref)	-	-	-
Yes	1.3	0.9 – 2.0	0.213
Threaten or injured by weapons			
No (ref)	-	-	-
Yes	2.7	1.9 – 3.7	< 0.001
Carry weapons			
No(ref)	-	-	-
Yes	2.9	2.2 – 3.7	< 0.001
Performing Car Drifting			
No (ref)	-	-	-
Yes	1.1	0.9 – 1.6	0.336
Join people performing car drifting			
No (ref)	-	-	-
Yes	1.6	1.2 – 2.1	0.001
Attempting suicide			
No	-	-	-
Yes	1.7	0.9 – 3.1	0.060
Being Bullied			
No (ref)	-	-	-
Yes	1.3	0.9 – 1.7	0.125
Bullies others			
No (ref)	-	-	-
Yes	2.0	1.5 – 2.8	< 0.001
Abused by teachers			
No (ref)	-	-	-
Yes	1.3	1.1 – 1.7	0.036
Abused by family			
No (ref)	-	-	-
Yes	0.9	0.7 – 1.3	0.777

-2 Log likelihood = 1543.037, Hosmer and Lemeshow Test p-value= 0.501, and Omnibus Tests of Model Coefficients p< 0.001

The model was run again without the non-significant variables eliminated one at a time (Table 6.74). In general, the model showed similar result for all significant variables, but attempting suicide during the past 12 months became associated with physical fighting.

Table 6-74. Multiple logistic regression of physical fighting and other risk behaviours

Variables	OR	95% C.I.	Likelihood ratio P value
Eating breakfast			
Every day	-	-	
Not every day	1.3	1.1 – 1.7	0.040
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	0.7	0.6 – 0.9	0.034
Smoking status			
Non-smoking	-	-	-
Current smoking	2.4	1.7 – 3.2	< 0.001
Threaten or injured by weapons			
No	-	-	-
Yes	2.7	2.0 – 3.8	< 0.001
Carry weapons			
No	-	-	-
Yes	2.9	2.3 – 3.8	< 0.001
Join people performing car drifting			
No	-	-	-
Yes	1.7	1.3 – 2.1	< 0.001
Bullies others			
No	-	-	-
Yes	2.3	1.6 – 3.0	< 0.001
Abused by teachers			
No (ref)	-	-	-
Yes	1.3	1.1 – 1.7	0.028
Attempting suicide			
No	-	-	-
Yes	1.9	1.1 – 3.3	0.030

-2 Log likelihood = 1543.037, Hosmer and Lemeshow Test = 0.346, and Omnibus Tests of Model Coefficients p< 0.001

6.6.8 The association between physical fighting and the significant variables from the previous models

In this final model (Table 6.75), all the significant variables in the previous model that were associated with being engaged in physical fighting have been included in the final model. Almost all the variables remained significantly associated with students being engaged in fighting behaviours, except for students' age.

Table 6-75. The final model of fighting behaviours and all the significant variables from previous model

Variables	OR	95% C.I.	Likelihood ratio P value
Liking school			
Yes	-	-	-
No	9.6	0.7 – 1.2	0.791
Academic Performance			
Good	-	-	-
Poor	1.3	1.1 – 1.8	0.040
Eating breakfast			
Every day	-	-	
Not every day	1.3	1.1 – 1.7	0.048
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	0.7	0.6 – 0.9	0.038
Smoking			
Non-smoking	-	-	-
Current smoking	2.4	1.7 – 3.2	< 0.001
Threaten or injured by weapons			
No	-	-	-
Yes	2.7	2.0 – 3.8	< 0.001
Carry weapons			
No	-	-	-
Yes	2.8	2.2 – 3.7	< 0.001
Join people performing car drifting			
No	-	-	-
Yes	1.7	1.3 – 2.2	< 0.001
Bullies others			
No	-	-	-
Yes	2.2	1.6 – 3.0	< 0.001
Abused by teachers			
No (ref)	-	-	-
Yes	1.3	1.1 – 1.7	0.030
Attempting suicide			
No	-	-	-
Yes	1.9	1.1 – 3.3	0.028

-2 Log likelihood = 1569.506, Hosmer and Lemeshow Test p-value= 0.820, and Omnibus Tests of Model Coefficients p< 0.001

The model was run again without liking school (Table 6.67). The model shows similar results.

Table 6-76. The final model of the association between fighting and the significant variables only

Variables	OR	95% C.I.	Likelihood ratio P value
Academic Performance			
Good	-	-	-
Poor	1.3	1.1 – 1.8	0.046
Eating breakfast			
Every day	-	-	
Not every day	1.3	1.1 – 1.7	0.046
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	0.7	0.6 – 0.9	0.037
Smoking			
Non-smoking	-	-	-
Current smoking	2.4	1.7 – 3.2	< 0.001
Threaten or injured by weapons			
No	-	-	-
Yes	2.7	2.0 – 3.8	< 0.001
Carry weapons			
No	-	-	-
Yes	2.8	2.2 – 3.7	< 0.001
Join people performing car drifting			
No	-	-	-
Yes	1.7	1.3 – 2.2	< 0.001
Bullies others			
No	-	-	-
Yes	2.2	1.6 – 3.0	< 0.001
Abused by teachers			
No (ref)	-	-	-
Yes	1.3	1.1 – 1.7	0.037
Attempting suicide			
No	-	-	-
Yes	1.9	1.1 – 3.3	0.029

-2 Log likelihood = 1574.969, Hosmer and Lemeshow Test p-value= 0.614, and Omnibus Tests of Model Coefficients p< 0.001

6.7 Bullying behaviours

6.7.1 The association between having been bullied and students' background:

Among students' socio-demographic variables, only living district was associated with being bullied in the past 12 months preceding the survey. Living in the south and west district of the city was statistically associated with being bullied in the past 12 months compared to the reference group. Model 2, showed no interaction effect between fathers' and mother's education (Table 6.77).

Table 6-77. Logistic regression for students being bullied in the past 12 months, according to age, school type, fathers' and mothers' education level and living district.

Variables	Model 1 without interaction		Model 2 with interaction	
	OR (95%C.I.)	Likelihood ratio/ *Wald test* P value	OR (95%C.I.)	Likelihood ratio/ *Wald test* P value
Age (years)	1.0 [0.9 – 1.1]	0.486	0.9 [0.8- 1.1]	0.482
School Type				
Private School	-	-	-	-
Public School	1.0 [0.8 – 1.3]	0.906	0.9 [0.8-1.2]	0.890
Living district		0.005		0.005
East	-	-	-	-
North	0.9 [0.6 – 1.4]	*0.842*	0.9 [0.6 -1.5]	*0.858*
South	1.7 [1.2 – 2.5]	*0.004*	1.8 [1.2 – 2.6]	*0.003*
Central	1.3 [0.9 – 1.8]	*0.239*	1.3 [0.9 -1.9]	*0.227*
West	1.6 [1.1 – 2.3]	*0.020*	1.6 [1.1 – 2.3]	*0.018*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.0 [0.7 – 1.3]	0.834	0.9 [0.5 – 1.6]	0.765
Mother's Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.2 [0.9 – 1.6]	0.299	0.8 [0.5 – 1.2]	0.271
Fathers by mothers education interaction	-----	-------	1.2 [0.6 – 2.3]	- 0.653

Notes: Being bullied in the past 12 months dichotomised to 0 time vs. ⩾ 1 time
Model without interaction: -2 Log likelihood = 1653.388, Hosmer and Lemeshow Test p-value= 0.426, and Omnibus Tests of Model Coefficients p= 0.039
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1653.184, Hosmer and Lemeshow Test p-value= 0.899, and Omnibus Tests of Model Coefficients p=0.050

Even after eliminating the non-significant variables one at a time the model did not change and only living district is a associated with being bullied (Table 6.78).

Table 6-78. Logistic regression for students being bullied in the past 12 months and living districts

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Living district			0.005
East (ref)	-	-	-
North	0.9	0.6 – 1.4	*0.830*
South	1.7	1.2 – 2.5	*0.005*
Central	1.3	0.9 – 2.0	*0.148*
West	1.6	1.1 – 2.3	*0.018*

-2 Log likelihood = 1693.484, Hosmer and Lemeshow Test p-value= 1.0, and Omnibus Tests of Model Coefficients p= 0.005

6.7.2 The association between being bullied and perceived health status and school related factors:

Adjusting for background factors, only poor health status was positively associated with being bullied by others (Table 6.79). I re-ran the model, omitting non significant variables from the model one by one, but it showed no improvement.

Table 6-79. Logistic regression for students being bullied behaviours in relation to students' perceived health, liking school and school performance adjusted for student's backgrounds

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	0.9 [0.8 – 1.1]	0.520	0.9 [0.9 -1.1]	0.559
School Type				
Private School (ref)	-	-	-	-
Public School	1.0 [0.7 – 1.3]	0.939	1.0 [0.8 – 1.2]	0.935
Living district		0.008		0.007
East (ref)	-	-	-	-
North	0.9 [0.6 – 1.4]	*0.690*	0.9 [0.6 – 1.4]	*0.699*
South	1.7 [1.2 – 2.4]	*0.005*	1.7 [1.1 – 2.5]	*0.005*
Central	1.3 [0.9 – 1.9]	*0.245*	1.3 [0.8 -1.8]	*0.241*
West	1.5 [1.0 – 2.2]	*0.041*	1.5 [1.0 – 2.2]	*0.038*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽12 years	1.0 [0.8 – 1.3]	0.868	1.0 [0.8- 1.3]	0.805
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽12 years	0.8 [0.6 – 1.1]	0.242	0.8 [0.6 – 1.1]	0.234

Perceived health status				
Good	-	-	-	-
Poor	2.2 [1.2 – 3.9]	0.009	2.2 [1.2 – 3.9]	0.009
Liking school				
Yes	-	-	-	-
No	0.9 [0.7 – 1.2]	0.815	0.9 [0.6 – 1.1]	0.292
Academic Performance				
Good	-	-	-	-
Poor	1.2 [0.9 – 1.5]	0.268	0.9 [0.6 – 1.4]	0.695
Liking school by academic performance interaction	-------	----	1.6 [0.9 – 2.8]	0.106

Model without interaction: -2 Log likelihood = 1615.000, Hosmer and Lemeshow Test p-value = 0.110, and Omnibus Tests of Model Coefficients p= 0.010
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1612.367, Hosmer and Lemeshow Test p-value =0.295, and Omnibus Tests of Model Coefficients p=0.008

The model was re-run again with the non-significant variables eliminated one at a time. There was no change in any of the variables remaining in the model. Only living districts and poor health status were associated with being bullied by others (Table 6.80).

Table 6-80. Multiple logistic regression for students being bullied in relation to students' health status and living districts

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test P value*
Living district			0.007
East (ref)	-	-	-
North	0.9	0.7 – 1.4	*0.796*
South	.17	1.2 – 2.4	*0.002*
Central	1.3	0.9 – 2.3	*0.132*
West	1.6	1.1 – 2.3	*0.021*
Perceived health status			
Good	-	-	-
Poor	2.1	1.2 – 3.8	0.009

6.7.3 The association between being bullied and other risk behaviours:

By investigating the association between being bullied and other risk behaviours, I found that students who reported they had been threatened or injured by weapons in the past 12 months, those who join people when performing car drifting, take part in bullying others, who had been abused by teachers and by family, feeling unsafe on the way to school, ever attempting suicide and feeling very lonely most of the time were independently associated with reporting being bullied in the past 12 months, after adjusting for students' backgrounds. On the other hand, current smoking students were less likely to report they had been bullied (Table 6.81).

Table 6-81. Multiple logistic regression for students' who being bullied in relation to other risk behaviours adjusted for students' socio-demographic variables

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	0.9	0.8 – 1.1	0.230
School Type			
Private School (ref)	-	-	-
Public School	0.9	0.8 – 1.1	0.780
Fathers' Education			
>12 years (ref)	-	-	-
⩽12 years	0.9	0.9 – 1.1	0.743
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.8	0.6 – 1.2	0.379
Living district			0.009
East (ref)	-	-	-
North	1.1	0.7 – 1.8	*0.655*
South	2.0	1.3 – 3.1	*0.002*
Central	1.4	0.9 – 2.3	*0.103*
West	1.7	1.1 – 2.8	*0.014*
Eating breakfast			
Every day	-	-	
Not every day	0.9	0.6 – 1.2	0.312
Brushing teeth			
Every day	-	-	
Not every day	1.4	0.8 – 1.6	0.371
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.5	0.8 – 1.6	0.251
Smoking behaviour			
Non-smoking	-	-	
Current smoking	0.606	0.4 – 0.8	0.009

Want to use drugs or alcohol			
No	-	-	-
Yes	1.1	0.8 – 1.6	0.772
Physical fight			
No	-	-	-
Yes	1.2	0.9 – 1.7	0.175
Threaten or injured by weapons			
No	-	-	-
Yes	2.4	1.7 – 3.4	< 0.001
Carry weapons			
No	-	-	-
Yes	0.8	0.6 – 1.2	0.272
Performing Car Drifting			
No	-	-	-
Yes	0.8	0.6 – 1.1	0.182
Join people performing car drifting			
No	-	-	-
Yes	1.5	1.1 – 2.0	0.010
Bullies others			
No	-	-	-
Yes	2.8	2.0 – 3.8	< 0.001
Abused by teacher			
No	-	-	-
Yes	1.7	1.2 – 2.2	< 0.001
Abused by family			
No	-	-	-
Yes	2.1	1.6 – 2.9	< 0.001
Unsafe going to school			
No	-	-	-
Yes	1.8	1.2 – 2.7	0.002
Attempting suicide			
No	-	-	-
Yes	1.9	1.1 – 3.2	0.030
Feeling very lonely during the past 12 months			0.070
Never	-	-	-
Rarely	1.2	0.9 – 1.6	*0.220*
Most of the time	1.7	1.1 – 2.8	*0.030*

Notes: -2 Log likelihood = 1280.176, Hosmer and Lemeshow Test p-value= 0.689, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-run without the non-significant variables one at a time (Table 6.82). In general the model did not change and showed similar results.

Table 6-82. Logistic regression for students' bullied behaviours in relation to other risk behaviours

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Living district			0.012
East (ref)	-	-	-
North	1.2	0.8 – 1.9	*0.423*
South	1.9	1.3 – 3.0	*0.002*
Central	1.5	1.1 – 2.3	*0.066*
West	1.7	1.1 – 2.7	*0.010*
Smoking			
Non-smoking	-	-	
Current smoking	0.60	0.4 – 0.8	0.003
Threaten or injured by weapons			
No	-	-	-
Yes	2.3	1.6 – 3.0	< 0.001
Join people performing car drifting			
No	-	-	-
Yes	1.4	1.1 – 1.9	0.010
Bullies others			
No	-	-	-
Yes	2.7	2.0 – 3.7	< 0.001
Abused by teacher			
No	-	-	-
Yes	1.6	1.2 – 2.1	< 0.001
Abused by family			
No	-	-	-
Yes	2.1	1.6 – 2.8	< 0.001
Unsafe going to school			
No	-	-	-
Yes	1.8	1.2 – 2.6	0.002
Attempting suicide			
No	-	-	-
Yes	1.8	1.1 – 2.9	0.020

-2 Log likelihood = 1290.573, Hosmer and Lemeshow Test p-value= 0.539, and Omnibus Tests of Model Coefficients p< 0.001

6.7.4 The association of students being bullied by others and the significant variables from previous models

In this final model (Table 6.83), all the significant variables remained significantly associated with being bullied by others, except poor health status. Current smoking, being threatened or injured by weapons, joining people during performing car drifting, bullying others, feeling unsafe going to school, attempting suicide, being abused by a teacher or by family were all independently associated with being bullied.

Table 6-83. The final model of the association between being bullied and all the significant variables from the previous models

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Living district			0.009
East (ref)	-	-	-
North	1.2	0.8 – 1.9	*0.434*
South	2.0	1.3 – 3.0	*0.002*
Central	1.6	1.1 – 2.3	*0.040*
West	1.7	1.1 – 2.7	*0.011*
Health status			
Good	-	-	-
Poor	1.5	0.7 – 2.8	0.252
Smoking behaviour			
Non-smoking	-	-	
Current smoking	0.6	0.4 – 0.8	0.003
Threaten or injured by weapons			
No	-	-	-
Yes	2.3	1.6 – 3.0	< 0.001
Join people performing car drifting			
No	-	-	-
Yes	1.4	1.1 – 1.8	0.020
Bullies others			
No	-	-	-
Yes	2.8	2.1 – 3.7	< 0.001
Abused by teacher			
No	-	-	-
Yes	1.6	1.2 – 2.1	0.002
Abused by family			
No	-	-	-
Yes	1.5	1.6 – 2.6	< 0.001
Unsafe going to school			
No	-	-	-
Yes	1.7	1.2 – 2.5	0.003

Attempting suicide			
No	-	-	-
Yes	1.7	1.1 – 2.8	0.040
Feeling very lonely during the past 12 months			0.079
Never	-	-	-
Rarely	1.2	0.9 – 1.7	*0.150*
Most of the time	1.7	1.1 – 2.7	*0.030*

-2 Log likelihood = 1345.853, Hosmer and Lemeshow Test p-value= 0.775, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-run without the non-significant variables (Table 6.84). The model showed similar results.

Table 6-84. The final model of the association between being bullied and the significant variables only

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Living district			0.010
East (ref)	-	-	-
North	1.2	0.8 – 1.9	*0.423*
South	2.0	1.3 – 3.0	*0.002*
Central	1.6	1.1 – 2.3	*0.047*
West	1.7	1.1 – 2.7	*0.009*
Smoking behaviour			
Non-smoking	-	-	
Current smoking	0.6	0.4 – 0.8	0.003
Threaten or injured by weapons			
No	-	-	-
Yes	2.2	1.6 – 3.0	< 0.001
Join people performing car drifting			
No	-	-	-
Yes	1.4	1.1 – 1.8	0.015
Bullies others			
No	-	-	-
Yes	2.7	2.1 – 3.7	< 0.001
Abused by teacher			
No	-	-	-
Yes	1.6	1.2 – 2.1	0.001
Abused by family			
No	-	-	-
Yes	2.1	1.6 – 2.8	< 0.001

Unsafe going to school			
No	-	-	-
Yes	1.8	1.2 – 2.5	0.002
Attempting suicide			
No	-	-	-
Yes	1.8	1.1 – 2.9	0.023

-2 Log likelihood = 1357.414, Hosmer and Lemeshow Test p-value= 0.521, and Omnibus Tests of Model Coefficients p< 0.001

6.7.5 The association between students' bullying others and students' socio demographic variables:

Mothers' education was the only variable independently associated with students' bullying behaviour. Age and fathers' education show weak association. The model was re-built several times omitting the non-significant variables one after another (Table 6.85).

Table 6-85. Logistic regression for students' bullies in the past 12 months, according to students' socio-demographic variables

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95%C.I.]	Likelihood ratio/ *Wald test* P value	OR (95%C.I.)	Likelihood ratio/ *Wald test* P value
Age (years)	1.10 [1.0 – 1.2]	0.086	1.10 [1.0 – 1.2]	0.087
School Type				
Private School	-	-	-	-
Public School	0.93 [0.7 – 1.2]	0.589	0.93 [0.7 -1.2]	0.577
Living district		0.738		0.726
East	-	-	-	-
North	1.05 [0.7 – 1.6]	*0.823*	1.05 [0.7 -1.5]	*0.807*
South	1.29 [0.9 – 1.9]	*0.194*	1.29 [0.8 – 1.8]	*0.185*
Central	1.07 [0.7 – 1.5]	*0.762*	1. 07[0.7 -1.5]	*0.738*
West	1.12 [0.7 – 1.6]	*0.559*	1.13 [0.7 – 1.6]	*0.534*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽ 12 years	1.17 [0.8 – 1.5]	0.292	1.05 [0.5 – 1.9]	0.875
Mother's Education				
> 12 years (ref)	-	-	-	-
⩽ 12 years	0.70 [0.5 – 0.9]	0.025	0.66 [0.4 – 0.9]	0.043
Fathers by mothers education interaction	-------	-----	- 1.15 [0.6 – 2.2]	0.685

Notes: Bullies other in the past 12 months dichotomised to 0 time vs. ⩾ 1 time.
Model without interaction: -2 Log likelihood = 1623.757, Hosmer and Lemeshow Test p-value= 0.660, and Omnibus Tests of Model Coefficients p= 0.266
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1623.592, Hosmer and Lemeshow Test p-value =0.635, and Omnibus Tests of Model Coefficients p=0.339

The model was run again without the non significant variables (Table 6.86). The model showed that students whose mother's education was ≤ 12 years were less likely to take part in bulling others.

Table 6-86. Logistic regression for students' bullies in the past 12 months, according to students' socio-demographic variables

Variables	OR	[95% C.I.]	Likelihood ratio P value
Mother's Education			
> 12 years (ref)	-	-	-
⩽ 12 years	0.690	0.5 – 0.9	0.024

-2 Log likelihood = 1629.341, Hosmer and Lemeshow Test p-value = 0.530, and Omnibus Tests of Model Coefficients p= 0.051

6.7.6 The association between bullying other and perceived health status, liking school and school performance:

Not liking school and poor school performance were independently associated with taking part in bullying others, Model (Table 6.87). Among the variables that I adjusted for low mother's education had an inverse association with bullying behaviour. In Model 2, there was no significant interaction between liking school and academic performance.

Table 6-87. Multiple logistic regression for students' bulling behaviours in relation to age, school type, fathers' and mothers' education level and living districts:

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95%C.I.]	Likelihood ratio/ *Wald test* P value	OR [95%C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.09 [0.9 – 1.2]	0.127	1.09 [0.9 -1.2]	0.130
School Type				
Private School (ref)	-	1	-	-
Public School	0.94 [0.7 – 1.2]	0.641	0.94 [0.7 – 1.2]	0.642
Living district		0.738		0.729
East (ref)	-	-	-	-
North	1.02 [0.7 – 1.5]	*0.920*	1.02 [0.7 – 1.5]	*0.921*
South	1.23 [0.8 – 1.8]	*0.284*	1.23 [0.8 – 1.8]	*0.284*
Central	1.06 [0.7 – 1.5]	*0.760*	1.06 [0.7 – 1.6]	*0.761*
West	1.11 [0.7 – 1.6]	*0.608*	1.11 [0.7 – 1.6]	*0.613*

Fathers' Education >12 years (ref) ⩽12 years	- 1.12 [0.8 – 1.5]	- 0.442	- 1.11 [0.8- 1.5]	- 0.451
Mother's Education > 12 years (ref) ⩽12 years	- 0.65 [0.5 – 0.9]	- 0.013	- 0.66 [0.5 – 0.9]	- 0.013
Perceived health status Good Poor	- 1.78 [0.9 – 3.2]	- 0.054	- 1.78 [0.9 – 3.2]	- 0.054
Liking school Yes No	- 1.54 [1.2 – 2.0]	- 0.001	- 1.59 [1.2 – 2.1]	- 0.002
Academic Performance Good Poor	- 1.43 [1.1 – 1.9]	- 0.010	- 1.50 [0.9 – 2.3]	- 0.052
Liking school by academic performance interaction	-------		0.92 [0.5 – 1.6]	0.753

Model without interaction: -2 Log likelihood = 1566.240, Hosmer and Lemeshow Test p-value = 0.817, and Omnibus Tests of Model Coefficients p< 0.001
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1566.141, Hosmer and Lemeshow Test p-value =0.273, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-built without the non-significant variables. Table 6.88 shows that students who reported not liking school and who performed poorly in school were more likely to take part in bullying others. Also, in this model, students who reported poor health were more likely to take part in bullying others.

Table 6-88. Logistic regression for students' bulling behaviours in relation to age, school type, fathers' and mothers' education level and living districts

Variables	OR	[95% C.I.]	Likelihood ratio P value
Mother's Education > 12 years (ref) ⩽ 12 years	- 0.7	- 0.5 – 0.9	- 0.037
Perceived health status Good Poor	- 1.8	- 1.1 – 3.2	- 0.045
Liking school Yes No	- 1.3	1.2 – 1.4	- < 0.001

Academic Performance			
Good	-	-	
Poor	1.2	1.1 – 1.4	0.007

-2 Log likelihood= 14571.545, Hosmer and Lemeshow Test p-value= 0.646, and Omnibus Tests of Model Coefficients p< 0.001

6.7.7 Bullies others and other risk behaviours:

Wanting to use drugs or alcohol, engaging in physical fights, carrying weapons during the past 30 days, performing car drifting, being bullied, abused by family and abused by teachers were all independently associated with taking part in bullying others, after adjusting for students' background. As in the other models among students' demographic variables, only mothers' education was associated with bullying others (Table 6.89).

Table 6-89. Multiple logistic regression for students' bullying others in relation to other risk behaviours adjusting for students' backgrounds.

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	1.1	0.9 – 1.2	0.329
School Type			
Private School (ref)	-	-	-
Public School	0.9	0.7 – 1.3	0.763
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	1.1	0.8 – 1.5	0.684
Mother's Education			
> 12 years (ref)	-	-	-
⩽ 12 years	0.6	0.4 – 0.9	0.016
Living district			0.999
East (ref)	-	-	-
North	0.9	0.6 – 1.5	*0.869*
South	0.9	0.6 – 1.5	*0.851*
Central	0.9	0.6 – 1.5	*0.837*
West	0.9	0.6 – 1.5	*0.777*
Eating breakfast			
Every day	-	-	
Not every day	0.8	0.7 – 1.3	0.675
Brushing teeth			
Every day	-	-	
Not every day	1.3	0.7 – 1.7	0.112

Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	0.9	0.7 – 1.3	0.661
Smoking behaviours			
Non-smoking	-	-	
Current smoking	0.9	0.6 – 1.3	0.687
Want to use drugs			
No	-	-	-
Yes	1.6	1.1 – 2.4	0.018
Physical fight			
No	-	-	-
Yes	2.1	1.5 – 2.8	< 0.001
Threaten or injured by weapons			
No	-	-	-
Yes	1.3	0.9 – 1.8	0.143
Carry weapons			
No	-	-	-
Yes	1.5	1.1 – 2.1	0.010
Performing Car Drifting			
No	-	-	-
Yes	1.8	1.3 – 2.5	< 0.001
Join people performing car drifting			
No	-	-	-
Yes	1.3	0.9 – 1.8	0.121
Been bullied by others			
No	-	-	-
Yes	2.8	2.0 – 3.8	< 0.001
Abused by teacher			
No	-	-	-
Yes	1.7	1.3 – 2.4	< 0.001
Abused by family			
No	-	-	-
Yes	1.8	1.3 – 2.4	< 0.001
Unsafe going to school			
No	-	-	-
Yes	0.9	0.6 – 1.4	0.877
Attempting suicide			
No	-	-	-
Yes	0.8	0.5 – 1.4	0.496

-2 Log likelihood = 1207.602, Hosmer and Lemeshow Test= 0.351, and Omnibus Tests of Model Coefficients p< 0.001.

The model was re-run without the non-significant variables. The same significant variables were consistently associated with bullying in this model (Table 6.90).

Table 6-90. Multiple logistic regression for students' bullying in relation to other risk behaviours

Variables	OR	95% C.I.	Likelihood ratio P value
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.6	0.4 – 0.9	0.011
Want to use drugs or alcohol			
No	-	-	-
Yes	1.6	1.1 – 1.3	0.009
Physical fight			
No	-	-	-
Yes	2.1	1.6 – 2.9	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.6	1.1 – 2.8	0.003
Performing car drifting			
No	-	-	-
Yes	2.0	1.5 – 2.7	< 0.001
Been Bullied by other			
No	-	-	-
Yes	3.0	2.2 – 3.9	< 0.001
Abused by teacher			
No	-	-	-
Yes	1.7	1.2 – 2.2	< 0.001
Abused by family			
No	-	-	-
Yes	1.7	1.2 – 2.3	< 0.001

-2 Log likelihood = 1275.007, Hosmer and Lemeshow Test p-value= 0.299, and Omnibus Tests of Model Coefficients p< 0.001

6.7.8 The association between bullying others and the significant variables from previous models

In this final model (Table 6.91), the majority of the significant variables from the previous several models remained significantly associated with taking part in bullying others except for not liking school and poor academic performance variables. Table below shows details.

Table 6-91. The final model of the association between bullying others and all the significant variables from previous models

Variables	OR	95% C.I.	Likelihood ratio P value
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.6	0.4 – 0.9	0.012
Liking school			
Yes	-	-	-
No	1.2	0.9 – 1.6	0.118
Academic Performance			
Good	-	-	-
Poor	1.1	0.8 – 1.5	0.510
Want to use drugs or alcohol			
No	-	-	-
Yes	1.6	1.1 – 2.4	0.008
Physical fight			
No	-	-	-
Yes	2.2	1.6 – 2.9	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.5	1.1 – 2.0	0.010
Performing car drifting			
No	-	-	-
Yes	2.0	1.5 – 2.7	< 0.001
Been Bullied by other			
No	-	-	-
Yes	3.1	2.3 – 4.1	< 0.001
Abused by teacher			
No	-	-	-
Yes	1.6	1.2 – 2.2	< 0.001
Abused by family			
No	-	-	-
Yes	1.7	1.2 – 2.3	< 0.001

-2 Log likelihood = 1251.808, Hosmer and Lemeshow Test p-value= 0.959, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-run without the non-significant variables (Table 6.92). The model shows similar results.

Table 6-92. The final mode of the association between bullying others and all the significant variables only

Variables	OR	95% C.I.	Likelihood ratio P value
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	0.6	0.4 – 0.9	0.011
Want to use drugs or alcohol			
No	-	-	-
Yes	1.6	1.1 – 2.4	0.009
Physical fight			
No	-	-	-
Yes	2.1	1.6 – 2.9	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.6	1.2 – 2.1	0.003
Performing car drifting			
No	-	-	-
Yes	2.0	1.5 – 2.7	< 0.001
Been Bullied by other			
No	-	-	-
Yes	3.0	2.2 – 4.0	< 0.001
Abused by teacher			
No	-	-	-
Yes	1.7	1.3 – 2.3	< 0.001
Abused by family			
No	-	-	-
Yes	1.7	1.2 – 2.3	< 0.001

-2 Log likelihood = 1275.007, Hosmer and Lemeshow Test p-value= 0.502, and Omnibus Tests of Model Coefficients p< 0.001

6.8 Car drifting

6.8.1 The association between performing car drifting and students' background:

Age was positively associated with performing car drifting among students. Public school was negatively associated with car drifting. The district of residence had no association with car drifting behaviours. Model 2 showed that there was no significant interaction between fathers' education and mothers' education to car drifting (Table 6.93).

Table 6-93. Multiple logistic regression for students' car drifting to students' background.

Variables	Model 1 without interaction		Model 2 with interaction	
	OR (95%C.I.)	Likelihood ratio/ *Wald test* P value	OR (95%C.I.)	Likelihood ratio/ *Wald test* P value
Age (years)	1.2 [1.1 – 1.3]	0.002	1.2 [1.1 – 1.3]	0.002
School Type				
Private School	-	-	-	-
Public School	0.7 [0.6 – 0.9]	0.015	0.8 [0.6 -0.9]	0.018
Living district		0.371		0.385
East	-	-	-	-
North	1.3 [0.9 – 1.9]	*0.124*	1.3 [0.9 -1.8]	*0.146*
South	1.2 [0.8 – 1.7]	*0.268*	1.2 [0.8 – 1.7]	*0.321*
Central	1.2 [0.8 – 1.7]	*0.253*	1.2 [0.8 -1.7]	*0.312*
West	0.9 [0.7 – 1.4]	*0.889*	0.9 [0.7 – 1.3]	*0.773*
Father's Education				
>12 years	-	-	-	-
⩽12 years	1.3 [0.9 – 1.6]	0.071	1.9 [1.1 – 3.4]	0.022
Mother's Education				
>12 years	-	-	-	-
⩽12 years	1.1 [0.8 – 1.5]	0.305	1.4 [0.9 – 2.0]	0.075
Father's by mother's education interaction	-----	-------	0.6 [0.6 – 2.2]	- 0.102

Notes: Bullies other in the past 12 months dichotomised to 0 time Vs. 1 or more time.
Model without interaction: -2 Log likelihood = 1878.902, Hosmer and Lemeshow Test p-value = 0.101, and Omnibus Tests of Model Coefficients p= 0.002
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1876.248, Hosmer and Lemeshow Test p-value =0.920, and Omnibus Tests of Model Coefficients p=0.002

The model was re-built without the district of residence since it was not significantly associated with performing car drifting (Table 6.94). The model shows that when age increases students performing car drifting increases. Students studying in public school were less likely to engage in performing car drifting.

Table 6-94. Logistic regression for students' car drifting to students' background

Variables	OR	[95% C.I.]	Likelihood ratio P value
Age (years)	1.2	1.1 – 1.3	0.001
School Type			
Private School (ref)	-	-	-
Public School	0.7	0.6 – 0.9	0.016

-2 Log likelihood = 1883.708, Hosmer and Lemeshow Test p-value = 0.779, and Omnibus Tests of Model Coefficients p< 0.001

6.8.2 Car drifting and perceived health status, liking schools and school performance:

Not liking school and poor academic performance were associated with performing car drifting. There was no interaction between liking school and academic performance. Among the variables we adjusted for, age and attending public school were associated with car drifting (Table 6.95).

Table 6-95. Multiple logistic regression for students' car drifting in relation to perceived health status, liking schools and school performance

Variables	Model 1 without interaction		Model 2 with interaction	
	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value	OR [95% C.I.]	Likelihood ratio/ *Wald test* P value
Age (years)	1.2 [1.1 – 1.3]	0.004	1.2 [1.1 -1.3]	0.004
School Type				
Private School (ref)	-	-	-	-
Public School	0.7 [0.6 – 0.9]	0.014	0.7 [0.6 – 0.9]	0.014
Living district		0.324		0.325
East (ref)	-	-	-	-
North	1.4 [0.9 – 1.9]	*0.103*	1.4 [0.9 – 1.9]	*0.103*
South	1.2 [0.8 – 1.7]	*0.261*	1.2 [0.8 – 1.7]	*0.260*
Central	1.3 [0.9 – 1.7]	*0.207*	1.3 [0.9 -1.8]	*0.207*
West	1.0 [0.7 – 1.4]	*0.913*	0.9 [0.7 – 1.4]	*0.917*
Fathers' Education				
>12 years (ref)	-	-	-	-
⩽12 years	1.2 [0.9 – 1.5]	0.191	1.2 [0.9 - 1.5]	0.188

Mother's Education > 12 years (ref) ⩽12 years	- 1.1 [0.8– 1.5]	- 0.499	- 1.1 [0.8 – 1.5]	- 0.501
Perceived health status Good Poor	- 1.6 [0.9 – 2.7]	- 0.135	- 1.6 [0.9 – 2.7]	- 0.135
Liking school Yes No	- 1.6 [1.3 – 2.0]	- < 0.001	- 1.6 [1.2 – 2.1]	- 0.001
Academic Performance Good Poor	- 1.6 [1.2 – 2.0]	- < 0.001	- 1.6 [1.1 – 2.2]	- 0.019
Liking school by academic performance interaction	-------	----	1.1 [0.6 - 1.7]	0.817

Car drifting dichotomised to 0 time vs. 1 or more time.
Model without interaction: -2 Log likelihood = 1797.548, Hosmer and Lemeshow Test p-value= 0.408, and Omnibus Tests of Model Coefficients p< 0.001
Model including interaction between mothers' and fathers' education: -2 Log likelihood = 1797.495, Hosmer and Lemeshow Test p-value= 0.563, and Omnibus Tests of Model Coefficients p< 0.001

The model was re-run without non significant variables (Table 6.96). Students who reported not liking school or performing poorly in school were more likely to perform car drifting.

Table 6-96. Students' car drifting in relation to perceived health status, liking schools and school performance

Variables	OR	[95% C.I.]	Likelihood ratio P value
Age (years)	1.2	1.1 – 1.3	0.003
School Type Private School (ref) Public School	1 0.7	- 0.6 – 0.9	- < 0.001
Liking school Yes No	- 1.7	1 1.4 – 2.1	- < 0.001
Academic Performance Good Poor	- 1.7	1 1.3 – 2.1	- < 0.001

-2 Log likelihood = 1856.566, Hosmer and Lemeshow Test p-value= 0.394, and Omnibus Tests of Model Coefficients p< 0.001

6.8.3 The association between car drifting and other risk behaviours:

Not brushing teeth every day, current smoking, wanting to use drugs or alcohol, carrying weapons, joining people performing car drifting, taking part in bullying others and being abused by family were all positively associated with performing car drifting, after adjusting for students' background (Table 6.97). Attempting suicide was of borderline significance.

Table 6-97. Multiple logistic regression for car drifting in relation to other risk behaviours

Variables	OR	95% C.I.	Likelihood ratio/ *Wald test* P value
Age (years)	1.1	0.9 – 1.2	0.131
School Type			
Private School (ref)	-	-	-
Public School	0.8	0.6 – 0.9	0.033
Fathers' Education			
>12 years (ref)	-	-	-
⩽ 12 years	1.2	0.9 – 1.6	0.253
Mother's Education			
> 12 years (ref)	-	-	-
⩽ 12 years	1.4	0.9 – 2.0	0.102
Living district			0.135
East (ref)	-	-	-
North	1.5	0.9 – 2.3	*0.063*
South	1.1	0.7 – 2.3	*0.644*
Central	1.3	0.9 – 1.9	*0.270*
West	0.9	0.6 – 1.3	*0.546*
Eating breakfast			
Every day	-	-	
Not every day	1.1	0.8 – 1.4	0.671
Brushing teeth			
Every day	-	-	
Not every day	1.3	1.1 – 1.7	0.035
Physical Activity			
⩾ 3 times a week	-	-	-
⩽ 2 times a week	1.2	0.9 – 1.6	0.243
Smoking behaviours			
Non-smoking	-	-	
Current smoking	1.6	1.2 – 2.3	0.010
Want to use drugs			
No	-	-	-
Yes	2.4	1.6 – 3.6	<0.001

Physical fight			
No	-	-	-
Yes	1.2	0.9 – 1.6	0.260
Threaten or injured by weapons			
No	-	-	-
Yes	1.3	0.9 – 1.8	0.118
Carry weapons			
No	-	-	-
Yes	1.7	1.7 – 2.2	< 0.001
Join people performing car drifting			
No	-	-	-
Yes	4.9	3.7 – 6.4	< 0.001
Been bullied by others			
No	-	-	-
Yes	0.8	0.6 – 1.1	0.210
Bullies other			
No	-	-	-
Yes	1.8	1.3 – 2.5	<0.001
Abused by teacher			
No	-	-	-
Yes	0.9	0.7 – 1.2	0.562
Abused by family			
No	-	-	-
Yes	1.3	1.0 – 1.7	0.050
Attempting suicide			
No	-	-	-
Yes	1.6	0.9 – 2.7	0.055

-2 Log likelihood = 1378.229, Hosmer and Lemeshow Test p-value= 0.50, and Omnibus Tests of Model Coefficients p< 0.001.

The model was re-ran without the non-significant variables starting by removing those with the highest p values (Table 6.98). The variables in the previous model remained significant in this model, except for being abused by family, which became non significant.

Table 6-98. Multiple logistic regression for car drifting in relation to other risk behaviours

Variables	OR	95% C.I.	Likelihood ratio P value
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	1.5	1.1 – 2.0	0.027

School Type			
Private School (ref)	-	-	-
Public School	0.7	0.6 – 0.9	0.022
Brushing teeth			
Every day	-	-	
Not every day	1.3	1.1 – 1.7	0.030
Smoking behaviours			
Non-smoking	-	-	
Current smoking	1.7	1.3 – 2.4	< 0.001
Want to use drugs or alcohol			
No	-	-	-
Yes	2.7	1.8 – 4.0	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.9	1.4 – 2.4	< 0.001
Join car drifting			
No	-	-	-
Yes	4.9	3.8 – 6.4	< 0.001
Bullying others			
No	-	-	-
Yes	1.7	1.3 – 2.4	< 0.001
Abused by family			
No	-	-	-
Yes	1.2	0.9 – 1.6	0.110

-2 Log likelihood = 1446.433, Hosmer and Lemeshow Test= 0.246, and Omnibus Tests of Model Coefficients p< 0.001

Finally the Model was re-ran without being abused by family (Table 6.99).

Table 6-99. Logistic regression for car drifting in relation to other risk behaviours

Variables	OR	95% C.I.	Likelihood ratio P value
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	1.5	1.1 – 2.1	0.015
School Type			
Private School (ref)	-	-	-
Public School	0.7	0.5 – 0.9	0.016
Brushing teeth			
Every day	-	-	
Not every day	1.3	1.1 – 1.7	0.030
Smoking behaviours			
Non-smoking	-	-	
Current smoking	1.7	1.3 – 2.4	< 0.001

Want to use drugs or alcohol			
No	-	-	-
Yes	2.8	1.9 – 4.1	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.9	1.5 – 2.5	< 0.001
Join car drifting			
No	-	-	-
Yes	5.0	3.8 – 6.4	< 0.001
Bullying others			
No	-	-	-
Yes	1.9	1.4– 2.5	< 0.001

-2 Log likelihood = 1458.905, Hosmer and Lemeshow Test= 0.794, and Omnibus Tests of Model Coefficients p< 0.001

6.8.4 The association between car drifting and the significant variables from the previous models

In this final model, almost all the significant variables in the previous model remained associated with performing car drifting. Low mother's education, studying in a private school, poor academic performance, current smoking, wanting to use drugs and alcohol, carrying weapons, joining people who perform car drifting, bullying others and attempting suicide were positively associated with performing car drifting. Not brushing teeth was of borderline significance (Table 6.100).

Table 6-100. The final model of the association between performing car drifting and all the significant variables from the previous model

Variables	OR	95% C.I.	Likelihood ratio P value
Mother's Education			
> 12 years (ref)	-	-	-
⩽12 years	1.4	1.1 – 2.1	0.050
School Type			
Private School (ref)	-	-	-
Public School	0.7	0.5 – 0.9	0.015
Liking school			
Yes	-	-	-
No	1.7	1.4 – 2.1	0.150
Academic Performance			
Good	-	-	-
Poor	1.4	1.1 – 1.9	0.041

Brushing teeth			
Every day	-	-	
Not every day	1.3	0.9 – 1.7	0.086
Smoking behaviours			
Non-smoking	-	-	
Current smoking	1.7	1.3 – 2.4	0.002
Want to use drugs or alcohol			
No	-	-	-
Yes	2.5	1.7 – 3.7	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.8	1.3 – 2.4	< 0.001
Join car drifting			
No	-	-	-
Yes	5.0	3.8 – 6.5	< 0.001
Bullying others			
No	-	-	-
Yes	1.9	1.4– 2.5	< 0.001
Attempting suicide			
No	-	-	-
Yes	1.8	1.1– 3.0	0.040
Abused by family			
No	-	-	-
Yes	1.3	0.9 – 1.6	0.070

-2 Log likelihood = 1408.93, Hosmer and Lemeshow Test= 0.864, and Omnibus Tests of Model Coefficients p< 0.001

The model was run again with the non significant variables eliminated one at a time (Table 6.101). In general, the model shows similar results.

Table 6-101. The final model of the association between car drifting and all the significant variables only

Variables	OR	95% C.I.	Likelihood ratio P value
School Type			
Private School (ref)	-	-	-
Public School	0.7	0.5 – 0.9	0.033
Academic Performance			
Good	-	-	-
Poor	1.4	1.1 – 1.9	0.004
Smoking behaviours			
Non-smoking	-	-	
Current smoking	1.7	1.3 – 2.4	0.001

Want to use drugs or alcohol			
No	-	-	-
Yes	2.2	1.5 – 3.2	< 0.001
Carrying weapons			
No	-	-	-
Yes	1.9	1.4 – 2.5	< 0.001
Join car drifting			
No	-	-	-
Yes	5.0	3.8 – 6.5	< 0.001
Bullying others			
No	-	-	-
Yes	1.8	1.4– 2.5	< 0.001
Attempting suicide			
No	-	-	-
Yes	1.7	1.1– 2.9	0.043

-2 Log likelihood = 1459.933, Hosmer and Lemeshow Test= 0.362, and Omnibus Tests of Model Coefficients p< 0.001

6.9 Result summary

Table 6.102 below shows a summary of the prevalence of the main behaviours and associated factors that this study found.

Table 6-102. Summary of the main findings

Behaviours	Prevalence %	Significant associated variables
Eating breakfast ≥ 5 days/week	36.7%	Younger age, living districts, liking school, good academic performance, not eating high fat food every day, drinking soft drinks ≤1 time/day, drinking milk every day, low BMI, brushing teeth every day, physical activity ≥ 3 days/week, not engaging in physical fights.
Brushing teeth everyday	29.7% brush their teeth once every day, 22.6% brush their teeth twice every day or more	Higher father's and mother's education, attending private school, living district, good academic performance, liking school, visiting a dentist during the last year, good teeth status, not suffering from teeth pain.
Physical activity≥ 3 days	32.9%	Younger age, liking school, good health status, lower BMI, father's, mother's, siblings' and peers' physical activity, not smoking, not fighting, not wanting to use drugs or alcohol, not feeling lonely.
Current smoking	20.8%	Higher age, studying in private school, poor health status, poor school performance, not liking school, father smoking, mother smoking, sibling smoker, peers smoking, low physical activity, wanting to use drugs and alcohol, carrying weapons, fighting, performing car drifting, being abused by teachers.
Physical fighting	49%	Interaction of low father's and mother's education, not liking school, poor academic performance, skipping breakfast, low physical activity, current smoking, being threatened or injured by weapons, carrying weapons, joining people performing car drifting, bullying others, being abused by teachers.
Carry weapons	36.6%	Higher age, not liking school, poor academic performance, current smoking, fighting, being threatened or injured by weapons, performing car drifting, joining people performing car drifting, taking part in bullying others, being abused by family.

Being bullied	26.1%	School district, poor health status, not smoking, being threatened or injured by weapons, joining people performing car drifting, bullying others, being abused by teacher, being abused by family, feeling unsafe going to school, attempting suicide, feeling lonely most of the time.
Bullying others	24.6%	High mother's education, poor academic performance, not liking school, wanting to use drugs and alcohol, fighting, carrying weapons, performing car drifting, being bullied by others, being abused by a teacher, being abused by family.
Car drifting	36.1%	Higher age, attending private school, not liking school, poor academic performance, not brushing teeth every day, current smoking, wanting to use drugs and alcohol, carry weapons, joining people who performing car drifting, bullying others, attempting suicide.
Attempting suicide	6.9%	Being bullied and car drifting,thinking of suicide, feeling lonely, feeling very worried, feeling sad or hopeless for 2 weeks, wanting to use drugs or alcohol (from chi-square).

Note: the associated variables were only from the regression analyses models.

7. Chapter Seven: Discussion

7.1 Overview

Research on health-related behaviours and their associated factors and determinants is of interest to public health for several reasons. First, implementation of successful health promotion programmes depends on both information about the prevalence of such behaviours and an understanding of their determinants. Secondly, research may highlight interactions between health related behaviours which may bring about synergistic effects on health status. Thirdly, information about patterns of health related behaviours can provide important data for adjustment of health education interventions within the context of health promotion programmes (Patersen et al., 2008).

This study was conducted in Riyadh city to identify health-related behaviours among male high school students. The aims were to identify the prevalence of dietary behaviours, oral health behaviours, physical activity behaviours, smoking behaviour, behaviours relevant to mental and psychological health, violence, injuries and safety behaviours among male high school students and to investigate the factors associated with these behaviours and the association between these behaviours. In addition, however, I hope that the findings of this project offer valuable information to policy makers, researchers, raise community awareness, and help to provide evidence to health education programs for adolescents. There is a lack of research in Saudi Arabia in general and especially research relevant to public health and adolescents' behaviours topics in particular. Thus, in this thesis I undertook an investigation of the health-related behaviours among adolescents in male high schools in Riyadh, Saudi Arabia. I started the investigation with a review of the published literature in Saudi Arabia and found that there is a lack of research in many areas of public health such as physical activity, violence, mental health, bullying and abuse, safety and injuries behaviours. In addition, smoking, oral health hygiene behaviours and dietary/nutrition behaviours are not well documented and studied in Saudi Arabia.

In this chapter I discuss the results presented in the results chapters, in light of the relevant findings from other studies conducted elsewhere. I also list the strengths

and the limitations of my research, which should be considered simultaneously with the methodology, and the results of this research. The findings will be discussed as follow:

- Study strength and limitations
- Demographical characteristics
- Dietary behaviours and BMI
- Behaviours that contribute to oral health
- Physical activity behaviours
- Smoking behaviours
- Behaviours contribute to injuries and violent behaviours
- Behaviours contribute to mental health
- Behaviours contribute to accidents and safety

7.2 General strength and limitations

The test-retest pilot study and the high degree of consistency of responses to the questionnaires items indicate that the adolescents' self-report questionnaire is valid and reliable. This cross-sectional study was conducted to investigate several behaviours that may influence adolescents students health using a well-designed stratified sampling strategy, quite large sample size, and valid and reliable questionnaire based on international standardized questionnaires from CDC and WHO. The response rates were high and missing data were low, and these could be attributed to the experience that I obtained from the pilot study, well-designed protocol, researcher enthusiasm, and superior supervision advice, comments and clear guidance. I also believe that the appropriate age group (high school students), the careful designed questionnaire, the clear research and questionnaire's instruction, volunteer participations, the protection of students privacy during filling the questionnaire, raising awareness of the importance of honest participation and the aim of the study for the generation and all the country, and the assurance of confidentiality contributed greatly to end this study safely and successfully and help to generate accurate data and formulate a distinctive information for policy makers, professionals and community.

The study is a comprehensive assessment of the prevalence of a number of health-related behaviours. This omnibus survey allows investigating how these behaviours might cluster together and how they might have similar or different associated factors. Also, to see if these behaviours are as prevalent in Saudi Arabia as elsewhere. It is a cross-sectional study based on self-reported questionnaire, but quite large with good responses rate. The questionnaires were administered to classes in schools. Administration of the questionnaires and height and weight measurement were not left to the class teachers, but rather was carried out by myself. This approach facilitated standardisation of the data collection process both in terms of the 'mechanics' of administering the questionnaire, and also in terms of the attitude and enthusiasm of the person introducing and explaining the study to the students. It also helped to reduce the likely effect of ‘interviewer biases’. There was a very high standard of comprehension and completion of the questionnaire. All the schools that were selected agreed to participate, yielding 100% response rate which eliminated non-response bias. There was a low level of non-response and missing response items. Moreover, there was a high level of consistency of responses. The sampling strategy was sophisticated and the sample size was large, yielding accurate results (See Chapter 4, Study methodology). This study is also one of the first in investigating the violent, injuries, psychological related factors, suicide and safety behaviours among adolescents in Riyadh, Saudi Arabia. Additionally, it is the first in Riyadh to my knowledge that includes several behaviours and investigates the association of different health related behaviours with each other and with socio-demographic variables and school variables.

Although this investigation yielded valuable information concerning health behaviours among adolescents, several limitations did exist. The present study is a cross-sectional study; therefore, it has several limitations. First, causal relationships cannot be assured or proposed and this study finding may only be valuable for stating hypotheses. There are several possible interpretations of the data. Also, with some behaviours, the accuracy of adolescents self-reports may be compromised by situational factors. Some behaviours might be sensitive and respondents may elect not to report on them in a survey. In addition, adolescents may purposely under report or over report certain behaviours because they believe engaging in these behaviours is either socially undesirable or desirable. However, a self-reported questionnaire gives

the impression of privacy and is therefore well suited for reporting different kind of behaviours. In addition, the Riyadh area does not represent the entire country. My study sample was school based, which may lead to non-sampling biases. Although, in Saudi Arabia the majority of adolescents are in schools; adolescents not attending school may differ from school attendees. Therefore, this study is not representative of the drop-out population, among whom risk behaviours use tends to be more common. Also, female participants, sexual, drugs and alcohol behaviours not investigated in this study. Therefore, further research is needed taking in account female adolescents, out of schools and in inner city, suburban and rural areas of the country as well as other behaviours such as sexual, drugs and alcohol behaviours.

There are a few reasons to be cautious about making generalizations of the results presented here. All the data are derived from adolescent self-reports. It was not possible to conduct a second round of enquiry as the questionnaires were completed anonymously. Moreover, a quite large sample was used, but the sample itself was restricted to Riyadh city. The fact that the sample size of the adolescents included in the study recruited from school was due to the fact that the study was not part of any larger project and that it was designed and carried out by one researcher. Thus, the resources were not available for a more extensive study. For future research, it would have been also interesting to survey middle schools students and out of school students.

Nevertheless, the findings may be generalisable to the male adolescents in Riyadh city, and to some extent to other cities in Saudi Arabia, but not all adolescents in Saudi Arabia, since females and adolescents in rural areas may differ from inner city male adolescents.

Within the limitations of my study, I believe that the results of this study reveal an interesting and potentially important relationship between health-related behaviours and socio-demographic, school factors and other health issues. In addition, I believe that the present study gives pointers for further research, and may be suggestive in terms of the kinds of social policies and debates, which ought to be pursued in the future. As mentioned many times, adolescent behaviours are complex issue. For this reason, I believe that future research should focus not so much on individual causes, but rather on blocks of reasons/causes and their possible interaction.

Significance was determined as the $p \leq 0.05$ level. This level of significance was used so that results could be compared with other previous studies from Saudi Arabia which have used $p \leq 0.05$. Since a large number of tests were performed it is possible that the choice of $p \leq 0.05$ could lead to some "false positive" results. However, it is reassuring that for many significance associations p-values were highly ($p \leq 0.01$) or very highly significant ($p \leq 0.001$), and so most results were very convincing.

Although the participants were selected from 5 districts from the city of Riyadh, there were no prior demographic data on these areas. This study has led to findings that may reflect underlying characteristics of these areas. Therefore, further research could gather demographic data for the 5 districts and if there are clear differences, then a multi-level approach could be adopted in future studies.

7.3 Adolescent students' demographic characteristics

The age of the students in this study ranged between 15 to 20 years old, with mean age of 17.4 years. The Youth Risk Behaviours Survey (YRBS) in United States targeted students 9-12 grades and did not ask for adolescents' age but it is comparable to my study sample's age. The world health organisation (WHO) HBSC survey carried out in European countries was targeted at a population aged between 11 to 15 years. It was not convenient in our study to select this age group, especially when sexual and alcohol behaviours initially were aimed to be investigated.

The class levels of high school students were selected in this study to measure the difference in health risk behaviour between 1st 2nd and 3rd level as an indicator for age; also age was reported by the adolescents. The participant were 488 (32.5%) in 1st level, 496 (33%) in 2nd level and 517 (34%) in 3rd level. There was a significant difference in the mean age among different levels of students.

As it has been explained in the research methodology (Chapter 4), this study aimed to be representative for high school students in the Riyadh city; therefore, students were sampled from public and private schools as well as from different districts (North, South, Central, West and East) and different level (1st, 2nd and 3rd grade). Since the majority of the adolescent students study in public school, proportionate sampling was used; therefore, the majority of the participants were

obtained from public school 1032 (68.8%), and 469 (31.2%) from private schools. Students were selected to be obtained from different districts equally since there is no evidence about the number of students in each district, and it seemed reasonable to recruit students equally from different districts. The nationalities of adolescent students were classified as Saudi and non-Saudi. Among the surveyed adolescents, the majority (89.6%) of the students were Saudis, while (10.4%) were non-Saudis. Although, students were asked about nationality, comparison between nationalities was not part of the main objectives for several reasons. First, almost all of the non-Saudi students in this study were Arabic and Muslim (non Arabic and non Muslim students have their own schools) and they share a lot of similarities such as religion, language, race and culture norms. Second, the percentage of non-Saudi was very small compared to Saudi students. Finally, students may be likely to influence each other regardless of their background and this study aimed to inform policy makers regarding students' behaviours in Saudi Arabia.

There is evidence for social inequalities in adolescents health and risk behaviours (Yorulmaz et al., 2002; Griesbach et al., 2003; Bergman and Scott, 2001; Barrerra et al., 2002; Boyce et al., 2006, Schnohr et al., 2009). Socio-economic status (SES) is usually measured by income, education or occupation (Currie et al., 2008). Data on family SES can be difficult to collect from young people because they do not know or cannot accurately report their parents' occupation or education level or may be not willing to reveal such information (Currie et al., 1997; Currie et al., 2008). Therefore, in Europe, HBSC projects in 1990 used family material affluence, which adolescents were much more likely to know, as an indicator for SES rather than parental occupation (Currie et al., 1997). A few years later, the survey in 1997/1998 used family affluence measurement of three questions (Griesbach et al., 2003), then the survey in 2001/2001 a revised family affluence scale (FAS) was developed and used (Currie et al., 2004). The scale was composed of four items: car ownership, bedroom occupancy, computer ownership and holidays. Certain limitation and biases may apply to these items, especially in cross-national context (Boyce et al., 2006). For example, car ownership may not be an issue in Saudi Arabia especially for several reasons such as: Saudi Arabia is the biggest oil producer in the world and oil and its products are cheap compared to other countries, and even to other products (1 litre of car fuel is between 0.4 to less than 1 Saudi Riyal, whereas 1 litre of milk is 4-5 times

more expensive than fuel); there is no effective and sufficient public transportation (no train and no metro or underground or public bus system) and people depend mainly on cars in their life; there is no road tax or MOT, and no parking meters in the street. Bedroom occupancy and a sharing room may not be an appropriate indicator and not reflect the SES due to cultural factors in Saudi (e.g, family size, age and gender of the students). In addition, my research was conducted in the capital city of Saudi Arabia, and, but many of the adolescents may had their roots and relatives out of Riyadh. Therefore, having a holiday might mean different lengths of time or distances (Boyce et al., 2006), different places of staying and different ways of travelling. However, there is no standardized measurement or scale to measure socioeconomic status among adults, children or adolescents in Saudi Arabia. In this study, I used fathers' and mothers' education as an indicator for SES. Findings from this study reveal the existence of inequality in health risk behaviours among Saudi adolescents. Therefore, there is a need for developing family affluent scale (FAS) to use as indicator for SES.

7.4 Dietary behaviours

Healthy eating habits at a young age may be an important factor for healthy eating habits in later life and health. For instant regular breakfast and a sufficient intake of fruit and vegetables are important items of a healthy eating pattern to promote health. Optimal and good food quality and healthy dietary behaviours during childhood and adolescents must be ensured and adequate to support growth and development. The need to promote healthy eating habits among young people has intensified in recent years due to the growing unhealthy dietary behaviours and disease related to diet. Understanding the students' dietary habits and the factors that influence student and defining population groups with the least healthy food habits is of great importance for the development of relevant interventions, programmes and policies. This survey was designed for many purposes and aims; one of the most important is to investigate several dietary behaviours and BMI.

7.4.1 Breakfast

Eating breakfast is important for the health and development of children and adolescents. It has been stated that breakfast makes an important contribution to the nutrient intake of children (Ruxton et al., 1996). There is evidence that children and adolescents who consume breakfast are more likely to have higher nutrient intakes and more healthy and adequate diets. Daily breakfast consumers have higher daily energy intake compared with breakfast skipper (Sjoberg et al., 2003; William, 2007; Nicklas et al., 2000). It was explained to my sample that a soft drink, or a cup of tea or coffee alone was not considered breakfast.

Published papers on dietary behaviours in Saudi Arabia, particularly the prevalence of eating breakfast and food type are very limited. The results of this study showed that only 36.7% of students' reported eating breakfast almost every day and the majority (63.3%) skip breakfast, despite the fact that breakfast is the first and an important meal of the day. One study from Riyadh published in 2004 reported 49.7% eat breakfast among male students (Al-Rukban, 2004). In Jeddah, another large city in Saudi Arabia, Abalkhail and Shawky found that overall regular daily breakfast intake was reported by 85.1% of the total students; they reported that 81.4 % male and

female adolescents age between 15-21 years are regularly eating breakfast (Abalkhail and Shawky, 2002). The difference between these research studies may be due to the difference in the age of the participants since in the first study the age range was 12 - 18 years and between 9-21 years for the second study, whereas in my study the age range was between 15-20 years, besides the date of collecting the data, and other differences in methodology and sample size. I believe that my study is more accurate and representative since I sampled students from public and private schools, from all high school level, from different districts and is the newest since it was conducted between February and April 2008.

A Greek study among a similar age group of students reported that only 29.4% male high school adolescents skipped breakfast (Gikas. et al., 2003), and data from The National Longitudinal Study of Adolescent Health (Add Health) in the United States reported almost one in five adolescents (20%) reported skipping breakfast the previous day of the survey (Videon and Manning, 2003). Also, it was reported that 80.5% of the Dutch adolescents eat breakfast 5 days or more during the week (Croezen et al., 2009). A 2005 review of breakfast studies related to children and adolescents indicated that 30% of adolescent age between 15- 18 years old regularly skipped breakfast (Rampersaud et al., 2005). Data from Malaysia, Kula Lumpur, reported 17.1% of students skipping breakfast (Ming et al., 2006). A 1997 review of breakfast studies primarily in the U.S. and Europe found that breakfast consumption in general is highest in children under 10 years and adults over 65 years of age (Ruxton and Kirk, 1997). A Taiwanese study by Yang and colleagues showed that 76.4% of school students (9-20 years old) were regular breakfast eaters (Yang et al., 2006). I conclude that prevalence of eating breakfast among Riyadh high school male adolescents is much less compared to adolescents in many countries and skipping breakfast is very high among adolescents in Saudi Arabia.

I found that students skipped breakfast more than lunch and dinner. Overall, the literature to date suggests that breakfast skipping is common in children and adolescents, and it was the most frequently skipped meal. Adolescents are more likely to skip breakfast than other meal (Dwyer et al., 2001). This trend is worrying since breakfast is the meal that reloads the body and brain with energy after a night's fast.

In my study, I found that the most common reasons for not eating breakfast were dislike or no appetite to eat in the morning (40.8%) and no time for breakfast (40.5%). Only 10% of the students stated there was no prepared food for them to eat in the morning. This finding was consistent with other studies worldwide. Common reasons cited by adolescents for skipping breakfast include no time, late waking, lack of hunger, lack of appetite, not being accustomed to having breakfast, dieting to lose weight or oversleeping (Shaw, 1998; Musaiger, 1994; Reddan et al., 2002).

From the data analysis of this study, both chi-square and multivariable analyses, I found that eating breakfast regularly has a strong inverse association with higher age (P=0.01, OR=0.8). The study is consistent with other studies since, as a general rule, skipping breakfast increases as age increase into adolescence (Rampersaud et al., 2005; Delva et al., 2006). Another study concluded that the mean number of days per week eating breakfast decreased significantly between adolescence and adulthood, and decreases were observed among all racial and ethnic groups (Niemeire at al., 2006). In my study there was no association between eating breakfast and other background factors such as fathers' and mothers' education, type of schools and only living districts showed weak association (P=0.49). On the other hand, it is been reported that breakfast skipping has been linked to low family socioeconomic status (SES) in developed countries (Brugman et al., 1998; O'Dea and Captui, 2001; Keski-Rahkonen et al., 2003).

The academic performance of children impacts their future educational attainment and health and has therefore emerged as a public health concern (Kramer et al., 1995). It is been stated that studies of nutrition and academic performance have typically focused on hunger, malnutrition, and micronutrient deficiency (Taras, 2005; Gala and Hulett, 2003). The relationship between diet and academic performance is often studied in developed countries; however, very limited study in Saudi Arabia looked to the link between the effects of dietary behaviours on academic performance.

However, my study findings tend to support earlier research findings from developed countries, which indicated that eating breakfast affects student performance. I found strong independent association between eating breakfast and school performance and liking school. Regression analysis and adjustment for students' age, fathers' and mothers' education, type of school and living district showed that eating

breakfast is independently, strongly and positively associated with good school performance (P=0.001) and liking school (P=0.004). Students who eat breakfast daily were more likely to report performing well and liking school more than breakfast skippers. Only one study in Saudi Arabia, to my knowledge, investigated this issue in different city in Saudi Arabia and my study is the first to investigate this issue in Riyadh city. Abalkhail and Shawky (2002) in their study in western Saudi Arabia reported that school achievement appeared to be influenced by breakfast intake as students with poor school results reported significantly less breakfast intake than those with excellent results (Abalkhail and Shawky, 2002).

A study from California in the US found a strong association between percentages of students eating breakfast and schools that had higher academic scores (Hanson and Austin, 2002). Studies of absenteeism rates among students offered breakfast at school found that children are more likely to attend school and have low rates of tardiness when a school breakfast program exists (Fernald et al., 1997). In a review by Taras it was concluded that there appears to be a positive impact of breakfast on a various cognitive skills (Taras, 2005). Rampursad in his review study concluded that there is evidence that children and adolescents who consume breakfast are more likely to have higher nutrient intakes and more adequate diets (Rampursaud, 2009). Children and adolescents who consume breakfast more often are more likely to have healthy diets (Basiotis et al., 1999), which may be beneficial for student's health and academic performance. In conclusion, my study finding supports earlier findings, which indicated that eating breakfast affects student performance. My study also provides a platform from which to encourage school students to eat breakfast as a method of enhancing healthy life style. It is important to formulate comprehensive policies to promote children's and adolescents' cognitive and learning development. However, due to my study design, I cannot draw a causal relationship between eating breakfast and school performance, but also it is important to look at the results in line with existing evidence.

Not eating breakfast every day may be an indicator for unhealthy eating behaviours. My study also investigated the association between eating breakfast and other dietary behaviours. Logistic regression controlling for confounding factors showed that breakfast as an important dietary behaviour was associated with some other healthy dietary behaviours and low BMI. I found that eating breakfast daily was

independently and positively associated with not eating high fat food every day (P=0.025, OR=1.3), low consumption of soft drink (one or less per day/week) (P=0.003, OR=1.5), consuming milk and milk products every day (P≤0.001, OR=1.9), and low BMI (P≤0.001). Unlike my study, one study in Saudi reported no difference in regular daily breakfast intake by gender, social class, or BMI (Abalkhail and Shawky, 2002). However, it is been reported that children who regularly eat breakfast consume a lower percentage of energy from fat (Nicklas et al., 2000). One longitudinal study suggests that routinely eating breakfast may lead to more regular eating habits and exercise patterns, healthful food choices, and consistent energy intake, which when taken together positively influence BMI (Affenito et al., 2005). Skipping breakfast is reported to be a risk factor for weight gain (Berkey et al., 2003; Cho et al., 2003; Keski-Rahkonen et al., 2003). Several cross-sectional studies have consistently found a positive relationship between breakfast skipping and measures of adiposity in children (Albertson et al., 2003; Boutelle et al., 2002; Ortega et al., 1998; Summerbell et al., 1996). On the other hand, it has been reported that students who regularly eat breakfast consume a lower percentage of energy from fat (Nicklas et al., 2000). Weight gain during the transition to adulthood may be a consequence of lifestyle factors, such as poor dietary choices, that appear to track from childhood into adulthood (Whalen and Kliewer, 1994). Also, similar to my study data from school children and adolescents students in Kuala Lumpur shows that BMI was significantly associated with skipping of meals, especially breakfast, for the whole sample (Ming et al., 2006). Students might have the misconception that skipping meals could reduce one's body weight; however, studies have shown that skipping of breakfast is significantly associated with obesity (Ma et al., 2003). On the other hand, Rampersaud et al. in their review study stated that research strongly supports a relationship between breakfast consumption and nutritional adequacy, but claim that the relationship between breakfast consumption and body weight is less well established; Rampersaud and his colleagues conclude in their review that some cross-sectional studies but not all studies reported that the BMI or weights of children and adolescents who skipped breakfast were higher than of those who consumed breakfast (Rampersaud et al., 2005). It could be hypothesised that individuals who do not eat breakfast may tend to be hungry and then consume a greater number of calories during the day. Wolfe also showed that students with higher BMI values missed their breakfast more often than

children with lower BMI values (Wolfe et al., 1994). It is been reported in many studies that skipping breakfast can be one approach to lose weight among adolescents, since overweight or obese children and adolescents are more likely to skip breakfast than their normal or underweight peers (Boutelle et al., 2002; Kovarova et al., 2002; Ortega et al., 1998). A similar result has also been reported in Spanish (Ortega et al., 1998) and American children (Malinauskas et al., 2006), and a study from Taiwan indicates that the adolescent regular breakfast eaters had a lower risk of being overweight (Yang et al., 2006). There is evidence of clustering of less healthy dietary behaviours such as increased snacking, irregular eating patterns, and increased intake of low-nutritive-value foods among adolescents who skip breakfast (Keski-Rahkonen et al., 2003).

Family behaviours regarding eating breakfast may have an influence on students' breakfast eating behaviours. For instance, children in two-parent families who skipped breakfast were almost two times more likely to be overweight than were breakfast consumers (Wolfe et al., 1994). Moreover, Keski-Rahkonen and colleagues reported that parental breakfast eating was statistically associated with adolescents' breakfast behaviours (Keski-Rahkonen et al., 2003). It has been reported that parental influence is one of the factors that affect adolescents' food choices (Pirouznia, 2001). Unfortunately, my study did not investigate the parents', and siblings' breakfast eating behaviours, which may be associated with adolescents' behaviours. Utter and colleagues make it clear that children who usually eat breakfast at home are more likely to have healthful nutrition behaviours and food choices than children who do not eat breakfast (Utter et al., 2007). Riz in her article points out that the omission of breakfast may be due to lack of companionship to share the meal, lack of desire to prepare breakfast themselves, and limited availability of ready to eat foods (Riz, 1991), which suggest that breakfast eating habits social activity and tend to be learned. Eating habits and attitudes about food develop early in early age of life. The American Dietetic Association pointed that parents need to be role models for children, especially when it comes to eating breakfast.

In general, skipping breakfast in adolescence may be associated with a higher prevalence of risk behaviours. It has been reported that breakfast skipping in adolescents has been associated with several health risk behaviours and unhealthy lifestyle (Keski-Rahkonen et al., 2003). My study, to my knowledge, is the first study

to have used rigorous statistical methods and analyses to study these sorts of health-related behaviours in Saudi Arabia. I found that among several health risk behaviours, eating breakfast was positively associated with regular physical activity (3 times and more per week) (P=0.011, OR=1.3), brushing teeth every day (P=0.002, OR=1.4), and negatively with engaging in physical fighting (P=0.003, OR=0.9). It has previously been reported that breakfast skipping is associated with physical inactivity (Zullig et al., 2006, Keski-Rahkonen et al., 2003). Lower levels of physical activity may be the reason that breakfast skippers had higher BMIs than breakfast consumers. From the chi-square analysis, I also found a significant association between breakfast and smoking status; the majority (82.2%) of breakfast eaters were non smokers. Lytle et al also found that exercise and healthy eating were linked, and that smokers had poorer eating habits compared to non-smokers (Lytle et al., 1995). Another study found that students who were non-smokers and active 3 or more times/week were more likely to eat breakfast daily (Cohen et al., 2003).

7.4.2 Type of food

Of the participants in this study, only 37 (2.5%), and 114 (7.6%) of the students consumed the recommended amount of fruits and vegetables, respectively. The majority, about 75.8% and 60% of the students respectively, did not eat fruit and vegetables, even at least once a day. It is been reported that many young people do not meet the dietary recommendations for fruit and vegetables. In the Unites States less than 20 per cent of children between 2 and 18 years eat the recommended 5 portions of fruit and vegetables a day (Krebs-Smith et al., 1996). For comparison reasons the response options were recorded into dichotomous outcome variables, eating fruit or vegetables at least one time daily and less than once every day. I found that 24.2% of the students ate fruit at least once a day and 39.9% ate vegetables at least once a day. One study in Riyadh among school students (12-20 years old) reported that 28.8% of the students ate fruit and vegetables every day, but did not differentiate between fruits and vegetables (Al-Rukban, 2004). Data from a neighbouring country reported that among students between 16-18 years about 40% and 47.7% of the students consumed fruit and green vegetables daily, respectively (Bashour, 2004). Moreover, data from Europe countries shows on average 33% of students reported daily consumption of

fruit and in all countries less than half of the students consume fruit daily; the data show a wide variation, with national figures between countries of daily fruit consumption of 17-43% among boys (Carine et al., 2005). Consuming fruits and vegetables is relatively low among adolescents in Saudi Arabia.

Also, in this study I found that 47.3% of the students did not consume milk products every day, and only 52.2% consume milk products at least once a day. Al-Rukban reported quite a similar result, finding 45.6% of the students consumed milk products daily. In contrast to Al-Rukban study, which reported only 32.8% consumed soft drinks everyday and 18.5% consumed candies and sweets daily. My study discovered high consuming every day of soft drinks (70.1%), sweets and candies (48.7%), though there were differences in between the students' mean age, sample size and time of collecting the data. In this study I investigated the consumption of energy drinks, and I found that 25.2% of the students consumed energy drinks daily. Another study in Jeddah found that 20% of students between 13-18 years consumed energy drinks at least 4 times every week (Musiger and Zagzog, 2005). The same study also reported that, on average, 26% of students reported daily consumption of soft drinks (range 10-48% among boys in schools); but the mean age of students is smaller than in my study.

Multivariable logistic regression analyses showed the relationships between background factors and adolescents' dietary behaviours. I found that lower consumption of fruits and milk products were associated with higher age. Higher age was also associated with higher soft and energy drink use. Al-Rukban found similar results in Riyadh city, reporting a significant negative association between age and consumption of milk, fruit and vegetables, and positive association between age and soft drinks. My study was also consistent with similar results from European studies; Carine and colleagues reported lower consumption of fruits and higher consumption of soft drinks among older pupils (Carine et al., 2005). Other data from Belgian students concluded that fruit and vegetables consumption decreased as function of age (Paulus et al., 2001; Mullie et al., 2006). I also found that fathers' low education level was associated with not consuming fruit and milk daily. That education level among fathers was associated with vegetables consumption and significantly with inadequate milk and fruit consumption. It is not clear whether the reason for the association is low of access to resources to purchase milk, fruit and vegetables or lack of knowledge as to

the benefits of fruits, vegetables and milk, or poor motivation to consume a healthy diet, and low socioeconomic status.

Students in public school were more likely to consume fruits and vegetables daily than private school students, yet only consuming vegetables was highly significant. Mullie and colleagues reported that the educational programme of the respondents influenced the fruit and vegetable consumption (Mullie et al., 2006). School districts showed no association with students' food intake.

7.4.3 Students' dietary knowledge

My study also demonstrates the weakness of the schools' role in equipping adolescents with basic necessary nutritional information. I asked students if they had been taught about several nutritional aspects such as: healthy eating, the benefit of consuming fruit and vegetables, the benefit of milk, the healthy way to gain weight, the healthy way to lose weight, preparing and storing food safely and information about making healthy meals and snacks. Adolescents' responses regarding the above items ranged from 16.1% and 66.7%. The main topic that students were taught about was the benefits of consuming milk and the least discussed topic was the healthy ways to gain weight. These results may reflect or explain the poor healthy dietary knowledge and behaviours among adolescents. One study among adolescents in Saudi concluded that nutritional knowledge of both male and female adolescents' students is inadequate (Al-Almaie, 2005a). Among the different sources of knowledge, family was the most common source of information regarding nutrition and diet, (70%) and, unfortunately, school came as the fifth source of information, with only 18.3% of the students reporting school as a source of knowledge. These findings from were consistent with another study; Bashour (2004) found that family was the common source for nutrition information and a school as source of knowledge was reported by only small percentage (Bashour, 2004). 90% of the student in my study stated that students need a health education programme regarding diet and nutrition. Nutritional knowledge of adolescents is limited, and this might be due to the lack of public education regarding healthy dietary behaviours, and/or unavailability of health information (Al-Almaie, 2005a).

7.4.4 BMI

Overweight and obesity is the accumulation excess of adipose tissue. Childhood overweight and obesity is an increasing public health concern. The exact reasons behind this phenomenon in adolescents are unclear, but it has been reported that overweight and obesity are caused by an imbalance between food –energy- intake and energy expenditure (Janssen et al., 2004). Changes in dietary patterns in the past few decades, such as an increase in the consumption of high fat and sugar foods, and low physical activity may have been implicated in the increase in obesity. However, personal lifestyle behaviours, and cultural environment seem to play major roles in overweight and obesity.

There are various methods to assess overweight and obesity, which include triceps skin fold, or arm fat area (calculated from triceps skin fold and mid-upper-arm circumference, and indeed the most common method body mass index. In this study, body mass index was calculated from practical weight and height measurement by the researcher. Cole et al. proposed BMI cut-off values for children and adolescents (Cole et al., 2000). The use of Cole et al. criteria (BMI cut-off values) is widely accepted and used (Fletcher et al., 2004, Andersen et al., 2005). However, It has been reported that Cole et al. values have a low sensitivity when compared with weight-for height, which makes their use to screen obesity in children less useful since they could not detect more than 80% of those classified as obese by WHO (Abrantes et al., 2003). Also, it has been found that the sensitivity, specificity and agreement of BMI values proposed by Cole et al. with weight-for-height index are better for pre-school children than for schoolchildren (Abrantes et al., 2003).

However, the ideal gold standard method to diagnose overweight and obesity is a more direct measure of body fat such as dual-energy X-ray absorptiometry (DEXA), which is clearly more difficult to obtain (Abrantes et al., 2003). Moreover, It has been reported that the American Obesity Association, a leading organization on education and advocacy related to obesity, defines ‘‘overweight’’ for adolescents (ages 13-17) as BMI greater than 25 or BMI greater than the 85th percentile (Taras and Potts-Datema, 2005). In my study BMI cut off for adults was used, but only for the chi-square test to investigate overweight differences among group. First because the majority (45%) of the participants were aged 18 or older, and BMI cut-offs of 25 and 30 are used to classify individuals as overweight and obese for this age, respectively, whereas the

remaining students were 15 years old (3.4%), 16 years old (20.1%) and 17 years old (30.7%). However, the average BMI cut off for adolescents between 15-17 years old (based on Cole et al., criteria) was 24%, and it has been presumed that it will not significantly affect the results.

It was interesting that I found that some overweight students failed to describe themselves as overweight. About 21.9% of the students who describe their weight as normal were actually among overweight students and 14.7% of who think they are overweight were among normal weight students after I compared their actual BMI with their weight perception. I found that only about 57% of the total students in this study reported they measured their weight in the last 12 months, and that could be one of the explanations for incorrect weight perception. O'Dea and Caputi reported similar conclusions and they gave some explanations regarding this puzzling result, which either some students are unaware of their body weight or/and are not affected by common body image stereotypes (O'Dea and Caputi, 2001). In my pilot study I discovered that the majority of school students did not know their weight and height and that was the main reason to measure their weight and height.

The results of my study provide evidence of a high prevalence of overweight and obesity among the adolescent students in Riyadh, Saudi Arabia. The prevalence of overweight and obesity combined was 36.3%, which was considered consistent with other studies among adolescents in Riyadh. Al-Rukban (2003) found that 34.3% of school students' age ranges from 12-20 years old were overweight or obese (Al-Rukban, 2003). On the other hand, overweight prevalence in my study was higher than any other study in Saudi Arabia. Al-Sekait et al. found that the prevalence of overweight and obesity combined in Saudi school boys was 27.1%. In Al-Nuaim and colleagues study, it was found that among male school children ages ranged from 6-18 years, attending public schools in different regions in Saudi Arabia, the overall prevalence of overweight and obesity was 27.5%; also, it was found that the highest prevalence was recorded in Riyadh, capital of Saudi Arabia (Al-Nuaim et al.,1996). Similarly, another community study in Riyadh found that 19.2% of children ages 6-17 years were overweight, and 53.4% of age 18 and over were overweight (Al-Shammari et al., 2001). Another finding from western Saudi Arabia, demonstrates that about 26.9% of male and female students (9-21 years old) in Jeddah were overweight (Abalkhail et al., 2002). El-Hazmi and Warsy determined the prevalence of

overweight in a total of 14,660 Saudi males and females (>14 years of age) in different regions of the Kingdom, and the prevalence of overweight was about 40.3% and 45.4 % in males and females, respectively (El-Hazmi and Warsy, 1997). However, the difference may due to several reasons such as the time of collecting the data, an increase in prevalence of overweight over time, sample size and methods of sampling and collecting the data.

Linear regression analyses were performed for BMI to investigate the association of students' BMI to other factors. The study shows a strong relationship between students' age, living district, level of fathers' and mothers' education and higher BMI. Older age was associated with higher BMI ($P< 0.001$) and this finding was supported by other studies in Saudi Arabia (Al-Shammari et al., 2001; Soyannwo et al., 1998; Al-Shagrawi et al., 1994). My results showed that students' BMI greater in students' whose fathers' and mothers' had higher education ($P=0.003$ and $P=0.027$, respectively. Parents higher education can be a strong indicator for high socio economic status. My study shows the opposite trend from studies in developed countries where low SES or living in a deprived area is associated with overweight and obesity (Wendt et al., 1994). I found that living in the north, central and south district of Riyadh is associated with having an increased BMI compared to our reference group (east district), and that there was no significant difference between students living in east and west. However this is supported by the finding from the descriptive analysis and linked to the fact that the north and central area tend to be inhabited by those with fathers and mothers with a high level of education, whereas the east district is associated with fathers and mothers with low education. There are no previous studies in Riyadh investigating the link between the living district and BMI.

An understanding of the relationship between students' health status, BMI and educational outcomes is important and may have major implications. In my study I investigated the associations between school performance and general perceived health status and BMI adjusting for student's background. Interestingly, linear logistic regression analyses showed that higher BMI was associated with poor health status and it was consistent with the finding from chi-square analysis showing that overweight students were more likely to report poor health. It has been recognized that children who are overweight or obese are more likely to have low self-esteem and that

they have higher rates of anxiety disorders, depression and other psychopathology (Zametkin et al., 2004; Vila et al., 2004). Swalen et al. found significant relationship between BMI and general health (Swallen et al., 2005).

Linear logistic regression analyses showed a positive association between poor health status and BMI, and negative association between poor academic performance and higher BMI. However, a study from the US found that obese boys were 1.5 more likely to consider themselves poor students, and 2.2 times more likely to expect to quit school (Falkner et al., 2001). Studies from Finland found that obesity was associated with a low school performance (Laitinen et al., 2002; Mikkila et al., 2003). Datar et al. (2004) suggests that obesity is a marker, not a cause, of low academic performance (Datar et al., 2004). Another explanation is that overweight or obese adolescents may miss school days more than the general student population, Schwimmer et al. (2003) found that severely obese children and adolescents report many more missed school days than the general student population (Schwimmer et al., 2003). However, it is been found that BMI has a relationship with general health but not with psychological outcomes (Swallen et al., 2005), and that might explain why there is no strong association between BMI and school performance in this study. Unfortunately, in this study I did not investigate school absenteeism which may be associated with school performance. Further research is needed to investigate this phenomenon in Saudi Arabia.

Several linear regression analyses were performed to investigate the association between students BMI and other dietary and non dietary behaviours. I found that BMI was associated with other dietary behaviours. Higher BMI was inversely associated with eating breakfast and this finding is consistent with the extensive literature that I mentioned above (Section 7.4.1). Surprisingly, there was a negative association between consuming sweet and energy drinks and higher BMI. However, this study was consistent with a study from Canada (Janssen et al., 2004). One possible explanation is that overweight adolescents may tend to skip breakfast and avoid consuming sweets as methods of losing weight. I did not find any association between consuming fruit and vegetable with BMI, but that may due to the low fruit and vegetables consumption among the whole sample. However, my finding was consistent with previous studies; Janssen et al. found no association between consuming fruit and being overweight among adolescents (Janssen et al., 2004). I

found that higher BMI was associated positively with physical inactivity, and inversely with being threatened or injured by weapons and being bullied by others. In this study I found that only 32.9% of those surveyed engaged in 60 or more minutes of physical activity on 3-7 days of the week. In my study, physical inactivity among adolescents could be observed to be a risk factor (Al-Rukban 2003, Janssen et al., 2004). Guidelines from the United States suggest that youth should engage in 30–60 minutes of physical activity on most or preferably all days of the week (Corbin and Pangrazi, 1998). In the recently released Canada's Physical Activity Guide for Healthy and Active Living, Health Canada recommends that all adolescents, regardless of their current activity level, should gradually increase their physical activity participation to 90 minutes per day (Health Canada, 2002). My findings support the hypothesis that physical inactivity is implicated in obesity, as there was an association between overweight and obesity with lower physical activity participation among adolescents.

7.4.5 Dietary behaviours' summary and implications

Beside the general limitations outlined earlier in this chapter, there are some limitations regarding the dietary behaviours section in this study. Over or under-reporting of foods or food groups consumed by the adolescents may bias the reported results. Participants relied on their memory to self-report dietary intakes; therefore, data were subject to non-sampling errors, such as underreporting. Also, consideration should be given to the fact that there is a lack of information on the exact serving sizes, since the adolescents were asked about their consumption frequency and no data were gathered regarding the portion size. Hence, it is difficult to estimate portion size accurately (Carine et al., 2005), particularly in Saudi Arabia where there is no concept of portion size. Despite the limitations, this study contributes to the existing literature, and most importantly helps to understand the dietary behaviours in Saudi Arabia.

I conclude that the data from this study show high overweight prevalence, generally poor and unhealthy dietary habits and low knowledge regarding healthy food. Breakfast eating behaviour, milk, fruit and vegetable consumption among most adolescents are relatively low and should be promoted and encouraged. In this study I also found that dietary habits are associated and clustered together. Findings demonstrate that consuming milk every day among adolescents was independently

associated with adequate consumption of fruit and vegetables (at least once daily), eating breakfast regularly (five and more days a week) and low soft drink intake (one or less day/week). Also, eating fruit everyday was associated with consuming vegetables and milk daily, and low soft drink intake (≤ 1 day/week). Moreover, consuming vegetables every day was only associated with consuming fruit and milk daily. Interestingly, eating sweets ≥ 2 times every day was associated with consuming milk and vegetables daily. These suggest that the healthy dietary habits are complex and correlated. Moreover, a strong relation was found between breakfast skipping and higher BMI, school performance, dietary behaviours, and other health risk behaviours and between BMI and other behaviours as well.

It is important to educate students and parents about the importance of eating breakfast because it provides an important part of a student's daily intake of nutrients needed for energy, growth, and learning. Food and nutrition professionals must continue to educate children, adolescents, and their parents and all the community about the importance of eating a nourishing breakfast, and efforts should be aimed toward the promotion of family meals and home availability of healthful breakfast foods that are easy to prepare and eat. School faculty and administrators, food and nutrition professionals can promote school breakfast programs to ensure that all children have access to a nutritious breakfast, especially those of low SES. The benefits of school-based programs that aim to improve access to breakfast for children have been recognized (Utter et al., 2006). Schools have the potential to influence students' and families' attitudes regarding healthy breakfast, healthy dietary knowledge and behaviours and BMI. Since most of the adolescents spend a large portion of their day in school, modified school policies providing health education and healthy breakfast could help to prevent them skipping this important meal. Consistent, healthy food intake throughout the day and throughout the year meets important educational outcomes in addition to health outcomes.

Teachers and leaders in schools and community can be responsible since they are in a unique position to comprehend the scope and consequences of good dietary health behaviours and advocate the well-established link between a good diet, breakfast, BMI and general health and learning. Promoting the importance of healthy eating will help ensure that students are prepared for their future and educational day. Public health and health promotion action and process is multidisciplinary and

collaborative work. It could be everyone's business. No single agency, organization, school teacher, health professional or parent can solve the problem of poor nutrition alone among youth. It will take and needs the combined effort of all of these groups to make an impact. Because eating habits developed during childhood have the potential to last a lifetime, the long-term benefits of ensuring our children eat nutritious meals every day will last years after they have graduated. Without public health policies and better policies targeting young people's needs, particularly associated to health, Saudi Arabia may face many difficulties in the near future. More research is required to address children's and adolescents' dietary problems and needs in large scale and in depth.

Adolescents represent the largest segment of the Saudi population and could be the target of focused efforts to promote health knowledge and healthy behaviours and prevent risky habits which may have negative an impact on health later in life. As the majority of them are studying in schools, it is recommended to investigate schools students' health and behaviours in order to promote healthy eating and encouraging physical activity as well as avoiding other risky behaviours. Probably, almost all public health researchers and physicians agree that prevention could be the key factor and cost effective strategy for controlling overweight and obesity increase. Prevention may include primary prevention through more public awareness and adolescents' education, secondary prevention or avoidance of weight regains following weight loss, or prevention of further weight increases and awareness of the related consequences of overweight and obesity. Childhood and adolescence may be considered the priority population for intervention strategies mainly because it is difficult to reduce excessive weight in adults once it becomes established. My findings suggest that policy makers, researchers, public health professionals and community members need to take responsibility and pay attention to of what is happening to youth in Saudi Arabia. I suggest that if the high prevalence rates of overweight and obesity among youth in Saudi Arabia are to be decreased, physical activity and education interventions will have to play a fundamental role. Therefore, it would be important to initiate obesity prevention and treatment of obesity during childhood and adolescence. Prevention may be achieved through a variety of interventions targeting change in the environment, increase physical activity in school, and promote healthy diet.

7.5 Oral hygiene

7.5.1 Oral hygiene behaviours

Research carried out in industrialized countries has indicated that oral health is an essential component of general health (Sheiham and Watt, 2000; Wickholm et al., 2003). Good oral health requires healthy oral practice such as regular visits with the dentist, daily teeth brushing and other healthy behaviours. Poor oral health and untreated oral diseases and conditions can have a significant impact on quality of life. Moreover, poor oral health is an important public health issue, and oral diseases might be significant in terms of personal suffering and financial burden for individuals, society and health services. The American Dental Association recommends that, to avoid oral diseases, individual should brush and floss at least once a day and visit a dentist regularly. The universally recommended frequency for tooth brushing is twice a day (Low, 2000).

The results of my study show that, in general, high school students in Riyadh have poor oral health hygiene behaviours. It was found that only 51.3% reported good teeth health status, 22.6% of the total sample brushed their teeth two times or more daily, 29.7% brushed teeth once daily, whereas 47.7% of the subjects never or do not brush teeth daily. The majority 54.3% did not visit the dentist for more than 13 months or never. About 29.5% have suffered from teeth pain sometimes or most of the time and 16.4% missed some school days because of teeth pain during the last 12 months.

A total of 52.3% of the students were brushing their teeth at least once daily. This result is comparable to the findings of a previous study in Saudi Arabia. Farsi and his colleague reported that 55.6% brush teeth daily among students aged between 12-18 years old (Farsi et al., 2004). Another study from Riyadh found that 61.4% of high school students brush their teeth daily (Almas et al., 2003). However, it is far less than the finding reported in some developed countries; since most children (83-73%) brushed their teeth twice a day in Sweden, Denmark, Germany, Austria, and Norway (Kuusela et al., 1997). Also, data from HBSC project showed that the prevalence of brushing teeth more than once range from 20-76% among 15 years old adolescents

(Currie et al., 2008). The difference might be attributed in part to the establishment of preventive dental public health programms in developed countries.

Data from chi-square analysis and logistic regression analyses showed positive associations between brushing teeth daily and good teeth health status, studying in private school (P< 0.001), living district (P=0.020) (students living in the north district more likely to brush their teeth), and fathers' and mothers' education (P=0.030, and P=0.050, respectively). These findings are consistent with a previous study in Saudi Arabia. Data from a studies in Riyadh and Jeddah, the biggest two cities in Saudi, found that students from private schools were significantly more likely to brush their teeth daily and use floss (Farsi et al., 2004; Al-Sadhan, 2003). More over Al-Sadhan in her study found that high education level in mothers was directly related to the oral hygiene habits (Al-Sadhan, 2003). Studying in private school and high level of parents' education may reflect students' socioeconomic status, which is associated with positive oral health behaviours. Surveys carried out in western industrialized countries have shown that the oral and general health behaviours of children and adolescents are highly influenced by the socioeconomic status (Nicolau et al., 2005; Locker 2000). Results from HBSC study have found that lower level of tooth brushing (less than once a day/week) are significantly associated with lower family affluence in almost all countries (Currie et al., 2008). Moreover, data from eastern countries (Hong Kong and China) also support these findings, since it was found that students with family backgrounds of higher education and income scored relatively highly on oral hygiene practices (Lee and Tsang, 2004; Petersen et al., 2008). It may seem that the most important oral health habit is regular tooth brushing. Use of dental floss has not been widely accepted by people (Honkala et al., 1990).

My study also investigated the association between oral health behaviours and perceived general health status and school factors. Several independent associations between these behaviours were detected. This study is, to my knowledge, the first to investigate the associations between oral health behaviours and general health and school factors among students in Saudi Arabia. Multivariable logistic regression analyses controlling for students' background (age, type of school, district of living, fathers' and mothers' education) demonstrated that poor teeth health status was independently associated with poor general health status, not liking schools, and poor academic performance. These findings were consistent with other findings elsewhere.

For example, in Finland it has been found that poor school performance was significantly associated with toothache (Honkala et al., 2001). In earlier studies, these factors have also been related to tooth brushing habit (Kuusela, 1997), and to dental caries (Milen, 1987). Students with preventable or untreated health and development problems may have trouble concentrating; have frequent absences from school (McCart and Stief, 1996). Poor oral health has been related to decreased school performance, poor social relationships, and less success later in life and it has been reported that experiencing pain is distracting and prevents students from concentrating on schoolwork (U.S. General Accounting Office, 2000). Students with chronic dental pain might be unable to focus, and may have problems with schoolwork completion, (Schechter, 2000). Left untreated, the pain and infection caused by tooth decay may cause more problem problems in eating, speaking, and learning achievement (U.S. General Accounting Office, 2000). Also, it is been stated that if a child is suffering pain from a dental problem, it may affect the child's school attendance, and mental and social well-being while at school. I, also, found that students who brushed their teeth more than once a day reported better dental health than those who brushed less often. This finding was consistent with the findings from a large international study (Kuusela et al., 1997).

Binary logistic regression analyses controlling for students' background (age, type of school, district of living, fathers' and mothers' education) showed that brushing teeth daily was positively associated with liking school ($P< 0.001$) and good school performance ($P< 0.001$). Similar findings were observed in many countries. Secondary data analysis from schoolchildren in 22 European countries and Canada conclude that school performance was consistently associated with tooth brushing in all countries except Latvia and Belgium (Kuusela et al., 1997). It has been estimated that 51 million school hours per year are lost because of dental-related illness (Gift, 1997), and students age 5 to 17 years missed 1,611,000 school days in 1996 due to acute dental problems, an average of 3.1 days per 100 students (National Center for Health Statistics, 1996).

My study also found that brushing teeth daily was associated with other oral health behaviours. It was found that brushing teeth daily was positively associated with good teeth health ($P< 0.001$, OR=2.7), visiting a dentist during the last 12 months ($P<0.001$, OR=1.5) and not suffering from toothache ($P=0.018$, OR=1.3). Less than

once-a-day tooth brushing seemed to be the most consistent risk factor for toothache (Honkala et al., 2001). Tooth brushing has also been shown to be related to lower levels of caries (O'Brien, 1994).

My study also found that only 45.7% of the total students visited a dentist in the last 12 months. Prevalence of visiting a dentist during the last 12 months was consistent with a study conducted among 12 year old in a neighbouring country, the State of Kuwait. Vigild et al. (1999) found that about half visited a dentist only when they had problems with their teeth or gums (Vigild et al., 1999). A study from the United States showed that about 68% of adolescents 11-21 years old (the majority was between 15-17 years old) visited a dentist during the 12 months prior to the survey. In Finland it has been found that 95% of adolescents between 12 and 18 years of age visit a dentist at least every second year (Honkala et al., 1997).

My study also found that those whose fathers had low levels of education and those who study in public schools, were also more likely to miss an annual dental visit. These findings are consistent with data from the National Longitudinal Study of Adolescent Health (Add Health) in the United States, where significant associations were found between parents' low education level and low income and visits to a dentist (Yu et al., 2001). However, not visiting a dentist frequently may be due factors related to the acceptability of the services themselves, to confidentiality and sensitivity to adolescents' health concerns, or to lack of access to care for financial or geographic reasons (Yu et al., 2001). It may be also due the cultural and family influences that people in Saudi are not used to visit a dentist on a regular basis in their childhood, which is reflected in their later behaviours when they are older. There might be another explanation for the low attendance to a dental clinic reported in this study. In Finland, all young people under the age of 19 years are entitled to free dental check-ups and dental care by the Public Dental Health Services, and 95% of adolescents visit a dentist at least every second year (Honkala et al., 1997). It is been reported that adolescents are among those least likely to use health services (Zimmer-Gembeck, 1997). The American Medical Association and the American Academy of Pediatrics guidelines for Children and Adolescents recommend a routine dentist visit each year for adolescents (American Academy of Pediatrics 2000; American Medical Association 1995), and it is been reported that that dental care is the most common type of unmet health care need in adolescence (McBroom et al., 2005). It is therefore

worrying that adolescents may not meet their need for utilization of dental services, which may, with poor oral health behaviours, negatively affect student's health, school factors and quality of life. This suggests that emphasis should be placed on efforts to provide dental health services in schools and community and to encourage students to visit a dentist regularly.

7.5.2 Oral hygiene behaviours' summary and implication

In conclusion, my study has shown that oral health-related behaviours among adolescents are poor, and associated with type of school, fathers' and mothers' education level, general health and academic performance. The significant association between oral hygiene and poor general health and academic performance emphasizes the important role and need for the health promoting school as a setting for the health of children and adolescents. School-based oral health services should be established since they can help make preventive services such as fluoride and dental sealants accessible particularly to children from families with low incomes. Services should include screening, education, behavioural modification and referral. There is a clear need to establish a regular oral health assessment and dental check-up program in Saudi Arabia for children, adolescents and young adults, to prevent dental diseases and to provide accurate information about oral health status and their prevention. It has also been shown that the tooth brushing habit is quite stable after it is adopted (Kuusela et al., 1996), and it is more difficult to change later on. Therefore, a public health programme, a community programme particularly for parents and schools should be systematically established. Further research is needed and based on the results of this study; it seems to be a universal finding that health behaviours models should include at least socio-demographic background factors.

7.6 Physical Activity

7.6.1 Physical Activity behaviours

Physical activity is important for young people's health (Biddle et al., 2004). Children and adolescents who participate in higher levels of physical activity are less likely to develop risk factors for cardiovascular disease in adulthood (Boreham and Riddoch 2001; Strong et al., 2005). Furthermore, there is evidence of associations between physical activity and mental health characteristics such as self-esteem, emotional well-being (Calfas and Tayper 1994; Steptoe and Butler 1996; Brosnahan et al., 2004). The U.S. Department of Health and Human Services recommends that adolescents participate in at least 60 minutes of physical activity daily (Department of Health and Human Services, 2008).

My study found that only 18.4% of the students had participated in physical activity (60 minutes) on 5 days or more per week. The data from my study also allows comparison with other studies. A study among adolescents in Riyadh found that 34% of public intermediate and high school students aged 12-20 years old were physically active for more than 3 times a week (Al-Rukban, 2005), and using comparable criteria, I found that only 24% were physically active. The difference may due several reasons such as different sample size, since my sample was nearly double the size of Al-Rukban study, type of schools, and the age of the participants. This study data were generated from public and private school students, different districts and focuses on high school students only. Unfortunately, published studies on the physical activity behaviours of Saudi people are very lacking on this important public health issue. No nationally representative population study has been conducted to describe physical activity behaviours in Saudi Arabia, despite the fact that such data represents an important public health concern. However, physical activities among Saudi adolescents were found to be low (Al-Rukban, 2005; Al-Hazzaa, 2004). I found that physical activity is much lower than the recommended level and the prevalence of physical activity is lower than other countries. In 2007, 43.7% of male high school students in the United States had participated in at least 60 minutes of physical activity on 5 or more days/week (YRBS-CDC, 2007). Also, it has been reported that 73.5% of high school boys students in the U.S. were physical active as proposed in the study as 3 days per week or more (Levin et al., 2003), whereas it is much less in my study

(32.4%). In Europe, an analysis of a survey of EU countries showed that the prevalence of total sufficient physical activity among 15 years and over across the member countries was 29%, ranging from 44% in the Netherlands to 23% in Sweden (Sjostrom et al., 2006). Another survey of health behaviour among adolescents aged 11, 13 and 15 years across Europe that measured participation in physical activity (Currie et al., 2008), has found that the average of practicing physical activity on most days during the week among 15 years old boys was 20%; however, the range of physical activity was from 11% in Sweden and 46% in Slovakia among 15 years old boys.

My study is, to my knowledge, the first to investigate physical activity with regards to students' socio-demographic factors among adolescents in Riyadh, Saudi Arabia. Findings from chi-square analyses and logistic regression analyses show identical results. Only a student's age was associated with physical activity behaviour. Area of living, type of schools, and parental educational level were not associated with adolescents' physical activity in this study. Higher age was negatively associated with regular physical activity (P<0.001, OR=0.8). Results from a comprehensive review suggested that less physical activity was associated with increasing adolescents' age, and socio-economic status was unrelated to physical activity among adolescents (Sallis et al., 2000). Consistently, Chen et al. (2007) found inverse significant association between higher age and physical activity among adolescents and no associations between parental education level and students' physical activity (Chen et al., 2007). This finding was supported by a previous study in Riyadh, where was found by Al-Rukban that physical activity was less prevalent among older adolescents than younger adolescents (Al-Rukban, 2005). The level of physical activity begins to decline before high school and continues to drop through the high schools grade levels (Sallis, 1993; Sallis, 2000).The decline in physical activity that occurs as adolescents' age is probably related to changing interests during the transition from childhood to adulthood.

My study is the first in Saudi Arabia to investigate the interrelation between adolescents' physical activity and family physical activity in Saudi Arabia. It was found that only 16.5% of students' fathers, 5.9% of students' mothers and 50% of students' siblings practice physical activity weakly. This study found that fathers' physical activity (P< 0.001, OR= 1.5), sibling physical activity (P< 0.001, OR=1.8),

and peers physical activity (P< 0.001, OR=3.1) were appeared to have strong positive influence on physical activity behaviour. The chi-square analyses found that fathers', mothers' and siblings' physical activity were strongly associated with adolescents' physical activity. My multivariable analyses showed similar results, except for a weak association with mothers' physical activity (*p*= 0.053). Sallis et al. (2000) found that siblings' physical activity was consistently associated with adolescents' physical activity (Sallis et al., 2000). Moreover, children whose parents are physically active have been reported to be nearly 6 times as likely to be active than children whose parents are both inactive (Morr et al., 1991). These results provide evidence that family physical behaviour is associated with adolescents' physical behaviour. In addition to parental influences, another possible social influence on physical activity behaviour among adolescents is peer pressure.

Despite the importance of peers in adolescents' life, there is no study in Saudi Arabia investigating adolescents' physical activity with regard to their peers' physical activity. However, Salvy and colleagues (2009) concluded that only few studies have included peers as part of the physical activity support network for youth. In line with that, an important finding of this study was the independent association that has been found between peers' physical activity and adolescents' physical activity. Adolescents, most of whose peers practice physical activity regularly during the week, are three times more likely to be involved in physical activity than those who had none of their friends practicing physical activity; whereas having only some friends practicing physical activity had no associations with students' physical activity. There are many factors that may influence children and adolescents physical activity behaviours, and one of the most important factors that may influence youth activity levels is the social context. Youth are more likely to be active when they are in the company of peers and friends than when they are alone (Salvy et al., 2009). Peer influences for physical activity behaviour among adolescents may actually replace the substantial parental influences observed in younger children (Kohl III and Hobbs, 1998). In a study of adolescents, influences of a best friend were more highly associated with physical activity behaviour than influences of parents (Anderssen and Wold, 1992). A review by Wold and Hendry (1998) provides support for the view that some peer influence is likely, arguing for a link between peers and adolescents via friendship patterns (Wold and Hendry, 1998). Another recent study investigating the influence of peers or a

friend concludes that friendship may increase adolescents' motivation to engage in physical activity and promote greater physical activity (Salvy et al., 2009). There is evidence that participating on a sports team with a friend is associated with increased physical activity during adolescence (Voorhees et al., 2005). Companionship provided by friends is associated with positive effects during physical activity and with the choice to participate in physical activity among adolescents (Duncan, 1993; Duncan et al., 2005; De Bourdeaudhuij et al., 2005). My study suggests that peers and friends can promote physical activity and increase adolescents' motivation to be physically active. These findings provide evidence that peer relationships are also relevant for understanding adherence to a healthy lifestyle. Thus, I suggest that interventions that target adolescents' physical activity could be more effective and have a greater chance of success if it included family members and peers than only those targeting individual adolescents.

Qualitative research (Mulvihill et al., 2000) has shown that many barriers to physical activity emerge during the time of transition. It is important to understand why some adolescents choose to be physically active and why others do not. Barriers to participation in physical activity may vary between groups and countries. This study is the first in Saudi Arabia to investigate the adolescents' perceived reasons for practicing physical activity. Notably, the three most common reasons for being physically active given by adolescents in this study were for recreation and enjoyment, for health and physical fitness, followed by improvement of body appearance. This finding seems consistent with finding of Al-Refaee and Al-Hazzaa study, who found that maintaining health, losing weight and recreation were the most reasons for physical activity among adults (Al-Refaee and Al-Hazzaa, 2001). It seems that age is considered as an important factor in influencing people's perception regarding ranking the reasons for practicing physical activity.

On the other hand, the three most common reasons for not practicing physical activity were lack of an available sport facility in community, lack of appropriate sport places suitable for youth, lack of time, lack of interest and dislike of exercise. One study in Riyadh found that the most important reasons for not being active among adults were lack of time, lack of facilities, followed by health condition (Al-Refaee and Al-Hazzaa, 2001); this again suggests the differences in priority as a result of age. In a systematic review, Rees and colleagues concludes that the barriers identified by

young people included: lack of time and facilities and dislike of highly structured activities or those organized by adults; not feeling competent enough to take part; negative reactions from peers over skills and choice of activity; feelings of inertia and conflicting interests; self-consciousness about bodies; parental constraints, sometimes related to concerns about safety or cultural restrictions (Rees et al., 2006). Also, Kohl III and Hobbs (1997) reported that perceived barriers such as lack of time, lack of interest or desire, lack of equipment and facilities are potential determinants of physical activity behaviours in children and adolescents (Kohl III and Hobbs, 1997).

My study also examined the association between physical activity and other health risk behaviours. The results of the logistic regression analyses show that regular physical activity was positively associated with non-smoking behaviour (P=0.007, OR=1.6) and not want to use drugs or alcohol (P=0.004, OR=1.9). Also, regular physical activity was positively associated with lower BMI (P<0.001), brushing teeth daily (P=0.003), not engaged in physical fights (P=0.014, OR=0.7), never or rarely feeling lonely (P=0.024, OR=1.4) and being taught about the benefits of physical activity (P<0.001, OR=1.5) . These important findings are consistent with some previous investigations. It has been found that physical activity among adolescents was associated with less likely to engage in risky behaviours, such as cigarette smoking, drug use, and marijuana use than non-sports participants (Pate, 2000; Pate et al., 1996). Consistently, a strong association between participation in sports and to be resistant to drug and alcohol addiction has been demonstrated (Kirkcaldy et al., 2002). Study among adolescents in Saudi Arabia found significant associations between smoking and low physical activity (Al-Rukban, 2005). Physical activity can be seen as protective factor, but controlled experimental studies examining the effect of increased participation in physical activity on smoking behaviours would be appropriate and worthwhile. There is no available information about the effects of physical activity interventions on smoking behaviours among adolescents in Saudi Arabia.

A previous study also supports the finding that physical activity is associated with adolescents' body weight (Al-Rukban, 2003; Janssen et al., 2004). This finding supports the hypothesis that physical inactivity is implicated in causing overweight and obesity, as there was a trend for increased BMI with decreasing physical activity participation among adolescents. This suggests that if the high prevalence rates of

overweight and obesity among adolescents in Saudi Arabia are to be decreased, physical activity and education interventions may play a fundamental role.

Another interesting finding is the association between students' physical activity and engaging in physical fights. In the regression model, it was found that never engaging in fighting was inversely associated with regular physical activity (P=0.014, OR=0.7). One explanation is that because of the competitive and/or contact of physical activity, such as soccer which is the most common sport among adolescents in Saudi, fighting between adolescents may occur during playing events. In such cases, the pressures that are with physical activity competition may produce high anxiety and aggressive behaviour. Therefore, adolescents who practise physical activity regularly have a greater chance to engage in fighting than non-active adolescents. However, it may also because aggressive individuals are more active, or non-active adolescents may lack the confidence to engage in sport competition that may cause fighting, thus they avoid physical activity. Another possible explanation could be due the insecurity of the adolescents' environment. Future research should investigate fighting and community safety differences in the ways in which the environment is associated with physical activity.

One more interesting finding is the positive associations that it was found between not feeling lonely and regular physical activity. The majority of adolescents who reported feeling lonely showed low levels of physical activity. Causal relation cannot be established using this type of data. However, it has been detected that physical activity and mental health such as self-esteem, emotional well-being were associated (Calfas and Tayper 1994; Steptoe and Butler 1996; Brosnahan et al., 2004). A review study concluded that physical activity can have positive effects for mental health (Mutrie and Parfitt, 1998). Physical activities may also improve children's quality of life (Jirojanakul et al., 2003). However, it might be that adolescents who feel lonely do not practise physical activity due to their personal difficulties or they have no friends to encourage them to practise physical activity, which further emphasises the role of peers on adolescents' physical activity behaviour. Another suggestion is that adolescents who practice physical activity make friends; therefore, they do not feel lonely. Physical activity may help adolescents to make friends and engage in active social life. It is been reported that peer relationships offer important opportunities for companionship and recreation (Bukowski et al., 1994) and may set

and create the occasion and opportunities to be physically active. Adolescents who report greater presence of peers in their lives report engaging in greater physical activity (Beets et al., 2006; Salvy et al., 2008; Salvy et al., 2009).

The associations between physical activity and other adolescents' health and school issues were also investigated in this study. This study found that regular physical activity (3 times or more per week) was negatively associated with poor general health (P=0.030, OR=0.4) and not liking school (P=0.005, OR=0.7). Consistent to this finding, it has been found that physical exercise was further significantly related to scores for physical and psychological well-being (Kirkcadly et al., 2002). Also, adolescents who exercised regularly also reported better psychological well being, self-perceived health and self-perceived fitness (Piko, 2000; Piko and Keresztes, 2006). Adolescents who engaged regularly in physical activity were characterised by lower anxiety-depression scores (Kirkcaldy et al., 2002). On the other hand, I found that there was no association between physical activity level and school performance, although such an association was found with liking school. However, it is been reported that the relationship between physical activity and cognitive or academic performance is unclear (Mutrie and Parfitt, 1998). Another study showed no effects of a health-related physical education programme on academic achievement (Sallis et al., 1999). On the other hand, it has been reported that physical activity has beneficial influences on behaviour and cognitive functioning that may result in improving students' academic achievement (Tomporowski 2003; Coe et al., 2006). Population representative data from children and adolescents in the United States (Nelson and Gordon-Larson, 2006) and Australia (Dwyer et al., 2001), observed significant positive association between physical activity behaviour and academic performance. Physical inactivity is likely to contribute to poor health status in Saudi Arabian adolescents.

This study is the first in Riyadh to investigate adolescents' physical activity behaviour in schools. Unfortunately, among all schools that I visited there were no school sport gymnasiums or proper sport fields and this study found that there is an only one physical sport class in all schools. However, only 65.2% participated in physical activity class regularly in schools. An association was found between taking part in practising physical activity in school and practising physical activity for 3 days and more per week, since about 80% of the active students participated in sport class

in schools. This study also found significant associations between being taught in school about benefit of physical activity and preventing injury during physical activity and physical activity among students. Not having been taught in school about the benefits of physical activity and about preventing injuries during physical activity were significantly reported more by the adolescents who were not active in this study. Participation in school physical activity sport class was found to be inversely associated with adolescents' age. A similar result was found among adolescents in the US (Gorden-Larsen et al., 2000). This study also found that engaging in physical activity in school is significantly associated with regular physical activity out of school and with adolescents' BMI. The finding of this study suggests that active adolescents in school are those who also active out of school. I also found that overweight students participate less in physical activity classes in schools. Possible explanation is that overweight adolescents are inactive in general or do not like sports. Another explanation is that overweight adolescents may avoid weight criticism by other students in the same class. It has been found that weight criticism was associated with reduced physical activity level (Faith et al., 2002). It is important to consider overweight children and adolescents' needs for confidence and respect. Therefore, it may be vital that sport classes in school address different types of physical activity and not only competitive sport such as football. Moreover, creating a secure private area for overweight students to practice physical activity in school might help to encourage overweight adolescents to participate. Low physical activity participation among adolescents in schools may suggest that the physical activity class in Saudi schools is not effective.

It has been reported that the primary mechanism for overweight and obesity is imbalance between energy intake and expenditure (Currie et al., 2008, Jansen et al., 2004). One side of this equation is excess sedentary behaviour which contributes to energy expenditure (WHO, 2005), since time spent in sedentary activities may reduces daily energy expenditure. This study was the first in Saudi Arabia to estimate (part of) sedentary behaviours among adolescents and their association to students' BMI. This study found that a high percentage (46.1%) of the participants watch television (including video, DVD or playing games) for 4 hours or more, a level twice more than recommended by the American Academy of Paediatrics (2001). This finding was consistent with findings from western countries. Prevalence estimates from European

countries suggest that approximately 28% and 49.9% of boys aged 15 years watch TV for 4 hours or more during weekdays and weekends, respectively (Currie et al, 2004).

Watching television and videos may affect the overall energy balance through its association with eating more and increased energy intake, thus contributing to increase in BMI. This study, however, found no associations between sedentary activity and physical activity among Saudi adolescents. The findings from this study are supported by findings from surveys across European countries, since it has been reported that in most countries and regions, there are no significant associations between physical activity and sedentary behaviour for boys (Currie et al, 2004). That may be because recommended physical activity is 60 minutes on most week days which is not really time consuming, and students may spend hours on sedentary behaviour but find some time for some physical activity. My study finding is consistent with other finding from survey in Europe countries, which do not support the view that high levels of sedentary behaviour are directly linked to low levels of physical activity; therefore imply that reducing hours spent in front of the television may not have a substantial impact on energy expenditure (Currie et al., 2004).

7.6.2 Physical activity behaviours' summary and implication

The results of this study provide evidence that physical activity behaviour is low among adolescents in Saudi Arabia and associated with several other important health behaviours, which may suggest that involving adolescents in an active lifestyle may reduce the likelihood that they will engage in health-risk behaviours. Many adolescents may make the choice to be sedentary rather than physically active. Research is needed to develop a better understanding of factors associated with children's choice of physical activity. Future research on what helps and what hinders physical activity among Saudi Arabian adolescents in order to plan effective interventions that are likely to make changes to activity levels and to identify risk factors are needed. A greater understanding of the social context in relation to children and adolescents' physical activity behaviour and motivation, particularly among those overweight, could be informative for the policy makers and for the design of effective physical activity intervention programmes.

Because high numbers of children and adolescents attend school and spend a lot of their time school, school can play a significant role in increasing their physical activity levels. School-based physical education may have many benefits, including increasing physical activity and improving physical fitness. Physical education classes provide an opportunity for students to be physically active during the school day. Consequently, research is needed on the role of physical activity in schools. Improving the school physical education programs can play a pivotal role in increasing physical activity levels of children and adolescents. Increasing physical activity through adding more physical education classes could be a public health strategy to reduce childhood obesity.

Adolescents reported high levels of television watching. Therefore, watching television is a significant part of adolescents' leisure time. Therefore, well designed TV health education messages regarding healthy lifestyle and health related behaviours could be effective and valuable. Moreover, further research investigating adolescents' attitude and behaviours regarding types of programmes and Internet use would be interesting and may be appropriate to generate information regarding the associations between sedentary behaviours, health behaviours and their associated outcomes.

The findings of my research suggest that much work is needed to increase levels of physical activity. Policy and programmes should bear in mind the key barriers to participation and the available evidence. Any efforts to improve levels of physical activity among young people should take into account the barriers to and facilitators of participation that they themselves have identified (for example, improving the environment, emphasizing the social aspects of sport and increase and improve the choice of physical). In addition, policy-makers should place more emphasis on wider societal challenges, such as the availability of facilities.

Findings from my study also suggest that there is a need to establish safe places for children and adolescent to enjoy and practise physical activity and socialize within their community. Participation in recreational activities may contribute to improving the level physical activity and life quality of adolescents. Participating in sports, joining clubs or groups, and taking art lessons are examples of ways in which young people can participate in their community, learn new skills, and socialize more. In

addition, adolescents' involvement in cultural and recreational activities can protect them from emotional and social problems and may offer valuable settings to deliver health education messages. Recreation can also have a positive effect on adolescents' psychological status. Boredom can be viewed as an important factor, particularly in adolescents' lives, because of its possible links to engage to risk behaviours.

Myths about physical activity should be explained to adolescents, such as physical activity takes too much time or physically active is expensive. It only takes 30-60 minutes five days a week to improve and maintain individual health and physical activity can be done almost anywhere and does not necessarily require equipment.

In conclusion, the results of the present study indicate that physical activity is very low among adolescents. Physical activity, community facilities and recreation programmes should receive attention at a national level. It also has been found that low levels of physical activity are associated with several other important negative health behaviours in Saudi Arabian high school students. Improving the school physical education programs can play a fundamental role in increasing physical activity levels of children and adolescents. Increasing physical activity through physical education also could be a public health strategy to reduce childhood obesity. Policy makers, families and community should consider that positive experiences with physical activity at a young age can help lay the foundations for being regularly active throughout life.

7.7 Smoking behaviours

Smoking is a major public health problem. It is a cause of major concern among countries worldwide. Smoking is an important cause of global mortality. It has been estimated that in 2000, 4.83 million premature deaths in the world were related to smoking; 2.41million in developing countries and 2.43 million in industrialised countries (Ezzati and Lopez, 2003). It has been reported that more than 1 in every 10 cardiovascular deaths in the world was attributable to smoking (Ezzati et al., 2005). In the developing world tobacco poses a major challenge, not just to health, but also to social and economic development and to environmental sustainability (The International Development Research Center, 1995).

It has been revealed that young smokers are more likely to develop respiratory illness and face co-morbidity issues (British Medical Association, 2007), and youth who become regular smokers and continue smoking in adulthood are more likely to develop cancer and cardiovascular disease (Ash UK, 2009). Also, it has been reported that smoking reduces life expectancy, increases overall medical costs and contributes to loss of productivity during the lifespan of an individual (Bronnum and Juel, 2001). In a community based study, during a five year period between 1995 and 2000 in Saudi Arabia, the overall prevalence of coronary artery disease (CAD) was 6.6% among adult male, and cigarette smoking was shown to be significantly associated with coronary artery disease among Saudi subjects age group of 30-70 years (Al-Nozha et al., 2004). Moreover, lung cancer, a smoking-related disease, was found to be a leading cause of cancer deaths among Saudi males (Al-Tamimi et al., 1996). Therefore, tobacco smoking is an important public health problem worldwide and in Saudi Arabia, particularly among men and that may be due to the gender inequality since male is more dominant and powerful in Saudi society and smoking is more acceptable among male than female in Saudi Arabia.

In this survey study, it was found that smoking among adolescent students in Riyadh city is occurring at an alarming rate and poses a high-risk problem. The total prevalence of current smokers among adolescent male high school students was 20.8%. This is worrisome since more than one out of five adolescents' students in Riyadh is a smoker. My study is consistent with a previous study in Saudi Arabia. It has been found that the prevalence of smoking among high school male students in

Riyadh was 21.8% (Felimban and Jarallah, 1994). Similarly, another study found that 20% of high school students were current smokers (Al-Yousaf and Karim, 2001). On the other hand, data from a study in different regions in Saudi Arabia, found that the prevalence of smoking among male high school students (15-25 years of age) was 29.8% (Al-Damegh et al., 2004). Higher smoking prevalence was reported from other studies among males 12 years and over (smoking prevalence of 34.4%) and among 15 years and over (smoking prevalence of 25.3%), (Saeed et al., 1996; Siddiqui et al., 2001). The difference in smoking prevalence reported among adolescents in some studies may be attributed to the different methodological approach, sample size and date of collecting the data. My study, had the highest sample size, comprehensive sampling (private and public school, different district, all high school levels), better designed methodological protocol, and it is the most recent. However, there is no nationwide study on the prevalence that tobacco smoking in Saudi Arabia. The smoking prevalence among different subgroups may vary among countries or even among different cities in same country, and it also depends on the age group of the sample surveyed and study methods. In neighbour countries, in the United Arab Emirates, Bahrain and Yemen, the prevalence of smoking was reported to be 19%, 25.8% and 21.9% among male high school students, respectively (Bener and Al-ketbi, 1999; Al-Hadad et al., 2003; Bawazeer et al., 1999). In the United States, the prevalence of current cigarette use increased from 27.5% in 1991 to 36.4% in 1997, declined to 21.9% in 2003, and stayed stable from 2003 to 2007 (CDC, 2008). In Canada the current smoking rate among youth aged 15-19 years was 15% (Health Canada, 2008). Data from HBSC project in 2001/2002, found that among male students (15–16- year olds), Sweden had the lowest prevalence of daily smokers with 9.6%, and Finland had the highest prevalence with 22.8% (Schnohr et al., 2009). In addition, data from HSBC in 2005/06, found that 7% (Canada, United States) to 37% (Greenland) among 15 years old were regular smokers (Currie et al., 2008).

In the chi-square analyses, I found that smoking was significantly associated with age and type of school. Smoking was more among adolescents whose fathers had low education and/or their mothers had high education. Smoking is a complex health problem and many interlinked factors, such as social, environmental and behavioural factors affect the smoking status of adolescents. Since these factors could also have inter-item associations, using a logistic regression model could reveal significant risk

factors for smoking. The use of the logistic regression models in the analysis allowed for adjustment of other potential risk factors. In the multivariate analyses, the first model investigating the independent association between smoking behaviours and students' background reveals that current smoking was positively associated with students' age (P<0.001, OR=1.7), and negatively associated with public school (P=0.006, 0.7), and mothers' low education (P=0.048, OR=0.7). Overall, living district was not associated with smoking status but living in the north and south district were associated with smoking status comparing to reference group. However, mothers' education was not found to be consistently and independently associated with smoking, unlike students' age and type of school.

The prevalence of smoking increased as the age increased, and this finding was consistent with previous studies in Saudi Arabia (Al-Damegh et al., 2004; Jarallah et al., 1996). In neighbouring countries, the UAE (Mandil et al., 2007), Bahrain (Al-Haddad and Hamadeh, 2003) and Yemen (Bawazeer et al., 1999), it has been reported that age was also associated with smoking. Also, the results are supported by findings from western countries. For example, in England it has been found that 20% of 15 year olds are regular smokers compared to only 1% of 11 year olds (ONS, 2006). Data from Greece, also, found that the prevalence of regular smoking increased steeply from 1.6% in 7^{th} grade to 31.7% in 12^{th} grade (Francis et al., 2007). In Germany, smoking prevalence was found to rise continuously among males from 7.9% of age 12 to 49.1% of age 17 (Pust et al., 2008). Similarly, in the US smoking rates among high school students (grades 10-12, or ages 15-18) are much higher (19.4%), compared to middle school students (6.8%) (National Youth Smoking Survey, CDC, 2006).While, in Canada, 10.4% of boys and girls aged 15-17 are current smokers, compared to 1.7 % among 10-15 year olds (Youth Smoking Survey, 2005).

In the chi-square analyses, fathers' education level was borderline associated with students' smoking behaviours. Smokers' students were more likely to report their fathers having low education. Consistently, it has been found from study in Saudi that the risk of smoking among adolescents decreased with increasing level of education of fathers (Jarallah et al., 1996). Another study in Saudi Arabia found that current smoking was higher among those who had lower and technical education (Jarallah et al., 1999). Difference in parental education (specifically fathers' education) was found to have a significant effect on attitudes towards smoking. In neighbour countries, in the

United Arab Emirates, it has been found that the highest prevalence of smoking was found among adolescents whose fathers were university graduates (Bener and Al-Ketbi, 1999). In general, the prevalence of smoking can be higher in household with low level of education than in households where the parents have a higher level of education (Pust et al., 2008). Accordingly, it has been found that students whose parents had a lower level of occupation were more likely to smoke (Rapeah et al., 2008). In fact, low level of education and low level of occupation could be seen as indicators for low socioeconomic status. Lower socioeconomic status leads to poorer health and associated with several health risk behaviours (Crone et al., 2003; Geckova et al., 2004; Piko and Fitzpatrick, 2007; Salonna et al., 2008). It has been proved that in lower socio-economic groups more smoking goes on (de Vries, 1995; Pust et al., 2008; Gecova et al., 2002; Gecova et al., 2005). Therefore, there might be a higher probability of social and environmental influence, that adolescents are surrounded not just by smoking parents but also by smoking adults and smoking peers. In fact, the influence of other people who smoke in one's immediate social environment has been well documented in various studies (Holom et al., 2003; LIoyd-Richardson et al., 2002; Ozcan and Ozkan, 2002). Therefore, maintaining a positive and supportive social environment is important for the prevention of adolescent smoking.

Saudi Arabia is a country undergoing a socio-economic transition and the educational level of the women may reflect the social level of the family. Thus, mothers' low level of education in my study may represent a more traditional family. In Saudi, smoking is an accepted behaviour for men more than women. In contrast, educated mothers may reflect what can call 'modern' family (Erbaydar et al., 2005).

However, fathers' and mothers' education and smoking behaviours may have different impact among boys and girls in Saudi Arabia, which suggest the value of also researching this issue among girls in Saudi Arabia because it may have implications for smoking prevention programmes in Saudi Arabia. It has been reported that epidemiological and qualitative research should focus on better understanding of the gender roles (Erbaydar et al., 2005). Socio-economic inequality has been proved to be an important factor to adult health (Kennedy et al., 1998). In addition, there is evidence that social inequalities is associated with adolescents health and risk behaviours (Yorulmaz et al., 2002; Griesbach et al., 2003; Bergman and Scott, 2001; Barrerra et al., 2002; Boyce et al., 2006, Schnohr et al., 2009). Lower socioeconomic

status has also been associated with a higher prevalence of smoking among adolescents (Lowry et al., 1996).

In addition to parents' education and socioeconomic status, parental communication is one of the basic building blocks of the family (Currie et al., 2008). It is been found that a good relationship between adolescents and parents and a good family environment have an important impact on risk reduction and has been shown to be a protective against risk behaviours (Suris et al., 2005, Ary et al., 1999, Resnick et al., 1997, Nelson et al., 1999). Also, family structure appears to be important in the context of adolescent tobacco use, as adolescents living in a single parent family are more likely to be smokers than adolescents in two parent families (Blum et al., 2000; Norton et al., 1998). Low parental monitoring has been found to predict adolescent smoking (Jackson et al., 1998; Cohen et al., 1994). On the other hand, parental anti-smoking attitudes (Griffin et al., 1999; Chassin et al., 1998) and a positive, supportive parent-child relationship (Chassin et al., 1998; Cohen et al., 1994) show to protect against smoking.

The influence of social context around the adolescents with regard to smoking behaviours was investigated in this study. A logistic regression analyses, adjusting for a student's background taking in account father, mother, sibling and peer's smoking were performed. The influence of family members and peers' smoking behaviours on the smoking status of the students was apparent from this study. The parents' and siblings' smoking behaviours were strongly associated with students' current smoking status. Students; current smoking was positively associated with fathers' smoking status (P=0.002, OR=1.7), mothers' smoking status (P=0.031, OR=3.2) and sibling smoking status (P<0.001, OR=2.4). These results are consistent with earlier studies conducted worldwide. In Saudi Arabia, Al-Damegh and his colleague found strong associations between father and brothers' smoking with students' smoking behaviours (Al-Damegh et al., 2004). Also it is been reported by Al-Yousaf and Karim that the influence of presence of smoking in the family was the most important reason for smoking among current smokers (Al-Yousaf and Karim, 2001; Siddiqui et al., 2001). Data from neighbouring countries, the United Arab Emirates and Bahrain, also found the same significant associations (Mandil et al, 2005; Al-Haddad and Hamadeh, 2003). In addition, a study conducted in non-Arabic cultures found similar significant associations between father and sibling smokers with smoking behaviours

(Shamsuddin and Abdul Haris,2000; Naing et al., 2004; Pinilla et al., 2002; Francis et al., 2007; Gecova et al., 2005). Flay et al (1994) reported that the influence of parental smoking on adolescents is the effect on negative outcome expectations about smoking and that smoking parents improve adolescents' perceived approval of smoking (Flay et al., 1994). Another possible explanations for adolescents' smoking include parental and sibling modelling of smoking behaviour and increased access to cigarettes at home. Another interesting finding was the association between students current smoking status and the interaction between fathers' and mothers' smoking behaviours. If the students fathers' and mothers' were not smokers the adolescents were less likely to be smokers (P=0.006, OR=0.1).

In addition, having a smoking friend (peer pressure or peer bonding) has been shown in this study to be significantly linked with smoking among adolescents (P<0.001). Interestingly, the likelihood of smoking increases with the number of peers' smoking. If some friends of the student were smokers the OR was 4.2, but if most of an adolescent's friends were smokers the likelihood increased dramatically (OR= 15.3). The influence of peers' smoking was found in several previous studies in Saudi Arabia (Siddiqui et al., 2001; Al-Yousaf and Karim, 2001; Al-Damegh et al., 2004). In addition, similar results were reported from other countries worldwide (Al-haddad and Hamadeh, 2003; Moody, 1998; Mandil et al., 2007; Bawazeer et al., 1999; Gecova et al., 2005, Naing et al., 2004, Pinilla et al., 2002; Rapeah et al., 2008). Peers also tend to serve as the initial access point for cigarettes (Carvajal et al., 2000). In fact, the influence of friends or peer pressure and family smoking behaviours and other social factors is not surprising; studies have found that smoking among young people is because or at least associated with social, cultural, and environmental factors (While et al., 1996; Hastings et al., 1997, Griesbach et al., 2003). It has been estimated that adolescents spend a third of their waking time with their peers or friends (Brown and Klute, 2003), and adolescents may spend twice as much time with their peers as with their parents (Brown, 2004). Data from HBSC surveillance 2005/2006, found that 10% (Portugal, Luxembourg) to 73% (Greenland) of male adolescents age 15 spend four evenings or more per week with peers (Currie et al., 2008). Evidence from longitudinal studies revealed that adolescents whose friends smoke are more likely to smoke themselves (Cohen et al., 1994; Jackson, et al., 1998; Wang, et al., 1999). It may be debatable, about whether having smoking peers actually encourages a youth to

initiate smoking (influence) or whether adolescents who smoke simply choose friends who are smokers. It has been proposed that peer smoking affects smoking risk via peer pressure, modelling, social reward or approval, or some combination of these or other mechanisms (Rowe et al., 1992). In addition, longitudinal research (MacKinnon, et al., 1991), including one study based on a nationally representative sample of initially non-smoking adolescents (Wang, et al., 1999), has suggested that perceived peer approval of smoking behaviour is predictive of adolescent smoking.

This study found that type of school was associated with smoking behaviours. Adolescent students in private school reported higher prevalence of smoking than students' attending public schools. It is been found that type of school was associated with smoking behaviours among adolescents in Saudi Arabia. Al-Damegh et al (2004) reported that technical and commercial school students had higher level of smoking behaviours. This may be due to lack of supervision by their teachers and a deficiency in administrative powers in the private school sector. In addition, the students may have the notion that because they pay for their education, the private school has no right to administer punitive actions against them. It has been found that smoking prevalence was higher in schools with weak compliance with smoking rules as compared with schools with medium/ strong compliance; the difference was significant (Pinilla et al., 2002).

To my knowledge, my study is the first of its kind to link smoking behaviours with school satisfaction, school performance and self-rated health status in Saudi Arabia. From the chi-square analyses, it was been found that current smoking was strongly associated with poor academic performance ($P<0.001$), disliking school ($P<0.001$) and poor health status ($P<0.001$). The findings from multivariable analyses were fairly consistent with the chi-square analyses. Logistic regression models revealed that current smoking was positively associated with disliking school ($P<0.001$, OR=2.3) and poor health status ($P=0.006$, OR=2.4), but poor school performance was of borderline significant ($P= 0.060$). It has been suggested that poor self-rated health is a strong predictor of subsequent mortality in all subgroups studied, and that self rated health, (Burstrom and Fredlund, 2001), therefore may be a useful outcome measure. Self-rated health has been associated with self-reported doctor-diagnosed illnesses, alcohol intake, exercise and BMI and smoking (Lim et al., 2007), overweight (Jonnalagadda and Diwan, 2005), and symptoms of anxiety and depression

(Gaspar de Matos et al., 2003). A systematic review, Naing et al concluded that smoking status was consistently related to school commitment, school performance, and educational aspirations (Naing et al., 2004). In addition, the adolescents who are less interested in school (Pinilla et al., 2002), and spend less time studying were more likely to smoke (Yorulmaz et al., 2002). Also, it has been reported that adolescents who dislike school drink alcohol and tend to have a smoker as their best friend (Pinilla et al., 2002). Researchers have shown that low or poor academic performance was significantly associated with being smokers (Hu et al., 1998, Shamsuddin and Abdul Haris, 2000, Yorulmaz et al., 2002; Naing et al., 2004, Rapeal et al., 2008).

Research suggests that cigarette smoking can have both acute and long-term effects on cognitive function. It was found among healthy adults that smokers performed poorly on the more cognitively demanding tasks than non smokers (Hill et al., 2003). It has been reported that liking school or school satisfaction is one of the key predictors of health behaviours (Samdal et al., 2000, Rasmussen et al., 2005). In addition, according to a Yale study in Biological Psychiatry, smokers experienced acute impairments of verbal and working memory after smoking cessation, along with chronic decrements in cognitive performance (Jacobsen et al., 2005).

Several studies suggest that smoking has an adverse effect on cognition (Kalmijn et al., 2002 and Richards et al., 2003). Psychomotor speed impairment of smoking-association has been found in previous studies (Friend et al., 2005 and Kalmijn et al., 2002), but others have found an association with adverse effect of smoking on information processing speed (Starr et al., 2006), and verbal memory (Richards et al., 2003). One possible explanation is that students who perform poorly in school may get engaged with other students who are smokers or/and perform poorly in school, and then pick up smoking through peers' influence. Also, there is a possibility that students with low cognition skills adopt poor decisions and make risky choices. However, poor school performance may also predict later smoking. One longitudinal study selected non-smoking adolescents from and followed these adolescents for three years (Wang et al., 1999). It has been found that adolescents with poorer school performance at the start of the study were more likely than their peers to become regular smokers. This finding is very important, especially since it has been documented that health risk behaviours and poor perceived health in adolescence predicted low level of educational in later life (Koivusilta et al., 2003). However,

studies about the association between smoking and school performance, and which cognitive domains are affected by smoking, require further confirmatory investigation.

Social inequalities in adolescent smoking behaviours across five European countries were found (Schnohr et al., 2009), and the study identified academic achievement as a mediator in the association. Therefore, findings from my study as well as from other studies suggest that doing well in school may help to prevent smoking. In the period of high school which actually correlates with adolescence, students may experience pressures not only from their family, but also from schools and school related factors. The important role of school-related factors (academic achievement, school environment, school satisfaction, student's school perception) in adolescence emphasizes the crucial role of the school system (e.g. administrative, policy, school services, school curricula, school principals and teachers) in supporting all students, especially from deprived area and families. It has been suggested that if this is done with a focus on students from lower socio-economic positions, it might help reduce the social inequality in smoking prevalence (Schnohr et al., 2009). Good education needs to include programs to develop positive and successful youth (Flay, 2002), and this need is urgent in Saudi Arabia as the existing education system and schools seem not efficient in helping children and adolescents to adopt healthy lifestyle and proper information.

Smoking behaviour was examined within a general lifestyle context in order to identify other behaviour patterns associated with smoking. It was found that smoking behaviours were associated with skipping breakfast, low physical activity, and poor teeth health status and teeth pain. Consistently, multivariable analyses adjusting for students' background showed that smoking is clustered with several risk behaviours; it was independently associated positively with less physical activity, a desire to use drugs and alcohol, carry weapons, physical fighting and being abuse by teachers in school, and associated negatively with being bullied. These findings were supported by previous literature worldwide. For example, smoking behaviours were associated with skipping breakfast and low physical activity (less than 3 times a week) among adolescents (Cohen et al., 2003). In addition, Lytle and others found that smoking behaviours, poor food choices and lower activity patterns cluster (Lytle et al., 1995). Also, it was found smoking was significantly related to unsafe drinking (odds ratio 2.38) and higher fat intake (Burke et al., 1997). In addition, other findings showed that

smokers had significantly poorer health-related quality of life than those who had never smoked, and were more likely to drink heavily, to binge drink, and report depressive and anxiety symptoms. It has been reported that current smokers were significantly more likely be physically inactive, to report frequent sleep impairment, to report frequent pain, and to eat less than five servings of fruits and vegetables per day with compare to those who never smoked (Strine et al., 2005). The U.S. Surgeon General's Report Preventing Tobacco Use among Young People found that youth who smoke were more likely to drink alcohol, get into fights, carry weapons, attempt suicide and engage in high-risk sexual behaviours, and they were less likely to wear seatbelts (US Department of Health and Human Services, 1994). Yorulmaz and others found that smoking behaviour was associated with high fast food consumption, eating less vegetables and irregular breakfasting. (Yorulmaz et al., 2002). A study among adolescents in United States revealed that smoking was associated with marijuana use, binge drinking, and fighting among adolescent males and females (Escobedo et al., 1997); additionally, cigarette smoking was associated with using smokeless tobacco, having multiple sexual partners, and not using bicycle helmets and carrying weapons. Similarly, findings showed that students who used tobacco also engaged in other substance use, intentional injury behaviours, and sexual risk behaviours (Everett et al., 2000). Data from Hungary found that the likelihood of smoking was significantly higher among students who rarely or never used a seatbelt when riding in a car driven by someone else, currently used alcohol, had engaged in episodic heavy drinking, had more sex partners during their life time, did not participate in vigorous physical activity.

Reasons for smoking among adolescents were investigated among participants in this study. In general, peer smoking (peer influence) was considered by adolescents in this study as the main reason for smoking, followed by parent smoking, and sibling smoking. Family problem or stress and family neglect were reported respectively by 32.5% and 31.9% of the students as reasons for smoking. It was found in another study that the reasons for smoking among Malaysian adolescents were friends' pressure, feeling of maturation, enjoyment, following parents, relaxation in free time, and feeling the smoking is the normal behaviour of a man (Naing et al., 2004). Also, it has been found among adolescents in the United Arab Emirates that stress was the most important factor for smoking (Bener and Al-Ketbi, 1999). The reasons that smokers'

university students in Jordan reported for starting smoking were pleasure, followed by stress and curiosity (Haddad and Malak, 2002). However, the reasons for tobacco use among adolescents are vast and complex, it relates to the behaviour, attitudes, and expectations of parents, peers, and broader society (Tyas and Pederson, 1999). Interpersonal factors, such as low-esteem, externalized behaviour problems (e.g., anxiety, depression), and exposure to trauma or abuse, also contribute to adolescents' smoking behaviours (Verduykt, 2002).

Smoking was relatively prevalent among adolescents in my study, even though the students seemed have a relatively high level of knowledge about the harmful effects of smoking. The majority (83%) of students reported that they had been taught about the harm effect of smoking. Parent's role in discussing the negative effect of smoking was low, since only 57% reported that their parents discuss smoking issue with them. The parents' and school's role in health education regarding smoking were investigated among smokers and non-smokers. Parents of the smoking students were significantly more likely to discuss smoking issues with their sons. The majority of the students (95%) believed that smoking is harmful to health, and there was no significant difference between smokers and non smokers. In spite of the fact that students were knowledgeable about the harmful effects of cigarette smoking, a considerable percentage of them were smokers. This suggests that information is not sufficient or persuasive to prevent adolescents from smoking. The social benefits of smoking may be more important than avoiding the risk of smoking. Another explanation is that although children may know about the dangers of smoking in general terms but they may not aware of the severe effects of smoking on their health. These findings confirm the results of other studies (Poureslami, 2003). However, this finding may raise the issue of the effectiveness of health education and intervention programmes in Saudi Arabia. Good news from this study is that the majority of smokers want to give up smoking, but only 42% think they are able to stop smoking.

Findings from this study indicate that a positive attitude toward smoking is associated with smoking status. A similar finding was also reported by many researchers (Rapeah et al., 2008, Zhang et al., 2000). However, in this study, smokers were significantly more likely to report that it is not easy to quit smoking and not support banning smoking in public places. In this study the majority of the participants recorded that there is no difference between smokers and non-smokers of having

friends, followed by the belief that smokers students have more friends, and only the least number of the students reported that smokers students have less friends. There is a significant difference between smokers and non smokers with regard to the number of friends that the smokers have. Non-smokers have negative attitude regarding smoking, whereas smokers have less negative attitude regarding smoking behaviours. In addition, the majority (55%) of the participants in this study believed that smoking helps to lose weight, followed by the belief that smoking does not make one gain or lose weight. Also, smokers significantly have a positive attitude regarding the positive influence of smoking in losing weight or preventing weight gain. Several longitudinal studies have suggested that attitudes and beliefs regarding smoking are important predictors of tobacco use in adolescence. For example, it has been reported that adolescents with more positive attitudes towards smokers (Dinh et al., 1995) are more likely to initiate a smoking habit. In addition, positive perceptions of smokers (e.g., having more friend, help to lose weight, healthy, cool, good-looking, independent) and negative perceptions of non-smokers among European-American sample of 1,663 children in the 5th and 7th grades predicted subsequent smoking in the 9th grade (Dinh et al., 1995). A general negative attitude toward smoking has also been associated with an increased likelihood of smoking cessation among a sample of adolescent smokers in the Netherlands (Engels et al., 1998). There is evidence that the perception of health hazards of smoking differ between smokers and non-smokers (Naing et al., 2004; Poureslami, 2003). In addition, if adolescents think they are less vulnerable to smoking-related health risks, then they have a higher probability of starting to smoke (Kropp and Halpern-Felsher, 2004). An understanding of children's perceptions of health is an important basis not only for the interpretation of results of studies, but also for the development of health education initiatives appropriate to children's and adolescents' concepts. In a similar way, it is important for those involved with anti-smoking initiatives to gain an understanding of children's perceptions of smokers and non-smokers.

Unfortunately, the majority of the adolescents in this study (89%) reported never or rarely had seen anti smoking messages in the media during the last 30 days preceding the survey. Also, the majority of adolescents (83%) reported never or rarely having seen anti smoking messages in public places. In addition, the majority of the students (89%) stated they need health education and prevention programmes

regarding smoking. These findings indicate the need of information for adolescents regarding smoking and the lack of provided programs. In addition, it can be an indicator of the weakness of school role, community, governmental and non-governmental agencies to educate adolescents about smoking issues. A comprehensive educational curriculum should be designed to emphasize the real serious health and social problems of smoking. It is also to stress that smoking cigarettes does not make them look like adults (Poureslami, 2003). Effective and sufficient media programmes and messages should be developed and advocate properly for the public.

7.7.1 Smoking behaviours' summary and implications

This part of the study was designed to assess smoking behaviours, knowledge, attitudes, and other factors and risk behaviours associated to smoking behaviours among high school students in Riyadh Saudi Arabia. Findings from this study contribute to the field of adolescents' health and public health in general in Saudi Arabia. Therefore, if used by policy makers, health professionals and educators, it would help them to understand the smoking behaviours situation among adolescents and to identify the most important factors (including social, cultural, personal, etc), and the interaction of smoking behaviours with other risk behaviours affecting adolescents.

I conclude that smoking behaviours are associated with several risk behaviours and socio-demographic variables. Findings suggest that programs designed to prevent smoking should consider related health-risk behaviours as part of a comprehensive program (Easton and Kiss, 2005). Understanding how health behaviours cluster is important because changing single harmful behaviour may help changing other behaviours since as it has been mentioned several times through this thesis that the risk behaviours are usually co-occur together. Therefore, as has been suggested by other researchers (Butterfield et al., 2004, Kaczynski et al., 2008, Easton and Kiss, 2005), health intervention programmes should target multiple related health-risk behaviours.

Smoking prevention programmes have been given a high priority in World Health Organization (WHO) policies. Although Saudi is suffering from a smoking epidemic, there is insufficient scientific literature on the health hazard and health services cost of related diseases. Consequently, studying the spread and pattern of

tobacco use among the population is crucial for the proper design of health policy and strategy in any country. Additional insight into the smoking epidemic can be obtained from studying specific subgroups of interest within the population, such as adolescents, women, etc.

Smoking prevalence among adolescents is high. Short and long term solutions to the problem are needed. Findings of this study reveal that that smoking is a complex health problem and has several associated factors and cluster with several health risk behaviours. The results illustrate the need for effective tobacco prevention and control policy in Saudi Arabia. No doubt there is an urgent need to promote multidisciplinary health promotion activities at different age groups and in different settings to prevent smoking behaviours, among children and adolescents in particular, and to help give up smoking among smokers. Smoking prevention programmes or campaigns among children and adolescents should also focus on adults within their homes (e.g. parents, siblings), and we support the importance of smoking prevention for young people to include a family component (Komro et al., 2003, Geckova et al., 2005). An effective early intervention program can be important chance in which adolescents can develop the skills and make the decisions which help them to resist and refrain from smoking. A school-based educational programme could be a very important strategy to prevent smoking in adolescence. It is important for the effective programme to be systematic and scientifically based and delivered by trained people. Educational material should be appropriate and designed to meet children and adolescents' needs. The findings of this study also support the availability of prevention programmes for adolescents from different SES and broader prevention efforts to meet the needs of high-risk youths (Geckova et al., 2005), such as out of school adolescents, deprived areas, and low academic status. Restricting access to tobacco products can play a vital role in smoking prevention; reduced availability may lessen usage or prevent smoking among regular or heavier smokers; studies have shown that exposure to cigarette advertising is predictive of smoking among youth (Evans et al., 1995). Because the effects of several factors such as personal, socio-economic, society and environmental factors on smoking behaviours is critical further detailed investigation and research among all subgroups in the country would be needed. Prior to any further survey research, it may be important that smoking categories and definitions be standardised across the country, which would facilitate easier and more meaningful comparisons. Restriction

on the sale of tobacco to minors has been identified as an important strategy to prevent the establishment of smoking behaviours among adolescents. There is an urgent need for public health efforts for regulation of tobacco companies marketing their products to children and adolescents. A solution to the problem also calls for more governmental and public awareness of the need for effective plan and action. In addition, qualitative research in this area is useful and may help to understand and clarify the real situation of smoking behaviours in Saudi Arabia, which is crucial for smoking policies and intervention programmes. Full political, professional and technical support should be provided to facilitate implementation of those recommendations.

The price of tobacco products could be one of the main causes of the problem. Tobacco products, mainly cigarettes, are still relatively cheap compared with the price of cigarettes in other country. Although not measured in this study, low price of cigarettes could be an important factor associated with smoking behaviours (e.g. refrain from smoking, quit, or decrease cigarette consumption) among adolescents. It has been found that financial consideration was not an important factor to be associated with smoking in Saudi Arabia (Saeed et al., 1996), and this is probably due to the very low cost of cigarettes in Saudi Arabia which is about less than 1 sterling pound for a pack of 20 cigarettes, whereas it costs about 5 sterling pounds in the UK. Therefore, they are easily accessible to adolescents, even those with limited spending power.

A possible strategy for reducing smoking would be to implement higher taxes to raise the price of tobacco products. Such actions would probably lead, as shown in other countries, to a decrease in tobacco consumption and to an increase in the population's health status (Vardavas and Kafatos, 2006). Ross and colleagues investigated the differential effects of cigarette prices, clean indoor air laws, and youth access laws on smoking uptake among US high school students (Ross et al., 2006), they found that seller compliance with youth access laws reduced the probability of youth being in higher stages of smoking uptake. Additionally, it has been found that the impact of compliance was greater for those who were in later stages of uptake.

Interventions that are multi-component in nature and with active and ongoing enforcement are the most successful (Richardson et al., 2009). In a systematic review

which aims to examine the existing evidence on the smoking related effectiveness of interventions that are designed for young people, Richardson and colleague suggest that when access interventions are implemented in a comprehensive manner, they can decrease the illegal sale of tobacco to young people. Findings from the review revealed that combined, successive retail inspections, public prosecutions and awareness of minimum age restrictions decrease illegal sales of tobacco (Richardson et al., 2009).

Rasch and Greiner in their review, conclude that according to the available evidence, they assume that smoking prevention in adolescents is cost-effective (Rasch and Greiner, 2008). In another review, the findings make it clear that effective school-based smoking prevention programmes exist, therefore can be adopted, adapted and deployed with success (Flay, 2009), and the author suggests that school districts and communities should implement and invest only in these research-proven programs and avoid spending money on programmes where there is little or no prior evidence of programme effectiveness. Adolescents may not know and understand the real nature of smoking addictions and more importantly may not be fully aware or may underestimate the negative health consequences.

It seems reasonable to assume, given the large sample size, the high response rate and the use of primarily validated questions in this presented study, that it has accurately estimated the smoking prevalence among adolescents in high school in Riyadh, Saudi Arabia. One of the main advantages of this study is the large sample of more than 1500 adolescents at 10 schools, which were selected from the public and private schools and from different five districts. Small samples have sometimes been used in studies in this area, but the advantage of a larger sample is that it allows use of large statistical models that include many relevant variables. Also, this study is original in Saudi Arabia since it investigated the interaction of smoking behaviours with several risk behaviours.

In my study the majority of smokers start smoking between 14 and 15 years old. Since the majority of smokers start smoking and smoked their first cigarette in their teens, it would be logical to make cigarette difficult for children and adolescents to obtain, which could be helpful in reducing the probability that they would adopt this behaviours. There are some essential elements of smoking prevention intervention;

these include (Torre at al., 2005): (1) information about social influences including media, peer, family members; (2) information about short-term physiological effects of tobacco use; (3) training in refusal skills. The CDC guidelines offer the following seven strategies that are effective in preventing tobacco use among adolescents:

1. Develop and enforce a school policy on tobacco use
2. Provide instruction about the short and long term negative physiological and social consequences of tobacco use, social influences on tobacco use, peer norms regarding tobacco use, and refusal skills
3. Provide tobacco-use prevention education in kindergarten through 12^{th} grade
4. Provide programme-specific training for teachers
5. Involve parents of families in supporting school-based programme to prevent tobacco use
6. Support cessation efforts among students and all school staff who use tobacco
7. Assess the tobacco-use prevention programme at regular interval

The involvement of governmental and non-governmental organization, social and community efforts and coordination between them appears to be fundamental in smoking prevention programme and beating smoking among adolescents and individuals in the communities. There is a need for further research on a large scale in Saudi Arabia to measures the prevalence of smoking among different population groups. Neighbourhood, community, schools and low SES areas deserve further research and more attention. Moreover, there are several areas relevant to adolescent smoking behaviour that will require further in-depth investigation such as reasons for smoking and smoking cessation. Also, there is a need to develop comprehensive multi-disciplinary prevention and intervention programmes and it should target everybody in the community. Smoking cessation clinics should be promoted in the community and schools.

7.8 Injuries and violence behaviours

Results from the 2007 national Youth Risk Behaviour Survey (YRBS) indicated that many high school students engaged in behaviours that increased their likelihood of death from motor vehicle crashes, other unintentional injuries, homicide and suicide (Eaton et al., 2008). Injuries are a leading cause of death for Americans of all ages accounting for more than 161,000 deaths in 2002, in spite of gender, race, or economic status (CDC, 2006). In addition, in 2004, about 29.6 million people were treated for an injury in the US hospital emergency departments (CDC, 2006). It has been reported by WHO international document that participating in physical fights, bullying and carrying of weapons are important risk behaviours for youth violence (Krug et al., 2002). Major public health concerns for adolescents are related to injuries and development of health damaging behaviours (Due et al., 2005).

In my study, I found that the majority of the students (55.5%) have reported being injured during the last 12 months, requires treatment by a nurse or a doctor. These percentages demonstrate that injuries prevalent problem among adolescents in Riyadh. Similarly, data from the HBSC study, in 35 countries, found that the percentage of 15 year old males reporting one or more medically treated injuries within the past 12 months was ranging from 33.4% to 62.9%, with average 50.8% (Pickett et al., 2004). It was reported in United States that 19.1% of male high school students were injured in the past 12 month preceding the survey (Hamming et al., 2001). In my study there was no association between being injured and any of the students' backgrounds factors. However, it has been found worldwide that low socioeconomic status was associated with injuries (Haynes et al., 2003; Reading et al., 1999, Pickett et al., 2005, Simpson et al., 2005). There is a need for studies of injuries and violence among all populations especially among adolescents, taking in account social factors such as SES to clarify social inequalities in violence and injury behaviours.

My study found that about 21.8% of the adolescents reported that they had been threatened or injured by weapons in the past 12 months. In United States, during the 12 months before the survey, 10.2% of male students had been threatened or injured with a weapon on school property one or more times in school (Eaton et al., 2008). I also found that students' age, low fathers' educations and living district were

associated with weapons threatened or injuries. Older students were more likely than any age group to be threatened or injured by weapons, and this might be because older students are more likely to carry weapons and be involved in physical fighting. Students whose their fathers have low education level were more likely to be threatened or injured. Students living in the north district of the city were less likely to report having been threatened or injured by weapons, whereas students living in the east district of the city were more likely to report having been threatened by weapons. It is worth noting that the highest of parents with more than 12 years of education was found to be living in north and the lowest in the east district. Thus, SES and social inequality could be an explanation for this relationship. Other explanations could be due the high prevalence of carrying weapons and physical fighting among students living in the east district. Further research is needed, and should examine the relationship between various socioeconomic indicators and violence behaviours in adolescents (Williams et al., 1996).

Although, violence among adolescents has emerged as an important global problem (Rudatsikira et al., 2008 Rudatsikira et al., 2007b; Smith-Khuri et al., 2004), and major concern among public health researchers, violence research is lacking in Saudi Arabia. There is no national scale data or any representative data among any city or subgroup population in Saudi Arabia. In my study, it has been found that 49% of the adolescents have reported they were involved in physical fight one or more time during the last 12 months preceding the survey. Consistently, a high prevalence of physical fighting among adolescents was also reported in several countries. Recent estimates, in 2007, from the Youth Risk Behaviour Survey in US indicate that 44.4% of male adolescents' students in grade 9-12 had been in a physical fighting within the preceding 12 months of the survey (Eaton et al., 2008). Similarly, secondary analysis of data from HBSC study in five countries (Ireland, Israel, Portugal, Sweden, and the United States) found that 40.3% had been in a physical fight during the past 12 months preceding the survey (Smith-Khuri et al., 2004), and in another developing country (Namibia) it was reported that 55.2% of male students reported having been in a physical fight in the past 12 months (Rudatsikira et al., 2007b). The differences may reflect the cultural, social and age differences between countries. In contrast to what has been found in HBSC, where physical fighting found to be decrease with age, older students were more likely to be engaged in physical fight than younger students in

Saudi Arabia (Smith-Khuri et al., 2004). In my multivariable analyses when all background factors were taken into account, only age was found to be independently associated with physical fights. When the interaction of fathers' and mothers' educations was included and tested in the model, the model interestingly revealed that students' whose fathers' and mothers' had ≤ 12 years of education were more likely to engage in physical fight (OR=2.30, p= 0.008). This finding may strongly suggests the role of social inequality of physical fighting behaviours among adolescents. Therefore, future research should examine the relationship between various socioeconomic indicators and physical fighting.

Also, the associations between physical fights and other health related behaviours were investigated in my study. A logistic regression model, adjusting for students' background, illustrates that physical fighting was associated with several health risk behaviours. It has been found that current smoking, being threatened or injured by weapons, carrying weapons, join people who performing car drifting (dangerous driving) and taking part in bullying others were independently associated with physical fights among adolescents in Saudi Arabia ($p < 0.001$ for all associations). The association with being abused by a teacher was found to be of borderline significance (OR=1.3; p=0.060; 95% CI 1.0 – 1.7) in the full model. Fighting was associated with several risk behaviours, and this finding was consistent with existing literature. It has been reported that violent adolescents tend to engage in several risk behaviours such as victimization, substance abuse, and school failure (Farrington and Loeber, 2002). Other data from developing countries, Namibia and Philippines, have found that smoking, drinking alcohol, using drugs and bullying victimization were positively associated with fighting (Rudatsikira et al., 2008, Rudatsikira et al., 2007b). Also, data from Israel, Ireland, United States and Portugal showed that physical fighting was associated with alcohol drinking, current smoking, feeling irritable and having been bullied in all countries in included in the analysis (Smith-Khuri et al., 2004). Fighting behaviour could be one of the earliest and most reliable markers of multiple-risk-behaviour syndrome (Sosin et al., 1995). This clustering of unhealthy risk behaviours suggest that adolescents who are likely to engage in physical fights are also likely to be engaged in other risky behaviours. This clustering of risk behaviours is important to implement comprehensive intervention and health promotion programmes.

Further regression analyses investigating the association between school factors and physical fight, adjusting for students' backgrounds was performed. It was found that physical fight was associated with not liking school and poor school performance and this finding is consistent with findings from other countries. Data from Israel, United States and Sweden showed that fighting was independently associated with disliking school and poor academic achievement (Smith-Khuri et al., 2004). In addition, adolescents exposed to community violence reported increased drug and alcohol use, delinquency and carrying weapons (Glodich and Allen, 1998, Glodich, 1998), substance abuse, mental and physical health problem, and HIV-risk behaviours (Steven et al., 2003; Gore-Feltun and Koopman, 2002).

I found that carrying weapons among adolescents in Riyadh is prevalent. It has been found in this study that 36.5% of the adolescents reported that they had carried weapons on at least 1 day during the last 30 days preceding the survey. Data from US show that the prevalence of carrying weapons among male high school students is 28.5% (Eaton et al., 2008). The chi-square attest and multivariable analyses of my data show that students' age was associated with carrying weapons behaviour. Multiple logistic regression also found that living in the west district of Riyadh was less associated with carrying weapons compare to the reference group (east). Students' living in the east district of Riyadh was more likely to report carrying weapons. This result may reflect social inequality of health-related behaviours in the society, since it found that students' who live in the east district of Riyadh have the highest rate of less educated fathers and mothers ($\leq$ 12 years of education).

Carrying weapons was found to be associated with several risk behaviours. A logistic regression model, adjusting for students background factors, revealed that current smoking, being threatened or injured by weapons, engaging in physical fighting, performing car drifting, join people performing car drifting, taking part in bullying others and having been abused by families were all independently and positively associated with carrying weapons among adolescents. My study confirms previous findings from many countries on the predictors of weapons carrying among adolescents. It has been found that carrying weapons was associated with substance use, depression, having been threatened or injured by weapons, and having been engaged in physical fighting (Mulla et al., 2008), victimization (Rudatsikira et al., 2007a, Sullivan et al., 2006), physical fighting and fighting-related injuries (Lowry et

al., 1998), history of physical abuse (Leeb et al., 2007). In addition, logistic regression model investigating the association between carrying weapons with liking/disliking school, school performance and self-rated health, adjusting for student's backgrounds was performed. Carrying weapons was associated strongly with school-related factors; it has been found that disliking school and poor school performance were independently associated with carrying weapons among adolescents in Riyadh.

7.9 Bullying behaviours

Bullying is one form of violence behaviour and can be a terrifying experience that children and adolescents face in their life. Generally, bullying can be direct (teasing, hitting, threatening, etc) or indirect (exclusion, rumours or manipulation), and can be physical or verbal. It could be a marker for more serious violent behaviours among school and adolescents. In my study, 26.1% of the participants reported being bullied at least once in the last 12 months. Similarly, in Europe, 3% (Hungary, Spain) to 34% (Bulgaria) of 15 year old boys reported having been a victim of bullying at least two times in the past couple of months (Currie et al., 2008). In addition, an estimated 30% of 6th to 10th graders in the United States were either a bully, a target of bullying, or both (Nansel et al. 2001). Being bullied was associated with younger age and home district in my bivariate analysis. Constant with this finding, data from HBSC reported being bullied significantly decline with age (Due et al., 2005; Currie et al., 2008). In the multivariable analyses, it was found that only living district was independently associated with ever having been bullied in the past 12 months preceding the survey. Students living in the south and west districts were more likely to report being bullied. Living district may reflect socioeconomic status or other social and cultural characteristics. It has previously been reported that there is a statistically significant interaction between bullying and adolescents' socioeconomic position (Due et al., 2009a; Due et al., 2009b). Adolescents from families of low affluence reported higher prevalence of being victims of bullying (Due et al., 2009b; Due et al., 2009a). Students who reported being bullied were more likely to have less educated mothers and to have communication problems with parents than others and more likely to have a lower socioeconomic status (Alikasifoglu et al., 2007). Also, it has been reported that adolescents who attend schools and live in countries where socioeconomic differences are larger are at higher risk of being bullied (Due et al., 2009b). It seems likely that Saudi Arabia, as a developing country, lacks research and intervention policies and people may suffer from huge inequalities. Therefore, research investigates social inequalities with regard to violence and bullying is needed to understand the problem and find solutions.

Also, after adjusting for student's backgrounds, it has been found that being bullied by others was associated with several risk behaviours. It was positively

associated with being threatened or injured by weapons, joining others while performing car drifting taking part in bullying others, being abused by family, abused by teacher, feeling unsafe going to school, attempting suicide and associated negatively with current smoking. Similarly, it has been found that bullying victims were less likely to smoke (Liang et al., 2007), and those who have experienced being bullied are associated with poor friendship making and loneliness (Nasel et al., 2001), as well as feeling low, feeling nervous, feeling lonely and several health illness symptoms (Headache, Stomach ache, Back ache, Dizziness, sleeping difficulties) (Due et al., 2005). It has been also found that bullying victims were significantly more likely to feel unsafe at school (Glew et al., 2005). It has been reported that young people who are being bullied become less able to defend themselves (Currie et al., 2008). It is possibly that those students whose relatively weak compare to others students are more likely to be a target for others to bully. In addition, students having social problems at baseline were found to be more likely to become a victim at follow-up; and being a victim at baseline led to increased risk of social problem (Kim et al., 2006). Therefore, having social problems may be both a cause and a consequence of victimization. In my study, being bullied was found to be common among those of younger age, which may increase the risk of becoming a bully and thus be a gateway to physical fighting in future. It has been reported that individuals who are a bully victim may be more likely to be engaged in physical fighting as an attempt to defend themselves (Rudatsikira et al., 2007a), and more likely to carry weapons than those not previously victimized. Due et al. suggest that bullying has not only wide contemporary effects for the victims, but may also have serious long-term effects on health and well-being later in life (Due et al., 2005).

Bullying in childhood and adolescence is harmful to health, well-being and social life of the victim (Due et al., 2009a, Due et al., 2005). Therefore, I examined the association between being bullied with school factors and health status to investigate such associations among adolescents in Saudi Arabia, and my study is the first to investigate this issue. Logistic regression analyses adjusting for background factors showed that poor health status was associated with having been bullied. This finding supported findings from 28 countries in Europe and North America. Due and colleagues found that being bullied was associated with suffering from physical symptoms (headache, stomach ache, backache, dizziness) and psychological

symptoms (bad temper, feeling nervous, feeling low, difficulties in getting to sleep, morning tiredness, feeling left out, loneliness, helplessness) (Due et al., 2005). Any type of bullying at early age may influence health in several ways. It has been suggested that bullying may be an indicator of social exclusion, and social exclusion may result in a lack of social participation and attachment and delayed and possibly weakened development of social competencies (Due et al., 2005), which may harm adolescents' future work and social life. Parents, education and health professionals should be aware of the influence of bullying and particularly on bully victims.

Taking part in bullying others was prevalent among my study participants, since 24.6% of the students reported bullying others in the past 12 months. Chi-square analysis showed that taking part in bullying others was associated with older age among adolescents. In the multivariable analyses, when background factors were taken into account, students' age was not significantly associated with bullying others, but was of borderline close significance (P= 0.080). The multivariable logistic regression analyses showed that among students' background factors, only students whose mother had ≤ 12 years of education were less likely to bully others.

Adjusting for students' background factors, it has been found that bullying others was associated with poor academic performance and disliking school. Poor health status was marginally significant with taking part in bulling others (OR=1.9, P= 0.054, [95%CI] = 1.0-3.2). Students involved in bullying behaviours were more likely to skip class and to spend time with friends than students who were not involved in bullying behaviours (Alikasifoglu et al., 2007).

The association between bullying others and other-health related behaviours were also investigated by multivariable logistic regression analyses, adjusting for students' background factors. Several important findings have emerged from the analyses. Taking part in bullying others was associated with physical fighting, carrying weapons, wanting to use drugs or alcohol, performing car drifting, having been bullied by others, having been abused by a teacher and abused by family. It has been reported that students involved in bullying behaviours were more likely to engage in many risk behaviours, such as not using seat belts, and to be involved in a physical fight than students who were not involved in bullying behaviours (Alikasifoglu et al., 2007).

7.10 Abuse behaviours

Being abused by teachers was prevalent among the participants in this study. I found that 34.4% of the students reported they had been abused by one of their school teachers in the 12 months preceding the survey. It seems that having been abused by teacher is prevalent more among younger adolescents and declines with age. It ranged from 39.3% among ≤ 16 years age and 32% among ≥ 19 ages. Also, it was found that students whose fathers and mothers had ≤ 12 years of education were more likely to be exposed to teacher abuse and the relationships were of borderline significance (p= 0.055 and p= 0.051, respectively). In Egypt, it has been reported that a large proportion of adolescents in high school (79.96%) had physical punishment from their teachers, and teachers were using their hands, sticks, straps, shoes for punishment (Youssef et al., 1998a). The high prevalence of teacher violence (abuse) is worrying, and may raise the argument that there is something wrong with the education system in Saudi Arabia. Since student may see their teachers as a model, teacher abuse may lead students to abuse others. Regardless of the type of abuse or the reasons, teachers should know that harming and abusing students cannot be justified. Teachers should learn more about the developmental characteristics that adolescents face and deal with them with care. Teachers should be taught skills to be able to control over their family problems, mood or temper that may influence their behaviours in class and school. They should be equipped with the necessary skills that facilitate adolescents learning and development.

Among the participants in this study, 39.5% reported being abused physically or verbally by family during the 12 months preceding the survey. Only parental education level was associated with being abuse by family. Low fathers' and mothers' education (≤ 12 years) were significantly associated with reporting being bullied by family. In Saudi Arabia, family members (particularly, father, mother and older sibling) may use their power as a method of teaching discipline. In one of the biggest Arabic country, it has been reported in Egypt that 37.4% of middle and high school students had been disciplined physically by parents and 26% had been physically injured as a result of such discipline (Youssef et al., 1998b). In a review by Al-mahroos about child abuse in Arab nations, he found that there was no large scale study regarding child or adolescent abuse in Saudi Arabia, only 11 case study reports was found in Saudi Arabia (Al-mahroos, 2007).

7.11 Mental health related factors

My study is the first to investigate several factors related to adolescents' mental health in Riyadh, Saudi Arabia. Factors related to mental health problem were prevalent among adolescents in my study. During the past 12 months preceding the survey 22.8%, 27.0% and 40% of the students reported feeling lonely, feeling very worried about something that they could not sleep at night sometimes or more, and feeling sad or hopeless almost every day for two weeks or more, respectively. Students' age was positively associated with all those symptoms. Feeling very worried and feeling lonely was strongly associated. Moreover, feeling very sad or hopeless for two weeks or more was strongly associated with having been thoughts of suicide, actual attempting suicide and wanting to use drug or alcohol ($P< 0.001$, for all associations). These findings are important and should be taken seriously in order to improve mental health which will help to improve adolescents' health, life and future. One previous study investigated the prevalence and pattern of depression among high school students in a western city of Saudi Arabia, has revealed that about one third of the sample has moderate to severe depression and about 11% has severe to very severe depression (Asal and Abdel-Fattah, 2007). In addition, the findings conclude and suggest that the experience of a stressful life events increase the risk of depression. Also, in another study among high school adolescents in south-western Saudi Arabia, it has been found that 59.4% had at least one mental health disorders, and more than one third of the participants (38.2%) had depression, while 48.9% had anxiety and 35.5% had stress (Al-Gelban, 2007). In addition, it has been revealed that 8.3% of the surveyed children and adolescents (6-18 years) were emotionally and/or behaviourally disturbed according to parent's reports (Abdel-Fatah et al., 2004). Depression, anxiety and stress were found to be strongly, positively, and significantly correlated (Al-Gelban, 2007). However, understanding the prevalence of psychiatric disorders among children and adolescents is an essential component of a sound public policy for the provision of mental health and other services (Roberts at al., 1998). The increased risk for the onset of depression in adolescents reinforces the importance of early recognition and interventions (Asal and Abdel-Fattah, 2007). Therefore, there is a need to pay more attention to the mental health of adolescent high school boys in Saudi Arabia (Al-Gelban, 2007).

In my study I found that 13.9% of the participants reported that they had thought of attempting suicide and 6.9% had actually attempted suicide. Similarly, the 2009 Youth Risk Behaviour Survey of students in grades 9 through 12 male students in the United States indicated that during the 12 months before the survey 8.6% had planned a suicide attempt, 4.6 had seriously attempted suicide, and 1.6% had made a suicide attempt that required medical attention (Eaton et al., 2010). In general, because of the sensitivity and the stigma around suicide the true numbers of attempting or thinking of suicide could be higher. However, in my study the rate of thinking of suicide and suicide attempting are higher than the rate in United States. However, the sample size of Eaton's study was very large, and the results were from a national survey, 39 state surveys, and 22 local surveys conducted among students in grades 9–12. Also, this rate may reflect the difference between developed countries and developing countries in several perspectives, such as policies and legislation, prevention and promotion efforts, education systems, and public health services. In Saudi Arabia, the issue of suicide is more neglected and the government and community live in a state of denial. For example, I could not find any study investigating suicide behaviours in Saudi Arabia. Moreover, there is no prevention and intervention programme regarding suicide in Saudi Arabia. This lack of research might be the reasons for the lack of policies and intervention programme. In line with that, as this study found, mental health symptoms (feeling very lonely, feeling so worried and feeling sad or hopeless for two weeks or more) were prevalent and high rate of being abused and bullying were also prevalent among adolescents, and all these may contribute to explain the high rates of thinking about and attempting suicide.

In my study, there was no association between actually attempting suicide and students' background factors, also there was no association between thinking of suicide, and students backgrounds factors. Yet, thinking of suicide was positively associated with feeling lonely, feeling very worried and feeling sad or hopeless for two weeks or more ($p< 0.001$ in all cases). Also, actually attempting suicide was highly associated with thinking of suicide, feeling lonely, feeling very worried and feeling hopeless or sad for two weeks or more ($p< 0.001$, in all cases). The relationship between thinking of suicide and attempting suicide and the similar association that found between them and psychological symptoms (e.g. feeling lonely, feeling so worries and feeling hopeless or sad) contribute to support the high level of consistency

of the finding in my study. Unfortunately, no one can accurately predict suicide, so even experts can only determine who is at higher risk (Shain and the Committee on Adolescence, 2007). Borowsky et al. reported some predictors such as a previous suicide attempt, violence victimization, violence perpetration, alcohol use, marijuana use, and school problems (Borowsky et al., 2001). Media coverage of an adolescent's suicide may lead to cluster suicides (Gould et al., 2003). Adolescents seem to be at much greater risk from media exposure than adults and may imitate suicidal behaviour seen on television (Gould et al., 2003).

Immediate interventions that aim to increase the awareness of mental health and equip adolescents with appropriate problem-solving and coping skills are needed, since those who are able to use effective strategies may less likely to become suicidal or violent. The media can play a powerful role in educating the public about suicide prevention. Stories about suicide can inform readers and viewers about the likely causes of suicide, its warning signs, trends in suicide rates, and recent treatment advances. They can also highlight opportunities to prevent suicide. Researchers, public health practitioners, educator, teachers and community health care providers may want to consider designing interventions that aim to promote psychological and mental health status. Such programs could be implemented in a wide range of settings, including schools and community centres. Policies that emphasize the development of mentoring relationships, especially in deprived areas and areas with a high incidence of violence and mental health problems, could be quite beneficial to youth. Population cross-sectional studies on a large scale are needed to measure the prevalence of mental health symptoms and suicide. Also, in depth research is need to investigate the real reasons and risk factors associated with mental health problem and suicide among adolescents in Saudi Arabia.

About 14% of the participants in my study reported that they have wanted to use alcohol or drugs during the past 12 months to feel better, because they had felt worried. Wanting to use drugs or alcohol was significantly associated with higher in age among adolescents in Saudi Arabia. Also, chi-square analyses showed that wanting to use drugs or alcohol was significantly associated with feeling very sad or hopeless for two weeks or more, thought of suicide, being bullied by others, being abused by family, abused by teacher, physical fight, carrying weapons and current smoking, and all had very strong association ($P < 0.001$). In addition from all

multivariable analyses that was performed for the other risk behaviours, I found that wanting to use drugs or alcohol was associated independently with low physical activity, smoking behaviours, carrying weapons, taking part in bullying others and performing car drifting. Wanting to use drugs and alcohol can be seen as a proxy for actual use and may predict future use of drugs and alcohol.

7.12 Dangerous driving and safety behaviours

Car drifting is one of dangerous behaviour among adolescents in Saudi Arabia. My study found that 36.1% of adolescents had performed car drifting. The chi-square analyses showed that car drifting was positively associated with studying in a private school and low fathers' education, and low mothers' education was of borderline significance (p= 0.07). Also, logistic regression analysing the association between performing car drifting with the students' background was performed. In the first model, performing car drifting was associated positively with students' age and inversely with attending a public school. In the second model, fathers, and mothers, educations interaction was included in the model and it showed that student from father and mother who had high education were less likely to perform car drifting and the relationship was close to significant (p= 0.102), and most importantly it improved the model (Hosmer and Lemeshow test p-value jumped from 0.101 to 0.920). In the final model, non-significant values were removed one on a time starting with the highest value. Fathers' and mothers' education interaction became more close to significant (p= 0.098). Overall, car drifting was strongly associated with older age and negatively associated with public school, and weakly and reversely association with students who their fathers' and mothers' had ≥12 years of education.

Similar to other risk behaviour clustering in this study, engagement in performing car drifting was associated with disliking school and poor academic performance. Also, practicing car drifting was associated with several risk behaviours. It has been found to be independently associated with smoking, wanting to use drugs or alcohol, carrying weapons, joining people while performing car drifting, taking part in bullying others, and being abused by family. Data from Italy showed that boys who displayed risky driving behaviours were more likely to engage in antisocial behaviours and smoke (Bina et al., 2006).

In Saudi Arabia the motor vehicle is the main means of transportation. Road traffic accidents are a major health hazard in Saudi Arabia. In this study, driving and safety were investigated among adolescents. It has been found that 78.7% drive vehicles and 96% of students who drive do not use a seat built. In addition, among all participants, 97.7% do not use seat belt when riding in a car as a passenger. Therefore, adolescent car users have a high risk of being injured. Also, among the participants in

this study 55.3% regularly used a motorcycle, but only 2.1% wore a helmet. In addition, in this study 37.1% regularly used a bicycle or other non-motorized vehicle, but among them only 1.4% wore a helmet. These findings indicate that adolescents in Saudi Arabia are engaged in many risk behaviours comparing to other. In United States, during 1999-2007, a significant linear decrease in the percentage of students who rarely or never wore a seat belt (25.9% to 11.1%) and who rarely or never wore a motorcycle helmet (42.9% to 33.9%). Moreover, students' prevalence of who rarely or never wore a bicycle helmet decreased during 1991-2001 (96.2% to 84.7%) but not change significantly during 2001-2007 (84.7% to 85.1%) (Eaton et al., 2008). In Italy, the frequency of self-reported helmet use as a driver of the motorcycle or as the passenger was 34.7% and 33.7% respectively among adolescents (Bianco et al., 2005). An audit of road traffic accidents in Saudi Arabia over a one-year period revealed that, out of 361 victims, 16% were less than 10 years and 47% between 11 and 30 years, and it has been found that none of those involved in accidents was wearing a seat belt (Shanks et al., 1994). In a study aiming to measures seat belt use and its impact on the number of road accident injuries after the first few months of enforcing the seat belt law showed that seat belt use in two Riyadh suburbs was 33% and 87%, respectively. Results also showed that there was a significant drop in certain types of injuries due to traffic accidents after the enactment of the seat belt law (Bendak, 2005). It has been reported that between 1971 and 1997; about 564,762 people died or were injured in car accidents, which is equivalent to 3.5% of the total population in Saudi Arabia, and 66,914 died in Saudi Arabia (Ansari et al., 2000). Moreover, 81% of deaths in Ministry of Health hospitals were due accidents and 20% of public hospital beds are occupied by accidents victims (Ansari et al., 2000). However, the law on use of seat belt is not effectively applied, and the use of a helmet either during motorcycle or non-motorized cycle riding is not legally compulsory in Saudi Arabia. Helmets use may reduce the risk of death and injury and the severity of head injury when a crash occurs. Adolescents may not know or realize the importance and the benefit of wearing helmet. Also, it is been reported that adolescents quit using helmets because they ugly, silly, uncomfortable, or inconvenient (Berg and Westerling, 2001). It is important to establish and increase the understanding that wearing a seat belt or helmet are effective methods for avoiding serious injuries. Strong policies aiming to use influence the use of helmets are needed. In addition, to increase the voluntary use of bicycle

helmets (Berg and Westerling, 2001), or motorcycle helmet among schoolchildren, their knowledge and attitudes must be influenced.

My study also investigated the role of school in equipping students with important information and skills regarding health and safety. It was found that only 49.4% and 42% reported they have been taught about how to prevent or avoid accidents such as fire or poisoning, and motor vehicle accident, respectively, during any of their school years. Only 31.2% and 25.1% reported being taught about how to avoid physical fighting and bullying during any of their school years, respectively. It has been also reported that, only 38.3%, 20.7%, 35.7% and 14.5% had been taught first aid skills, how to handle stress in healthy way, manage anger in healthy way, and about what to do if a friend were thinking of attempting suicide, respectively. These figures may suggest the lack of school service with regard to prevention and health education issues. Moreover, these findings are supported by the finding that the majority of adolescents (80%) in this study reported that they need health education programs to know more about how to avoid or prevent injuries and violence.

During adolescence, risky lifestyles or risk taking is a way of coping with the physical and environmental changes that adolescents undergo (Rolison and Scherman, 2002). This thesis presents a novel analysis of adolescent health-related behaviours in Saudi Arabia. In addition to reaffirming the prevalence of overt health-related behaviours of adolescents in Saudi Arabia, the findings indicate the clustering of several risk behaviours and the importance of socioeconomic factors as possible determinants of health. The high rate of risk behaviours that I found among male adolescent in Saudi Arabia is striking. The prevalence of violence, bullying and injuries are high and the safety behaviours, such as using seat belt, motorcycle and bicycle helmet use among adolescents in Saudi Arabia is alarmingly low. Although, it has been suggested that risk is a central component of the masculine world view (Hirschberger et al., 2002), the prevalence of risk behaviours that I found was striking. The results have implications for adolescent health policy. Adolescent injuries, violence, bullying and safety should be recognized as a major public health issues in Saudi Arabia. Health policy makers responsible for the prevention of adolescent injuries require a solid evidence base and this study identifies vulnerable subgroups and social factors that associated with adolescents' injury, violent, safety and factors associated with mental health. It is useful to advocate safety and healthy behaviours

through health promotion programmes in school setting. The results of this study give insight into the wide range risk behaviours and of factors that associated with injuries, violent behaviours, bullying and safety behaviours. Although, this is not an intervention or prevention study, the results showed several associations between independent factors and outcome variables. Adolescence is a key time for the promotion of a healthy lifestyle, as many behaviour patterns begin to be established. Moreover, a large proportion of the disability and death that does occur during adolescence could be alleviated through effective injury prevention. Although the available research can provide us with some important and useful knowledge to work from today, there is a need for more research to guide and inform policy makers and health behaviour promotion and injury prevention.

There is a lack of research on policies, driving behaviours and accident and related-injuries in Saudi Arabia. This lack of research may be responsible for a lack of policies and lack of intervention programme. It has been noted that although ‘‘most of us want to drive safely,’’ we lack a definition of ‘‘what this implies in actual behaviours’’ (Gregersen and Bjurulf, 1996). I support Hirsch argument that the absence of an authority’s set of safe driving behaviours increases injuries injury risk by hindering the development of effective driving education curricula and driving license evaluations (Hirsch, 2003).

7.13 Injuries, violence, mental health related factors and safety behaviours' summary and Implications

Adolescence is a period of changes and challenges. This period of development is influenced by several social factors such as relations to parents and family, and as they grow older to an increasing extent by peer relationships and their acceptance and positive feedback. Adolescents may therefore be especially susceptible to the health effects of negative social interactions (Due et al., 1999). Taking bullying behaviours among school-age seriously could be the key for future prevention. Bullying behaviour can act as an indicator of violent, anti-social and risk-taking behaviours. My research identifies the bullying behaviour problem and factors that associated and may be used to help design interventions aimed at improving school safety. Schools are a breeding ground for safety and violent behaviours. Teachers may know who the bullies and victims are within classes. Further information may be obtained through teachers and families of adolescents. Direct observational methods may be used to assess this type of behaviour. Bullying and being bullied appear to be important indicators that something is wrong among students and within the society.

Political action is needed to prevent violence among adolescents and in the community. There is needed to make schools and neighbourhoods safer for adolescents not to be involved in fighting or any violent behaviour. School policy (regulations, staff supervision and a supportive environment) and social and family support are all critical and should be involved to tackle adolescents physical fighting.

Research must continue to investigate injuries and violent behaviours among children and adolescents. To date, scientific research and effective intervention strategies have not been established in Saudi Arabia. It is likely that aspects of the school, family, and community environment play important parts in these strategies (Dahlberg, 1998; Valois et al., 2002). This study offers insights into the prevention of fighting among male adolescents, by identifying factors associated with violence (carrying weapons and physical fighting) and injuries among adolescents. Continued research may identify factors that associated with violence and injuries and their related consequences. Continued efforts on the part of the public health community are needed to understand and prevent violence and injuries among youth in Saudi Arabia. Longitudinal studies are needed to investigate developmental and risk factors for

violence. Such studies should include multiple cohorts, to draw conclusions about different age groups, and they should measure a wide range of risk and especially protective factors (Farrington and Loeber, 2002). There is a need for bullying prevention programmes in schools in Saudi Arabia. Therefore, this study supports the need for political efforts to develop and manage legislations about how to prevent and treat students.

Mental health is equally important as physical to the overall well-being of a person. It should be one of strategic aim for the country to promote positive mental health and to contribute to better quality of life. Therefore, it is important to educate students in schools and people in the community regarding mental health issues (anxiety, stress, depression, suicide thoughts and attempt and mental health problem management), to initiate research into the assessment of population mental health and to initiate the development of national positive mental health strategy and practice.

The World report on violence and health (Kurg et al., 2002), is encouraging development agencies, donors, and recipient governments to support and implement nine recommendations. The report was produced with the contribution of over 160 experts from around the world. It was the first comprehensive review of the problem on a global scale, covering the fundamental questions of what violence is whom it affects, and what can be done about it (Butchart et al., 2008). The objectives of the campaign are to raise awareness about the problem of violence, highlight the crucial role that public health can play in addressing its causes and consequences, and encourage action at every level of society. The nine recommendations of the World report on violence and health include six country level recommendations and three international level recommendations. The recommendations call on countries to:

1. Create, implement, and monitor a national action plan for violence prevention
2. Enhance capacity for collecting data on violence
3. Define priorities for, and support research on, the causes, consequences, costs, and prevention of violence
4. Promote primary prevention responses
5. Strengthen responses for victims of violence
6. Integrate violence prevention into social and educational policies, and promote gender and social equality

7. Increase collaboration and exchange of information on violence prevention
8. Promote and monitor adherence to international treaties, laws, and other mechanisms to protect human rights
9. Seek practical, internationally agreed response to the global drugs trade and the global arms trade

In 2008, WHO report on violent prevention was released (Butchart et al., 2008), and the report highlights 10 key strategies for violence prevention. It has been noted that the strategies can potentially impact multiple forms of violence, they are:

1. Increase safe, stable, and nurturing relationships between children and their parents and caretakers
2. Reduce availability and misuse of alcohol
3. Reduce access to lethal means
4. Improve life skills and enhance opportunities for children and youth
5. Promote gender equality and empower women
6. Change cultural norms that support violence
7. Improve criminal justice systems
8. Improve social welfare systems
9. Reduce social distance between conflicting groups
10. Reduce economic inequality and concentrated poverty

Community and family member especially parents should be taught about how to deal with their children particularly in adolescence, where adolescents experience several changes in themselves as well as in surrounding them. Schools and teachers can and should play critical role in observing adolescent problems at home, schools or in the neighbourhood. There is no clear and direct legislation for protecting adolescents from being abused by any member of the family in Saudi Arabia. Therefore, policy makers should consider the findings of this study and tackle family abuse as a social, public health and security problem in Saudi Arabia. Research throughout the region is needed to identify the extent, patterns, characteristics, and risk factors for abuse and the best ways to prevent and respond to the problem. There is a need to establish and enhance child protection laws, policies, and procedures for preventing and responding to child abuse and neglect. Also, there is a need to increase public awareness, develop parenting and teachers skills.

Suicidal thoughts or comments should never be dismissed as unimportant. It is essential that individual, family, school, and community take suicidal and related behaviours seriously. Apart from professional treatment, suicidal teens need to know there are people available to talk to and who care. Good support means being available and listening without judgement. Parents and teachers should be taught to watch for the signs of suicide and educate them as to the options for evaluation and prevention. A person should be reassured that there are always solutions to problems or ways other than suicide for coping with them. Giving an adolescent the chance to open up and talk about his or her feelings will help relieve some of the distress of those intense emotions, and make that person feel less alone. Unfortunately, suicide as a topic is not well addressed in Saudi Arabia and if it is addressed it is taught from religion perspective and as a sin. School programmes that educate adolescents about the problem of suicide and about what they can do if they or one of their friends has suicidal feelings may be helpful. Some of these programs may help students improve their problem-solving skills so that they will be better able to handle stress that might lead to suicidal feelings. School should facilitate the establishment of mental health consultation services aimed at preventing suicide. Epidemiological studies on mental health related factors, alcohol and drugs use as well as suicide, and its risk factors and methods of prevention should be conducted in Saudi Arabia. Further research is needed, and public health researchers and policy makers need to learn more about both the risk factors for suicide among adolescent, reasons for suicide in populations that are vulnerable and effective strategies for suicide prevention.

7.14 Comparisons between findings from Saudi Arabia and other countries worldwide

The below table provide a summary of the main findings and shows the prevalence of the main behaviours that this study investigated in line with other studies around the world (Table 7.1)

Table 7.1. Comparisons of the prevalence of behaviours between Saudi and other countries

Behaviours	This study	Previous Study in Saudi	Study world wide
Eating breakfast regularly (≥5 days/week)	36.7%	In Riyadh, among male between 12-18 years was 49.7% (Al-Rukban, 2004), and in Jeddah, among male between 15-21 years old was 81% (Abalkhail and Shawki, 2002)	Among male 13-15 years old, in Lebanon, was 69.3%, In UAE was 61.8%. Among 15 -16 years old, in England 65%, and in Europe the range is between 42% (Slovenia) to 79% (Portugal).
Eating fruit every day ≥1	24.2%	Consuming fruit and vegetables every day, 28.8% (Al-Rukban, 2004)	Among male 13-15 years old, in Lebanon, was 80.6%, in Jordan was 67.6%. Among 15-16 years old, in England 33%, and the range in Europe is between 12% (Greenland) to 40% (Belgium (French)).
Eating vegetables every day ≥1	39.8%		Among male 13-15 years old, in Lebanon, was 74.7%, in Jordan was 78.6%.
Consuming milk products every day ≥1	52.2%	45.6% (Al-Rukban, 2004)	Consuming milk products 2 or more time daily among male 13-15 years old, in Lebanon, was 38.5%, in UAE was 36.9%, in Jordan was 37.3%.
Having drunk soft drink at least one time per day ≥1	70.1%	32.8% (Al-Rukban, 2004)	In USA, among male between 15-18 years old, was 34.6%. Among male 13-15 years old. Among 15-

			16 years old, in England 28%, and the range in Europe was between 9% (Finland) to 52% (Belgium (French)).
Brushing teeth everyday ≥1	52.3%	55. 6%(Farsi et al., 2004), 61.4% (Almas et al., 2003)	Among male 13-15 years old, in Lebanon, was 85.1%. Among 15- 16 years old, in England 67%, and the range is between 20% (Malta) to 76% (Switzerland, Sweden).
Physical activity every day	18.4%	NA	Among male age between 15-18 years old, in USA was 24.18 %. In England 18%, and the range is 11% (Sweden) to 46% (Slovakia).
Current smoking	20.8%	15% (Almas et al.,2002)	Among 15-18 years old, in USA was 29.8%. Among male 15 -16 years old, in England 13%, and the range is 7% (Canada) to 37% (Greenland).
Physical fight during the last 12 months	49%	NA	Among 15-18 years old, in USA was 39.3%. Among 15-16 years old, in England 51%. And the range is 32% (Finland) to 60% (Belgium (French), Ukraine, Malta). Among male 13-15 years old, in Lebanon, was 64.6%, in UAE was 56.9%, in Jordan was 63.9%.
Carrying weapons during the 30 days before the survey	36.6%	NA	Among male age between 15-18 years old, in USA was 27.1%. Among 15-16 years

			old was in Belgium (French) 10.5%, Estonia 17%, Latvia 14.2%, Portugal 17.7% (Pickett et al.,2005).
Being bullied	26.1	NA	Among male 13-15 years old, in Lebanon, was 38.7 %, in UAE was 24.5%, in Jordan was 46.6%.
Bullying others	24.6%	NA	NA
Car drifting	36.1%	NA	NA
Joining people performing car drifting	46.7%	NA	NA
Not using seat belt when driving a vehicle	96%	NA	Among male between 15-18 years old, in USA was 11.5%
Using seat belt when riding a vehicle	97.7%	NA	
Not wearing a helmet when using non-motorized vehicles	98.6	NA	Among male between 15-18 years old, in USA was 88.3%. Among male age 15-16 years old, in England 86.7%, Sweden 91.8%, Germany 80.4% (Klein et al., 2005)
Not wearing helmet when using motorcycle	97.9	NA	Among male between 15-18 years old, in USA was 36.8%.
Attempting suicide	6.9%	NA	Among 15-18 years old, in USA was 4.6%.

8. Chapter Eight: Overall Conclusion and Implication

8.1 Conclusion

Adolescents have the ability to be positive individuals in their communities, acting to help their families, communities, schools, and society. Adolescent positive citizenship often provides both needed services to the community and society, as well as psychological, social, and intellectual growth for youth (Janoski et al., 1998; Johnson et al., 1998). Most adolescents are relatively healthy. In my study, it has been found that only 2% of adolescents were in fair or poor health. Despite this general good health, there are many important opportunities to promote health during adolescence. Many of the most common causes of morbidity and mortality are influenced by behaviours, such as tobacco use, physical inactivity, and unhealthy diet (Kann et al., 2000). These risk behaviours may track from adolescence into adulthood (Kelder et al., 1994), suggesting that promotion of good health behaviours in adolescence may have positive effects on future health behaviours and disease risks.

As adolescence is a time of tremendous growth, it is also a time of risk taking. Investigating health behaviour among adolescents and the influences of social, economic and health status is precious for both understanding and capturing the right magnitude of the serious health risk behaviours of adolescents.

In Riyadh, I found that most adolescents engage in behaviours that put their immediate and future health at risk. Based on the results of my study, several important conclusions are obtained. They are as follow:

- The study's findings indicate that adolescents in Riyadh engage in several health risk behaviour
- Skipping breakfast, low fruit and vegetable consumption and overweight were prevalent
- Oral hygiene behaviours were very poor
- Physical activity and sport exercise were at low rate and way below recommendation among adolescents. Lack of available facilities in the

community, lack of public sport club and lack of companion (friends) were the most common reason for not practising physical exercise

- Smoking prevalence was also notably high
- Violence related behaviours (e.g. carrying weapons, fighting, bullying and abuse) were high among adolescents
- Mental health related symptoms (feeling sad, being worried, unsafe, suicide thoughts and attempt) were also notably prevalent
- The prevalence of safety behaviours, using seat belt, motorcycle and bicycle helmet use among adolescents in Saudi Arabia is alarmingly low
- Many health risk behaviours were found to be clustered
- The questionnaire was found to be valid and reliable
- Height and weight should be measured and we should not rely on self-report questionnaires, since it has been found in the pilot study that adolescents in Saudi are not aware of their height and weight
- The findings of my study were mostly consistent with previous literature worldwide
- Health behaviours during adolescents are associated with a number of important factors (personal, socio-demographic and environmental) and cluster
- Socioeconomic and school-related factors were found, and always important factors to adolescents' health risk behaviours
- The research method was found to be appropriate to collect the needed information to answer the research questions of this study

In general, from the above conclusion, these outcomes are extremely important and encouraging for further quantitative and qualitative research, programmes and policies implementation. The results of this study are both critical and valuable for policy makers, researchers, schools, and communities.

8.2 General implications

Adolescents appear to be involved in many health risk behaviours. Health behaviours during adolescence are regarded as multidimensional and complex phenomenon. Risk and problem behaviours, unhealthy behaviours, antisocial behaviours, poor mental health, and poor academic performance are highly prevalent (Flay, 2002), and may continue to pose critical dilemmas for parents, educators, community and national and global economy. In this thesis, I showed evidence that these behaviours are clustered. I argued and presented proof that these risk behaviours are highly associated. As there is a need for effective health promotion programs, education is the key to youth development (Flay, 2002). Therefore, comprehensive health promotion intervention programs in school and out of school are needed. Schools at all levels must develop and encourage positive attitudes toward positive health and self efficacy. Studies and research on health risk behaviour are recommended and needed in Saudi Arabia. It constitutes a fundamental step in the strategic planning of improving adolescents' health and to movement achieving the national health objectives.

Flay (2002) argued that emerging programs still appear to be only somewhat effective, and not consistent, and that because of some limitations. First, most programs are too brief, too scattered and too infrequent. Second, many programs target the individual students, and they do not address the cultural environment and social context in which the students live. Third, many programs have not been developed in appropriate way. Therefore, programs need to be designed carefully to specifically target the biological, cognitive, and social relational issues of this developmental period. Factors such as age, family characteristics, socioeconomic status, and developmental stage, however, must be taken into consideration when designing successful interventions to change the prevalence of healthy and risky behaviours (Spear and Kulbok, 2001).

The family always has a great impact over adolescents' life and health. Strong source of support for developing adolescents, providing close relationships, strong parenting skills, good communication, and modelling positive behaviours are crucial to adolescents' development and can be addressed by their family. Parents must know the benefits of healthy living. There is considerable potential for improving health and

well-being in US and Europe and other developed countries, but lacking or less in developing countries and in Saudi Arabia. Lifestyle behaviours are established early in life and associated with many personal and social problem, such as low school performance, poor health, and other health problems such as obesity, diabetes, hypertension, chronic disease, cancer, and poor psychological health which largely preventable. Due to the interrelation of adolescent behaviours, a comprehensive approach is necessitated to create an environment that empowers and encourages children, families, and communities to adopt healthy lifestyles. Specifically, strategies aimed at children and adolescents should take a long-term perspective and engage all sectors of society, including government, schools, families and media.

It has been reported there is a need for more research on autonomy, decision-making, self-reliance as these are important factors that impact health behaviours and have not been adequately addressed (Spear and Kulbok, 2001). In addition, there is a need to conduct qualitative research about risk health-related behaviours and behavioural risk factors to help us understand how adolescents feel, behave and what they feel and why they engage in risk behaviours as they do in Saudi Arabia. No qualitative research addressing adolescents' behaviours was found in Saudi Arabia. As several health-damaging behaviours are likely to co-exist, researchers should assess the development, implementation and evaluation of multiple component intervention programs (Botvin and Griffin, 2004). Adolescents need to be reached with health-related interventions and health-promoting programs that are based on a fundamental understanding of their developmental, psychological, and physical needs in order to insure healthier lifestyle during adolescents and throughout adulthood (Spear and Kulbok, 2001). School is very important and privileged environment for the implementation of health programs, and educational approaches should focus on developing adolescents' health and life skills.

Findings from this study highlight the need for initiate agenda, improved action and policy coordination, across both national and Region levels, to address risky childhood lifestyle behaviours in Saudi Arabia. It is wise to take advantage from previous experience and information exists from other countries such as in developed countries. National coordination mechanisms are needed to provide clear leadership and ensure effective allocation of resources during the development and implementation of lifestyle-related policies (World Health Organization, 2001). Based

on current evidence for healthy lifestyle development, additional policy and programmatic actions are recommended:

- Long-term education campaigns are required to increase public awareness of the relationship between lifestyle behaviours and health.
- Information should be communicated through, and coordinated among, several channels: schools, health care providers, community organizations, and mass media. Enhancing the health literacy of parents is crucial to the success of such campaigns.
- As media is a very important tool to reach people and influence community initiatives can support the improved content of associated programming. Therefore, more efforts and funding should be aimed at increasing access to such programmes through public television or other media.

As has been discussed in Section 2.17, multi-sectoral policies are needed to promote healthy behaviours throughout Saudi Arabia. Schools should provide appropriate health promotion intervention and education and introduce a healthy lifestyle (i.e., nutrition, fitness, social and mental well-being) component in teacher training. Additional funding and other incentives is needed to create safe and accessible sport, recreation facilities and safe environment in communities, in Saudi Arabia. Schools, government, families and relevant health authorities should collaborate to support good and healthy behaviours by offering healthy choices for adolescents in the communities.

As has been discussed through this thesis, there is a large body of knowledge on adolescents' health and behaviours in developed countries, but data on health-related behaviours its association factors and effects are still limited in Saudi Arabia. The responsibility for conducting research lies with government, health agencies, education authorities, universities, and medical schools.

Better data and surveillance systems are needed to monitor the risk factors and associated outcomes of adolescents' health risk behaviours. Gulf and Arabic countries should collaborate to develop systematic and comparable data collection systems and regional networks. It would be beneficial to initiate a systematic survey effort to examine the synergies between a comprehensive range of childhood behaviours (e.g.,

tobacco use, nutrition and obesity, physical activity, alcohol/drugs, sexual behaviours, etc) and their impact on health across the lifespan.

8.3 Implications for prevention and intervention

The study's findings indicate that adolescents in Riyadh engage in several health risk behaviour. All the risk behaviours that were investigated in this study can contribute to disease, disability and mortality. Therefore, all need to be tackled in an effective approach. However, smoking, violence, safety and mental health need to be tackled first since they appear to be highly prevalent and neglected in Saudi Arabia.

In Saudi Arabia there are varieties of obstacles that have hindered the ability to develop and implement effective, theory-based, prevention programmes to decrease smoking rate, suicidal and violent behaviour simultaneously. First, Saudi Arabia remains a developing country and still suffers from the lack of infrastructure, public health scientists and researchers. Second, only a limited understanding of the mechanisms that may link risk factors with health related-behaviours and several risk behaviours together with general public health in Saudi Arabia. Third, there is a shortage of research and more importantly lack of translating research findings to action. Also, it seems that there is a lack of interest and of perceived importance of many aspects public health area and of adolescents behaviours. It is important for policy makers in Saudi Arabia to invest in public health research and policy targeting reducing risk taking among adolescents. There is experience around the world especially from developed countries regarding effective health policy.

In general, risk behaviours are not, however, random, invisible or uncontrollable. Indeed, there is ample empirical evidence indicating that they are preventable and amendable to change (DiClemente et al., 2009). Adolescents' health promotion programs that directly encourage individuals to adopt and maintain health-protective behaviours remain an important and practical strategy.

Programs designed to decrease health risk behaviours among adolescents can focus on several key behavioural determinants. They may (1) enhance adolescents' awareness of the threat posed by risk behaviours, (2) increase their perception of

personal vulnerability, (3) modify their beliefs, norms, attitudes, motivations, and intentions, (4) enhance behavioural skills, (5) increase their accessibility to and the affordability of product that are health-protective (DiClemente et al., 2009).

The importance of acknowledging the stage of adolescence when planning health promotion and prevention programmes has been emphasized in the literature (Juszczak and Sadler, 1999; Dryfoos, 1998). In order to help adolescents take an active interest in optimizing their own health, it is necessary to understand their needs (e.g., the requirements to promote adolescents health and developments) and wants (e.g., the personal interests, desires, wishes, and goals that motivate the adoption of different behaviours) (Breinbauer and Maddaleno, 2005).

The factors that influence adolescents to engage in health risk behaviours can be quite complex (Breinbauer and Maddaleno, 2005). The levels of influence for health-related behaviours have been identified as follows (McLeroy et al., 1988); (1) individual factors, (2) interpersonal factors, (3) organizational or institutional factors, (4) community factors and (5) public policy factors.

However, programme designer may be confronted with the challenge of how to address the multi-level determinants of the youth smoking, involving individual characteristics, family variables and societal factors that contribute to this problem. In the design of programmes, early intervention and prevention are keys. Kok and colleagues insist on not to select one single theory (Kok et al., 1996), but as it has been mentioned, in Section 2.16 and Section 2.17, a theoretical framework that include a series of theories which lead to a better understanding of the specific problem to be addressed and of how best solve the problem. Bartholomew and his colleagues proposed using a social ecological approach in designing promotion and intervention programmes (Bartholomew et al., 2001). In this approach, health is viewed as a function of individuals and the environments in which the individuals are embedded, including the family, social networks, organizations, communities and society as a whole. Therefore, programme developers are encouraged to see these various level as embedded systems, in which higher-order level or systems (e.g., society) set constrains

and provide input to lower- order levels (e.g., individuals), and the lower-order levels in turns provide input back to systems at higher level (Bartholomew et al., 2001).

Although individual-level interventions can be effective at motivating behavioural change, they might be not sufficient to sustain behaviour changes over time because of social pressures that promote or reinforce risk behaviours (DiClemente et al., 2009). Changing community norms reinforce and maintain health-promoting behaviours. Therefore, community-level interventions may have four interrelated outcomes (DiClemente et al., 2009). First, they may promote the adoption of health-protective behaviours among adolescents engaged in risky behaviours. Second, they may help sustain newly acquired health-protective behaviours. Third, they may serve to amplify individual-level programme effects over extended time periods, which may reduce the potential for relapse to high risk behaviours. Finally, community-level intervention may support and foster an atmosphere that discourages the initial adoption of risk-related behaviours.

Social norms, regulation and policies are key factors to support the adoption of health promoting behaviours and to reduce or eliminate health-compromising reinforcements in the social and physical environments (Breinbauer and Maddaleno, 2005). Health promoting behaviours also require a comprehensive and multi-faceted approach comprising policy and programme interventions in schools and other places frequented by adolescents, and reinforced by public service campaigns and advocacy in the media, as well as by legislative and fiscal measures (Breinbauer and Maddaleno, 2005). This multilevel, interactive perspective clearly shows the advantages of multilevel interventions, such as those that combine developmental, behavioural, social and environmental components (Breinbauer and Maddaleno, 2005).

It has been found in this study that smoking prevalence is high among adolescents in Riyadh, Saudi Arabia. The situation is likely to be worse, particularly where the economic situation is improving and knowledge about the serious harmful effects of tobacco among the general population and adolescents and preventive policies are lacking. As adolescents are considered the most vulnerable and receive unclear messages about smoking (Crawford, 2001), effective efforts to fight smoking

are crucial to defeat smoking among adolescents in particular. Unfortunately, tobacco control activities in Saudi Arabia are not effective. These include lack of health education for the community, lack of preventive programmes in the media; lack of smoking cessation clinics, absence of laws to prohibit smoking in public places, and inactivated legislation prohibiting smoking on government premises. Moreover, the tobacco price is very cheap and there is no law to prevent selling cigarettes to teenagers or from smoking.

Preventing smoking is a very important public strategy and needs comprehensive effective efforts. I will use this important public health risk behaviour to explain how a multi-level approach might be use to address smoking problem. For example, adolescents are less likely to take up smoking if they reach early adolescence with strong internal sense of what is “right” and what is “wrong” and believe that smoking is dangerous and unpopular, even if this feeling disagrees with that of other peers (individual level). Similarly, if their best friends also disapprove of their habit, their role models do not smoke, and they have developed healthy coping mechanisms to deal with daily pressures of their personal lives, they will be less inclined to begin smoking (interpersonal level). Also, programmes targeting population and national level through public polices could be more effective to persuade individual and to influence social norms. Adolescents will also be less likely to adopt smoking if they live and study in a smoke-free environment and listen to mass media advertising with effectively design messages that encourage health-promoting behaviours (community level). In addition, adolescents will also be more inclined to refrain from tobacco use if product prices are high and laws that prohibit tobacco sales to minors are strictly enforced (public policy level). To show the powerful of health policy upon changing people behaviours, and according to research studies conducted in developed countries, for example in the United States, the two policy and legislative actions that have had the most decisive and immediate effect on preventing youth smoking are the establishment of smoke-free environments and cigarette tax increases (U.S. Department of Health and Human Services, 2000). Moreover, the study by Saffer and Chaloupka (2000) provides empirical evidence of the effect of tobacco advertising bans in 22 countries. The results showed that comprehensive bans could reduce tobacco consumption by 6% (Saffer and Chaloupka, 2000). There is evidence indicating that smoking cessation programmes for adolescents have some

effectiveness, but the effect size is small, about a 3% absolute difference in cessation (Sussman et al., 2006). School-based prevention programmes have been popular, but there is little evidence that these programmes have long-term effects on prevention of smoking (Wiehe et al., 2005). Programmes to increase the tax on cigarettes and implement smoking advertising ban can potentially reduce adolescents smoking by as much as 26 percent (Rivara et al., 2004). Moreover, population-based public health approaches have proven to be effective, and these include mass media campaigns, bans of smoking in public smoking and increases in tobacco price (Clayton et al., 2009).

The CDC guidelines offer the following seven strategies that are effective in preventing tobacco use among the young:

1. Develop and enforce a school policy on tobacco use
2. Provide instruction about the short and long term negative physiological and social consequences of tobacco use, social influences on tobacco use, peer norms regarding tobacco use, and refusal skills
3. Provide tobacco-use prevention education in kindergarten through 12^{th} grade
4. Provide programme-specific training for teachers
5. Involve parents of families in supporting school-based programme to prevent tobacco use
6. Support cessation efforts among students and all school staff who use tobacco
7. Assess the tobacco-use prevention programme at regular interval

The involvement of governmental and non-governmental organization, social and community efforts and coordination between them appears to be fundamental in smoking prevention programmes and beating smoking among children and adolescents. Health services, schools, recreational and sport facilities, community institutions, government agencies, businesses and political leaders are all part of the community where the adolescents grow, develops, studies, and play (Breinbauer and Maddaleno, 2005), and all are essential stakeholders that can play a pivotal role in promoting healthy lifestyles among adolescents. As has been mentioned several times, there is an urgent need to promote multidisciplinary health promotion activities to tackle risk behaviours, smoking prevention programmes or campaigns among children

and adolescents should also focus on adults within their homes (e.g. parents, siblings), and in the community that they live. Therefore, I support the importance of smoking prevention for young people to include a family component (Komro et al., 2003, Geckova et al., 2005), and to target smoking behaviour among all the population.

Moreover, also this study revealed that violence behaviours were very prevalent among adolescents in Riyadh, Saudi Arabia. Saudi Arabia policy makers, schools and communities members should tackle this important public health problem issue, since violence may breed violence and lead to harmful and unlikely outcomes. Programme preventions are required targeting multilevel area and using a multidisciplinary approach. The World report on violence and health (Kurg et al., 2002), is encouraging development agencies, donors, and recipient governments to support and implement nine recommendations published. The report, produced with the contribution of over 160 experts from around the world. It was the first comprehensive review of the problem on a global scale, covering the fundamental questions of what violence is, whom it affects, and what can be done about it (Butchart et al., 2008). The objectives of the campaign are to raise awareness about the problem of violence, highlight the crucial role that public health can play in addressing its causes and consequences, and encourage action at every level of society. The nine recommendations of the World report on violence and health include six country level recommendations and three international level recommendations.

The recommendations call on countries to:

1. Create, implement, and monitor a national action plan for violence prevention
2. Enhance capacity for collecting data on violence
3. Define priorities for, and support research on, the causes, consequences, costs, and prevention of violence
4. Promote primary prevention responses
5. Strengthen responses for victims of violence
6. Integrate violence prevention into social and educational policies, and promote gender and social equality
7. Increase collaboration and exchange of information on violence prevention
8. Promote and monitor adherence to international treaties, laws, and other mechanisms to protect human rights

9. Seek practical, internationally agreed response to the global drugs trade and the global arms trade

In 2008, WHO report on violent prevention was released (Butchart et al., 2008), the report highlights 10 key strategies for violence prevention. It has been noted that the strategies are scientifically credible, can potentially impact multiple forms of violence, and represent areas where developing countries and funding agencies can make reasonable investments. They are:

1. Increase safe, stable, and nurturing relationships between children and their parents and caretakers
2. Reduce availability and misuse of alcohol
3. Reduce access to lethal means
4. Improve life skills and enhance opportunities for children and youth
5. Promote gender equality and empower women
6. Change cultural norms that support violence
7. Improve criminal justice systems
8. Improve social welfare systems
9. Reduce social distance between conflicting groups
10. Reduce economic inequality and concentrated poverty.

However, enhancing adolescents' health does not only depend on the development of effective prevention, but on how effectively these interventions can be translated and integrated into school curricula, community programmes or clinic practice, etc (DiClemente et al., 2009). Understandings the barriers that impede the rapid adoption of health promotion programmes by governmental and community-based organization is an important need in the field in Saudi Arabia. The development of sustainable systems and processes for the efficient transfer of health promotion programmes is contingent to many factors. Foremost is the need for an infrastructure responsible for collecting and collating new information as well as organizing, managing, and coordinating the active transfer of information to practitioners and consumers (Diclemente et al., 2009). Thus, for efficient programme transfer, investing in the development of an infrastructure to design and continually monitor systems and processes needed to promote rapid and widespread use of evidence-based

interventions might be critical. Gaps and inadequacies in the infrastructure might hinder health promotion programmes. It has been reported that without a competent and fully operational infrastructures for dissemination, it is doubtful that interventions will be effective (DiClemente et al., 2009). Therefore, in Saudi Arabia, to support the effectiveness of interventions, it might be necessary to invest in training, monitoring, improving multidisciplinary system for health issues, provision of relevant materials and ongoing programme technical assistance. However, behaviour change on a large scale population required comprehensive community and national effective policies and sustained efforts.

In Saudi Arabia, much work remain to be done to establish comprehensive profile regarding adolescents behaviours and to determine the risk factors and the nature of the relation between health-related behaviours. Cross-sectional studies need to attend to potential factors such as socioeconomic status, personal factors, social and environmental factors. Also, qualitative and longitudinal studies are important to be performed to enhance our understanding of the development and the associations of health-risk behaviours, with an eye on clarifying the probable direction of the link.

8.4 Implications for research and researchers

- Research on adolescents and their health-related behaviours is interesting, essential for disease prevention and health promotion and should be conducted on regular basis
- There is a need for extra work on adolescents' health issues especially health risk behaviours
- Alcohol use, substance use, violence behaviours, suicide and mental health related factors need extensive cross-sectional research to measures the prevalence among population and to detect the change over time.
- There is a great need not only for research, but also for taking action by policy makers, schools, professionals and media throughout dissemination of research findings
- There is a need for qualitative research to in depth investigation of adolescents' health-related behaviours in Saudi Arabia to gain insight into

adolescents attitudes, beliefs, concerns, motivations, aspirations, culture norms and value regarding health-related behaviours and risk taking

- Future research (qualitative and quantitative) should address social inequalities and socio-economic factors and its association with adolescents' behaviours
- The questionnaire used in this study was found to be comprehensive, reliable and valid; therefore, it can be used in other part in Saudi Arabia to produce comparable related data.

8.5 Implication for adolescent's parents, member of the family and community

- Seek advice on adolescent's health in order to improve adolescents' health.
- Seek advice on how to deal with adolescents, adolescent's need and problems.
- Instil and encourage positive attitude and healthy behaviours in early childhood.
- Implant moral and ethical values in your adolescents and from early age.
- Build friendly relationship with adolescents.
- Support adolescents and improve self-confidence.
- Adopt healthy behaviours, relinquish unhealthy ones, and therefore set a good example

8.6 Implication for policy makers in the Ministries of Health, Education, Media, Interior, Planning and Youth Welfare

- Encourage and support researchers and research according to adolescents' health-related behaviours.
- Encourage and support collaboration among private and public agencies in order to share information and provide services for adolescents.
- Funds and all kind of supports should be provided to achieve better health and education for adolescents.
- Health evaluation and screening are highly required especially those related to health behaviours.

- Environmental and population health issues should be addressed in the school curriculum and health education programmes should be addressed in schools at an early age.
- Health education campaigns' focusing on adolescent health needs is essential for adolescents and communities.
- School should play significant roles in students' life, schools are recommended to be open after schooldays or even on the weekend to let students take advantage of its facilities.
- Cigarettes price should be increased, to discourage students and others from buying it and decrease their daily cigarette smoking.
- Cigarettes should be illegal to sell to children and school age and strong law should be enforced in Saudi Arabia.
- Legislation should be established and activated for not smoking in public closed area.
- Physical exercise education should be addressed to sport class curriculum, and sport class should be increased to moderate level 2-4 times per week and not only one like now.
- Adolescents' safety and mental health should be protected and ensured.
- All members of the community need a place and equipment to practice physical activities, thus, sports clubs and such facilities in the community should be established, provided and their use promoted to attract adolescents amongst the community
- Better data and surveillance systems are needed to monitor health related behaviours, risk factors and associated outcomes and to evaluate the effectiveness of related policies and programmes in Saudi Arabia.
- Arabic countries should collaborate to develop systematic and comparable data collection systems and regional networks as in Europe collaboration system. It would be beneficial to initiate a systematic survey effort to examine the synergies between a comprehensive range of childhood behaviours (e.g., tobacco use, nutrition, physical activity, alcohol/drugs, obesity, injuries, safety, mental health and sexual behaviours) and their impact on health across the lifespan.

- Data are needed at national and local levels. National data can be used to draw attention to the magnitude of behavioural problem and to examine differences in rates among groups (e.g., socioeconomic, age, groups) and locales (e.g., rural vs. urban).

In summary, this study has not covered all health-related behaviours and its influence or associated factors among adolescents, but it has pointed out several major problem and important issues connected to adolescents' health and development. Adolescence should be recognized as a credible area of scientific inquiry. There is a great need for field work research to investigate more aspects of children and adolescents behaviours. There is a need for research to investigate in-depth and on a wide scale, the realm of health-related behaviours among different population segment in Saudi Arabia. Advancing the field's understanding of adolescence requires a focus on research and on the policies that are ideally informed by this research. Research is needed to study the factors that promote or impede health and health related behaviours in adolescence. The gap among research, policy, and practice needs to be narrowed. In the field of adolescent health more knowledge is available than is put to use. Although there is much more still to learn about adolescent health in Saudi Arabia, the knowledge base may be sufficient to allow reconsideration of many policies now. The focus needs to shift to one that embraces both prevention and health promotion. Programs aim to prevent problems and promote a wide range of healthful behaviours are needed. Further, personal, social, economical and environmental surveys need to be considered, not only for maintaining healthy behaviours, but also, for making a data base for health policy decision making and for projecting future interventions and programmes. The various governmental and non-governmental agencies, related either directly or indirectly to health and development should corporate in order to promote health, prevent diseases and raise population awareness and society regarding health and its protective and risk factors. It is hoped that this research project has illustrated and raised many concern and issues for both future action and research.

From this extensive study, I have learned several things about my practise as a future public health researcher. Although I have answered my original research questions, I realize that any answers that I have found are only for male students, at

high school grade level in Riyadh city. I am aware that with different students and a different school district, I could have found different answers to my questions. Given my robust methodology, it is likely that my results are representative of the general situation in male adolescents in Riyadh. However, in addition to my original questions, here are some new questions that I have started to think about for my future research career:

- As a researcher, how can I become more aware of health-related behaviours in which adolescents are involved?
- What is the nature and prevalence of health-related behaviours among girls?
- What other sources of data collection can I use to gather information about health-related behaviours?
- What can I do to foster healthy behaviours in adolescents, families, schools and communities?
- How can I get researchers from different fields more involved in conflict resolution or problem solving?
- How can I motivate adolescents, parents, school and community to become active in risk behaviours prevention and promoting health?

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