Factors affecting nutritional status and eating behaviours of adolescent girls in Saudi Arabia

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Declaration

I, Elham Al-Jaaly, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated.

Signed:

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August 2012

Abstract

The objective of this study was to assess factors affecting nutritional status and eating behaviours among adolescent girls in Jeddah, Saudi Arabia. A cross-sectional survey was conducted in 1519 13 to 18-year-old girls from 18 schools. Nutritional assessment included anthropometric, haemoglobin measurements, and a questionnaire exploring a range of nutrition-related issues. Since one of the major influences on eating behaviours is food marketing and media, a descriptive analysis of TV advertisements aired on three of the most popular TV channels was carried out. In addition, analysis of the content of school meals was conducted. The overall prevalence of overweight girls is 24% of the population, obesity 13.5% and underweight 14%. The prevalence of anaemia (Hb<12 g/dl) was 29%. Some eating behaviours were found to be particularly prevalent, including snack consumption, eating outside the home, consumption of sugar-carbonated drinks, and very low consumption of vegetables and fruit. The media was regarded as one of the most important sources of health information. The analysis of the sampled advertisements (n=6,272) showed that of the entire number of paid product advertisements, (n=5150) 17.6% were for food and drink products. Of the total 1106 food and drink advertisements, 49% were for high-fat salt and sugar (HFSS) products. School meals were found to have very high HFSS content. This is the first in-depth study of factors affecting eating behaviours and nutrition status of adolescent girls who was guided by a theoretical framework. The study revealed that all aspects of the girls' environment, including home, schools and community combined to promote unhealthy eating behaviours and lifestyle. This could have an impact on their diets, long-term health outcomes and therefore, warrant further evaluation. Results also emphasized the central role and obligation of decision makers in protecting young consumers through providing a healthy environment in home, community and schools. In addition, through tightening legislation and controlling media contents (particularly food advertising) that are targeting young people. It is anticipated that the findings of this research will serve as an impetus for planning appropriate nutrition intervention programmes for Saudi adolescent girls.

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Table 1 Abbreviations

BMA	British Medical Association
BMI	Body Mass Index
CDC	Centres for Diseases and Prevention (USA)
CDSI	Central Department of Statistics & Information (Saudi Arabia)
FP	Finger Prick methods for measuring haemoglobin
FSA	Food Standards Agency (United Kingdom)
Hb	Haemoglobin level
HDL	High Density Lipoprotein cholesterol
HDR	International Human Development Reports
HFSS	food to be high in fat, sugar and salt (HFSS)
ICO	Index of Central Obesity
MBC TV channels	The Middle East Broadcasting Centre (MBC) group, they are privately owned free- to- air TV channels
NCHS	National Centre for Health Statistics (USA)
MoH	Ministry of Health Portal (Saudi Arabia)
NICE	The National Institute for Health and Clinical Excellence (United Kingdom)
NP	Nutrient profiling by the Food Standards Agency (United Kingdom)
PASW Statistics (version 18)	Predictive Analytics Software Statistics for Windows (version 18)
SD	Standard deviation
SDS	standard deviation scores or z scores (The SDS or Z score of a child's measurement is calculated from the L, M and S curves, using values appropriate for the child's age and sex.
SH	The School healthcare department (Ministry of Education, Saudi Arabia)
UKSDS	Standard deviation provided with LMSgrowth and based on the British1990.xls: length/height & BMI for ages -0.13 to 23 yrs.; weight -0.33 to 23 yrs.; head circumference -0.33 to 18/17 yrs. (males/females); sitting height & leg length 0-23 yrs.; waist circumference 3-17 yrs., percent body fat 4.75-19.83 yrs.
WC	Waist Circumferences
WHO	World Health Organisation
WHOSDS	Standard deviation provided with LMSgrowth and based on the WHO2007.xls references. References include: height and BMI for ages 5-19 yrs. weight for ages 5-10 yrs.
WHtR	Waist-to-height ratio

CHAPTER ONE

Introduction

1.1 Purpose of the Study

The purpose of this study is to assess the nutrition status of adolescent girls in Jeddah city, focusing on two main health problems that are derived from poor nutrition eating behaviours: weight status (underweight and overweight) and anaemia. The study investigates the factors that contribute to both problems in Saudi female adolescents. Factors explored in this study include self-reported dietary consumption and behaviours, physical activity and environmental factors (social, physical and societal). More specifically, the study aims to determine the effects of societal environmental factors, particularly 'media and food advertising' on adolescent food choices and nutritional status.

1.2 Progression and Organization of the Thesis

In order to offer a comprehensive and accurate report of the nutritional status of adolescent girls in Jeddah, the thesis has been organised as follows: In Chapter One, the purpose of the study is outlined and the aims and objectives are stated. A general introduction about the nutrition status of adolescents can also be found in this chapter. The chapter concludes by presenting the rationale for the study and discusses reasons for research approaches.

Chapter Two provides a review of the relevant, predominantly Saudi-Arabian literature on the nutrition status of adolescent Saudi girls, including growth patterns and trends of growth, nutrition-related concerns of adolescent girls in Saudi Arabia. In addition, it provides an overview of the food intake and common eating patterns, behaviours and lifestyle of Saudi adolescents; methods used to assess nutrition status and factors related to nutrition status of adolescents. The second part of the chapter reviews some of the Saudi governmental guidelines, health and nutrition policies and regulations for schoolgirls related to school snacks and physical activity performance in female schools in Saudi. Moreover, the chapter reviews and evaluates some of the national and international evidence on food advertising and promotion in addition to the marketing strategies that are used in targeting young people. It examines Saudi marketing for snacks, Saudi media and advertising, particularly in TV. The chapter also reviews some legislation and guidelines related to school meals and media directed to children and adolescents. The last section in the chapter introduces the theoretical framework used in the thesis to evaluate factors affecting eating behaviours and nutritional status of adolescents.

The aim of Chapter 3 is to describe the specifics of research focus and chosen methodology that related to school-based survey in addition to methods used in evaluating school meals. Chapter Four aims to present results, analysis and interpretation of school-based survey and school's meals.

Chapter Five describes the methodology of content analysis of TV data. Chapter Six demonstrates analyses and interpretation of TV data. Chapter Seven concludes and discusses the results of both studies. The closing chapter, Chapter 8, presents conclusion and recommendations for future work and research in the area of school meals, adolescents' growth and development, assessment of nutritional status of adolescents and media and advertising to adolescents.

1.3 Definitions and explanation of terms

The meaning of terms is clarified in this section to avoid confusion and to establish a common understanding of how terms are to be used in this thesis

Public schools (governmental sponsored schools)

Public schools are schools sponsored by the government under the supervision of Ministry of Education that provide general education for Arabic-speaking Saudis and non-Saudi students who are willing to study. Education is provided free of charge. It includes education from kindergarten up to and including secondary schools (Al Rawaf & Simmons 1991)

Private schools

Private schools are independent schools or non-state schools. The national government does not administer them. However, the Ministry of Education supervises them.

Intermediate schools

Caters for girls from 12-15 years and include grade level 7 to 9. An intermediate school certificate is required to enter secondary or high school

High schools (secondary schools)

Caters for girls from 15-18 years and include grade level 10 to 12

The School Healthcare Department (SH)

The School healthcare department in Saudi Arabia was established in 1964; it provides medical services for students, teachers, and the other education staff through healthcare units. There are two healthcare units available in Jeddah City. The department provides medical care and treatment for general check-up, emergency cases, and referral cases for serious health problems. In addition, the department is responsible for health school environment and school foods that are provided by canteens. Besides, the department is conducting some periodic health and nutrition surveys in order to investigate, evaluate and control the prevalent health and nutrition-related problems (Al-Shehri 2008). However, the author did not have a chance to access any of these surveys while conducting the present study.

LMS method

Reference centiles curves show the distribution of a measurement as it changes according to age. The LMS method summarises the changing distribution by three curves representing the median (M), coefficient of variation (S) and skewness (L), the latter expressed as a Box-Cox power. Using penalised likelihood the three curves can be fitted as cubic splines by non-linear regression, and the extent of smoothing required can be expressed in terms of smoothing parameters or equivalent degrees of freedom (Cole & Green 1992).

LMSgrowth

LMSgrowth is a Microsoft Excel Add-in designed to manipulate growth data using growth references based on the LMS method.

1.4 General Introduction

Adolescents (10 to 19 years, WHO 2005) comprise 20% of the world's total population. Saudi Arabia as a country has a very young population with a median age of 21 years. Based on a population census conducted in 2007, 55.51% of Saudi Arabia's females population are younger than 20 years of age of which 13% are females within the age range of 10-14 years and 11% within the age range of 15-19 years.

School education, policies and health promotion for girls in Saudi Arabia

The first formal Saudi school for girls (Madrasat AlBanat AlAhliah) was a private school. The school was established in 1941 by a non-Saudi businessperson from Indonesia, and it was based in Mecca. However, people of Mecca were not overly interested in girls' education at that time (Al Rawaf & Simmons 1991). In the years that followed, a number of private schools for girls in different cities were established. Two decades after (in 1960), the first formal public school for girls was established in Saudi Arabia with some opposition from Ulama[1] and some conservative parents. The curriculum was more for religious subjects and home

[1] Ulama: A member of such a body, and a body of Muslim scholars who are recognized as having specialist knowledge of Islamic sacred law and theology (Oxford Dictionary 2011).

economics. Currently, the Saudi government has placed considerable emphasis on the provision of high-quality education for girls, with substantial efforts being made by the Government to decrease the gender gap at different educational levels. The literacy rate for females aged 15-24 has now reached 97% (HDR 2011). Table I shows indicators for education in Saudi Arabia in addition to other indicators such as health and income. The significant progress in Saudi girls' education has brought a number of social developments to the country such as improvement in girls' health and nutrition (AlMunajjed 2009).

The link between education and health has been recognised worldwide as being important to ensure the protection of young people because education empowers people to achieve an optimal health (WHO 2006). The role of schools in contributing to the promotion of health status more than any other institution in a country is well documented. In response to this evidence, many international concepts and programmes have been developed to promote health through the education system. A good example is the World Health Organization (WHO) Global School Health Initiative ''promoting health through schools'' that was introduced and launched by WHO in 1995 and aimed to improve the health of students, school personnel, families and other members of the community through schools (WHO 2006). The same report has defined some strategies of the global school health initiative such as *research* to improve school health programmes, building *capacity to advocate* for improved school health programmes, strengthening *national capacities* and creating *networks and alliances* for the development of health-promoting schools.

The concept of adopting programmes and activities with the view to promoting healthy living and practices in schools was implemented, to some extent, by many Arab countries, including Saudi Arabia. The concept was endorsed in different localities in Saudi Arabia; however, measurable outcomes were not recorded or totally evaluated, and the programmes were mainly applied in boys' schools (WHO 2006). The School Healthcare Department in Saudi Arabia recommended schools to restrict the selling of high sugar and high-fat foods on school premises. That being said, no legislation was implemented to enforce these recommendations. The consumption of fresh milk and dates as sources of energy and natural sweets was also encouraged in schools at all levels. A plan to allocate a health advisor to each school at all levels of education was established in 2008, and qualified health professionals extensively trained some teachers with no health or medical background to take the responsibility of the health advisor. The training programme covered such areas as health education, immunizations, health screening (e.g. screening for the anaemia programme that was started in the academic year 2008-2009), the school environment and means of security, safety, and first aid. The role of the health advisor in schools, however, has yet to become a fully established position in the Saudi school system.

One of the more important and strongly effective issues in promoting nutrition and health in schools could be through the integration of health concepts in the curriculum. Despite the large amount of money that has been devoted by the Saudi government in public education for girls, the curriculum at all levels of education lacks the required focus on nutrition and healthy cooking skills. General science, biology and home economics (which mainly are cooking classes that provide limited information on health and nutrition for two hours per week) are the main sources of nutrition and health information in the current Saudi curriculum.

Physical education classes are nonexistent in Saudi girls' curriculum at all educational levels and physical activities are not permitted at public schools. However, the exclusion of physical education from girls' schools does not limit girls' Access to information about this type of education and Saudi girls were reported to use alternative sources of information about health and diseases such as media (mainly TV). In addition, their knowledge about the protective effects of physical activity against diseases did not differ from their male counterparts (91.8% vs. 92.9%) respectively, (Taha 2008).

Physical activity opportunities outside schools

Despite the absence of sporting activities at schools for females, gyms (health fitness centres) for women in general exist in major Saudi cities. In addition, most of these gyms include swimming pools. Furthermore, having a swimming pool inside the home is prevalent among wealthy families.

Girls who cannot afford a membership to fitness centres or do not have a home swimming pool can do outdoor activities such as walking. Many suitable and private places for out-of-doors activities were developed by the government in the last decade to encourage this behaviour. Jeddah is an urban waterfront city with a long coastline 'the corniche' (40 kilometres) and this provides a perfect setting for outdoor activities, both water and non-water oriented activities. However, the hot and humid climate of Jeddah for most times of the year encourages individuals to participate in indoor rather than open-air activities. One important limitation is that of culture. In the Jeddah society, it is still somewhat of a taboo for women to engage in many sporting and recreation activities (Abou El-Ela *et al*., 2007).

Saudi Arabian women are also required to wear dresses that strictly follow the principle of Hijjab (the Islamic principle of modesty, especially in dress) when in public. Abaya[2] is the dress code for Saudi women. Clothing must cover the entire body except the hands and face. However, some women cover their faces and wear gloves to cover their hands as well. This type of clothing, in addition to the hot and humid weather limits the options available to Saudi women with respect to sport and recreation.

Life of Saudis and changes before and after the growth of the oil industry

Before the discovery of oil in the Arabian Peninsula, and before the control of the Saudi state that unified a number of different areas of the peninsula under one

[2] Abaya: a black loosely fitting and flowing dress that covers the entire body except the head and it is worn over cloths. Recently colours other than black are used for Abayas, particularly in the western province of Saudi Arabia.

ruler (before the 1930s), the region was composed of several regions that had specific resources and distinguished human activities. The western province, the Hijaz, for example, depended chiefly on subsistence agriculture, some long-distance trade, and the provision of services to pilgrims traveling to the holy cities of Mecca and Medina. The Eastern Province dominated the plantation economy. An extremely hostile environment determined geographical separation of peoples. The long distances between water sources isolated clusters of people and hampered travel. The difficulty of travel also discouraged penetration from the outside, as did the lack of readily exploitable natural resources.

The current structure of the Saudi economy based on some measures such as the discovery of oil in the Eastern Province in 1938, which came six years after the establishment of the Kingdom of Saudi Arabia and the rebuilding of Europe after World War II and its need for cheap, reliable sources of oil. These measures significantly enhanced the position of the newly established Saudi Arabian oil industry. After the transition period, the Saudi Arabia's income was largely derived from oil reserves, which is estimated to be over 30% of known global reserves. The Saudi population is therefore, relatively affluent. In 2001, according to Euro monitor statistics, 99% of the 2,754,140 Saudi households owned a colour TV, 99% a passenger car, 23%, a personal computer, and 84% an air conditioner (Rice 2004). However, having a TV set inside rooms and the owning of personal computers are becoming more prevalent among the Saudi youth. The oil-led economic development influence growth in the country's social welfare performance and improvement in equality and employment (Karl 2007). The Kingdom of Saudi Arabia, similar to the other Arabian Gulf Countries has been witnessing a rapid economic growth during the past four decades and major changes, including changes to the education system accompanied the growth of the oil industry, such as expanded job opportunities that enabled more women to work. Employment opportunities for women are no longer restricted to teaching, medicine or jobs in girls' schools and women's sections of universities, and in recent times their employment has expanded to social work, banks that cater to female clients, television and radio programming, and computer and library work.

Additionally, sections of markets are set aside for women sellers, and many women can run their private business and organize their own investments. This growth and associated improvement in the economic status of women similarly has been accompanied by another positive development that of free health and social services, resulting in the control of infectious diseases and improvement in public health conditions (Appendix XVII). Besides, economic reform has also resulted in increased per capita income, and consequently, led to the rise of the daily per capita intake of energy and other macronutrients. In a report that was prepared to highlight the state of nutrition in Saudi Arabia and its link to food consumption patterns during the period 1974-1995, the daily per capita intake of energy in Saudi Arabia has increased from 1,807 to 3,128 calories (7560.5-13087.6 KJ). Daily protein intake has increased from 51.5 to 80.0 g, while that of fat has increased from 33.6g to 78.2g. Using the Body Mass Index (BMI) as an indicator, the report also showed that the prevalence of overweight status and obesity in Saudi Arabia is about 25-45% in adolescents according to several studies (Madani 2000). In other words, as the country matures there has been a shift of health problems from infectious diseases to non-communicable diseases such as obesity, diabetes and coronary artery disease (Lobstein *et al*., 2004). World Health Organization has related the great prevalence of obesity in the Middle East Region to several factors such as urbanization, higher incomes with the elevated intakes of energy, fat and sugar and the dramatic change in food habits, which become more westernized (WHO 1989). Factors related to obesity included sedentary behaviour, particularly television viewing (Al-Hazzaa 2002). Moreover, the economic status and the technological innovations have made high-calorie foods ubiquitous and reasonably priced to Saudi adolescents. Furthermore, food producers have made their products more accessible and attractive to the wider population by making prices more affordable. In very competitive market, the lower prices have been accompanied by more aggressive marketing activities on the part of food producers. The wealth of the country has influenced some lifestyle changes and family structure such as the use of servants and drivers in most households. Access to fast-food restaurants has become easier, which has naturally led to the increase of food portion sizes among all age groups and affected the nutritional values of

Saudi meals. These changes have affected the responsibilities, and the amount of time women spend in the home. This in turn has affected their children's eating habits, and the amount of time spent undertaking physical activities.

1.5 Research Rationale

Why a nutritional survey was carried on adolescents?

Adolescents are tomorrow's adults. Looking at the quality and quantity of food consumed by adolescents is a concern because adolescent growth and development and future health are linked to their diet. In a 2005, WHO report titled "Issues in Adolescent Health Development" called for the development and use of adolescent-specific anthropometric references as one of the sources of data used to define the nutritional status of this group.

Eating patterns are frequently erratic in adolescents and might predispose them to some nutritional problems such as obesity or micronutrient deficiencies. Problems related to nutrition that originate earlier in life can track into adulthood. They can also be corrected if current ones can be addressed, so nutrition-related chronic diseases in adulthood can, then be prevented (WHO 1997). Therefore, up to date information is necessary about health and nutrition, and this has to start at young age; the 2005 WHO report has as well called for policies and regulations at a country level to improve adolescent nutrition.

Why using a theoretical framework to guide the study?

Food choices of adolescents have attracted the interest of many professionals, including nutritionists, dieticians and food marketers. Many countries have considered eating behaviours and dietary choices of adolescents in their programmes when promoting healthy eating (BMA, 2003). The food choice and behaviours of adolescents are influenced by different factors, including food availability, peer and parental influences, cost, convenience, individual beliefs, mass media and body size satisfaction (Story *et al.,* 2002).

As a dietician, to understand the process of food choice of Saudi adolescents and determinants of their choice of food, to understand obstacles that might be effecting such changes and to make such recommendations, I need a comprehensive understanding of the determinants of Saudi adolescents' food choice that could affect their nutrition status. Theories and models that are relevant to understanding food choice behaviour of adolescents could potentially have implications for attempts at dietary change (Shepherd & Raats 2006). Therefore, the study has used a conceptual model of multiple factors influencing eating behaviours of adolescents to systematically understand and study Saudi eating behaviours of adolescents. In addition, the model was used to help in developing interventions for correcting unhealthy eating behaviours.

Why Jeddah City was chosen?

Life in Jeddah is different from many cities in Saudi Arabia. Jeddah is a cosmopolitan city, more so than any other city in the country. Jeddah is also considered to be one of the most ethnically diverse cities in Saudi Arabia and its culture more eclectic in nature. This is because over the centuries Jeddah has received millions of pilgrims of different ethnicities and backgrounds, many of whom stayed and became citizens of the city. In addition, hundreds of thousands of foreign workers are working in the city. These factors have created a cultural and ethnic diversity, which affects eating patterns and lifestyle of the Jeddah population, particularly young people.

Why the study was conducted on girls only?

The combined stresses of puberty, marriage and pregnancy place great nutritional demands on adolescent girls, which affect their health. The Saudi population comprises a high proportion of Saudi girls. They are facing a lot of stress such as gender differences in many situations, including schools' curriculums, restrictions of physical activities and sports at school and sometimes away from school. In addition, other cultural and social aspects that limit much of their behaviour and activities affect Saudi girls' health status. Previous Saudi research has studied the nutrition and health-related issues of boys more so than girls have. Moreover, as a female researcher in Saudi Arabia, access to boys' schools is not legally possible. Assessing the nutritional status of Jeddah adolescent girls could fill a gap in the data regarding the nutritional status of this population. As well, it could highlight and provide information to guide policy makers, especially those in the Ministry of Education and the Ministry of Health in their development of intervention programmes.

Why schools and school meals were surveyed?

Taking the responsibility for running school meals should be based on a healthy foundation. In Saudi Arabia, one contractor is running all public school meals' provision and there is no defined guidance or legislation for the school meal provision. Therefore, it is critical to evaluate the food provided in these schools and to evaluate its impact on girls' health. As mentioned above, school programmes and environment for Saudi girls are limited in health and nutrition basics as part of the school curriculum. Schools are also lacking in physical education classes in addition to limiting the level of physical activity in schools, understanding the impact of these polices on girls' nutrition, and health status is an important subject.

Why food advertising and the media were analysed?

Food advertising in the media is considered one of the factors influencing adolescents' eating behaviours. Many food advertisements can be considered obesogenic as the foods they promote are high in sugar and fat content (Story & French 2004). There is no published research examining the extent, characteristics and content of food advertisements on Saudi television channels. Some Saudi research has reported a relationship between screen time and health problems such as obesity. However, research on how TV time and food advertising could influence adolescents' eating behaviour is limited. As part of this study, we were interested to examine and determine the extent, the characteristics and the content of food advertisements on television channels preferred by Saudi girls using an objective data in a defined period.

1.6 Aims & Objectives

The aim of the study is to assess the nutritional status and eating behaviours of female adolescents in Jeddah city, and will be addressed by the following objectives:

- To measure weight, height, waist circumference and haemoglobin levels of participants
- To assess participants' food intake, eating behaviours and lifestyle
- To identify the prevalence of overweight/obesity, underweight and anaemia in Jeddah female adolescents
- To explore personal and environmental factors influencing the eating behaviours and nutritional status of adolescent girls in Jeddah City
- To identify the associations between eating behaviours and nutritional status (based on weight categories, BMI z-scores, WC, WHtR and anaemia status)
- To assess schools 'meal menu and snack food options prepared and served by caterers at public and private schools
- To detect differences in eating behaviours and other determinants of the nutritional status of girls in both school sectors
- To detect differences in eating behaviours and other determinant factors of nutritional status of participants according to media influence based on-screen time and perceptions about TV advertisements and their influences on eating behaviours and nutritional status of participants.
- To quantify and classify the nature and extent of food advertisements being advertised on the television channels most watched by Jeddah adolescent girls.

CHAPTER TWO

Literature Review and Conceptual Framework

2.1 Chapter introduction

The chapter consists of a literature review of the subject area followed by an overview of the theoretical framework used in the study.

The purpose of the literature review is to examine the available evidence on methodologies used to assess the nutritional status of adolescents, including anthropometric and biochemical measurements. In addition, the aim is to examine the literature related to weight status (overweight and underweight) of Saudi adolescents and anaemia and their determinants.

The review is divided into **seven sections,** and it provides overviews of the following:

Nutrition issues in adolescence;

Weight status of adolescents (particularly those who are overweight), methods used to detect/diagnose weight status, causes of obesity, prevalence and determinants within a specific Saudi context;

Anaemia status in adolescents causes and types of anaemia, methods used to detect/diagnose anaemia, prevalence and determinants within a specific Saudi context;

Growth, development and assessment of adolescents' nutritional status, particularly, in Saudi Arabia;

Research conducted about food habits and physical activities of adolescents, principally among Saudi girls;[3]

School health environment for schoolgirls: These include school meals and snacks provided at schools, as well as policies and regulations that are specific to physical activity performance in female Saudi schools;

Evaluation of the national and international evidence on food advertising and promotion, in addition to marketing strategies used in targeting adolescents who may result in behaviour change. In addition, it reviews the food marketing in Saudi Arabia that could affect the adolescent age group.

2.2 Methodology of literature Review

2.2.1 Search strategies

The relevant literature was obtained by conducting electronic searches of different databases, including: Medline, Pub Med, EMBASE, Health and psychosocial instrument, SSSI (Site of Special Scientific Interest), PSYCHinfo (American Psychology Association), HMIC (Health Management Information Consortium), Social Policy and Practice.

The following keywords were used in varying combinations to identify relevant primary (collected by the researcher) and secondary studies (collected by others to be "re-used" by the researcher:

The search for the first part of the literature used the following keywords:

Adolescents, teenagers, females; AND
Eating behaviours, eating habits, nutrition, diet, nutrition or diet, weight status, nutritional status, risk factors and physical activity

[3] This was limited to studies on nutritional status and eating behaviours that have been conducted on urban adolescents in Middle East Arab countries, particularly Saudi Arabia. This was in order to focus the review and to allow for comparison with similar populations to the study population.

The search for the second part of the literature used the following keywords:

Adolescents, teenagers, females; AND
Eating behaviours, food advertisements, food marketing and commercials
Research was also undertaken on a range of other business and media resources in the Middle East, particularly in Saudi Arabia because there were few studies from the published academic literature on the extent and nature of food promotion.

The search included MeSH and text, word terms with combination using and, or Boolean operator.

A number of specialised electronic Journals were searched including the Saudi Medical Journal, International Journal of Behavioural Nutrition and Physical activity, International Journal of Advertising and International Journal of Advertising and Marketing to Children. In addition, ETHoS (Electronic Theses online Services) was searched using the above search terms, and theses related to both parts of the search were included. The general search engines revealed government reports, discussion papers, expert opinion, information from websites, articles in newspapers and magazines, were equally important retrieved to find relevant information.

Policy statements, consultation papers and periodicals were examined to abstract evidence related to the present literature review questions. Official Saudi reports such as health ministry reports that included the prevalence of obesity, underweight and anaemia among adolescent girls were also considered. WHO Library Cataloguing-in-Publication Data were also searched to find relevant literature.

2.3 Nutrition issues in adolescence

Adolescence is a period of dramatic physiological changes when the regular development of childhood is rapidly altered by an increase in the rate of growth. This sudden spurt is also associated with hormonal, cognitive, and emotional changes. Because of all these changes, adolescence is considered to be an especially nutritionally vulnerable stage of life. The nutrient needs in this period are greater than in infancy or childhood periods (Lifshitz *et al*., 1993). For example, the obvious physiological growth in adolescence affects the body's nutritional needs increasing adolescents' requirements for energy and all nutrients to support rapid growth rate and development (Stang, 2001). As much as 50% of adults' ideal body weight is gained in adolescence, and a failure to consume an adequate and balanced diet at this period of time can have a negative impact on growth status. In extreme situations, it may also result in delaying sexual maturation, and it can hinder or slow linear growth (Story,1992). In adolescence, muscle and fat development are rapid in both boys and girls. However, there are significant sex differences along the two dimensions. The growth of muscle tissue is greater in boys, compared to girls while, body fat is finer in girls, compared to boys, particularly just before puberty.

Adolescents are vulnerable to nutrition-related problems, including malnutrition, micronutrient malnutrition, obesity and other nutrition-related malnutrition. Low nutrient intake may result in under-nutrition problems. In many industrialised countries, eating disorders have become a significant chronic illness among adolescent girls (Fisher *et al.*, 1995). Anorexia and bulimia are the extreme sides of a broad range of disordered eating, which includes frequent dieting, binge eating and partial syndromes (limiting of food intake and concerns about weight). However, eating disorders are still uncommon in societies where obesity is not widespread or marked by society (WHO, 1998). In Saudi Arabia, severe malnutrition secondary to poverty has almost disappeared with the oil boom during the last four decades. Though, underweight status is still common (Hammam *et al.*, 1980, Attallah *et al*., 1990, Abahussain *et al*., 1999, Abou-zeid *et al*., 2006, Farghaly *et al*., 2007& Collison *et al*., 2010).

On the other hand, excess intake of energy-dense foods may result in additional fat and cause health problems such as obesity. Relative to both obesity and under-nutrition problems, some attitudes and practices that are related to cultural values might result in some health problems (WHO, 2005). A good example is the cultural aspects of body-size perceptions that make adolescents, particularly girls, interested in weight management. Weight management and body image are topics of great importance, and interest in adolescence. Serious concerns about body image can cause some health consequences such as dietary disorders, and psychological discontent (Heinberg et al. 1996). As a part of nutrition support and obesity prevention it is, therefore, important to develop a positive body image and self-esteem among adolescents. Behaviour patterns acquired during adolescence are likely to be continued to adulthood (Kelder *et al*., 1994) and 'adolescence period could prevent the prevalence of nutrition-related chronic diseases in adult life' (WHO, 2005). This could be achieved by optimal nutrition and healthy eating practices that decrease young people's risk of a number of health problems such as iron deficiency anaemia, obesity, eating disorders, and dental caries. This may also protect them from long-term health problems, such as chronic heart diseases, cancer, stroke, hypertension and osteoporosis (Williams *et al.,* 1995).

2.4 Weight status of adolescents, determinants and complications

2.4.1 Definitions of weight status

Definitions of weight status in adolescents do not follow the same criteria as that of adults. Changes in weight reflect short-term nutrient intake and are regarded as a general indicator of nutrition status and overall health.

Body Mass Index (BMI); wt (kg)/ht (m)^2 is commonly used as a tool, to assess weight status in all age groups. Childhood and adolescence demand the use of age specific standards and the 50th centiles BMI values change with age.

The increase in BMI, which has been considered as a good indicator of adiposity in adults was significantly linked to increased risk of morbidity and mortality. The WHO published updated growth charts in 2007 for weight status in children and adolescents. Adolescent obesity is defined as a BMI-for–age equal or greater than the 95th percentile and adolescent overweight between the 85th and 95th percentile. Adolescent underweight is defined as a BMI-for-age less than the 5th percentile on the WHO growth charts.

It has been suggested that adult BMI cutoffs for overweight can be used two years after the onset of puberty, and equivalent cut-offs to be defined for BMI-for-Age at adolescence (Dietz & Robinson 1998). The 85th percentile corresponds roughly to overweight grade I, or BMI above 25 in adults and the 95th percentile corresponds to grade II (BMI >30). These cut off points for obesity may need to be applied with confirmatory evidence of excess fat in all populations, in particular, those with a high rate of stunting, although stunting may itself increase susceptibility to obesity (Sawaya *et al*., 1995). These cut off points are age-specific, so age should be collected as accurately as possible for all adolescents measured during survey research (Woodruff & Duffield 2002).

2.4.2 Trends of changes in weight status of Saudi adolescents

A recent systematic review by (Alhyas *et al*., 2011), reported that the prevalence of overweight status and obesity (≥ 85th percentile) in children and adolescents (less than 20 years) in the Arabian Gulf Countries (GCC), are lower than those in the adult population. However, the prevalence appeared to be increasing among young groups, and rates are comparable to those in adults. Moreover, the prevalence was shown to be higher among girls with increasing age, compared to the younger groups. The prevalence was marked in urban areas. As in other GCC, the overall trend of obesity prevalence in Saudi Arabia appears to be increasing as well. The peak of obesity in Saudi children was found to start at 10-13 years of age (28%) and keeps the same high prevalence at age 14-18 years (Al-Dossary *et al.*, 2010).

A study showed that over a four-year period, the rate of obesity increased by 5% from 28% to 33% in the Eastern part of Saudi Arabia. The study aimed to review the prevalence of overweight and obesity, and included 12071 Saudi children (boys 6281; girls 6420), with ages ranging from 1-18 years (El-Hazmi and Warsy 2002). However, the findings of Abahussain in 2011 did not confirm the increasing weight gain among the adolescent female population in the same area. The author found that the overweight status and obesity remained prevalent in about 30% of Saudi girls (15-19 years) from 1997 to 2007. Moreover, there was no change in the underweight status during the 10-year-span, which remained at 3.5% (Abahussain 2011).

In Jeddah, an increase in BMI for the 50th, 85th and 95th centiles was seen over a 6-year period (Abalkhail 2002). In Riyadh, Al Hazzaa demonstrated about an 8-fold increase in obesity over a 17-year period from 3.4% to 24.5% in 2007 after reanalysis of two primary datasets that involved boys aged 6-14 years from Riyadh. The first study was conducted in 1988 (n=1082), and the second set was conducted in 2005 (n=702).

2.4.3 Obesity and associated risk factors

2.4.3.1 Causes of obesity

In general, the causes of obesity are understood as biologic predisposition and environmental. The biologic factors that have been identified to include the individual's genetic predisposition, resting energy expenditure (REE)[4] and the size and number of adipose cells[5] (Hark & Morrison 2003). More than 300 genes that influence obesity in humans have been identified (Zhang *et al*., 1994). A common example of the human genes that are identified to influence the fat storage is a gene called ob gene. It is expressed in the fat cells and codes for the protein leptin[6].

Although obesity is a result of interaction between genetics and environmental factors, there is strong evidence that the genetic factor accounts only for one third of the variation in the body weight. This is supported by increased prevalence of

[4] Resting Energy Expenditure is defined as the amount of energy required to maintain vital organ functions in resting state

[5] The amount of fat in a person's body reflects the number and size of fat cells. During adolescence, fat cells increase in number

[6] Leptin is suggested to promote negative energy balance by suppressing appetite and increasing energy expenditure (Qian *et. al.,* 1998). Very few obese people were found to have low blood leptin level. It is much common to detect a high blood level of leptin in obese people. Insensitivity, resistance, or even defective leptin receptors could be the cause of its improper function (Jand *et al.,* 1997)

obesity over the past two decades, although there has been no change in the gene pool in that period of time (Rankinen *et al*., 2002).

The development of the 'obesogenic' environment, the unhealthy dietary habits and lifestyles that tend to stay throughout life, is linked to a systematic rise in obesity and its related co-morbidity among this group (WHO 2003). For example, a sedentary lifestyle where adolescents spent most of their times sitting at school, in front of a television or computer, in addition, to the increase in the amount of fast food available to adolescents could help store excess fat.

2.4.3.2 Risk factors for obesity

Obese adolescents are vulnerable to many risk factors. The clustering of risk factor variables, which occurs in adolescence, is described as the metabolic syndrome. The clustering of a physiological catalogue of disorders is associated with insulin resistance, including hyperinsulinaemia, impaired glucose tolerance, hypertension, elevated plasma triglyceride and low High-Density Lipoprotein cholesterol (HDL) (Reaven, 1988 and Defronzo & Ferrannini 1991). Risk factors of obesity during adolescence have been reported by the WHO in 2003 and showed that more than 60% of overweight children have at least one additional risk factor for cardiovascular disease, such as high blood pressure, hyperlipidaemia or hyperinsulinaemia, and more than 20% of them could be affected by two or more risk factors. The early occurrence of manifestations of chronic disease tends to track in individuals throughout life, and the later the weight gains in childhood and adolescence, the greater the risk persistence. However, on a more positive note, there is evidence that they can be treated (Parsons *et al.,* 2001). Health consequences among obese adolescents can be reduced if body fat has been decreased effectively and this requires involvement from all health care professionals (Kohn *et al.,* 2006).

2.4.3.3 The tracking of risk factors related to obesity throughout life

Wright and *et al*., (2001) in their prospective cohort study conducted in the United Kingdom found some evidence to track childhood overweight to adulthood obesity. They found that children who were obese at 13 years of age had an increased risk of obesity as adults, and that there was some proof that excessive adult health risk from childhood or adolescent overweight occurs. Interestingly, they found that in underweight children, the more obese they became as adults, the greater the subsequent risk of developing chronic diseases. Many studies have demonstrated that parental obesity and overweight status, and the child's birth weight, dietary fat intake and family income could help to predict fast tracking and circumstances associated with tracking of obesity from childhood to adolescence and then to adulthood (Parsons *et al*., 2001).

2.4.4 Prevalence of overweight and obesity among Saudi adolescents and contributing factors

Despite little written research about underweight status and aberrant nutrition practices of Saudi adolescent girls (such as eating disorders), the present review revealed that much Saudi research had been conducted on the excess weight of adolescent groups.

For findings on the prevalence of overweight status and obesity among Saudi adolescents, published Saudi studies and national surveys that include adolescent girls were included. Information gathered included sample size, province or city, definition of overweight and/or obesity and the survey year. If the reviewed survey did not report the survey year, the publication year of the survey was used.

2.4.4.1 Prevalence of overweight status & obesity among Saudi adolescents

A number of Saudi studies on nutritional status that include adolescent girls were conducted. Overweight status and obesity are prevalent among the Saudi youth, and they are increasing chronologically. This is especially true where the country is undergoing rapid urbanisation and economic transition. Table 3 summarizes and compares the available Saudi studies that have been conducted in different areas in Saudi Arabia. Studies included both children and adolescents, and most of the studies were not particular about adolescent girls. The summary of comparisons is based on age, gender, and sample size. In addition, date and place of conducting each study were included. Types of measurements used in these studies and which reference standards or cut-off points were used were also summarized in the same table. Studies showed that Saudi researchers have used different measures to assess the weight status of Saudi adolescents, with BMI being the commonest. These measures compared to different international standards for comparison such as the International Obesity Task Force (ITOF), Percentiles of National Health and Nutrition Examination survey-1 (NHANES), WHO, and Growth Charts for Disease Control and Prevention (CDC). Results of studies showed that the definitions of obesity varied from one study to another. Several definitions of excess weight status were used, based on comparisons to reference data.

Overweight status and obesity among adolescent girls are prevalent in most areas. In 2009, Zamakhshary & Al Alwan conducted a systematic review on the prevalence of overweight and obesity among Saudi young people and concluded that overweight and obesity among adolescents, particularly girls, is prevalent across all regions; the East Province showed a higher prevalence, compared to Western Province and the Southern Province, which is considered the lowest. This was addressed by four comparative studies in the different provinces in the country.

The present review concluded that in localised studies, the prevalence of overweight ranged from 11% (n=767) to 27% (n=13,177) and obesity from 8.1% (n=600) to 24% (n=13, 177). National studies showed a prevalence of overweight ranging from 12.7% (n= 12,701) to 23.1% (n= 19, 317) and obesity from 6.7% to 11.3% (El-Hazmi and Warsy 2002) & (El Mouzan *et al*., 2010) (Figure 1).

Although some studies reported an increase in the prevalence of overweight status and obesity over time, the overall prevalence appeared to be unchanged during the period 1990 to 2010. Studies that were not specific for adolescent girls (those include either genders or other age groups) may provide a less accurate estimation of the prevalence. Another factor to consider, when looking at the prevalence of obesity among Saudis, is the different types of references and cutoffs that were used in Saudi studies. For example, the WHO reference data were found to give a higher prevalence of obesity, but a lower prevalence of overweight, compared to other standards (Musaiger 2011).

2.4.4.2 Contributing factors to overweight status & obesity of Saudi adolescents

Saudi studies that have been carried out in the area of obesity predictor factors were limited, and relatively few studies have been devoted to factors that influence more typical eating behaviours across the general adolescent population, particularly girls. Therefore, for the factors associated with obesity, all factors were included regardless of the sample size or the chronological time of the conducted study. Results showed that predictor variables such as demographic, physical activities or lifestyle variables were assessed separately or in the set of outcome measures (e.g. food frequency consumption of food and drink items). The different levels of factors that could have an impact on adolescent girls' eating behaviours and those that allow for assessing the quality of the diet, in addition to, the nutritional status has not been studied comprehensively in the area, specifically on Saudi girls.

Although most of the epidemiological research on childhood obesity in Saudi Arabia consists of cross-sectional surveys, several temporal relationships have been studied independently and consistently, some risk factors were identified.

Factors included the following:

Socioeconomic status

Socioeconomic status was defined using some indicators such as parental work in a private sector and parental education. The high prevalence of overweight and obesity among girls was significantly associated with those whose mothers are highly educated and with those whose fathers are running a private business (Al-Saeed *et al*., 2006). Overweight of Saudi children and adolescents was linked to the high socioeconomic status of their families.

Ethnicity

Overweight status was linked to ethnicity in some Saudi studies, which was usually defined by nationality (either Saudi or non-Saudi national). Al-Dossary and her colleagues survey's results in 2010 showed that children of Saudi Arabian nationality were less likely to be overweight, compared to their non-Saudi counterparts (18.7% (n=1048) vs. 20.1% (n=293). Conversely, the prevalence of obesity was high among Saudi, compared to non-Saudi (23.7% (n=1329) vs. 21.6% (n=315).

Other risk factors related to Saudi adolescents' overweight status and obesity include:

- Family history of obesity;
- Unhealthy dieting of adolescents;
- High intake of fast foods, high consumption of fizzy drinks and erratic eating; behaviours such as skipping breakfast (Al-Sheri 1996; Al-Shoshan 1990; Al-Sudairy 1992; Musaiger, Zagzouk, & Almaaie 2005);
- A low intake of vegetables (*P*=0.003) and fruits (*P*=0.044), Fayssal *et al.*, (2007);
- Low physical activity (Alwan & Zamakhshary, 2009)

2.5 Iron-deficiency anaemia in adolescents

Anaemia is considered as a public health problem in countries of the Eastern Meditation Region (EMR), with prevalence figures varying from 14% to 42% among adolescents (Bagchi 2004). Anaemia can be caused by several factors:

chronic and recurrent infections such as malaria, some parasitic infections e.g. hookworms, amoebiasis and schistosomiasis. Both types of infections, cause blood loss, which consequently cause iron deficiency. Other causes of anaemia include genetic factors such as thalassemias and sickle-cell trait. In Arab Gulf countries, several different causes of anaemia were reported to be responsible for iron deficiencies. These include poor weaning habits, low intake of food items that are rich in iron, low intake of food, e.g. fruits and vegetables that are rich in vitamin C and could enhance iron absorption, or high intake of food that can inhibit iron absorption (Musaiger 2001). Other causes of anaemia in the region that were reported by the same review were parasitic infection, early age of menarche and ethnic differences.

Nutritional anaemia can be caused if nutrients such as iron, folic acid, vitamin A, B_{12}, and C, protein and copper are deficient (WHO 2001). However, the commonest cause of nutritional anaemia is iron deficiency, or lack of the nutrient iron (King 2006 & Burgess 2008). Moreover, this is recognised as the most common cause of nutritional disorders among adolescents in industrialised countries (CDC, 1998) as well as in the developing countries.

2.5.1 Iron needs during adolescence

During puberty, iron needs increase to supply the extra blood needed in the larger body size, especially during the growth spurt that leads to an increase in haemoglobin mass (Osowski 2008). Adolescent females might require an even higher iron intake compared to boys, due, mainly to blood loss that occurs during menstruation. For example, if girls aged 11-14 years require 0.55 mg/day of iron intake for their growth, their total, absolute requirements of iron intake might increase to 3.27 mg/day during menstruation. This increase in requirements is necessary to replace menstrual iron loss (FAO and WHO 2002).

Studies on iron intake in the Arab Gulf region are extremely limited, and low intakes of food rich in iron by children, and adolescent girls were reported (Musaiger 2001). Saudi children aged 0-6 years were reported to meet 38% of the

Recommended Daily Allowance (RDA) by FAO/WHO (Sawaya *et al*., 1988). For Kuwaiti adolescent girls, RDA for iron decreased with increasing age. Girls aged 16-17 years consumed 78% of the RDA for iron, while the 13-15 years-old girls consumed only 32% of intake (Eid *et al*., 1986).

2.5.2 Assessment of iron status

Haemoglobin concentration is the most common test used in screening iron deficiency anaemia, and it detects the late stages of iron deficiency (WHO 2001). Other laboratory tests to assess iron nutrition status include haematocrit, serum ferritin and zinc (CDC, 1998). The correct interpretation of haemoglobin values requires the consideration of changing factors such as age and gender in selecting appropriate cut-off values. Interpretive reference data of haemoglobin are age- and sex- oriented and different data sets are available. The most-recent CDC cutoff values for haemoglobin are 11.8 g/dL for females in the age group 12-14.9 years and 12.0 g/dL for girls in age groups 15-17.9 years and 18+ years (CDC, 1998). In addition, many researchers define adolescent anaemia using the WHO 1994 cutoff values for haemoglobin (WHO 1994) which is <12.0 g/dl for 12–14 years and 15+ girls.

2.5.3 Epidemiology and risk factors of adolescents' anaemia in Saudi Arabia

Saudi studies on anaemia used different techniques for collection of samples of haemoglobin such as the hemoCue tests and venepuncture. Different cut-off values to interpret haemoglobin values were also used (Abou-zeid *et al*., 2006) and (Abalkhail and Shawky 2002).

The Saudi data on anaemia show that anaemia is a frequent problem in Saudi children and adolescents and different types of anaemia were reported. Anaemia types included both nutritional and genetic (hemoglobinopathies or inherited haemoglobin defects, such as sickle-cell-anaemia (SCD) or thalassemias). For example, the reported prevalence of SCD trait ranged from 2% to 27% (Jastaniah 2011). In addition, the prevalence of thalassemias ranged from 0.16% (El-Tayeb *et al*., 2008) to 3.4% (Al-Suliman 2006). The prevalence is variable according to the region in the country. In order to detect, control and prevent the prevalence of genetic-caused anaemia in the Saudi community, the Saudi Ministry of Health has implemented a premarital testing programme in 2004.

The overall prevalence of anaemia among children less than 14 in Saudi Arabia was reported as 24.8% (El-Hazmi & Warsy, 1999). About 8.5% of Saudi girls (11-19 years) were reported to have haemoglobin levels below 10g/dl, and in 55% cases, the haemoglobin level was below 12g/dl (AL-Othaimeen *et al.,* 1999). In Jeddah City, iron deficiency anaemia was present among 20.5% of 800 school students of both genders (5-11 years, 12-14 years and 15+ years) (Abalkhail & Shawky 2002).

The high prevalence of anaemia among Saudi adolescents has been attributed to the socio-economic status (SES), when using the school sector as a proxy indicator of SES, and prevalence was marked among governmental school attendees (Abalkhail & Showky 2002). The same study has also linked the prevalence of anaemia to menstruation status. Anaemia was markedly higher among menstruating girls, compared to their non-menstruating counterparts. The same study showed an association between anaemia status and poor education of mothers, and had a negative impact on school performance. Anaemia was also reported being more present among breakfast skippers and those who rely on snacks available in the school canteen that mostly consisted of poor nutrition quality snacks (AL-Othaimeen *at al.,* 1999) & (Abou-Zeid *et al.,* 2006).

2.6 Growth and development status

In adolescence, growth occurs in the skeleton, in the muscles, and in almost every system and organ of the body, except the brain and head (Tanner, 1972). The typical duration of this period is three to four years, but it can be shorter or longer (Mitchell, 2003). Growth monitoring is an important technique for identifying groups whose growth is deviating from expected patterns. In addition, the severity of any health problem can be assessed by its influence on growth.

2.6.1 Patterns of growth

Growth stunting and wasting were prevalent among adolescents in many parts of the world, especially in developing countries. Recent studies have reported a decline in growth stunting among adolescents. Several researchers have attributed the decline in growth stunting to the improvement of dietary intake (Golden 1994; Martorell *et al.,* 1994). Some studies in the Arabian Gulf region have linked this decline to a more affluent life (Madani, 2000).

2.6.2 Assessment of nutritional status in adolescents

Adolescents' nutritional status has been assessed in various published surveys and approached at different levels of evaluation (Woodruff and Duffield 2002). Levels of evaluation range from minimal to in-depth, and assessment include anthropometric, laboratory, medical, socioeconomic and dietary evaluation.

2.6.3 Anthropometric measurements and indices

Body Mass Index (BMI)

Researchers to describe growth patterns and body composition of children and adolescents use anthropometry. These indicators are used because they are non-invasive, economical, and have been shown to be valid and reliable in the determination of total body fat (Himes 1999). WHO in 1995 have recommended anthropometric measurements such as weight, height, circumferences (e.g. head and waist), and skinfold thickness to be expressed in percentiles or z-scores. Anthropometric measurements can detect the two forms of malnutrition (under and over nutrition), and they are widely used for assessing nutritional status in adolescents, particularly physical growth. It is essential to take the criterion of sexual maturation into consideration when interpreting the data obtained from nutritional assessment. In adolescence, anthropometry should be coupled to indicators of sexual maturation and it was recommended to be age-adjusted for maturity status in adolescents (Spear, 1996). In addition, another practical indicator (the median age of menarche) was recommended for girls (WHO, 1995).

On defining and assessing growth and nutritional status of populations, based on anthropometrical measures, international references can be used for comparisons

Sigulem *et al*., (2000), and it is important to use one reference population for all recommended anthropometrical indicators for uniformity of reporting purposes (WHO, 1995). To draw these comparisons, scales such as percentiles[7] and Z scores[8] could be used. Decreasing percentiles over a period is a sign of decreased growth velocity (Sigulem *et al*., 2002).

Body mass index (BMI) or Quetelet index, is obtained from weight and height measurements and is used to assess body size, and to determine whether an individual's weight is appropriate for his or her height. In recent years, BMI has received increased attention for adolescent use, and it was recommended to be used routinely as a screening guideline for overweight adolescents. However, the BMI indicator has the limitation of not making a distinction between lean body mass and fat mass (Sigulem *et al*., 2002). Moreover, it does not provide information on body composition (Barlow 2007).

Age and sex-specific BMI curves for children and adolescents have been developed in some countries, e.g. France (Rolland-Cachera *et al.,* 1991), UK (Cole *et al.,* 1995), USA (Muat *et al.,* 1991 ; (Hammer *et al*., 1991); (Rosner *et al.,* 1998), Italy, and Sweden (Lindgren *et al.,* 1995). Since the French data are older, French BMI reference data are lower than the other reference sets, and this is possibly related to secular trends.

The BMI indicator was recommended by WHO, irrespective of the main type of nutrition problems, whether over-nutrition or under-nutrition (WHO, 1995). In spite of their limitations, the NCHS/WHO reference was recommended by WHO to be used in adolescence (WHO, 1995). For Example: the NCHS/WHO reference for adolescent height-for-age has been recommended by WHO to evaluate stunting in adolescents with the appropriate stunting indicator, which was defined at the 3rd percentile (or z-score of 2 below the median) of height-for-age while the wasting indicator was defined at the 5th percentile cut-off of BMI-for-age (WHO, 1995).

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[7] Percentiles: Is observed in a given age or gender to estimate how many persons, with same age and gender are for example, lighter or heavier in relation to the assessed parameter.

[8] Z scores: the number of standard deviations where the data are distributed from the reference mean of the distribution

The BMI-for-age charts that have been developed in 2000 by CDC growth charts for children ages 2-20 years were recommended to be plotted on growth grids and then to be compared to indicators of weight for height status for adolescents to determine whether individuals are maintaining their growth patterns. These indicators are presented in (Table 2). The table illustrates indicators of weight for height status (Mahan & Escott-Stump, 2004).

Wang *et al.,* (2006) reported some limitations to these references, and they considered a number of weaknesses of the NCHS/WHO references for school-age children and adolescents. The global obesity epidemic has posed another challenge that the NCHS/WHO reference cannot appropriately meet. In spite of this, a single international reference to assess the nutritional status and growth of school-aged children and adolescents across different countries was recommended (Butte *et al.*,2007).

Table 2: Indicators of weight for height status by Mahan & Escott-Stump, 2004

Indicators of Height and Weight Status for Adolescents

Indicator	Anthropometric Variable	Cut-off Values
Stunting (low height-for-age)	Height-for-age	$<3^{rd}$ percentile
Thinness (low BMI-for-age)	BMI-for-age	$<5^{th}$ percentile
At risk for overweight	BMI-for-age	$\geq 85^{th}$ percentile, but $<95^{th}$ percentile
Overweight	BMI-for-age	$\geq 95^{th}$ percentile

Reprinted from Story M, Holt K, Sofka D, eds. Bright Futures in practice: nutrition. Arlington, VA: National Center for Education in Maternal and Child Health, 2000, Table 5, p. 115. Compiled from Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organization Technical Report Series 854:1-452, World Health Organization; 1995; and Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an Expert Committee. Am J Clin Nutr 1994;59:307-316.

Cole *et al.,* (2007) reviewed six large nationally representative cross-sectional studies on growth in Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States. The study covered a total of 97, 876 males and 94, 851 females from birth to 25 years. The aim of study was to determine the cut offs to define thinness in children and adolescents, based on the body mass index at age 18 years. They reported that the World Health Organization defines the grade II thinness in adults as BMI <17. This same cut off, applied to the six datasets at age

18 years, gave a mean BMI close to a z-score of −2 and 80% of the median. Thus, it matches existing criteria for wasting in children based on weight for height. For each dataset, percentile curves were drawn to pass through the cut off of BMI 17 at 18 years. The resulting curves were averaged to provide age and sex-specific cut-off points from 2-18 years. Similar cutoffs that were derived based on BMI 16 and 18.5 at 18 years, together providing definitions of thinness grades 1, 2, and 3 in children and adolescents consisted with the WHO adult definitions. The proposed cut-off points can help to provide internationally comparable prevalence rates of thinness in children and adolescents. The use of BMI in adolescents has been used by several studies, mostly for the diagnosis of obesity (Freedman & Bettylou 2009).

This measure approch was also used as routine in health care and in-school health (WHO 2005).

2.6.3.1 Body composition

Body composition can be measured as a body mass or free body mass. It can be measured by using anthropometric measurements, including waist circumference (WC), mid-upper arm circumference (MAC) and mid-upper arm muscle circumference (MUAMC). Mid-arm and midthigh circumferences were recommended to replace some of the direct methods when estimating muscle mass. Other measures such as skinfold thickness and ratios such as the waist–to-hip ratio (WHR) and a waist–to-height ratios (WHtR) are used to measure body composition (Gibson 2005).

The use of skinfold caliper and some circumferences were introduced since the 1950s and were considered as reliable measurement of subcutaneous fat in different regions of the body. These measurements were used in community-based research, to estimate various components of body composition. Waist and hip circumferences were used to determine risk factors for heart disease and diabetes mellitus (Siervogel *et al.,* 2003). Both waist-hip ratio and skinfold thickness data were recommended by WHO to be collected alongside BMI as an indication of nutritional status (WHO 2005). They are widely used to assess individual patients in clinics. However, extensive training is required to take these measurements and to monitor patients. Moreover, to achieve a high reliability for scientific research purposes, the research team should be well trained in this method of measurement (Siervogel *et al*., 2003)

Centralised excess body fat, which might carry an increased risk for obesity, is associated with metabolic complications in children and adolescents (Taylor *et al*. 2000). Visceral fat measurements using tools such as waist circumference can be used in the assessment of centralised deposition of excess body fat. Waist circumference is considered as an indicator of adiposity, and it reflects total abdominal fat levels. According to the National Institutes of Health guidelines (National Institutes of Health 1998), adult men and women with waist circumferences of >102 cm and >88 cm, respectively, are considered at high risk of obesity-related disorders. However, the classification of obesity associated with health risks is not typically made according to WC among children and adolescents.

The influence of stature on magnitude of the waist circumference in both children and adults is been a matter of concern for many researchers. Height was found to be strongly and positively correlated to the waist circumference throughout growth. This was through childhood and into adulthood. A measure of WC, either alone or in combination with height or the ratio of the waist circumference to height (WHtR) has been suggested as a rapid and simple screening tool of excess abdominal fat accumulation (Sweeting 2007). In addition, it was thought to offer a more sensitive means than BMI for identifying overweight and obese children (McCarthy & Ashwell, 2006).

2.6.3.2 Biochemical Assessment

Biochemical methods could include blood and/or urine samples, to assess nutritional status, specifically nutritional deficiencies such as iron deficiency (explained above).

2.6.4 Growth, development and assessment of nutritional status of Saudi adolescents

Saudi findings on growth and development in addition to different anthropometric measurements used in assessing the nutritional status of Saudi adolescents are presented in Table 3. Results of comparison between studies showed that stunting and wasting are observed among adolescents in Saudi Arabia.

El-Mouzan *et al.*, (2007) has established the reference growth charts for Saudi Arabian children and adolescents aged from birth to 19 years. The data was entirely based on and collected from Saudi children and adolescents (urban/rural), from 13 administrative regions of the Kingdom of Saudi Arabia. The anthropometric data comprised 51,485 observations of which 25,987 are made on boys and 25,498 on girls. Measurements included length, for children two years of age and below, height, for children above two years of age, weight and head circumference. The results of this study presented the most comprehensive and up-to-date reference growth charts for Saudi children and adolescents. The authors recommended the use of these charts by clinicians practicing in Saudi Arabia, or those belonging to other countries, when assessing children and adolescents growth. Moreover, the developers of these growth charts have recommended clinicians to replace older charts.

Studies done so far show Saudi researchers have used multiple measures to assess growth and nutritional status of Saudi adolescents. Anthropometric measures, including height, weight and BMI were frequently used to monitor growth in adolescents and to assess their nutritional status. The measures were referred to different international standards for comparison.

Recently, Saudi researchers have used WC as an indicator of adiposity in children and adolescents (Collison *et al.*, 2010; AL DISI, 2008). Other circumferences used was MUAC in addition to triceps skinfold (Mohamed & Fayed 2011). However, to our knowledge ratios such as WHtR to assess adiposity in this group, was not used.

Other assessment instruments like questionnaires (self-reported questionnaire or in-person interviews) to collect data on socio-demographic, diet histories, and nutritional behaviours have also been used.

Additionally, biochemical and haematological measures for haemoglobin and haematocrit concentration have been assessed. Saudi studies on anaemia have used different techniques to collect samples of haemoglobin such as HemoCue hemoglobin tests and venepuncture. In addition, different cut-off values to interpret haemoglobin values have been used (Abou-zeid *et al*., 2006) and (Abalkhail and Shawky 2002).

2.6.5 Dietary assessment

2.6.5.1 Food intake, eating behaviours and lifestyle of adolescents

Since the 1940s, diet has been increasingly recognised as a major determinant of health and disease. Surveys of food intake are indirect indicators of nutritional status, and they should be supplemented by surveys on behaviours such as physical activity and presence of acute or chronic diseases (Sigulem *et al*., 2000). Evaluation of dietary intake, eating behaviours and other behaviours is essential in all nutritional assessments, and data obtained from both quantitative and qualitative methods are useful in this type of evaluation (Growth 1973).

Food intake

Analysis of the nutrient content of food intake as part of an assessment of nutritional status can provide information that is suggestive of adequacy, or indicative of specific dietary deficiencies (Guthrie 1986). Evaluations of nutrient intakes are carried out in a number of ways and there is no single dietary method suitable for all consumption surveys. Differences exist according to the purpose of the study, precision needed, particular population, period of interest (if it is past or current) and available resources.

Dietary methods are often classified according to "group" or "individual" methods. Group data are based either on national food availability statistics or on household data while the individual dietary methods are considered as direct methods for dietary assessment. Generally, these methods include food frequency questionnaires (FFQ), 24-hour recall or occasionally recent recalls of three to seven days, food records or diaries, and diet histories.

Eating behaviours

The studies of eating patterns are important in redefining nutritional education of adolescents (Sigulem *et al*., 2000). From dietary histories, the importance of various foods or food groups in the diet can be determined.

Eating patterns and nutritional behaviours vary frequently in adolescents, and they are influenced by many factors. These factors affect the dietary intakes of adolescents, which become less constant when they make their transition to adulthood. This in turn places them in the higher-risk category for many diseases irrespective of the area (Story *et al.,* 2002). Changes in eating patterns during adolescence are influenced by cognitive, physical, social, and lifestyle factors. For example, studies of adolescent diet have shown that food consumed at home is related to socio-economic variables, while the food consumed outside home is independent of family background or social class groups but more a result of peer pressure (European Food Information Council 2005). For example, the diets of British schoolchildren showed no regional variation in consumption of unhealthy foods such as crisps and fizzy drinks (Sheffield 2002). Some of the dietary patterns such as snacking, meal skipping, wide use of fast food, low consumption of fruits and vegetables, and of dairy products in some instances and faulty dieting practices in girls are quite common among adolescents in industrialised countries, and in a few developing countries, particularly in cities (Cavadini et al., 1999).

Resmussen and colleagues, in their review of the literature for potential determinants for fruit and vegetable intake in American children and adolescents (98 papers) found that the determinants were as follows: age, gender, socio-economic position, preferences, parental intake experience, and the most vital home availability/accessibility (Rasmussen *et al*., 2006). Girls and younger children tended to have a higher or more frequent intake of fruits and vegetables than boys and older children. Socio-economic position, preferences, parental intake experience, and home availability/accessibility are all consistently positively associated with the intake of fruits and vegetables**.**

Adolescents from Western countries demonstrated knowledge of healthy food. The barriers to knowledge were identified as time limits, availability of healthy food in school, and lack of concern with healthy food consumption, convenience of fewer healthy alternative, taste preference for less healthy food and lack of parental/school support (Neumark-Sztainer *et al*., 2003); (O' Dea, 2003).

Physical activity and lifestyle

Recent studies and reviews have summarized the benefits of regular physical activity on several health and behavioural outcomes of adolescents and its potential for reducing the incidence of chronic diseases that are manifested in adulthood. The level of physical activity in adolescents is a predictor of subsequent adiposity and decreases in physical activity over the teenage years are associated with increases in a body mass index (Kurz & Johnson-Welch 1994). Risk factors associated with cardiovascular disease in adolescence that includes overweight status, hypertension, increased blood lipids, and cholesterol are linked to physical inactivity (Bonnie & Spear 2002). A consensus panel from various countries developed guidelines for physical activity for adolescents that might maintain and/or enhance health. The guidelines state that all adolescents should be physically active daily or nearly every day as part of play, games, sports, work, transportation, recreation, physical education, or planned exercises in the context of family, school, and community activities. The guidelines also state that adolescents should engage in 3 or more sessions per week of activities that last 20 minutes or more at a time and that require moderate to vigorous levels of exertion (Sallis & Patrick 1994).

The UK NICE public health guidance 17 (PH17) for those who are involved in promoting physical activity among children and young people, including parents and schools was issued in 2009. The NICE included recommendations for multi-component school and community programmes for children and young people aged 4 to 18 who attend schools or other education institutions. Organizations were advised on methods of promoting benefits and encouraging participations on physical activity. They were also advised on planning strategies and consultations with young people. Moreover, they were advised in promoting physically active travel such as cycling and walking (NICE, 2009).

Physical activity in adolescence may contribute to the development of healthy adult lifestyles and help to reduce chronic diseases' incidence in adulthood (Hallal *et al.,* 2006). Strong and colleagues published a systematic literature review of evidence about physical activity for school-age youth in 2005, by identifying 850 articles. The aim of the review was to evaluate the effects of physical activity on health and behaviour outcomes in US school-age youth and to develop evidence-based recommendations for physical activity considered appropriate to yield beneficial health and behavioural outcomes. Results of the review showed evidence of the influence of physical activity on some health and behaviour outcomes in youth for weight, cardiovascular health, asthma, mental health, academic performance and musculoskeletal health and fitness. The reviewers recommended that adolescents participate every day in 60 minutes or more of moderate to vigorous[9] physical activity that is enjoyable and developmentally appropriate to achieve desired health and behavioural outcomes. The reviewers discouraged physical inactivity, which has been evidenced as a strong contributor to obesity and overweight status. Moreover, sedentary activities and behaviours such as excessive television viewing, computer use, video games, and telephone conversations were recommended to be reduced to less than two hours per day to encourage activity that is more physical.

Brodersen and colleagues conducted a five-year longitudinal study in London, seeking to assess developmental trends in physical activity and sedentary

[9] Moderate-intensity activity e.g. brisk walking and vigorous-intensity activity e.g. running (CDC, http://www.cdc.gov/physicalactivity/everyone/guidelines/children.html)

behaviour in British adolescents in relation to gender, ethnicity and socioeconomic status (Brodersen *et al.,* 2007). The study compromised a diverse cohort of 5863 students aged 11-12 years at baseline in 1999, and they were categorised as white, black or Asian. The results yielded that there were marked reductions in physical activity and increases in sedentary behaviour between ages 11-12 and 15-16. The study further found that boys were more active than girls were, and the decline in physical activity was greater in girls (46% reduction) than in boys (23%). Asian students were less active than Whites were, and this was true for Black girls but not boys. Black students were more sedentary than White students were. Levels of sedentary behaviour were greater in lower SES respondents. Most differences between ethnic and SES groups were present by the age of 11.

In their systematic semi-quantitative review of 150 studies on environmental factors that determine youth physical activity, Ferreria and colleagues concluded that environmental factors such as support from others, mother's education level, family income, and non-vocational school attendance correlates with adolescent's physical activities (Ferreira *et al*., 2006).

2.6.5.2 Food intake, eating behaviours and lifestyle of Saudi adolescents

Food intake and habits of Saudi adolescents

In most parts of the country, Saudi adolescents follow eating patterns that are similar to their counterparts from other parts of the world, especially those from western countries. Differences in dietary habits exist among Saudi adolescents in different regions of Saudi Arabia with more boys and girls in the Western region, than Northern and Eastern region, prefer vegetables and fruits in their diet (Fayssal et al.' 2007).

Differences in food intake of female adolescents in Jeddah were linked to socio-economic status. SES was indicated by school sector either private or governmental sponsored. The study concluded that the nutritional habits and lifestyle for adolescent girls were better in private schools than government sponsored schools (Musaiger *et al*., 2005). The comparison of eating patterns included vegetable intake, consumption of fizzy drinks, fast foods' consumption, snack consumption and eating while watching television.

Saudi girls are less likely to take regular daily breakfast compared to Saudi boys (74.3% vs. 82%). However, both genders were reported to either skip breakfast or rarely take breakfast (Al-Shoshan 1990). In Abha city, south of Saudi Arabia, breakfast was skipped by about 49% of both genders in secondary schools. However, in another study in the same region, a significant gender difference in relation to consumption of breakfast was found only among younger groups (12-14 years) (Farghaly *et al.*, 2007). The same study reported regular consumption of milk at breakfast by only 51.5% of the Saudi female adolescents. The milk consumption was lower among the older group (16-18 years), compared to the 12-15 years group.

In Riyadh city, 42.1% of schoolgirls aged 10-18 years, were reported to miss their breakfast (Al-Sheri 1996). According to a previous Saudi study by Al-Dossary *et al*., in 2010, the nutritional status of Saudi teenagers includes excessive dependence on fast-food outlets.

In aiming to determine the level and sources of Saudi adolescents' knowledge about foods and healthy diets, Al-Almaie (2005) reported that 65.3% of 1331 surveyed Saudi female students thought that unsaturated fats were healthier than saturated fat in food. In general, most of the students did not know the difference between the two types of fats, and they defined cholesterol incorrectly, as a type of carbohydrate.

Physical activity of Saudi adolescents

Physical activities and physical education programs are not permitted at Saudi government-sponsored girls' schools because they are still considered to be contrary to cultural and social norms and beliefs. However, the issue is being reviewed by the relevant government authority, namely the Consultative Council (Majlis al-Shura) which has sent its recommendation, based on a majority vote. The recommendation made in 2005 urge introduction of legislation, which allows physical education and activities for school-aged girls. Furthermore, Saudi girls rarely use walking as a method of transportation to and from school and many leisure activities, including television and computer use are sedentary and used by teen girls after school. Unlike governmental schools, physical education and activities are permitted at private schools and students at such school typically perform physical activities of around 45 minutes 2-3 classes per week on average. However, some adolescent girls are also involved in other extra- curricular outdoor activities such as walking, sports and exercises in public areas or fitness centres. AL-Hazzaa made a review of the status of physical activity among Saudi children and adolescents in 2002 and discussed its implications for cardiovascular health and fitness (AL-Hazzaa, 2002). He found that most Saudi children, and adolescents do not meet the minimal weekly requirement of moderate to vigorous physical activity necessary for an effectively functioning cardiorespiratory system. Furthermore, active Saudi boys tend to have favourable levels of serum triglycerides and high-density lipoproteins-cholesterol compared to inactive boys. The same researcher carried out another review that aimed at investigating the factors related to inactivity in Saudi children. The review demonstrated that 71% of Saudi youth do not engage in physical activity of sufficient duration and frequency. Television viewing, videos, and computer games were the most contributing factors to the inactivity epidemic. Moreover, physical activity levels are considerably reduced from childhood to early adulthood while television-viewing time was substantially increased (AL-Hazzaa 2002).

Current Saudi research related to gender and physical activity participation, documents that females are consistently reported as being less involved in sports, exercise, and physical activity than boys (Al-Hazzaa 2002). Saudi boys and girls at the age of 15 years and above were shown to be equally physically inactive while girls below 15 years were reported as more physically inactive, compared to boys in the same age (Fayssal, 2007). Farghaly *et al.,* (2007***)*** found that in Abha city duration of exercises is significantly different between Saudi girls and boys (F=15.99). In intermediate schools, for instance, self-reporting of daily exercises was 0.4±0.6 vs. 1.1±1.0 hours/day in girls and boys, respectively. While in the secondary schools, it was found that 0.4±0.8 vs. 1.0±1.0, respectively. The same study found that female students study for a longer time (2.3-3.2 hours/day) than males and spend less time watching television (0.8±0.9 vs. 1.2±1.2 hours/day).

According to school type, 60% of Jeddah adolescent girls in governmental schools do not perform any type of physical activities, compared to 40 % of their counterparts in private schools that perform different types of physical activities. Physical education classes are not included in curriculum in both school sectors (Musaiger *et al*., 2005).

2.7 School meals and nutrition education

Research has demonstrated that adolescents' eating patterns are strongly influenced by both the physical and the social environment. Concerning physical environment, adolescents are more likely to eat foods that are available and easily accessible. Mealtime structure is an important factor related to eating behaviours of adolescents, and it can be affected by their social and physical environment, including the presence of family, peers and friends at mealtimes, TV viewing during meals, and the source of foods (e.g., restaurants, schools) (Story et al., 2002).

The school is a vital setting for modeling healthier eating choices amongst adolescents. It is particularly relevant to the present study to consider school meals provided to schoolgirls and their nutritional standards in addition to factors affecting the quality of these meals such as the quality of school catering, nutrition education provided by schools, and policies and regulations related to school meals.

Conway et al., (2002), reported the content of packed lunches of the adolescents in the USA. The study was conducted on 1,381 students from middle schools, and results showed that the most common foods were found to be high in salt, sugar, and fat. Snacks are easily available at school in vending machines and seventy percent of adolescents used vending machines to purchase snacks when at school (Bonnie 2000). In the United Kingdom, high-fat and high-sugar foods (HFSS) were popular in secondary schools. Secondary schools had vending machines with crisps, confectionery and carbonated beverages for sale but the UK government has banned all HFSS foods from both school meals and vending machines from September 2009. The 'Education and Inspections Act 2006' provided legislative powers to affect changes to the nutritional standards of school foods. Under the Act, the system made regulations in connection with nutritional standards that are extended to cover all foods and drinks provided to pupils by local education authorities (LEAs) and governing bodies. The duty to ensure that these standards are met has been placed on LEAs and governing bodies. The Act is introducing further guidelines to increase pupils' access to healthier foods and reduce the amount of HFSS food and drinks. Nutrient profiling (NP) developed by the UK Food Standards Agency (FSA) was suggested to be imposed in secondary schools in 2009 (Simpson *et al*., 2006). The nutrient profiling model was developed by FSA in 2003 for use in relation to the promotion of foods to children. Moreover, the model was used in relation to provision of foods through vending machines and for school lunches (Rayner et al., 2004).

A survey was done to assess school canteens in Dubai city, UAE. The survey covered 216 schools (82 public and 134 private) with 150,000 students from April to June, 2010. The survey concluded that almost half the numbers of schools do not offer fresh fruits to students as a food choice. Some schools offer carbonated drinks, energy drinks and processed foods. Public schools were found to have canteen, committees that involve both children and their parents in planning and choosing menus and food items provided by school canteens and this is probably due to the implementation of the School Health Project. Only 45 per cent of schools follow nutritional guidelines issued by Dubai Municipality that mainly concerns food safety and hygiene (Zain, 2010).

2.7.1 School meals and nutrition education in Saudi Arabia

In Saudi Arabia, the School Healthcare Department was established in 1964. The Department is responsible for health in the school environment and school foods that are provided by canteens. In addition, they conduct periodic health and nutrition surveys in order to investigate, evaluate and control the prevalent health and nutrition-related problems in schools throughout Saudi Arabia [Personal contact with Al-Shehri (Department Chief of School Health) March, 2008]. As mentioned in Chapter 1, all governmental sponsored schools across the Kingdom of Saudi Arabia are run by one outside caterer who provides meals and snacks for students at reasonable prices. As a result, individual schools have little influence over the food provided.

Despite the polices and regulation for school health services, the meals and snacks provided by the caterer do not meet the basic provision for healthy foods, and the most prevalent options in school canteens are HFSS foods and imitation fruit juices. These meals and snack foods are intended either to supplement foods brought from home or in many cases, these actually constitute the student's breakfast. Private schools operate their own canteens by making contracts with different caterers who give them the right to sell fast food meals or snack foods and mostly have no healthy options. In addition, the regulations for some of these schools do not prohibit the sale of sweetened carbonated beverages. As mentioned above, nutrition and health education in schools are within the national curriculum core subjects of science, and food and nutrition education is part of science in both education levels (intermediate and secondary levels). The curriculum covers the basic need for food as a vital part of life through to the more complex aspects of how nutrients work within the body (Ministry of Education, 2008). Passmore pointed out that food, nutrition and health can be incorporated into most of the other subjects as a cross-curricular theme (Passmore 1996).

2.8 Media, food marketing and advertising

2.8.1 Media in Saudi Arabia

Social, cultural and political forces are important factors to consider when studying or analysing media, and its relation to Arab youth but religion is more influential (Kraidy and Khalil 2008). Saudi Arabia has no written secular constitution except a constitution in the form of the Koran (the Qur`an) and the Sunnah (saying and actions) of the Prophet Mohammed. Both constitute the primary sources on which Islamic law is based, and it is Islamic law, which used by the Saudi monarchy to control all aspects of life, including the media (Rice, 2004).

While Saudi Arabia is a particularly conservative country, lifestyle in the Kingdom is ultramodern and high-tech. For example, in 2001, 99% of the Saudi households were reported by Euromonitor statistics to own a colour TV and 23% to own a personal computer (Rice 2004).

In the age of globalization and similar to youth in other parts of the world, young Saudis are avid users of mobile telephones and text messaging, the internet, social-networking satellite television and popular music. In addition, they can access mass media through print media, e.g. books, magazines, and comics or through electronic media, e.g. the home utilities of radio, television (and variations, including broadcast, cable, satellite, video, and DVD), and the internet. Films can only be accessed by these adolescents on video cassettes or DVDs and on paid TV channels such as ART Cinema, Rotana Cinema, and 'Melody Aflam'. This is because paid cinema and cinema halls are not permitted in Saudi Arabia except in very limited and private occasions, and places were girls can watch films separately from boys or when accompanying their family on special occasions.

2.8.2 Food promotion and marketing & Saudi adolescent consumers

Because of cultural and political factors in developing countries including the spread of Western eating habits, children in developing and emerging economics are widely targeted by fast food marketing and marketers use the same techniques used in developed countries (Hastings *et al.*, 2006). As a result, traditional family mealtimes have become outdated for these children.

Saudi Arabia is considered as the largest market in the Arabian Gulf region which offers investors and exporters many opportunities, including food marketing and advertising (Rice 2004). In their report that was based on a Jeddah survey on snack foods, the United States Department of Commerce & Department of Agriculture (2011) reported that Saudi Arabia has, about 25 producers of snacks and half of them are located in Jeddah. The rests are located in Riyadh and Eastern Province (Department of Commerce & Department of Agriculture 2011). The same research reported that more than 60 different brands of savoury snacks are sold in Saudi retail outlets such as supermarkets and corner stores. Two-thirds of these are local brands and several other are U.S.-origin brands. There are more than 55 local brands on the market and salted snacks are the most widely available snacks in the Saudi market (e.g. Tasali and Lays).

Because of the economic development and technological innovations in the country and the wide access to mass media, aggressive advertising and marketing, through television, the internet and mobile technology, target young Saudis (Kraidy, 2006). Many products that are easier to consume on the run, more convenient to prepare, and/or are specifically designed for older children have made food easily available in a variety of places, e.g. vending machines and gas stations. In addition, marketing of beauty and body-related industries, including the fitness industry, the diet industry, and cosmetic surgery in addition to products and services to achieve ideal weights are very widespread in the Arab media, including Saudi Arabia. All these body-related industries are promoted and marketed through global, regional and national mass media, which allows disordered body images to be spread among some women throughout the country of Saudi Arabia, particularly among young women.

2.8.3 Television viewing and food adverts' exposure

Although the mass media can reach adolescent audiences through different channels of communication, the focus in this thesis will be on television.

Among children and adolescents, television viewing is a fundamental leisure-time form of entertainment (Swinburn & Shelly 2008). While the hypermedia space involves various media and information technologies, television remains the dominant medium for Western (Story *et al*., 2002) and Arab youth (Kraidy 2006). It is also considered as the largest source of food-related messages, especially for younger children (Story & French 2004). In Saudi Arabia, 61% of young girls (n=1331) rely on television as a source of knowledge about health, including food and diets (Al-Almaie 2005).

In the UK, children between the ages of 4-15 years watch an average of about 2.5 hours of television per day (Ofcom 2004). In addition, it has been reported that 75% of 12-15 years old have a TV set in their bedroom (Ofcom 2006). Al-Dossary *et al*., (2010) mentioned in her study that on average, a child in Saudi Arabia spends six hours per day in front of the screen. These findings (six-hours screen time per day), however, have not been reported by any other Saudi research. On the other hand, in another study in Abha city, girls from intermediate schools were self-reported to watch TV only for 0.8±0.9 hours per day while girls from high schools watch TV for 1.1±1.1 hours/day (Farghaly *et al*., 2007). The same study showed that girls have significantly less screen time, compared to boys (F=7.04).

Previous generations of some Arabs, particularly Saudis, grew up in a world where there was only one-state television channel. The state television channel does not or only rarely airs advertisements. However, the current Saudi teenage generation that lives in a country that have a (possible) number of TV sets (for each three persons, there is a one TV set), could choose between more than 200 satellite television channels. These TV channels are saturated with commercial messages (Marwan *et al.,* 2008).

Currently, food producers use advertising on the channels most frequently viewed by Saudis including teens. Advertising is important on both the national television channels and other regional satellite channels, e.g. Middle East Arab television. The foods advertised on these channels are generally nutrient-poor foods. In addition, fast foods are highly promoted on these channels.

The impact of globalization on media is evident in Arab satellite channels. Most of the TV channels are in the Arabic language but are saturated by Western ideas and values, (Khalil 2005). Some programmes that are related to food and 'weight' issues such as 'Oprah' and 'Dr. Phil' have positive influence on adolescent health. These programmes are extremely popular among Arab girls. This naturally increases their exposure to a foreign culture, and consequently, influences their food habits, and may cause them to behave the same way as those from different cultures towards food or to 'weight' watch.

2.8.4 The effects of food promotion on children's and adolescents' behaviour

The impact of food advertising on young people's food choice has been comprehensively studied and reviewed by previous international research, particularly in Europe, including the UK and in the USA. Few studies have investigated the media effects on eating behaviours and nutritional status of Saudi and other Gulf States' adolescents, and these investigations were largely subjective and conducted using self-reported surveys.

Food preferences, consumption choices and purchases of children and adolescents of different ages can be affected by the food advertising that they are exposed to. Findings about the influences of food promotion were reviewed from both developed and developing countries (Hastings *et al*., 2006). The finding of this same review concluded that food promotion might have little influence on children's general perceptions of what constitutes a healthy diet. However, it may affect more specific types of nutritional knowledge such as information about body image or healthy dieting practices. The review also concluded that different promotional techniques are used by food marketers in developing countries to persuade children and young people to purchase their products are as follows: emphasis on television advertising, creative themes of fun, excitement and animation for young children, sports sponsorship and celebrity endorsement, collectable toys and child-oriented distribution strategies.

The World Health Organization in 2003 has documented food marketing as a crucial area of focus on the prevention of obesity in young persons. Regulating the marketing for energy dense foods and beverages on TV could reduce the effect of TV viewing on weight gain was the conclusion of Swinburn & Shelly (2008). Some evidence about significant associations between television viewing and diet, and health was found by the review of (Hastings *et al*., 2006). This included television viewing and obesity. However, the potential effect of food advertising on this relationship could not be separated from the general effect of television viewing as factors included not only the impact of advertising seen while watching television and the impact of other messages seen while watching television (such as programme content) but also the sedentary nature of the activity itself. In the Arab countries, research on obesity has considered different factors such as cultural and environmental factors (Musaiger 2000). However, there has been little attention focused on the association with and the impact of television viewing and food advertising.

Food industry is in direct with consumers and can make a strong contribution to diet and health of individuals. This can be achieved by providing foods that meet consumers' needs in terms of taste, convenience, and quality and nutrition value (Gassin, 2001). Information on healthy eating or lifestyle can be provided to consumers through advertising, product packaging, educational materials and online communications. However, providing this information to the young group requires teamwork and incorporated promotion that involves health professionals, educators, media, the food industry and vendors, which facilitate better implementation of public health nutrition approaches. Health messages in television food advertising might be confusing when including, for example, overstated health claims or exaggerated pleasure responses to eating a food product. A US-based study of advertisements during children's programming showed that although 90% of advertisements were for food high in fat, sugars or sodium, or low in nutrients, almost half of all food advertisements contained health and/or nutrition or physical activity messages (Batada *et al.,* 2008).

A qualitative research study to evaluate the relationship between consumption of HFSS foods and the amount of TV viewed was conducted by Ofcom in 2004. The findings were based on parents' response to a question about the screen time of their children on average schooldays and on average weekends. The findings indicated that the overall consumption of HFSS foods was significantly associated with the amount of stated television viewing.

The age and gender of characters ''who present food advertisements'' were also found to be important factors in influencing the food choice of adolescents. Nassif & Gunter (2008) conducted a content analysis of TV adverts from the Saudi national channel (Channel 1) and ITV1 in the United Kingdom in 2000–2001. The study included 164 adverts from each country and adverts on both channels were compared as regards to the representation of both genders. Results showed that men and women were equally visually represented as leading characters in advertisements in both countries, but male voice-overs dominated in Saudi advertisements more than in British advertisements. In both channels, women appeared more frequently in domestic roles and settings and less often in occupational or leisure roles and settings. However, in Saudi advertisements, women were much more likely to promote body care and household cleaning products than men.

There is a growing body of literature about sedentary behaviour, particularly television viewing, which merits some attention. In his review, Al-Hazzaa, (2002), associated television viewing by Saudi youth with obesity and lack of physical activities.

2.8.5 Regulations and concerns about the effects of television advertising on children

Despite the importance of individual behaviour and responsibility of young people, (Caraher & Landon 2006) emphasised the important role and obligation of decision makers in protecting young consumers. Government and society could provide tools for adolescents and their families to empower them to control the flow of media content and messages to their homes. Many countries have already recognized the importance of controlling media content that is directed at young people through legislation. In addition, many of these countries have already established different types of regulations related to food advertising that is directed at children and adolescents.

Two approaches have been followed by countries that have control and regulations on food advertising, particularly those directed at children and adolescents; the first approach is based on a total ban of food advertising and to our knowledge this has not been used by any country yet. The second approach is based on a partial exclusion of food advertising (Hawke 2004). The same review concluded that regulations have generally taken the following forms; the times of advertising, the amount of advertising by types/categories of food advertised, the use of personalities to promote foodstuffs, and the messages communicated and to whom they were directed. For example, the amount of snack food advertising, soda, and fast foods on prime time and children TV has been regulated by countries such as the United Kingdom, Australia, the Netherlands and Sweden. Some of the regulators also implemented restrictions or a ban on the use of celebrities or cartoon characters in food advertising aimed at children. As a result, some of these countries have reported lower rates of childhood obesity (Hawke 2004) & (Nestle 2006). In Britain, a ban on the advertising of food and beverages that are HFSS in programming for children & teens is currently being considered (Ofcom 2010). Recently, the Public Health Responsibility Deal was established in March 2011. One of the aims of the deal is to make healthy products and choices available to British people. The healthy choices are to be through commercial actions or community events. The inclusion of commercial in this deal was for its powerful impact on health and wellbeing of the population. A diverse range of organizations such as the public sector, commercial, non-governmental, and academia were suggested by The Health Responsibility Deal to work in partnership to enhance healthy choices (Department of Health 2011)

According to Hawke in 2004, none of the Arabian Gulf countries including Saudi Arabia follows any type of regulations regarding food advertising aimed at children and adolescents (Hawke 2004).

The schools could also have a role in controlling food advertising for youth. This could be through the teaching and including of media literacy in the school curriculum. This can help to avoid media manipulation, and to educate and help adolescents gain skills to analyse media they consume. The media literacy could also include awareness of the presence of mass media in teenagers' lives, analysis of media's content, the perception of media and the aim of messages, they provide to this group. Moreover, the understanding of policies and regulations that can control the media is central for these teenagers to help them understand how the media operates and how it can influence their health (Potter 2010).

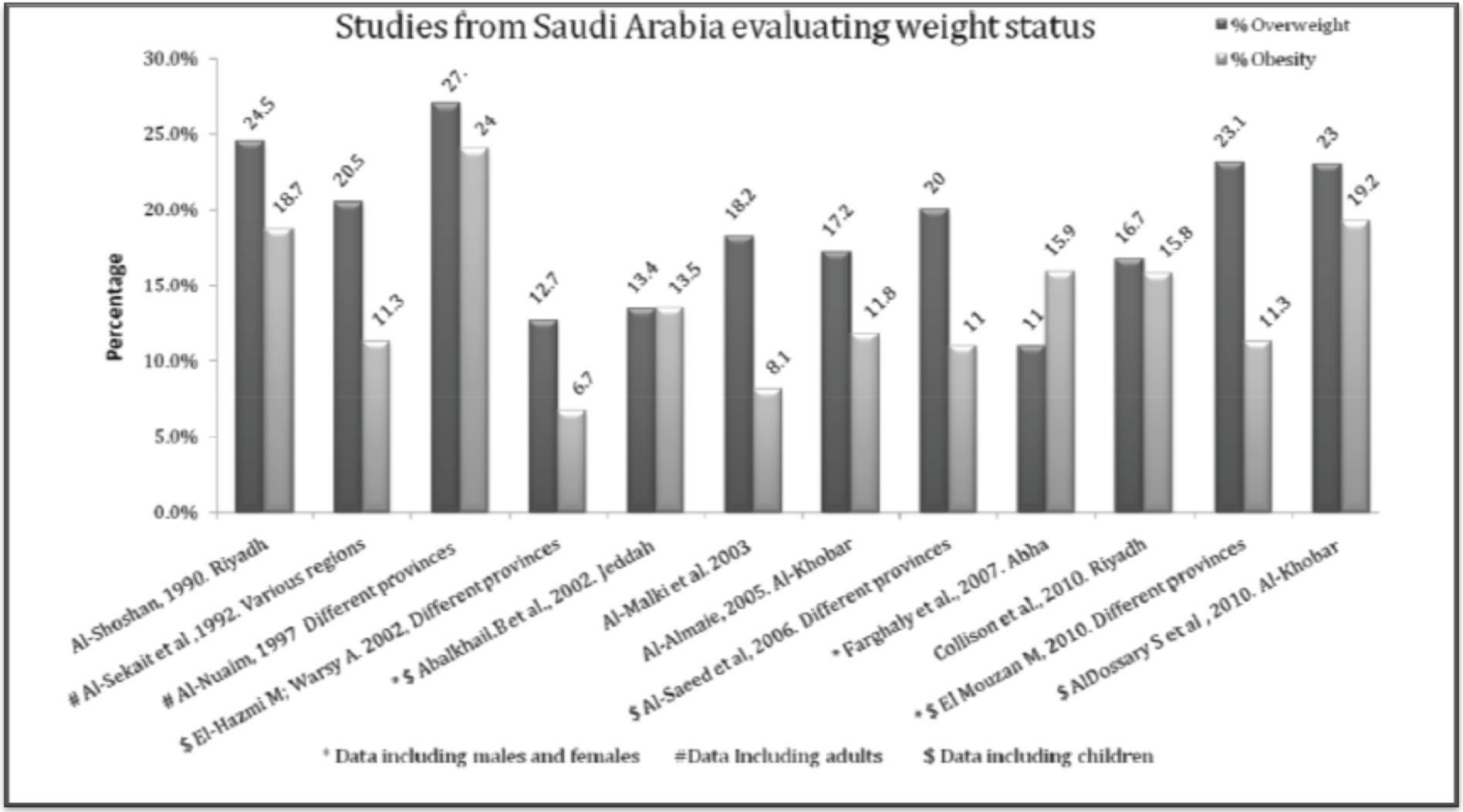

Figure 1: Some of the Saudi studies on prevalence of overweight status and obesity among adolescent girls in Saudi Arabia over the last 20 years

Table 3: A summary of studies from Saudi Arabia evaluating weight status and growth patterns of Saudi young people

Author, Year Region	**Target young people**	**Sample size(n), Gender, Age (Year)**	**Measurements & Growth status**	**Standard or Reference population**	**%Obesity/ Overweight prevalence**	**%Underweight prevalence**
(Hammam *et al*., 1980): Barza, Western province	Schoolchildren rural community	470 (M/ F) Age: 6 -18 y	n/d	NCHS[10] percentile Data		57.1% (M), 32.0% (F) <3rd centiles
(Attallah N *et al*., 1990): Asir region, South province	Non-pregnant females	300 (F) Age: 17-20	WT,HT & age at menarche …………………. -mean HT-153.7 cm -mean WT-53.0 kg	Relevant British Young Women presented by Eveleth &Tanner (1976)		
(Al-Hazzaa 1990): Riyadh, Central province	schoolboys	1169 (M) Age: 6-14 y.	WT, HT, grip strength, chest triceps, sub-scapular skinfold thicknesses biacromial, chest bi-iliac, knee, and elbow breadths. ……………………….. -Mean HT (for 13±yrs) 147.5±6.9 cm & mean WT-39.7± 7.6 kg -mean HT (for 14±yrs)-153-0±9.0 cm& mean WT-47.8± 12.9 kg	NCHS standards		

[10] NCHS National Centre for Health Statistics

Table 3: A summary of studies from Saudi Arabia evaluating weight status and growth patterns of Saudi young people(continue)

Author, Year Region	Target young people	Sample size(n), Gender, Age/Year	Measurements &Growth status	Standard or Reference population	%Obesity/ Overweight prevalence	%Underweight Prevalence
(Al-Shoshan 1990): Riyadh, Central province	Adolescents and adults at the Health Week Exhibition campaign in 1988	311 (M/F) Age:15-18 y	WT, HT & BMI / Questionnaire -Adolescents (M): HT-165 ± 6.4cm WT-61 ±14.1 kg -Adolescents (F): height =156 ± 6.4 cm weight = 53 ±10.3 kg	American standards for Weight, height and BMI	(M) Overweight 14.3% & obesity 5.5%. (F)Overweight 24.5% & obesity 18.7%	
(Al-Sekait *et al*., 1992): Different provinces	schoolchildren	48.000 (M/F) Age: 6-18 y.		NCHS Z score data	(M) Overweight 17.6% & obesity 6.5%(F)Overweight 20.5% & obesity 11.3%	
(Magbool 1994): 4 districts/ Eastern province	Schoolchildren rural & urban community	21,638 (M/ F) Age:6-16 y	WT, HT& BMI determination of BMI percentiles for Saudi children	BMI centiles for American children (Hammer *et al.* ,1991)	Age | M (BMI 90th &95th) | F (BMI 90th &95th) 13 | **23.10** | **26.35** | 25.88 | 28.40 14 | **24.65** | **27.48** | 27.11 | 29.94 15 | **24.65** | **27.20** | 28.15 | 31.18 16 | **25.35** | **28.33** | 28.68 | 31.97	
(Abolfotouh and Badawi 1995): high-altitude area/ Asir /South province)	Schoolboys	1407 (M) Age: 6-14 y.	WT & HT Mean HT (for 13&14 yrs.)-145.8 cm & mean WT-39.6 kg	NCHS standards		

Table 3: A summary of studies from Saudi Arabia evaluating weight status and growth patterns of Saudi young people(continue)

Author, Year Region	Target population	Sample size(n), Gender, Age (Year)	Measurements & Growth status	Standard or Reference population	%Obesity/ Overweight prevalence	%Underweight prevalence
(Al-Nuaim *et al*., 1996). Different provinces	Schoolchildren	9061 (M) Age: 6-18 y.	WT, HT& BMI	NCHS/CDC	Overweight-11.7% Obesity- 15.8%	
(Al-Nuaim 1997) Different provinces	Schoolchildren & adults, elderly	13,177 (M/ F) >15 y (15-95 y)	WT, HT& BMI Questionnaire	WHO classification overweight (BMI 25-30) & obesity (BMI > 30)	(M) Overweight 29% & obesity 16% (F) Overweight 27% & obesity 24%	
(Abahussain *et al*.,1999) AL-Khobar city. Eastern province	Adolescent girls	676 (F) Age:12-19 y.	WT, HT& BMI ………………………. - Median HT< the 50th percentiles -Median WT- between the 75th & 50th	The standard international definition for child overweight and obesity (IOTF) (Cole *et al*.,2000)	Overweight/obes2 8%	Underweight: 11%
(El-Hazmi and Warsy 2002): Different provinces	National epidemiological & household survey	12,701 (M/ F) Age: 1-18 y.	WT, HT& BMI	The standard international definition for child overweight and obesity (IOTF) (Cole *et al*., 2000)	(M) Overweight 10.7% & obesity 6.0% (F) Overweight 12.7% & obesity 6.7%	

Table 3: A summary of studies from Saudi Arabia evaluating weight status and growth patterns of Saudi young people(continue)

Author, Year Region	Target young people	Sample size(n), Gender, Age (Year)	Measurements & Growth status	Standard or Reference population	%Obesity/ Overweight prevalence	%Underweight prevalence
(Abalkhail 2002). Jeddah City, Western province	Children & adults	(M/ F) Age:10-20 y.	WT, HT& BMI Comparison of BMI data from 1994 -2000		BMI: increased between (1994 and 2000) at the 50th percentile & more higher at the 85th & 95th	
(Abalkhail.B *et al.*, 2002): Jeddah City, Western province	Schoolchildren	2860 (M/ F) Age: 9 - 21 y.	Self-reported WT& HT Actual WT & HT/BMI In-person interview	The adopted NHANES growth charts from the WHO	Overweight 13.4% & obesity 13.5% (All population)	
(Al-Rukban 2003): Riyadh, Central province	Intermediate & secondary schools	894 (M) Age: 12-20 y.	WT, HT& BMI Self-administered questionnaire	WHO classification of overweight and obesity for adults	Overweight 13.8% & Obesity 20.5%	.
(Al-Malki *et al.*, 2003):	Students & housewives/outpatient clinics	600 (F) . Age: 16 – 45 y.	WT, HT& BMI	WHO classification of overweight and obesity for adults	In the age group (16 – 20 y), Overweight 18.24% & obesity 8.1%	

Table 3: A summary of studies from Saudi Arabia evaluating weight status and growth patterns of Saudi young people(continue)

Author, Year Region	Target young people	Sample size(n), Gender, Age (Year)	Measurements & Growth status	Standard or Reference population	%Obesity/ Overweight prevalence	%Underweight prevalence
(Al-Almaie 2005). Al-Khobar, Eastern province	Intermediate and all 3 grades of secondary school	1766 (M/F) 14-19 y.	WT, HT& BMI	-The NHANES growth charts from the WHO -The standard international definition for child overweight and obesity (IOTF) (Cole *et al.*, 2000)	(M) Overweight 10.2% & obesity 19.3% (F) Overweight 17.2% & obesity 11.8%	
(Al-Saeed *et al.*, 2006) Different provinces	Primary and preparatory schools	2239 (F) Age: 6 to 17 y.	WT, HT& BMI Self-administered questionnaire	The standard international definition for child overweight and obesity (Cole *et al,*. 2000) & CDC -BMI-for-age percentiles for girls (for 2–20 years)	Overweight 20%. & Obesity 11%	
(Abou-zeid *et al.*, 2006): AL-Hada Area, Taif, Western province	Schoolchildren From primary schools	513 (M) Age: 6-13 y.	WT, HT& BMI Haemoglobin & haematocrit concentration		Obesity 9.8%	Underweight: 14.2% 13.8% were wasted & 12.2% were stunted.

Table 3: A summary of studies from Saudi Arabia evaluating weight status and growth patterns of Saudi young people(continue)

Author, Year Region	Target young people	Sample size(n), Gender, Age (Year)	Measurements & Growth status	Standard or Reference population	%Obesity/ Overweight prevalence	%Underweight prevalence
(Farghaly *et al*., 2007): Abha, Asir/South province	Schools	767 (M/F) Age: 7-20 y.	WT, HT& BMI Self-administered questionnaire	WHO/National Centre for Health Statistics (NCHS) Reference population (Dibley *et al*., 1987)	Overweight 11% & Obesity 15.9%	
(Al Turki 2007): Riyadh, Central province	Primary care clinics	267 n/d Age: 12-20 y.	WT, HT& BMI Questionnaire	n/d	Overweight 18.7% & Obesity 21.0%	
(Fayssal *et al*., 2007): Different provinces	intermediate schools for boys and girls	1454 (M/F) Age:12-19 y.	WT, HT& BMI Questionnaire	WHO/National Center for Health Statistics (NCHS) Reference population(Dibley *et al*., 1987)	N/A Sig higher prevalence of overweight in girls compared to boys	
(Collison *et al*., 2010): Riyadh, Central province	intermediate & secondary schools	5033 (M/F) 3 age groups: 10-13,14-16, 17-19	WT, HT, BMI & WC Food Frequency Questionnaire (FFQ)	2000 Centre for Disease Control gender-specific Growth charts. (teens 2010 acssed March). For WC (Fernandez *et al*,. 2004)	(F) Overweight 16.7% & obesity 15.8% -WC of >75th percentile was among 11.98% of girls	(F) Underweight: 6.8%

Table 3: A summary of studies from Saudi Arabia evaluating weight status and growth patterns of Saudi young people(continue)

Author, Year Region	Target young people	Sample size(n), Gender, Age (Year)	Measurements & Growth status	Standard or Reference population	%Obesity/ Overweight prevalence	%Underweight prevalence
(El Mouzan Mohammad I 2010)EL-MOUZAN, 2010: Different provinces	Schoolchildren & adolescents	19, 317 (M/F) Age:5 to 18 y.	BMI	2007 WHO reference	prevalence of overweight, obesity and severe obesity in all age groups was 23.1%, 9.3% and 2%	
(Al-Dossary *et al*., 2010) Al-Khobar city	Schoolchildren & private hospital	7056 (M/F) Age: 2–18 y.	WT, HT, BMI Questionnaire	CDC) 2000 growth chart	Overweight 19.0% & obesity 23.3%	none of the children were underweight
(Abahussain, Nada, 2011) Al-Khobar city, Eastern province	Adolescent girls	1st data, 1997 (n=400) 2nd data, 2007 (n=321) (F) Age: 15 to 19 y	WT, HT& BMI Comparison of BMI data from 1997 -2007	National Center for Health Statistics (NCHS)	%Overweight & obesity remained the same in about 30%	Underweight is about same level of prevalence at 3.5%
(Mohamed & Fayad, 2011) Riyadh, Central province	Adolescent girls	408 (F) Age: 16 to 19 y	WT, HT, BMI & TSF, MUAC Questionnaire	NA	Overweight 23.5% & obesity 10.3%	

2.9 Theoretical Framework

Theories and models that are relevant to understanding food choices and eating behaviours of adolescents could potentially have implications for attempts at dietary change. They are also important to understand what obstacles, there might be to affect such changes. The importance of using a theory to make dietary recommendations to adolescents has been recognised by previous research.

Story *et al*., (2002) suggest that the development of effective strategies for improving the dietary behaviours of young people requires an understanding of the multiple factors that influence these behaviours.

Genetic predispositions such as the preferences for a particular type of food and its taste and the tendency to reject new foods were referred to as social contexts of eating such as eating food with friends and families (Woodruff *et al*., 2010). Food preferences are learned via people's experience with food and eating, and this depends on the food that is made available and accessible and emphasises the critical role played by the food environment in determining the adequacy of diets (Birch 1999).

The increased emphasis of research on the significance of environmental and structural factors when explaining food choice and eating behaviours of children and adolescents has initiated actions on more than one level (Larson & Story 2009). Factors related to environmental levels such as social, physical and macro-systems and factors related to personal behaviours were identified as important for food choices and eating behaviours of adolescents. Neumark-Sztainer *et al*., 1999, Story *et al*., 2002, and Livingstone & Helper 2004 concluded that some of these influences influence food choices throughout the life. In addition, other influences that include developmental, e.g. rapid physical growth are exclusively associated with this age group. The same authors suggested that other researchers when conducting prospective research consider the possibility that these factors interact with each other, thereby indirectly affecting young people's food preferences and behaviours. They also recommended researchers should not study factors at each level separately.

Models of eating behaviours have been developed because of the increased awareness of researchers that the aetiology of many health problems facing adolescents are influenced by a myriad of diverse causative or associated factors existing at multiple levels of analysis. Story *et al.,* (1996) developed a conceptual model of multiple factors that influence eating behaviours of adolescents. The model depicts three interacting levels of influences that affect adolescent eating behaviours: personal or individual, environmental, and macro-systems.

Investigating dietary habits and behaviours during the adolescent years offers challenges depending on the multilevel factors that influence the food choice of adolescents (Story, *et al*., 2002). For adolescents, a number of individual factors may influence food choice such as psychosocial (e.g. food preferences, taste and sensory perceptions of food, health and nutrition, meanings of food, self-efficacy and knowledge), biological and lifestyle factors. According to Story *et al.,* (2002), the most influential social environmental influences are the family and peers. The physical environment (e.g. schools and fast-food restaurants) in the community has a major impact on the dietary behaviour of adolescents, influencing, for instance, food availability and perceived norms. Some of the major macro system influences in society as a whole includes the media, cultural and social norms and food production systems.

2.9.1 Overview of Model

According to Story *et al*., (2008), the achievement of eating habits and behaviours is a complex process that involves many factors across different backgrounds. A theoretical framework can be used to understand the multiple factors related to personal behaviours and environments that influence eating behaviours of adolescents (Story *et al*., 2002). As described by Story *et al*., (2008), the proposed theoretical framework is based on Social Cognitive Theory[11] and an ecological perspective. The basic principle of the ecological systems theory is that individuals, and their environment have a dynamic interaction and relational nature (Laustsen 2006), (Davison & Birch 2001). Ecological models of health behaviour in general focus on individual influences such as physical activity and sedentary activity, as well as on social such as family meals and environmental factors (such as access to food). These factors may affect individual behaviour either positively or negatively (Sallis & Owen 1996). Story and her colleagues have also recommended the model to be used when guiding interventions (Story *et al*., 2008). The model also highlights factors at different levels that influence health and nutrition, adolescents and their environments (Story *et al*., 2008). According to the same authors, individual-level factors include cognitions, behaviour, biological and demographic factors. As described by the same authors, environmental factors include the immediate social environment such as family, friends and peer networks, and other factors such as school, fast-food outlets and social and cultural norms are related to the physical environment. Food production and marketing, mass media and advertising in addition to food distribution systems, policies and laws that regulate food-related issues, such as pricing are factors that are related to macro-level environments. The same model also includes other factors that related to social norms, agriculture policies and economic price structures. According to Story's model, although macro-systems or societal influences play a more distal and indirect role in determining eating behaviours, they are considered as one of the multiple factors that have been identified as important for young people's food choices.

[11] The social cognitive theory explains how people acquire and maintain certain behavioral patterns, while also providing the basis for intervention strategies (Bandura, 1997).

The aim of using a theoretical framework in this study was to make a trial to explain and predict some behaviour related to Saudi girls, particularly eating behaviours of adolescents. The current study has chosen the social ecological model of Story *et al.,* (2008) because it incorporates a multilevel approach. In addition, some factors and variables that are related to the major food providers to the group of adolescents have not been studied together in previous or recent Saudi research. These variables include schools, restaurants or advertisers. These variables will be studied together in the present research using the described above model. The model was adapted and modified with permission from the main author (see Appendix VI).

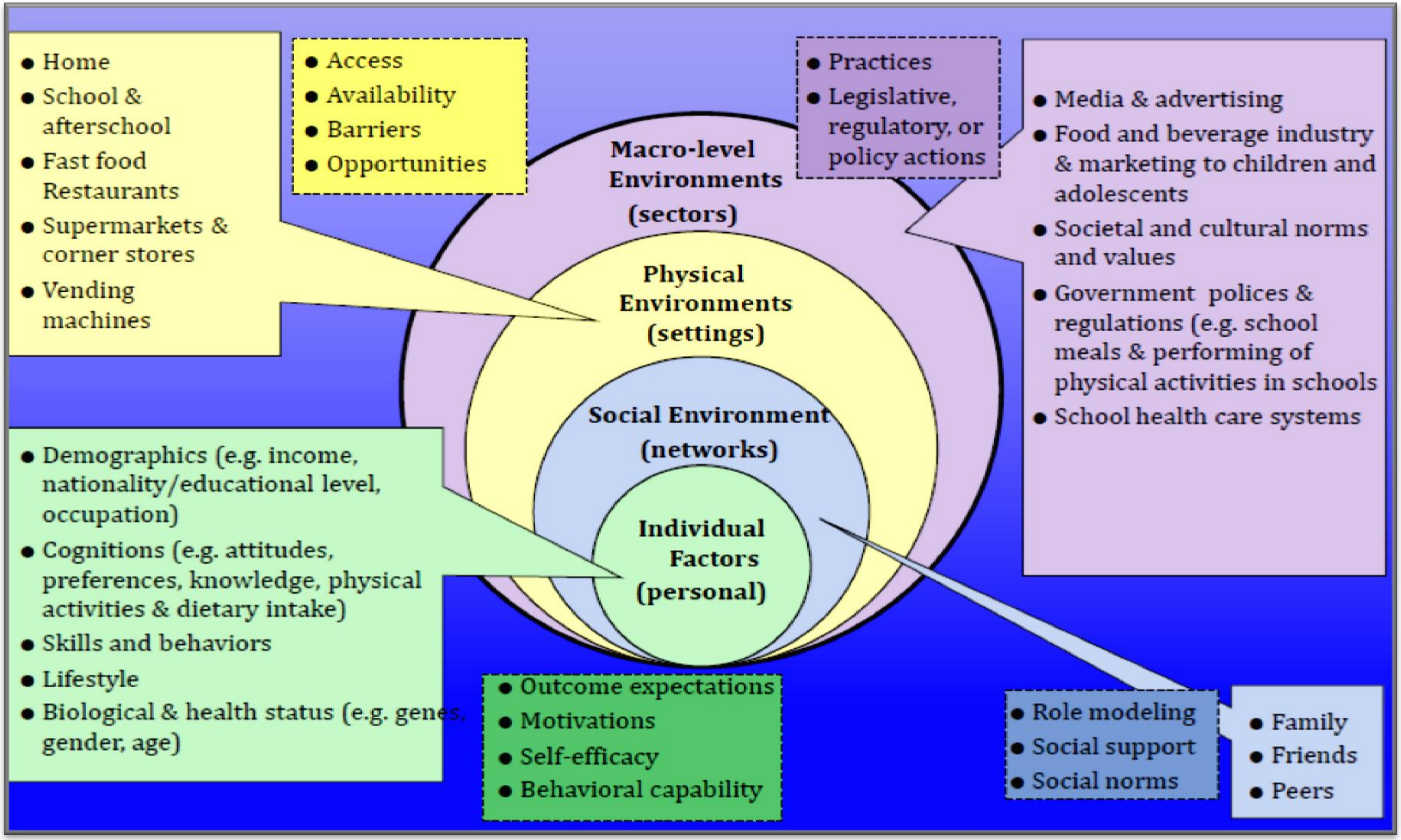

Figure 2: A theoretical framework depicting the multiple influences on food choice (Story, 2008)

CHAPTER THREE

Cross-Sectional Survey Methods

3.1 Chapter introduction

This section describes the methodological approach of the survey part of this thesis. It presents methods used to assess anthropometry, haemoglobin levels and factors affecting eating behaviours and nutritional status of female adolescents. It also presents measures used for the survey part.

The chapter also describes analyses' plan of the primary data, including anthropometry and data collected using the face-to-face interviews at intermediate and high schools for girls in Jeddah city.

This survey tackled the three-level factors of the theoretical framework used in the present thesis (chapter two).

The principal aim of this thesis is to evaluate the nutritional status and its determinants, and to explore eating behaviours of Saudi adolescent girls.

Methods used in this section were devices to fulfil the principal aim and the first eight objectives of this study (see Chapter 1) as follows:

1. To measure the anthropometric profile (weight, height, body mass index, waist circumference and waist-to-height ratio) and haemoglobin levels of participants;
2. To assess participants' food intake, eating behaviours and lifestyles;
3. To identify the prevalence of overweight/obesity, underweight and anaemia in Jeddah female adolescents;
4. To explore personal and environmental factors influencing the eating behaviours and nutritional status of adolescent girls in Jeddah City;

5. To identify the associations between eating behaviours and nutritional status (based on weight categories, BMI z-scores, WC, WHtR and anaemia status);
6. To assess schools 'meal menu and snack food options prepared and served by caterers at public and private schools;
7. To detect differences in eating behaviours and other determinants of the nutritional status of girls in both school sectors; and
8. To detect differences in eating behaviours and other determinant factors of nutritional status of participants according to media influence based on screen time and perceptions about TV advertisements and their influences on eating behaviours and nutritional status of participants.

3.1.1 General methods for the survey

A representative sample of Saudi and non-Saudi students who attended intermediate and high schools both public and private in Jeddah between 2008 and 2009 were selected at random to participate in the study. Survey procedures were designed to protect the students' privacy by allowing for anonymous and voluntary participation. Active parental consent and written personal consent were obtained for each student prior to data collection. All participants were adolescents between the ages of 13 and 18. Face-to-face interviews and a self-reported questionnaire, onsite anthropometric and haemoglobin measures and data collection sessions were undertaken. All BMI data was converted into standard deviation scores (SDS) using LMSgrowth programme (Pan and Cole 2011) with directions and help of the main developer of the programme at Institute of Child Health (ICH), UCL. London. Primary anthropometric data for BMI distribution was compared with the 2007 WHO reference for BMI for children and adolescents (5-19 years) (De Onis *et al.*, 2008) while the waist circumference for Saudi girls who age 13-17 years old was compared with those from the UK using the percentile curves for British girls aged 5.0 ± 16.9 years (McCarthy *et al.*, 2001). In addition, the WHO cut-off level for haemoglobin (<12.0 g/dl) was used for the interpretation of haemoglobin values. Moreover, visits to different school canteens from both sectors were performed in order to investigate and collect data on types and brands of snacks and beverages served in these schools. Statistical analyses were undertaken to determine the variables of interest in the study.

3.1.2 Study site

The study was carried out in the city of Jeddah in Saudi Arabia. More than 3.4 million people live in Jeddah city. Jeddah is located on the coast of the Red Sea and is the major urban centre of western Saudi Arabia. Most Saudis in the Jeddah region are ethnically Arabs. Some are of mixed ethnic origin and are descended from South Asians, Iranians and others, most of whom immigrated as pilgrims and reside in the Hejaz region along the Red Sea coast (Farsi 1991). There are also significant numbers of economic migrants from villages and towns around Jeddah. These migrants move to Jeddah city for seeking employment or an improved financial position (Farsi 2000).

In Jeddah, more than 200 governmental schools provide general education for girls at the intermediate and secondary level. These schools are distributed in four regions, namely, North, Centre, South East and South West. Education in schools is free, but is not compulsory. All children in public schools usually enter school between 6 and seven years of age. Pupils are enrolled in year 1 according to the time they entered school regardless of age and move according to the grades they achieved at the end of each academic year. Most classes which are all single-sex have about 25-30 students, including both Saudi and non-Saudi students. Along with public schools, there are about 150 private schools providing general education for both levels. Tuition is expensive at these schools, and the number of students enrolled is understandably lower than in public schools. Table 4 shows a summary for the distribution of schools, the number of classes and number of students in intermediate and secondary school girls in Jeddah city for the academic year 2007/2008.

Table 4: Projected summary statistics for general education for girls (Intermediate and secondary levels)

Description	Schools	Classes	Total Students	Average No. Students/ classes	Geographical Distribution (Supervision Centre) North	Centre	South E	South W
Intermediate								
Public	117	1,688	48,183	29	29** 10,734*	24 11,894	37 12,966	27 12,589
Private	86	407	6,574	16	30 1,897	37 2,970	2 155	17 1,552
Total	203	2,095	54,757		59 12,631	61 14,864	39 13,121	44 14,141
Secondary								
Public	99	1,495	42,523	28	21 8,222	25 10,558	30 11,868	23 11,875
Private	63	425	7,231	17	20 2,055	27 3,314	1 116	15 1,746
Total	162	1,920	49,754		41 10,277	52 13,872	31 11,984	38 13,621
Total for Both levels	365	4,015	104,511		100 22,908	113 28,736	70 25,105	82 27,762

Source: Statistics Department at Ministry of Education (girls section)
*No. students/schools ** No. schools

3.1.3 Sampling methods

The sample size in the present study was approximately equal to 1% of the total number of the population studied [~1115 (sample population)/10, 4511 (total population) = 1%]. This was calculated by applying the Cochran equation that was formulated to be used for the calculation of the sample size in studies. The formula was used to determine the minimum sample size required as follows (Cochran 1963).

$$\boxed{n = (Z^2 PQ)/e^2}$$

(n) Represents the minimum sample size required for participants in present study

(Z) Represents the number of the abscissa of the normal curve that cut offs an area at the tails (1 - equals the desired confidence level, e.g., 95%)

(e) Represents the level of precision (sampling error): The range in which the true value of the population is estimated to be and the range used for this study was expressed in percentage points as 2%

(p) Represents the anticipated population proportion and for the present study, P = 13.4%, which is a previous average rate of obesity that was reported among Saudi school girls aged 12-17 years (Al-Saeed *et al*., 2006).

(Q)Represents the value that is derived from (1 – p)

Calculation of sample size

In the first stage, we used a 95% confidence interval, the average prevalence of obesity from a previous study that is 13.4% and e, which is the level of precision, is equal to 2%. Therefore, we used the formula $n = (Z^2 PQ)/ e^2$ to determine the sample size where Z = 1.96, P = 0.134, Q = 1- 0.134 and e = 2%

$n = Z^2 p (1- p)/e2$

$n = z^2 * p * (1- p)/ (e^2)$

$n = 1.96 * 1.96 * 0.134 * (1 - 0.134) / (0.02 * 0.02)$

n = 1114.5 (rounded up to 1115)

The weight status of different groups, including overweight, obesity and underweight status is one of the main outcome measures for assessing Jeddah adolescents' nutritional status in this study. In order to calculate the study sample, the anticipated population proportion (p) used was the average rate of obesity among Saudi school girls aged 12-17 years found by (Al-Saeed *et al*., 2006) in Al-khobar city (Eastern Saudi Arabia) is *P* = 13.4%. The rate of obesity in this study was used because it included an age group that was close to the age group of our study's population, i.e. 13-18 years. In addition, the rate of obesity was used because no reliable data was available for the incidence of the other variables included within this study such as underweight and anaemia, for the age groups concerned.

A scaling-up factor of ~ 20% was included for the calculation of the sample to cover the effect of non-response, and a total of ~ 1400 student girls from 20 schools were invited to participate in the study. However, the actual students who participated were 1600 students from 17 schools because of the high response from schools and students. Originally, data was planned to target population as shown in Table 5.

Table 5: Summary of sample size

Items	Total population	Calculated sample size	Actual sample size
NO. Of eligible students	104,511	1400	1519
NO. Of schools	365	20	17

3.1.3.1 Subjects, recruitments and recruitment criteria

Sample size

The study population included adolescent girls 13-18 years old attending schools for the academic year 2008/2009. The initial sample consisted of 1600 students of whom 95% met the inclusions' criteria for age and ability to perform physical activities. The study involved first, second and third grade intermediate and high school girl students from Jeddah city. Twenty schools were selected randomly from both intermediate and secondary levels in both governmental and private sectors; 18 schools agreed to participate but only 17 schools were included due to the drop out of one school.

Criteria for selecting the subjects

The population was selected according to the age 13-18 years and stratified by age groups, 13 to 15 and 16 to 18 years. Participants were selected through their schools using a multistage random sampling technique as follows:

Jeddah city is divided into four regions, according to the four local school supervisory centres in the city. The number of students in the sample was proportionally allocated to these four districts. The second stage was to choose randomly five schools from each district, with at least one private school per each level in each region. Three classes from each school were randomly selected and thereafter; each class was considered as a cluster in which all students were enrolled in the study (average 28-29 students per class for schools in governmental sectors and 16-17 students per class for schools in private sectors). Thus, 1519 students participated in the study. Seventeen schools (94%) were surveyed, and 66 classes were included. Grades incorporated were first, 2nd and 3rd from both intermediate and high schools. Students from public schools comprised 75.7% (1150 students) of the sample while 24.3% (369) were from private schools. A flow chart which illustrates criteria for sample selection is shown in Figure 3.

Inclusion and exclusion criteria

All students (Saudi and non-Saudi) who were aged between 13 and 18 years old, enrolled in the academic year 2008-2009, and registered in general education schools (from intermediate and high schools) in Jeddah city were included. Students who were aged less than 13 years old or above 18 years old were excluded. Participants with disabilities that could affect their physical activities were also excluded.

Ethical consideration

In order to protect and respect participants, to develop and evaluate appropriate responses to the needs of the survey, the main researcher has maintained high ethical standards from three committees as follows: The Research Ethics Committee of UCL reviewed the study protocol and granted approval (Appendix 2X). A local ethical clearance from the Ethics and Research Committee at King Abdul-Aziz University was also obtained (Appendix IX). Permission to administer this survey at intermediate and secondary schools for girls was, firstly granted by School Health Department at Ministry of Education in Saudi Arabia. Then, the local School Supervisory Centres at Jeddah city and the principals of the selected schools were contacted after. An introduction about the objectives of the study, the permission letter from the ministry of education to collect data from schools, were taken personally by the main investigator to each principal teacher in school one week before gathering data. This was in order to obtain permission to arrange suitable times to conduct the study. The particular classes were contacted prior to data collection.

3.1.4 Informed consent[12]

Information letters and consent forms were provided to students and their parents one week before collecting data, (see Appendix III & IV). This was in order to define the number of students with parental consents. Students who returned their letters completed and signed were agreed by the main researcher to participate in the survey.

3.1.5 Data management and confidentiality (protection)

In order to ensure proper confidentiality and management in the data, several procedures were followed. As part of the training sessions for data collection, data collectors were trained in the importance of maintaining confidentiality. No names were written on the questionnaires, and the only file with the participant's name was the consent form. Consent forms with information that identified participants were kept separate from other instruments. All consent forms were kept in a locked cabinet, in the researcher's office at King Abdul-Aziz University in Jeddah. A unique participant number coded all survey data, including blood tests. All blood tests had been administered in privacy, and confidentiality was guaranteed. While in the field, the data were kept secure with the main investigator who was the only person that had access for data entering. The survey data was entered into SPSS programme with no identifying data included, and the primary investigator in the study utilized this data.

3.1.6 Preliminary studies

3.1.6.1 The development of the questionnaire

The design of the questionnaire was originally developed based on adapting three different preliminary questionnaires (Al-Jaaly 2005; WHO 2002; WHO 2008), which were valid and reliable, and were constructed and administered to similar groups and/or in similar conditions.

The three questionnaires were modified according to the study population and to the mode of data collection, and they were as follows:

[12] Informed consent: process to ensure that each participating individual does so willingly and with adequate understanding (Schenk & Williamson 2005)

The Global School Health Survey (GSHS)

The Global school-based student health survey (GSHS) is a project conducted by the World Health Organization (WHO) in collaboration with the US Centres for Disease Control and Prevention. It is designed to help countries measure and assess the overall health of school students using factors that include behavioural risk factors among young people aged 13 to 15. This school-based survey uses a self-administered questionnaire. Some questions regarding food consumption, daytime physical activity and smoking habits were adapted and modified for adolescent girls in Jeddah. To avoid copyright infringement, the Department of Chronic Diseases and Health Promotion at the World Health Organization was consulted before use. The team leader of the Department gave permission to use and modify the questionnaire in response to an E-mail from the main researcher (WHO 2002) (see Appendix V).

A Global physical activity questionnaire (GPAQ) for physical activity surveillance

The World Health Organization (WHO) developed the instrument to be used as a standardized protocol to measure physical activity levels in countries, including developing countries. It collects information on physical activity participation in three settings as well as sedentary behaviour and comprises 16 questions. The domains are activity at work; travel to and from places, and recreational activities. The GPAQ was adapted and modified for adolescents in this study because of its validity, reliability, and adaptability in many countries within the Gulf region to incorporate cultural, climatic and other differences (WHO 2008).

Total Study Population

Intermediate & high school girls in Jeddah city in both public & private sectors who were registered in the general education in the academic year (2008 -2009)

N = 104511 students, 365 schools & 4015 classes

Jeddah city is divided into 4 geographical regions according to 4 local school supervisory centres and schools are distributed according to these supervisory centres

Sample population

Initial random sample from both levels

- n = 1600 students & 18 schools (12 from public/ 5 private)

* School recruitment were limited to 18 because of the high response from participants and schools according to the completed consent forms

Excluded

Students

n = 81

- students who were absent at the time of data collection
- students < 13 years old
- students > 18 years old
- students with disabilities e.g. those who cannot perform physical activities

Schools

- one school has dropped out but did not affect the recruitment because of the high response.

Total recruited

- **n** = 1519 (95%) met the inclusion criteria (randomly sampled). 1050 (75.5%) from public sector & 369 (24%) from private sector
- **Schools**: 17 out of 18 (randomly sampled).

12 public (6 schools from each level of education, intermediate/high)

5 private (each school included both levels of education)

- **Classes:** 66 classes (one class from each grade was randomly sampled & students in each class were considered as a cluster

- A subpopulation for Haemoglobin test were recruited using based on a separate consent form that include consenting on one or two tests or both tests two tests:

1. Finger prick test: (n= 797)
2. venous blood samples : (n= 408)
3. Girls who have done both tests: (n= 367)

Figure 3: A Flow diagram illustrates the criteria for the survey sample selection

A Randomized Diet and Physical Activity Intervention in Obese Women in Saudi Arabia's Questionnaire

The questionnaire was earlier developed by the researcher using a previously designed questionnaire for diet and physical activity that was used by the nutrition clinic in King Abdu-Aziz University Hospital in Jeddah to obtain and assess diet histories of overweight and obese patients. The questionnaire was validated by its combination with a food frequency questionnaire (FFQ) that was adapted from the 'national nutrition survey for Bahrainis' (Moosa, 2002) and modified to obtain the past dieting history for participants using foods that are usually consumed by Jeddah citizens. Major design considerations were related to the choice of food, categorization of consumption frequency. Administration of the FFQ was through an one-to-one interview.

This questionnaire was adapted for the current study for its reliability and validity in Saudi females. For example, questions like 'Do you take time considering the type of food you eat, when you're hungry?' and 'Is your meal size affected by the presence of friends or family members?' were adapted to the present study for its applicability to the groups studied (Al-Jaaly 2005).

The questionnaire was translated first into Arabic and then back to English using a back-translation method by the Translation & Arabicization Unit, Faculty of Art. University of Khartoum and pre-tested on 23 piloted students at King Fahad Academy School (KFA) in London in March 2007. The Translation & Arabicization Unit was chosen to translate the questionnaire of the present study, because the author and some colleagues at King Abdul-Aziz University, Jeddah had previously translated some work that was related to the research area. Moreover, the department usually involves professionals from other departments to participate in the translation method, and this will be according to the translated materials. For the present survey's questionnaire, the department included expertise from the Food and Nutrition Department, to participate in the translation of the questionnaire (see Appendix VIIIa).

The option of completion of the questionnaire by respondents was used for this survey for the following reasons:

1. For its lower cost when compared to other options such as the interview format, which entitles more labour cost;
2. For its speed to enhance the ability to administer questionnaires simultaneously to the large number of subjects in this survey;
3. For its greater convenience for the respondents who were mostly not familiar with such studies and questionnaires;
4. For the ability of respondents to remain unidentified, and this is for ethical considerations;
5. For excluding the possibility of interviewer bias or error.

3.1.6.2 The pilot study

The pilot study was done at King Fahd Academy (KFA) School in London. The aim of the study was to examine and refine methods and measuring instruments prior to conducting the major study and to redraft the research question as well as the research protocol. The study was carried out in March 2007. Twenty-three adolescent girl students were included from KFA school grades of (seventh, eighth, ninth, and 10th grades).

Ethical Consideration for the pilot study

Ethical approval was obtained from the Royal Embassy of Saudi Arabia Cultural Bureau in the UK and King Fahd Academy School in London. In addition, consent forms (for 80 students) were sent to all parents (through the school) to be signed before including their daughters in the study. However, twenty-three parents responded, therefore, their daughters were included in the pilot study.

Data collection

Data were collected using two types of measurements:

Anthropometric measurements

Seca 700 mechanical medical scale (Seca, UK) at the treatment room in the KFA School was used to measure participants' weights and heights.

Questionnaire

The administration of the draft questionnaire using the mode of administration specified for the final questionnaire product was carried out in both English and Arabic, because some students preferred to use the English version while others used the Arabic version. Each student included filled out the structured self-reporting questionnaire.

Results of the pilot study

Some questions from the Arabic version that were originally translated at the University of Khartoum were modified to develop an easy, simple and understandable written Arabic version (because written classical Arabic is different from colloquial Arabic). The questionnaire was refined and minor changes were made to the original questionnaire. Some questions focusing on socio-economic status, health and family influence were also added to the questionnaire. For example:

1) A direct question concerning the girls' family income was added.

2) A question about body image was added to confirm the influence of body image on weight status.

In addition, questions regarding parents' influence on girls' nutritional status "Do you think that your mother/father is obese, overweight, just about the right weight or underweight?" and "Has your mother/father tried to change his/her weight? And why?" were added. Furthermore, a question to measure health status "Do you have any chronic health illness?" was also added to questions. Moreover, time management for all research tools was defined, and the time needed to fill out the questionnaire was 25-35 minutes. Finally, coding for all research variables was defined, and the researcher developed groupings to open-ended questions according to answers to questions.

3.1.7 Validity of the study's questionnaire

To ensure the validity of the initial and back translation of the questionnaire, a discussion was conducted with an expert panel from King Abdul-Aziz University, Faculty of Applied Medicine College, and Department of Clinical Nutrition in Jeddah to review, edit, and double-check the questionnaire. The expert panel group were bilingual, composed of four members: the main researcher, the head of the nutrition department at the College of Applied Medicine, a lecturer at the nutrition department and a dietician. The panel's members were selected based upon the experience of the subject area and familiarity with questions. In addition to the expert panel, two female teenagers were involved in parallel in discussing the layout, the wording, and the understanding of questions. This was done by asking them to read each question and being able to understand and answer it clearly.

3.1.7.1 Testing of the questionnaire at study site

The questionnaire was tested and re-tested on third-grade high-school students from AL-Manarat private school (girls section) in Jeddah city. The testing of the questionnaire was done one week prior to the data collection in January.06.2009. The instrument was tested on 30 adolescent girls, to ensure its reliability before applying it in the survey. All subjects in class who agreed to participate in the procedure, and who had returned the signed consent letter, which was made especially for this procedure, were asked to fill out the questionnaire (Arabic version), and all questionnaires were completed in the classroom during one regular class period. One week later, the same recruited subjects were asked to repeat the same questionnaires and in the same conditions. Because of this testing, it was noticed that participants had not answered many of the questions, particularly those focusing on socio-economic status, health and lifestyle. Questions that were answered differently were:

1) The question concerning the girls' family income was answered differently in about 5% of participants;

2) The questions regarding smoking behaviour, three students changed their answers for the question (Do you smoke?) and two students reduced cigarettes' consumption in relation to the question (If yes, how many cigarettes/day?).

3) Some students had different answers regarding their frequent consumption of some food items, e.g. fats, vegetables or fruits. In addition, the question (Are you a vegetarian?) was not fully understood by some of the students and was further explained.

Furthermore, it was planned, to explain fully the meaning of the term 'vegetarian' to students during the process of data collection. Other questions that need further explanation or simpler Arabic languages were identified. Moreover, the investigator defined the time needed to complete the questionnaire, which was about 30-40 minutes.

3.1.8 Recruitment and training of field Staff

Six graduate students who were doing their dietetic internship programme were recruited from King Abdul-Aziz University, Faculty of Applied Medicine College, Department of Clinical Nutrition to participate in data collection and their participation was considered as part of their internship-training programme. Three academic staff in the field of Nutrition and Dietetics also participated in data collection. Two expert phlebotomists from the School Health Department at the Ministry of Education were included in the research team in order to withdraw blood from participants using a venous blood procedure and to help the investigator in carrying out the Reflotron Plus system test for haemoglobin level. Before collecting data, the research team was trained about the questionnaire, the use of equipment, correct calibration of equipment and measurement techniques, to ensure the reliability of each of the tools before conducting the study (Wang *et al*., 2006). The investigator stressed calculation of measurement error and the importance of quality control procedures to data collectors.

3.1.9 Data collection procedure

Objectives of the study and methods for data collection were explained in each consent form and were explained to all students in class at the time of data collection.

Three types of data collection were used: 1) questionnaire data, 2) anthropometric measurements, and 3) haematological data. All data collection occurred during normal class times with participants in their usual room seating arrangement. Based on the pretesting of the questionnaire prior to data collection, 30-40 minutes was calculated as the time needed to complete the questionnaire. The time needed for an introduction to the study and an explanation of the instructions on how to complete the questionnaire was about 20 minutes. The time needed for anthropometric measures was 15-20 minutes, and the rest of the time was required for the haematological measures (HemoCue test and/or venous blood). Firstly, students were provided with the questionnaire on their socio-demographic status, food habits, physical activities and other behaviours. Afterwards, the research team completed anthropometric measurements and the blood tests. Exercises

3.1.10 Assessment of nutrition status

3.1.10.1Questionnaire data

The questionnaire was self-reported. The respondents alone, without the involvement of the main teacher or research team completed the questionnaires. There were closed and open-ended questions. All completed questionnaires were reviewed by the data collectors to make sure that all questions were answered completely except for questions that were purposely not answered by participants. Most of the students were not familiar with such studies and questionnaires, and the fact that this was not an exam was stressed to enhance the possibility that they were relaxed in filling out the questionnaires (The tool is fully detailed in appendix VIIIb).

3.1.10.2 Measurements

Height

For the purpose of height measurement, each subject was asked to remove her shoes, stand with her legs straight, feet flat with heels together, arms at the side with shoulders relaxed, her spine and all her back surfaces against the measuring surface, head straight and finally taking a deep breath before the measurement was taken. The same procedure was done for all participants using the same plastic tape, as stadiometers were unavailable in some public schools.

Height was measured in centimetres using a simple builder's plastic tape measure. The tape measure was used to measure the distance from the floor to the base of a book placed horizontally on the head against a wall. In order to check the reliability of the present measuring method, pilot measurements for height were carried on research team using two methods for height measurements, the tape measure and measurement using a single standard stadiometer for height that was used in a nutrition clinic at the King Abdul-Aziz university hospital in Jeddah city. Then, both results were compared to confirm the reliability of the tape measure. Height was measured in bare feet with a stadiometer to the last 0.1 cm.

Body Weight

Weight was measured with portable calibrated scales [Seca Floor Scales - S761 (G50736)].The Seca scales were chosen to be used in this survey for the reason that they were easy to carry and suitable for heavy duty. The capacity of the scales is 23st/150kg. Scales were always placed on a flat surface, re-zeroed and checked with known weights each time they were moved. Weight was measured without shoes, in light school uniform (weighing ≈ 0.5 kg) and with empty pockets. Each student stood on in the centre of scale with weight equally distributed over both feet, then the scale was read to the nearest 0.1 kg. From the ratio of weight to height square, the Body Mass Index (BMI) was determined where BMI = Weight (kg) /Height^2 (m).

Reference data for BMI

As a standard reference for the present study's population, the current growth charts for Body Mass Index-for-age (3 to 19 years old) percentiles for Saudi girls (El-Mouzan *et al*., 2007) were planned to be used to verify whether the sample derived from the present study is representative of the national population. However, BMI distribution was compared with the 2007 WHO reference for BMI for children and adolescents (5-19 years) (De Onis *et al.,* 2007). Because the Saudi references were only available as charts and not as a dataset at the time of data comparison.

The main researcher has visually compared both references (national and international) for girls (13-18 years). The range of percentiles included six percentile curves: (5th, 25th, 50th, 75th, 85th, and 95th). The summary of the comparison demonstrated that for 13 year-old girls, compared to WHO standards, the BMI of Saudi girls is lower at the fifth and twenty fifth percentile while at the 50th percentile and the higher percentiles, Saudi girls show an average BMI higher than the international level.

For 14, 15, 16, and 17 years, only up to the 25th percentile, the BMI of Saudi girls is lower than the average international level and for the rest of the BMI's distribution, Saudi girls show an average BMI higher than the one for international level. On the other hand, for 18 years, the average BMI for Saudi is lower at the fifth percentile, the same at the twenty-fifth, and higher for the rest of percentiles compared to the one for the international level (Figure 4).

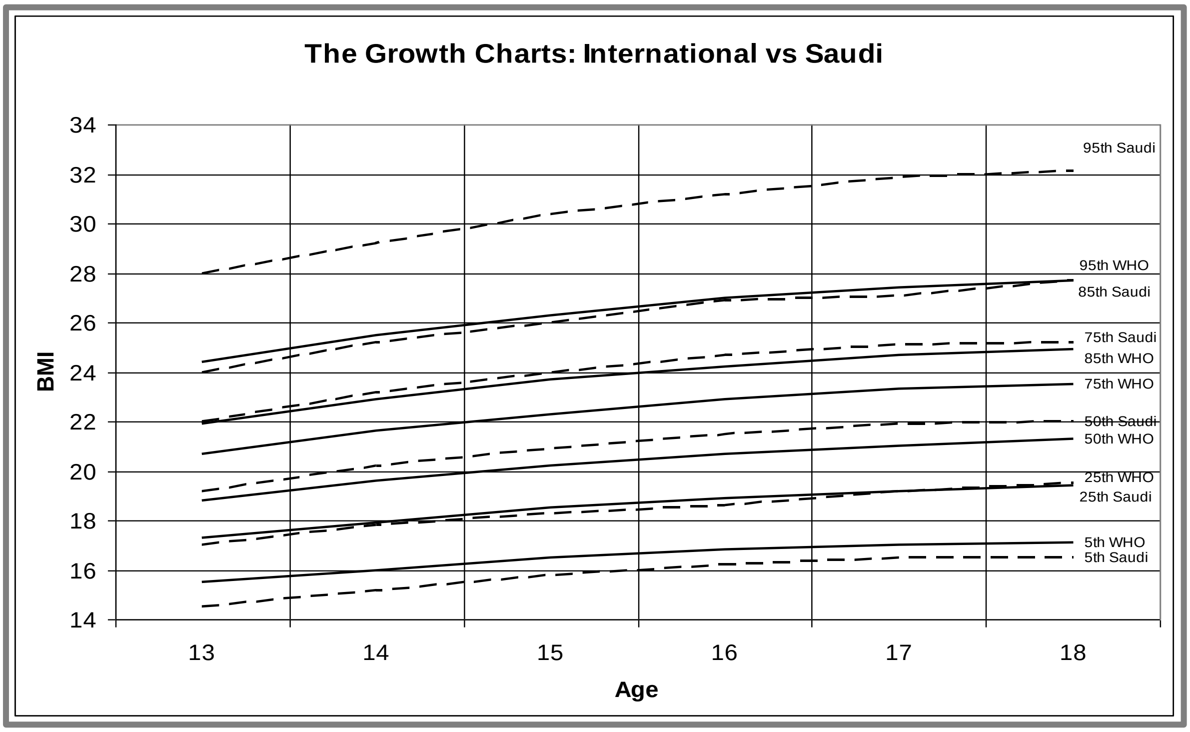

Figure 4: A comparison between the Saudi and WHO for BMI reference data for adolescent girls. (----- Saudi girls) & (_____ WHO)

Underweight, normal and overweight categories & BMI z-scores

The girls in the current study were grouped into three categories according to their weight status: underweight, normal, and overweight. Weight categories were defined in terms of percentiles using the WHO 1995 guidelines for BMI classification by age and gender, and the cut-off percentiles used to classify the nutritional status of the girls were underweight, BMI p<5; normal, BMI p≥5 to p<85; overweight, p≥85 to p<95; and obese, BMI p≥95 (WHO 1995). In this survey, adolescents, whose BMI exceeded the 85th were referred to as overweight. This was in accordance with previous researcher approach to classification of BMI in adolescents (Haines *et al*., 2007).

Moreover, to adjust BMI for age in this study, all individual data were converted into standard deviation scores (SDS) using LMS growth programme (Pan and Cole 2011). BMI was converted to BMI for age Z-scores, relative to the WHO 2007.

Waist circumference (WC)

For waist circumference measurement, a standard tape measure was placed around each participant’s abdomen, and the natural waist site (at the narrowest part between the lower rib and the iliac crest) was the site of measurement used in this study (McCarthy *et al*., 2001). Data's collectors were trained to make sure that the tape was not compressing the participant's skin. However, a single observer carried out all WC measurements. Students were asked to be relaxed and exhale prior to the measurement process. Waist circumference was measured in centimetres using standard tape measures.

LMS growth programme (Pan and Cole 2011) was also used to adjust WC for age for all participants by converting the baseline WC values into standard deviation percentiles and scores (SDS). Values were derived against the UK 1990 data (McCarthy *et al*., 2001).

Waist circumference status and reference data

A national or regional assessment of adolescents' WC reference values was suggested by previous research to be used because these values may differ from one country to another. Also, these types of assessments will help to avoid the variations in the WC phenotype that is likely to be explained by genetic and environmental factors (Hatipoglu *et al*. 2007a). However, the mean values for waist circumference (WC) for Jeddah adolescent girls at each age was compared with the United Kingdom reference data that was developed for waist circumference percentile curves for British girls aged 5.0 ± 16.9 years (McCarthy *et al*., 2001). The UK reference was used because no national or regional references were available at the time of comparison. In addition, a recent review on adults' anthropometry concluded insufficient evidence to suggest that those of Middle Eastern background have different WC or WHtR than those in the European countries (Savva 2010).

In order to describe the actual WC findings among Jeddah adolescent girls, age and gender-specific WC were divided into the following percentiles according to Fernandez *et al.* 2004 ≤ 10th percentile;≥ 10th and ≤75th percentile; ≥ 75th and ≤ 90th percentile and ≥ 90th percentile. This method of description was used because it was previously used to describe the WC status of similar Saudi population (Collison *et al*. 2010).

Waist circumference and waist-to-height ratio and definitions of risk factors

In order to define health-related classifications for WC, several cut-offs for WC in children have been suggested such as age- and gender-specific values. For example, some previous studies such as (Fredriks *et al*., 2005) considered the 90th percentile as a cut-off point for high WC, whereas other studies such as (Sarria *et al*., 2001; Savva SC 2010) considered the 75th or 70th percentile. The WC cut-offs used in this study was based on the 75th which was developed to identify risk factors associated with the metabolic syndrome (Savva 2010).

The WC to HT ratio (WHtR) which was proposed as an indicator of excess abdominal fat accumulation with a cut-off or boundary value of ≥ 0.5 to define those with excess abdominal fatness was used in this study (Ashwell and Lejeune 1996).

Haemoglobin level Investigations

This was determined by two methods: 1) the capillary blood, which was used for its previous examined reliability by the School Health Department in Saudi Arabia. 2) The venous blood that used to re-examine the precision and accuracy of the capillary method on the present participation.

First method used: Examination of hemoglobin using finger prick technique

Examination of capillary blood from finger pricks using the Reflotron Plus system method by Roche. Previously, the School Health Department has used the method as a quantitative approach in determining some clinical chemistry parameters, including haemoglobin concentrations. This was to examine the prevalence of anaemia in some field surveys. The SH reported satisfactory accuracy and precision of using the system and when evaluated against standard laboratory methods. However, to confirm the accuracy for this method, a venous blood test was also carried on to compare results.

The Reflotron Plus system works on the principle of reflectance photometry and is simple in use. It consists of a portable, battery-operated photometer and a supply of a capillary blood collection system, which includes test strips. The capillary blood collection system is designed for tests using undiluted specimens. The Reflotron system incorporates a plasma-separating system, which allows the use of the whole blood as well as serum and plasma. It includes control materials for checking the performance and cleaning of the system. Participants' blood was collected into capillary blood collection tubes suitable for haemoglobin tests.

The specimens were pipette with Reflotron pipettes in order to allow blood to be aspirated from blood collection tubes without air bubbles, and all sample materials adhered to the outside of the pipette tip were wiped off to avoid contamination while drawing up the sample. Capillary blood collectors followed all instructions and precautions during capillary blood collection strictly. For example, puncture site, warming up of the site prior to puncture, cleaning of the puncture site prior to puncture and the proper blood drop to be collected. Results were recorded immediately using the same serial number applied to each participant. Moreover, this system was used for this study because it was available in the two Health Units at School Health and phlebotomists in both Units were joining the research team for data collection. Both phlebotomists were well-trained and had good experience in using this device in earlier field surveys. In addition, they conducted successful laboratory training sessions with the main investigator and the rest of the research team on the device.

Second method: Examination of haemoglobin using venous blood technique

The same two phlebotomists withdrew blood from consenting participants who had consented for venepuncture test. Samples were kept in a thermal insulated bag, gently handled and were then taken immediately by phlebotomists to the laboratory at the school health department for analysis. The blood sampling equipment bag was prepared and supplied with alcohol swabs, tourniquet, sterilized needles, sterilized pieces of gauze, bandage strips, thermal insulated bag, and a one ml EDTA (Haem) vacuumed tubes for haemoglobin test. Vacutainers (tubes) were labelled with the same serial number that had been applied to the consent form and questionnaire. A professional phlebotomist collected the blood samples. The participants were asked to relax for about 15 minutes before blood sampling started. Skin at the site of the venepuncture was sterilized by alcohol swabs and left to dry; tourniquet was applied proximal to the venepuncture site; and tightened. Blood was withdrawn immediately using the sterilized needles and the previously labelled vacutainers. A few gentle turns for each tube were done to mix blood with the additives in the tubes. The same phlebotomist did the analysis of the blood using the (ABX MICROS 60-OT Automated Haematology Analyzer. Part number: RAB042 AInd.D). The main researcher using the same code number for each participant recorded haemoglobin levels of participants afterward.

The screening for haemoglobin using blood obtained from venepuncture was carried out to confirm the capillary values. Those obtained from capillary blood that could be less reliable than those from venous blood could since variation in technique can alter results. For the interpretation of haemoglobin values, the (1994 WHO) cut-off levels for anaemia were used: blood haemoglobin <12.0 g/dl for 12–14 years and 15+ girls.

3.2 Measures

All measures in this survey were derived from the actual anthropometric and haematological measurements and the self-completed questionnaires. All measures will be described and presented within this section according to the theoretical framework of the study. In addition, an objective measure, such as assessment of school meals and snacks provided by the governmental-sponsored and private schools' caterers, was added to the actual measurements and self-assessment surveys. All study variables for survey part, and their indicators are shown in Appendix VII. Variables representing the actual measurements and participants' responses to each question were created and coded using abbreviations to variables' names, the whole text (questions) that supplies the data that labelled them, and their indicators.

3.2.1 Outcome Measures

There are several subjective and objective measures reflecting the nutritional status of adolescents, for example, BMI, haemoglobin level, eating behaviours and lifestyle. However, the main outcomes of this survey included the body-fat measurements such as body mass index (BMI), waist circumference (WC) and WHtR in addition to anaemia status, school type and media-related outcome measures.

3.2.1.1 The first outcome measure (BMI)

This measure was based on objective measurements for height, weight and calculated BMI. The measure was used in two forms, BMI-for-age in percentiles and the smoothed BMI Z-scores. Both variables of the outcome BMI were used to evaluate the nutritional status of the study population when compared to reference data as described above and factors that might influence eating behaviours and nutritional status of the sample. BMI-for-age was stratified into two risk-based BMI categories, underweight and overweight.

3.2.1.2 The outcome measures related to WC & WHTR status

The waist circumference measure was the second objective outcome in this study, and the calculated waist-to-height ratio was the third objective outcome measures. Both WC and WHtR were used to describe differences according to distributions of centralised fat.

3.2.1.3 Anaemia status

Looking at iron deficiency anaemia based merely on haemoglobin measure would have been one of the objective outcome measures to assess differences in eating behaviours and nutritional status of the study population based on nutritional anaemia. However, using haemoglobin alone in this study might not reflect the status of nutritional anaemia. Therefore, the fourth outcome measure was the anaemia status and not the iron-deficiency anaemia. Although haemoglobin concentration of participants was screened using two tests; the venous blood test and the RefletronR test, diagnosis of anaemia using venous blood values was used in the coming analyses, and this was considered for its precision and accuracy. In addition, intraclass correlation test was conducted to calculate the agreement between both techniques on participants who had done both tests (n= 367) and demonstrated a good agreement between both tests (ICC = 0.87, 95%CI [0.845, 0.892]. Those reported to have sickle cell anaemia or thalassemia minor as previously diagnosed were excluded from the analysis.

3.2.1.4 School type

Participants were from the two sectors, private and governmental (Figures 5b & 5c). This was in order to allow comparison of nutritional status, policies and regulations for school meals and snacks and physical activities between girls from both sectors. The school type was used as a proxy outcome measure for socio-economic status (SES). This is because of the following reasons:

1) It was not possible to use other socio-demographics such as the family monthly income because girls aged 13 years old, were asked not to report their family income, which was suggested by UCL Research Ethics Committee to be reported by parents only, because girls at this age might not know monthly incomes to their families (Appendix, I).

2) The fees for private schools are quite expensive and so attract students from higher socio-economic classes.

3) The same approach was previously used by Saudi researchers, e.g. Abalkhail *et al*., (2002). The current sample included more than 60% Saudi national girls[13], and this classification would be valid largely. Socio-economic class was defined as high for private school students and low for governmental school students.

3.2.1.5 The media and its influence on food choice

Two survey variables concerning media issues were created as outcome measures. Variables include: 1) the screen time with a cutoff of ($\geq$ 2 hours) 2) The questions about girls' thoughts of influences of TV advertisements on their eating behaviours ''Do you think that TV advertising has an influence on your eating behaviours? 'These two outcomes were considered to examine differences in eating behaviours and nutritional status.

3.2.2 Explanatory measures

3.2.2.1 Individual variables (intrapersonal)

To understand and determine the possible individual influences on participants eating behaviours that consequently could affect their nutritional status, variables were collapsed into four categories: socio-demographics, biological, cognitive-affective, and personal behaviours and lifestyle variables. Factors underpinning these variables are described below.

[13] The study included both Saudi and non-Saudi national students because the class was used as a cluster. In addition, because the study was not ethnocentric, this could allow the studied age group to be more represented to Jeddah adolescent population, and to gain empathy with all participants.

Socio-demographic characteristics

Demographic questionnaires were included using a number of questions to characterise the participants for the study. A combination of in-home and in-school objective and subjective surveys of girls and parents, which provided surveys on nationality, education data, data on family size, and family affluence, were conducted.

School geographic location

The distribution of Jeddah's schoolgirls was into four regions, namely, (north, centre, southeast and southwest). Figure 5a shoes a map for distribution of school regions according to the supervisory centres at Ministry of Education.

Education level

Intermediate and high levels

Nationality

Most of the population in Jeddah comes from mixed ethnic groups particularly Arabs. Others descended from South Asians or Iranians. This may affect the eating behaviours among adolescent girls as a group. Participants were asked to reply "Saudi" or "non-Saudi" with regards to which nationality they are carrying.

Family affluence

In order to allow for assessment of socio-demographics and socio-economic status relationships with the nutritional status of respondents, participants responded to six items, asking about household income, household type and ownership status of that house, family size, family ownership of one or more cars, family keeping of driver(s) or maid(s), and living status.

Household income per month (SR)

Income has an important reflection on socio-economic status, and hence, individual's decisions about diet and on the access to food. However, information on family income was used for this survey to evaluate socioeconomic status of participants who age more 13 years old. The question rated income in Saudi Riyals as (**>** *1500 SR, 1500 -3500 SR, 3500->5500 SR, 5500->7500 SR, > 7500 SR).*

Information on the presence of other siblings, owning of a car, keeping a driver or domestic maid were initially derived from questions using dichotomous responses, "Yes/No". Further questions derived included the number of siblings, cars, housemaids and drivers. These variables and categorisations of their responses are shown in Appendix VII (Var. 18-24).

The family size, owning of cars, keeping of drivers/domestic maids

Household type

Household type was derived from information collected on the residential status and whether the house type is "apartment", "villa", "compound", or "traditional" is "owned" or "rented". Girls were also classified into groups depending on whether they were living with one or both parents and with or without other siblings by asking, "With whom do you live" (Var. 13-19).

Parent’s employment status

The employment status of parents was derived from the head of household and girl’s mother. Participants responded to two items, asking about whether the parent was in paid employment, and response was assessed using dichotomous responses, "Yes/No’’

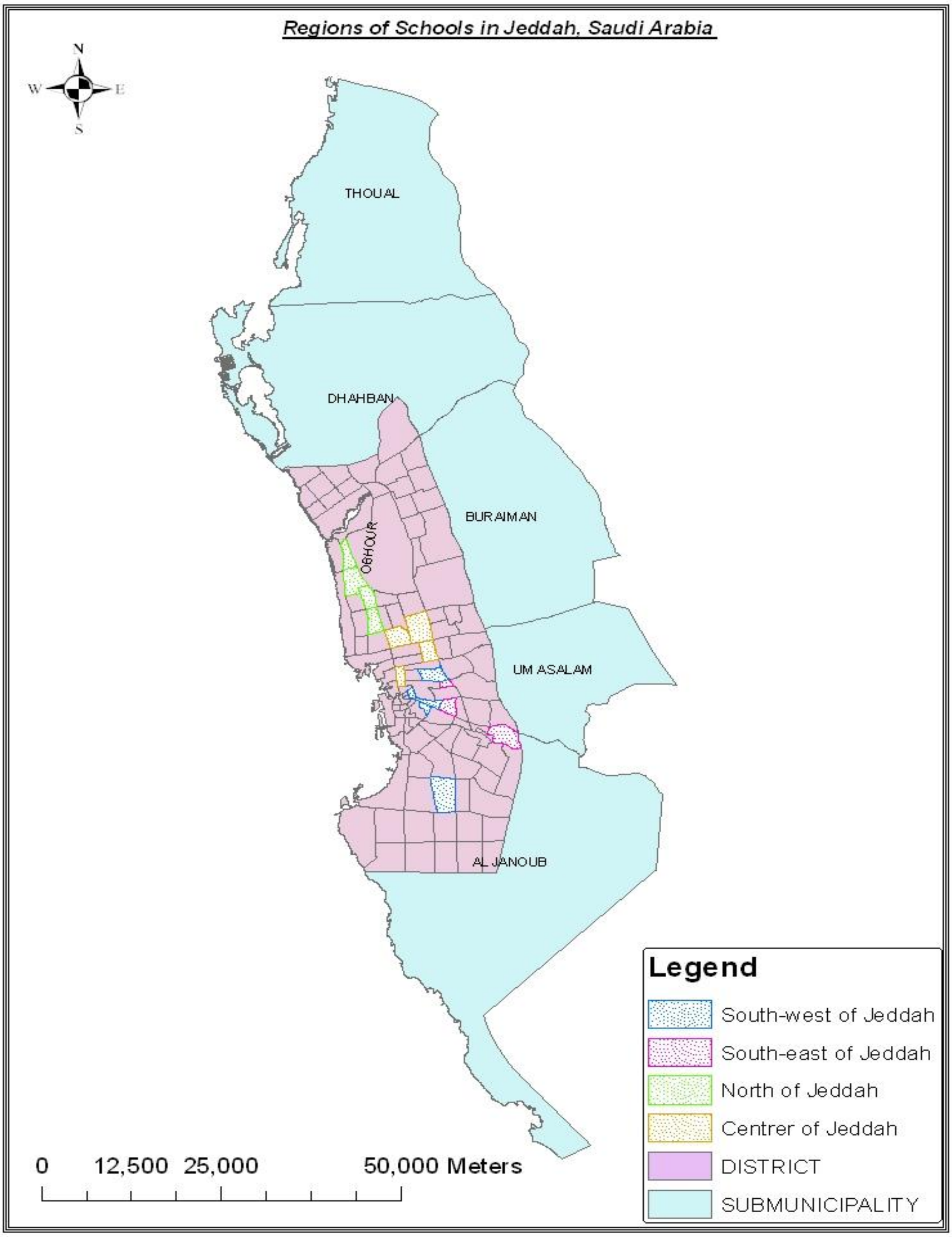

Figure 5a: Map for distribution of schools regions

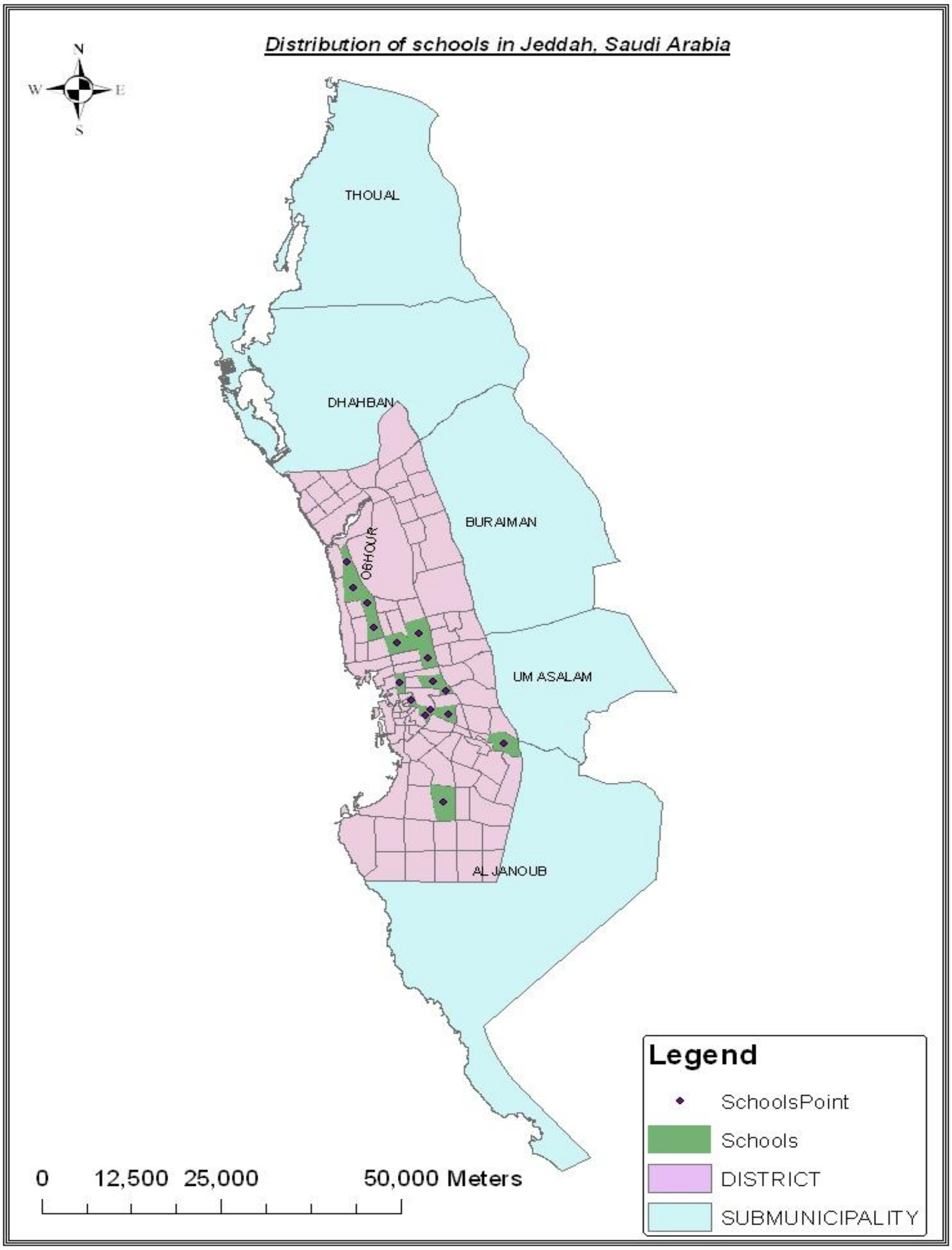

Figure 5b: Map for distribution of schools from both sectors

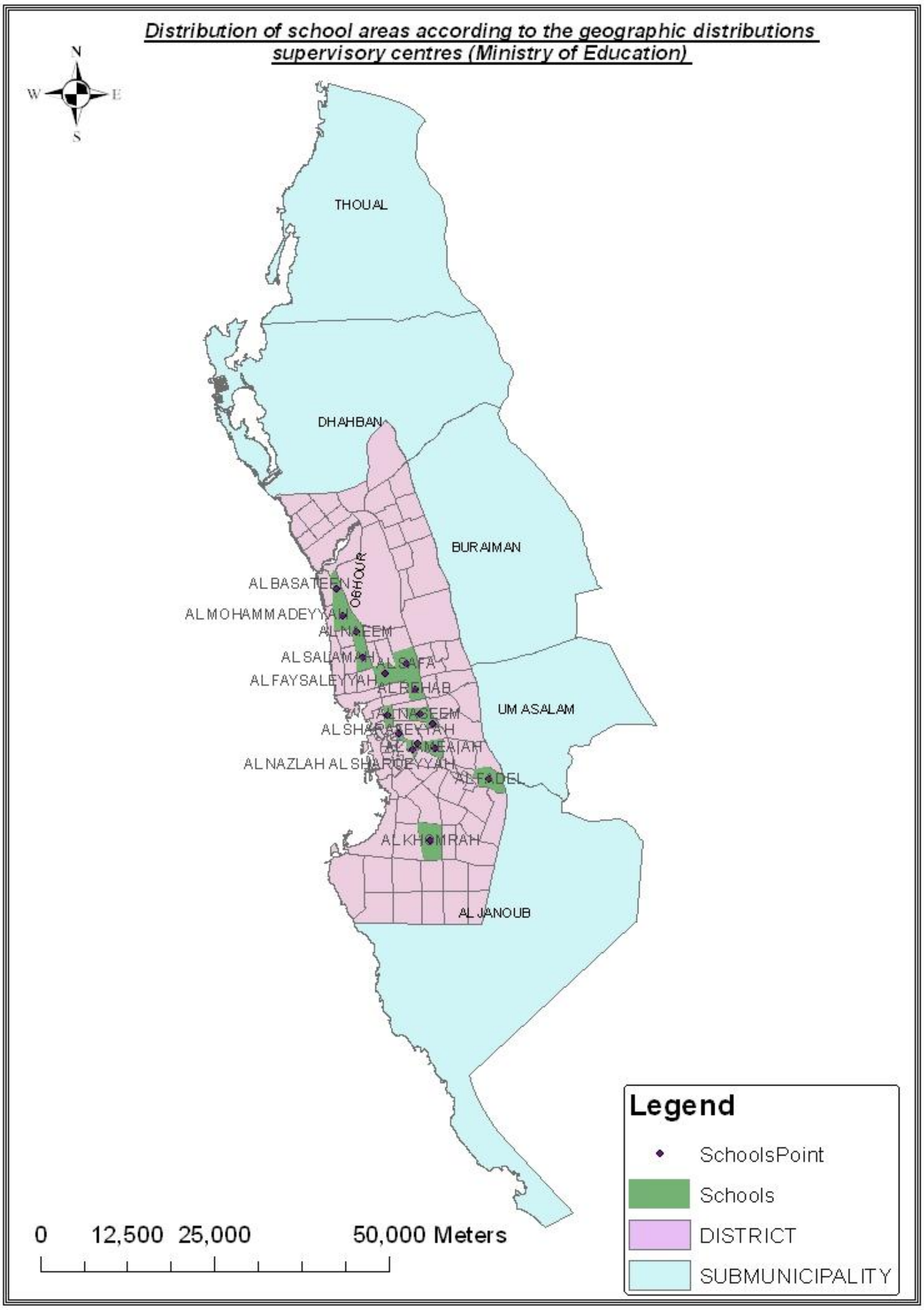

Figure 5c: Map for names of areas of which schools located

Biological and health Variables

The data obtained on biological and health variables were compounded into objective measurements-such as height, weight, waist circumference (growth status) and haemoglobin levels in addition to some other subjective surveys, e.g. age, age of menarche, and some health-related variables.

Biological

Age

Girls' self-reported their age using months and year. Then, their birth was calculated by comparing their reported age to the month and year of the interview.

Pubertal status

Menarche age was used as an indicator of girls' maturation and developmental stage. Girls were asked if they had started menstruating and if so when (Var.8).

Hunger

Adolescents' demands for energy and nutrients increase because of their rapid growth during the growth spurt of their adolescent years. Thus, hunger as a physiological drive, which influences the food intake of adolescents, was considered in this survey. The dichotomous responses "*Yes/No*" to the question, "*Do you often feel hungry?*" was used to assess respondents' hunger status (Var.34).

Health status

The interview included questions about the girls' awareness of their current and previous health status, medical problems, and the use of vitamin/mineral supplements (Var.35-38).

Adolescents' knowledge, perceptions and attitudes

Cognitive-affective (psychosocial) compound measures were derived from questions on participants' perceptions and satisfaction on food, figure, eating, and health in addition to nutrition knowledge, values and sources, which could have an impact on their eating behaviours e.g. effectiveness of mass media and advertising. In addition, information on girls' satisfaction about their physical activity performance which was self-completed based upon their evaluation of their own activity levels and then when compared with that of peers of the same age (Var. 39-58).

Personal behavioural variables and lifestyle

Personal behaviour investigation was characterised by eating patterns, nutrition and health-related lifestyle factors as well as by the intake of food groups and food items. Available variables included smoking, type of food mostly eaten, breakfast habits, and other special dietary habits, sweetened carbonated beverages consumption, snacks consumption, and hours of sleep.

The food and drinks consumed

Girls consuming various foods and drinks were assessed based on their frequent consumption of foods and food groups during the seven-day period prior to the interview. The food groups (vegetables, fruits, meat, dairy products, cereals and grains), food items, e.g. desserts, cakes, pastries, and ice cream) were assessed by applying the same question *[How many times did you eat (food or food group) in the last seven days?]*. The same coding for all questions was applied *"None", "one to two times", "three times or more"* (Var. 59-67). Further questions on food consumptions and preferences for some foods and drinks were assessed (Var. 68-76).

Behaviours and Lifestyle

Lifestyle factors were collected by structured questionnaire on time and convenience, meal patterns, dieting practices, physical activities, and other health behaviours such as smoking.

Time and convenience

Information was obtained to assess if perceived time constraints and convenience influenced Jeddah adolescents' food choices by assessing girls access to 'money factor' which has been considered by the other research as adolescents who have the resources to buy snacks as economically active (Anderson *et al*., 1993). Other assessments included the girls' involvements in food purchasing and preparation (Var. 77-80).

Eating patterns

Information was collected on meal patterns, which were known to be generally practised by adolescents in different parts around the world e.g. skipping meals, snack consumption, breakfast eating habits, eating out and fast food consumption (Var. 81-90). Participants were assessed as to whether they are vegetarian dieters or not and whether they were skipping meals with special concern given to breakfast meal because it is reported previously as the most commonly missed meal among adolescents (Lin *et al*., 1999). Snacking between meals, type of the favourite snack/snacks consumed in school or after school, and the number of snacks was considered. Fast food consumption was assessed in comparison to homemade food consumption, and other foods made outside home. Furthermore, information on lifestyle included assessment of smoking behaviour and girls were asked if they were smoking (cigarette or Shisha) or not, and if they were regular smokers or only smoke in special occasions, e.g. in the presence of friends.

Dieting practices

In order to assess the prevalence of dieting practices and attempts to change weight among Jeddah participants, girls were asked to reply to various surveys including; girls' dieting and weight control behaviours (prescribed by a "health professional" or from "other sources, e.g. media"), their success or fail in their attempts to change weight are presented in (Var. 91-95).

Physical activities

The main purpose in collecting information on physical activities was to allow an investigation of relationships between physical activity levels and nutritional status of Jeddah adolescents. Information was self-completed and based on participants' observation and evaluation of their own activity levels. Activities included those done at different times in the day either at school, after school, at home, or in girls' free times (Var. 99-115). Information was collected using the same guidelines of GPAQ (WHO 2002); however, they were developed to evaluate physical activities on adults and at work but data surveys, were modified according to our participants' age group and settings. Data on physical activities were designed, grouped and collected based on physical activity participation in three settings (or domains) as well as sedentary behaviours. The domains were activities at school (travels to and from school and apart from school.

Activity at school and physical education are precluded at governmental sponsored schools and permitted for (about 1-2 hrs/week) in independent schools (not compulsory), activities performed during the school day were evaluated according to participants 'personal involvements in some activities, including those at break times.

Reduction in physical activities among young people was previously explained by their travel to school using a car or bus rather than walking (Smithers ,. 2000). Jeddah girls' methods of transportation to school and apart from school were evaluated by their response to the question; "*Which form of transportation do you normally use when travel to and from school and apart from your journey to school?*

A recreational activity included activity performed after school, at home, or away from home (indoor or outdoor). Respondents completed survey data, including a survey of sleep habits, a survey that assessed different types of physical activities, and another survey that assessed whether the student was involved in exercises, including outdoor exercises or those at fitness centres, or in their leisure times. Some of the activities were evaluated according to daily performances while others on weekly basis. The exposure categories used by dividing physical activity into three levels: 1) Sedentary behaviours. 2) Very light (activities those which require a lowest energy expenditure such as sleeping hours. 3) Very low energy activities such as television watching or playing on computer. 4) Light, moderate or hard activities (activities on a range of prompted activities that were known to require light, moderate, high or very high levels of energy expenditure). The grouping and classification of activity levels used was based on the 1997 UK Survey for young people with modification (Smithers *et al.*, 2000). However, activities in this survey could be reported by girls as 'were occasionally performed' and not as 'being done regularly'.

The questions on sedentary behaviours or very light physical activities were designed to give information about sitting or reclining after school or at home, including time spent doing homework, reading, playing on computer or computer games or watching television or video, and bed time information. Moreover, information about bedtimes was included within the assessment. This was in order to allow the periods of sleep to be evaluated, and girls were asked to report if they go to bed or wake up early.

Information collected on the time spent inactive or in very light activities in which the girls were mainly seated each day while assessment to the other activities was over a seven-day period.

3.2.2.2 Socio-environmental factors

Family and peer influence

Four measures of parental and peer influence (Var. 113-117) were considered by this survey, the first to which examined the influences on meal size. Adolescents were asked whether their meal sizes were affected by the presence of friends or family members. Three other measures of parents' weight estimation and satisfaction by their daughters, parents' satisfaction about their daughters' attempts to weight change, and their own attempts to change weight were included. These measures indicated whether a girl thinks her parents are *"too fat"*, *"too thin"*, or *"about the right weight".* The reference categories consist of respondents *"my parents*, *"encourage me"," discourage me,"* or *"they do not care" "when I try to change my weight."* Finally, girls were asked whether any of their parents have tried to change his or her weight and the reason for their attempts to change their weight. Respondents were divided into three groups: *"No "*, *"Yes, "due to medical advice,"* and *"Yes," "due to other reasons."*

Physical environmental factors

Girls were asked about their access to food in different places inside home, and outside home in schools and restaurants (Var. 113-117).

Eating places at home

Places where girls eat at home were evaluated by applying a single measure, which was constructed to evaluate home eating environment, and respondents were asked to report the place where they eat their meals at home "*Where do you usually eat.*" Respondents were divided into four categories: *"dining room," "bedroom,"*
Kitchen" and "in front of TV"

Schools

The present survey is a school-based survey and assessment of participants' food availability at schools, and the access to these foods was considered. Two measures were constructed, and respondents were asked to report whether they *"buy food* *from schools"* and to report the *"type of canteen food they buy."* The reference categories consist of respondents who were collated into *[Sandwiches (cheese, eggs, hamburger, others), Potato crisps, Chocolate, Biscuits, Fruit, Donuts, Pizza, Nuts, Ice cream, and others)].*

Restaurants

Respondents were asked about how frequently they ate outside home per week (How often do you eat outside your home?) using responses? Once, twice," "three times," "more than three"

3.3 Assessment of school meals, snacks and beverages

Based on the frame model in this study, access to food and beverages at school was examined using some survey questions. In addition, assessment for the type of food/beverages available in both sectors was done. In public schools, three school canteens in both education levels were visited in different days at the time of the survey. Other canteens were visited in different private schools.

3.3.1 Information of school snacks and beverages

The research team visited canteens at public schools during data collection with permission from the principal teachers, then snack, beverage options during three different days, and in three different schools in both levels in the academic year 2008-2009 were observed and evaluated. A one-day sample menu that includes all food and beverage items provided for the school canteen for the visited day was collected from one of the visited schools for assessment (see Appendix XII).

Private schools were operating, their own canteens by making contracts with independent caterers. The research team visited two other canteens in different private schools, and types of food/beverages provided were assessed. The research team has recorded all the food and beverage items that were provided at the AL-Manarat private school's canteen during the school visit. Then, the recorded listing of food/beverage items for both schools in both sectors were assessed and analysed using the NP.

In addition, personal contacts with principal teachers and students in either public or private schools were the other sources of information about schools' meals and snacks provided in schools.

3.4 Data analyses

SPSS PASW[14] Statistics for Windows (version 18) was used in entering, managing survey data and in generating the statistics in this study.

The nutritional status of participants was estimated using body mass index for age, smoothed mean BMI Z-scores, WC percentile, WHtR and haemoglobin levels as main outcome measures. In addition, other outcome measures such as school type and media-related factors were included. All other factors included within the study model were described as explanatory to the main outcomes of this study.

Data were initially screened to assess the presence of outlying and potentially erroneous outliers. In addition, histograms of all variables were examined to ensure that the selected statistical methods were appropriate. Outcome measure variables were used to generate descriptive and bivariate statistics. Continuous and categorical variables were expressed as frequencies and percentages, and were summarized in tables. Differences in eating behaviours and factors contributing to the outcome (BMI for age) were examined by creating a three-categorical outcome variable for weight status (overweight, normal and underweight), a dichotomous outcome variable of WC based on the cut-offs used ($< 75^{th}$ & $\geq 75^{th}$) was used to examine associations with WC. Associations related to other outcome measures such as anaemia, WHtR, school type and media-related variables were also dichotomous variables. The relationships were examined using contingency tables and chi-square statistics. Moreover, associations between BMI Z-scores and individual specific characteristics and behaviours were analysed using to compare mean tests [independent t-test and the-one-way analysis of variance (ANOVA)]. School meals' analyses for one-day meal menus from two schools (one in each sector) were conducted using the nutrient profile (NP) scoring (described below).

Mean, SD, percentages, independent t-test, ANOVA and chi square were the primary statistical analyses and used the significant levels of $p<0.05$ unless otherwise mentioned. A statistical analysis plan is presented in Table 6, and all statistical analyses are discussed below in detail by the research' objectives:

[14] PASW stands for Predictive Analytics Software for Windows

3.4.1 Objective Ia: Description of anthropometric profile included, weight, height, waist circumference and haemoglobin levels

Z-scores and percentile construction and smoothing for all anthropometry measurements were performed using the LMS methodology as described above, followed by transformation of all individual measurements into standard deviation scores. The units used were standard deviation scores based on all the data used to fit the LMS model for the given measurements and two references were used for comparisons (according to the availability of the source), the WHOSDS[15] and UKSDS[16]. Means and standard deviations were calculated and used to describe weights, heights, waist circumference, WHtR and BMI z-scores of Jeddah adolescent girls. Weight status of participants was categorized using body mass index (BMI-for-age) and was described using frequency and percentages.

3.4.2 Objective Ib: Describing personal and environmental characteristics of participants

Mean, SD, percentages were used to describe all characteristics.

3.4.3 Objective II: Associations of nutritional status with personal and environmental factors based on weight status, WC and WHtR

To determine significant factors influencing the nutritional status of Jeddah girls (BMI), the statistical analysis of this section was done through different steps that included both BMI and WC as outcome measures. As described above, data on BMI was used to develop two outcomes: BMI-for-age and the smoothed BMI Z-scores (based on the WHOSDS). In addition, WC data was used to define another outcome: WC percentiles, which was based on the UKSDS. All steps used were described as follows: Descriptions of the characteristics of Jeddah's adolescent girls and frequencies of all factors that could influence their eating behaviours. Means, SD, frequencies and percentages. Bivariate analyses and mean compare to define independent variables and relationships among all outcome variables that were related to both BMI and WC. Firstly, BMI-for-Age as an outcome was defined

[15]WHOSDS: Standard deviation provided with LMSgrowth and based on the WHO2007.xls references. References include: height and BMI for ages 5-19 yr; weight for ages 5-10 yr

[16]UKSDS: Standard deviation provided with LMSgrowth and based on the British1990.xls: length/height & BMI for ages -0.13 to 23 yr; weight -0.33 to 23 yr; head circumference -0.33 to 18/17 yr (males/females); sitting height & leg length 0-23 yr; waist circumference 3-17 yr, percent body fat 4.75-19.83 yr

according to weight status (overweight, normal and underweight) as explained above. This was in order to define differences between the different groups of weight status when associating with the explanatory factors. Secondly, correlations between BMI Z-scores (outcome) vs. all independent variables (personal and environmental factors) were performed. Thirdly, the WC percentile and WHtR as indicators of abdominal fat were used to define explanatory factors for abdominal adiposity. Chi square analyses were performed to detect significant relationships while independent *t*-test and a one-way analysis of variance (ANOVA) with Tukey's posthoc test were performed to compare differences in means of BMI z-scores among all participants according to factors affecting adolescents' behaviours and nutritional status.

3.4.4 Objective III: Assessing of school 'meal menu and snack food options' prepared and served by the caterer in public schools

The components of food items in public schools and one private school were analysed and classified according to the UK Food Standards Agency (FSA) classification to either foods high in saturated fat, sugar or salt (HFSS) or non-HFSS foods using the nutrient profiling (NP) model by (FSA 2008). The NP model has been developed by the FSA as a tool to categorise foods as a basis of their nutrient content and to evaluate the overall balance of nutrients in any food or drink item, and it was used for this study to distinguish between HFSS foods and healthier alternatives that were available in Saudi schools.

This model was based on a 'simple scoring' system, where points were allocated based on the nutritional content in 100g of a food or drink. For example, HFSS foods were worked out by totalling 'A' points. Total 'A' points = (points for energy) + (points for saturated fat) + (points for sugars) + (points for sodium) while total 'C' points = (points for fruit, vegetables and nut content) + (points for fibre content) + (points for protein). Then, three steps were followed in order to work out the overall score for the food or drink. First step was to calculate the total points A; second step was to calculate the total points' C, and the third step was to work out overall score using total points for A and C. The following table indicates the points scored, depending on the content of each nutrient/ food component in 100g of the food:

TABLE 6: FSA WXY scoring method (100g) (Quinio *et al.*, 2007)

	Points										
	0	1	2	3	4	5	6	7	8	9	10
Negative nutrients											
Energy (kJ)	≤335	>335	>670	>1005	>1,340	>1,675	>2,010	>2,345	>2,680	>3,015	>3,350
SFA (g)	≤1	>1	>2	>3	>4	>5	>6	>7	>8	>9	>10
Total sugars (g)	≤4.5	>4.5	>9	>13.5	>18	>22.5	>27	>31	>36	>40	>45
Sodium (mg)	≤90	>90	>180	>270	>360	>450	>540	>630	>720	>810	>900
Positive nutrients											
Protein (g)	≤1.6	>1.6	>3.2	>4.8	>6.4	>8					
Fibre (g)	≤ 0.7	>0.7	>1.4	>2.1	>2.8	>3.5					
% of fruits and vegetables	≤40	>40	>60	–	–	>80					

Some of the beverages and packed samples of the meal menu either local or imported were purchased from local supermarkets in Jeddah city. Then, they were analysed by using the nutrition information and labels of each item. Most products bought in supermarkets, and food shops had some level of nutritional information about the label. This is usually per 100g product. All the other food items labelled on basis of portion size were calculated by changing their contents into the basis of 100 gm or ml. The nutritional composition of mixed and readymade items was analysed, using international food composition tables (USDA 2011). Analysis included serving size (100 gm or ml), and its nutritional contents such as energy, saturated fat, total sugar and sodium in addition to the presence of fruits, vegetables, fibre and nuts in the food.

3.4.5 Objective IV: Differences in personal and environmental factors according to school type

To detect differences in eating behaviours and other determinants of the nutritional status according to type of schooling (private and public), Chi-square analyses were performed.

3.4.6 Objective V: Personal and environmental factors and associations with media (screen time and media influences on food choice)

The last part of analysis for the survey's results included questions that were designed to solicit information regarding media (books, magazines, computer and computer games and TV viewing) and their effect on eating behaviours and nutritional status of Jeddah young girls, especially using food advertisements, which was used throughout this analysis. Influences of screen time, TV advertisements and

TV characters on eating behaviours were considered, in particular. Bivariate analyses were performed to define differences in eating behaviours and nutritional status of respondents according to their exposure to TV, and concerns of media influence on food choice using Chi-square analyses to detect significant relationships.

Multivariate Analysis

In retrospect, Multivariate Analysis might have revealed the associations between different factors. This will be further examined when parts of this thesis are prepared for publications.

Table 7: A statistical analysis plan according to research' objectives

Related Study Objectives	Number and Type of Variables Independent Variables	Dependent Variable	Analytical Procedures
Description of participants' anthropometric profile & characteristics and factors (personal & environmental) of all participants			
Variables related to growth & factors affecting eating behaviours & nutritional status (neither independent or dependent)			
*1a. To measure the anthropometric profile (weight, height, BMI index, WC & WHtR) and haemoglobin levels of participants & *1b.To explore factors affecting eating behaviours of adolescent girls in Jeddah City	- Z scores and/or percentiles for: Weight, Height, BMI & abdominal fat status using WC & Waist-height ratio (WHtR) -Haemoglobin levels -Personal and environmental factors		Mean/SD & Frequency/percentages
Nutritional Status of Jeddah adolescent girls based on: anaemia status (haemoglobin level < 12 gm/dl), weight categories, BMI z-scores, WC size, and WHtR and associations with factors (personal & environmental)			
More than one independent variable and one categorical dependent variable			
*To identify the associations of participants' nutritional status (based on weight categories) with factors influencing their nutritional status	- Categorical variables (two levels) - Categorical variables (three or more levels) Variables include: Personal and environmental factors	Nominal (3 categories): underweight, normal weight, overweight & obese	Chi-square

Table 7: A statistical analysis plan according to research' objectives (continue)

Related Study Objectives	Number and Type of Variables: Independent Variables	Dependent Variable	Analytical Procedures
More than one independent variable and one continuous dependant variable (BMI Z-scores)			
*To identify the associations of participants' nutritional status (based on differences in mean BMI) with factors influencing nutritional status	-Categorical variables (two levels) -Categorical variables (three or more levels) Variables include: Personal and environmental factors	Continuous variable: BMI Z-scores	Independent *t*-test -One-way analysis of variance (ANOVA)
More than one independent variable and one categorical dependent variable			
To identify the associations of participants' nutritional status (based on waist circumference) with factors influencing their nutritional status	- Categorical variables (two levels) - Categorical variables (three or more levels) -Variables include: Personal and environmental factors	Nominal (2 categories): WC of<75th percentile & WC of $\geq$75th percentile	Chi-square
More than one independent variable and one categorical dependent variable			
To identify the associations of participants' nutritional status (based on waist-to-height ratio) with factors influencing their nutritional status	- Categorical variables (two levels) - Categorical variables (three or more levels) -Variables include: Personal and environmental factors	Nominal (2 categories): WHtR of <0.5 & WHtR >0.5	Chi-square

Table 7: A statistical analysis plan according to research' objectives (continue)

Related Study Objectives	Number and Type of Variables: Independent Variables	Dependent Variable	Analytical Procedures
More than one independent variable and one categorical dependent variable			
To identify the associations of participants' nutritional status (based on haemoglobin levels) with factors influencing their nutritional status	independent and dependant variables (Hb level) only - Categorical variables (two levels) - Categorical variables (three or more levels) Variables include: Personal& environment	Nominal (2 categories): anaemic/non-anaemic	Chi-square
Assessing & analysing of schools 'meal menus and snack food options' at public & private schools using the nutrient profiling (NP) model by (FSA, 2005) and food items was classified to either HFSS and non-HFSS foods			
No independent or dependent variables & classification will be to (HFSS and non-HFSS foods)			
To assess schools 'meal menu and snack food options' prepared and served by the caterers at public and private schools	Calculation of two actual meal menus provided by school meal provider of public schools, and one of the school meal provider in one of the private schools, using NP		
Differences in eating behaviours and nutritional status of public and private schoolgirls			
More than one independent variable and one categorical dependent variable			
To detect differences in eating behaviours and other determinant factors of the nutritional status of girls in both school sectors	Categorical variables (two levels) - Categorical variables (three or more levels) Variables include: Personal & environmental factors	Nominal (2 categories):public schools & private schools	Chi-square

Table 7: A statistical analysis plan according to research' objectives (continue)

Related Study Objectives	Number and Type of Variables Independent Variables	Dependent Variable	Analytical Procedures
The impact of macro-systems (based on media) on eating behaviours and nutritional status of Jeddah' schoolgirls			
More than one independent variable and one categorical dependent variable			
To detect differences in eating behaviours and other determinant factors of the nutritional status of participants according to media influence using the screen time	Categorical variables (two levels) - Categorical variables (three or more levels) Variables include: Personal and environmental factors	Nominal (2 categories) Screen time: < 2 hours & ≥ 2hours	Chi-square
More than one independent variable and one categorical dependent variable			
To detect differences in eating behaviours and other determinant factors of the nutritional status of participants according to media influence based on perceptions about TV advertisements and their influences on eating behaviours and nutritional status of participants	Categorical variables (two levels) - Categorical variables (three or more levels) Variables include: Personal and environmental factors	Nominal (2 categories): Do you think that TV advertisements have any influence on your eating behaviours? Two responses: Yes/No	Chi-square

CHAPTER FOUR

Survey Results

4.1 Chapter introduction

This chapter looks at the survey findings, which include general characteristics of Jeddah adolescent girls, frequency of consuming various foods, dietary patterns, dieting practices and lifestyle characteristics. Views on healthy eating and perceptions on the healthiness of participants' own diet and lifestyle are included. In addition, results related to the environmental factors that could influence nutritional status of participants or, which are affected by eating behaviours are described. Findings are presented in the following sections as follows:

Section one: descriptive characteristics and anthropometric profile of Jeddah adolescents' girls. Food patterns, knowledge, attitudes and behaviours of participants are also described throughout this section;

Section two: associations of nutritional status based on weight status and BMI z-scores with factors affecting eating behaviours;

Section three: associations of nutritional status based on WC and WHtR with factors affecting eating behaviours;

Section four: evaluation & description of school 'meal menu and snack food options' in public & private schools;

Section five: Differences in participants' characteristics, behaviours and nutritional status by school sector;

Section six: Participants' characteristics, behaviours and nutritional status and associations with media-related variables, including screen time and participants' concerns of media influences on food choice.

4.2 Characteristics of Jeddah adolescents' girls

4.2.1 Socio-demographic characteristics of the sample

A total of 1519 female students participated in this survey. Their ages' range was 13 to 18 years with a mean age of 15.5 years (SD=1.70). Sixty-two percent (938) of the sample was Saudi. Seventy-seven percent of adolescents' mothers in the survey were not working compared to only 2% of non-working fathers. The household monthly income for 64% of the sample ranged between (1500 to >7500 Saudi Riyals) or (£250 to >1250) and more than half of the population has reported incomes of more than 7500 SR. Most of the girls (63.3%) were living in apartments, and the proportion of home ownership was 51%. Fifty-five percent of the participants had live-in domestic workers in their houses. Table 8 presents some of the socio-demographic characteristics of the participants.

Table 8: Socio-demographic characteristics of the sample (n=1519)

Variables name (number of respondents)	No (%)
Age Groups (Years) (n=1519)	
13-15 years	767 (50.8)
16-18 years	743 (49.2)
Nationality(n=1519)	
Saudi	938 (61.8)
Non-Saudi	581 (38.2)
Education Level(n=1519)	
Intermediate	794 (52.3)
High	725 (47.7)
School Sector(n=1519)	
Public	794 (52.3)
Private	725 (47.7)
Parents occupation	
Mother working (n=1469)	332 (22.6)
Father working (n=1414)	1386 (98)
Household Income Monthly (SR) (n= 973)	
< 1500 SR	54 (5.5)
1500 -3500 SR	148 (15.1)
>3500≤5500 SR	112 (11.5)
>5500≤7500 SR	136 (13.9)
> 7500 SR	523 (53.9)
House Type(n=1513)	
Apartment	957 (63.3)
Traditional house	85 (5.6)
Compound	17 (1.1)
Villa	454 (30)
Residential status (n=1508)	
Owned	773 (51.3)
Rented	735 (48.7)
Family Car(n=1512)	1442 (95.4
Keeping a House maid at home(n=1483)	819 (55.2)

*Data reflects numbers and percentages

4.2.2 Anthropometry profile of Jeddah adolescent girls

The mean weight and height for girls were 51.9 kg and 156.3 cm respectively. Table nine presents the anthropometry characteristics of the participants in comparison to the WHO and UK references' data. Data were compared to each reference according to it's availably (see chapter three).

The weight and height z-scores for girls relative to UK reference averaged -0.471 (1.65) and -0.797 (1.06) respectively; while the height z-scores averaged -0.705 (0.97) when compared with the WHO reference. The BMI Z-score relative to WHO averaged -0.0714 (1.51). On the other hand, the WC Z-score and percentile averaged 0.9011 (1.58) and 72.5 (31.3) respectively, and both calculations were derived from the UK 1990 reference.

Table 9: Anthropometric characteristics (Height, weight, BMI & WC) of Jeddah adolescent girls compared to the UK 1990 & the 2007 WHO references

Reference	Value (Mean ±SD)
Height z-score (WHOSDS)	-0.705± 0.97
Height z-score (UKSDS)	-0.797 ±1.06
Weight z-score (UKSDS)	-0.471±1.65
BMI z-score (WHOSDS)	-0.0714±1.51
WC z-score (UKSDS)	0.901±1.582
WC Percentiles (UKSDS)	72.5±31.3

Observations: Weight z-scores (UKSDS); Height z-scores (WHOSDS); Height z-scores (UKSDS); BMI, Mass Index z-scores (WHOSDS); WC, Waist Circumference z-scores (UKSDS), Waist Circumference Percentile (UKSDS)

4.2.3 Description of weight status of participants

4.2.3.1 Body Mass Index (BMI percentiles)

The BMI-for-age for all age strata (Table 10) (except age 18 years) increased significantly with age (*P*<.001). The mean BMI for each age stratum was plotted (manually) in two charts: the Saudi BMI for age-percentiles charts for girls 2 to 19 years old was the only available source for comparison with Saudi reference (as mentioned above), and the WHO BMI-for-age for girls 5 to 19 years (see graph 7 & 8). These comparisons were carried out to compare mean BMI using percentiles and to indicate the relative positions of the participants' mean BMI among the Saudi population and the (WHO) reference population of the same sex and age. The comparison indicated that mean BMI for 13, 14, 15, 16, & 17-years old girls, compared to Saudi charts, lay slightly above the 50th percentile whereas mean BMI for girls aged 18 years old lay below the 50th percentile. This could be due to the sample variations as shown in Table 10. Furthermore, exploring data regarding this age group reflected that 15% (40 out of 258) were underweight (BMI<17 kg/m^2). The comparison with WHO charts indicated that the mean BMI for girls aged 13 to 17 years lay between the 50th and the 85th percentile. While, the mean BMI for girls aged 18 years old lay on the 50th percentile.

The overall prevalence of overweight girls (BMI≥85th and <95thpercentile) was 10.6% (n=161), whereas obese (BMI≥95th percentile) girls constituted 13.5% (n=205) of the study population. Approximately, 62% (n=935) of this population had a BMI-for-age within the normal range of between BMI≥5 to p<85th percentile (Figure 6). For the purpose of data analysis and as described above, the term overweight is used for both overweight & obese status groups (BMI≥85th) and 24% of the sample was either overweight or obese.

Table 10: Mean BMI per age

Age	N	BMI (Mean ±SD)	Minimum	Maximum
13	238	19.99± 5.12	12.3983	40.1547
14	263	20.60 ±4.94	12.8104	39.8586
15	256	21.19±5.25	12.8156	49.3056
16	237	21.55±5.27	12.7383	45.7058
17	267	22.06±5.35	13.5602	45.3287
18	258	21.32± 4.92	13.6864	43.4385

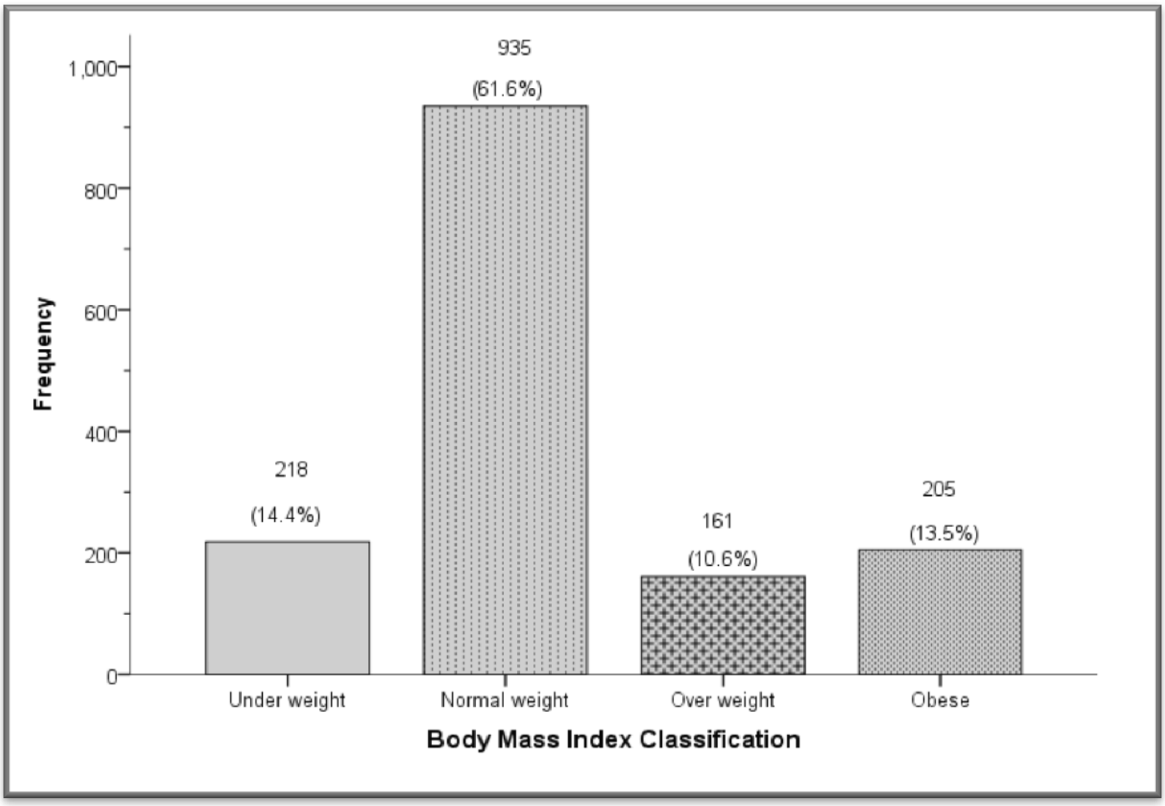

Figure 6: Body Mass Index classification of participants

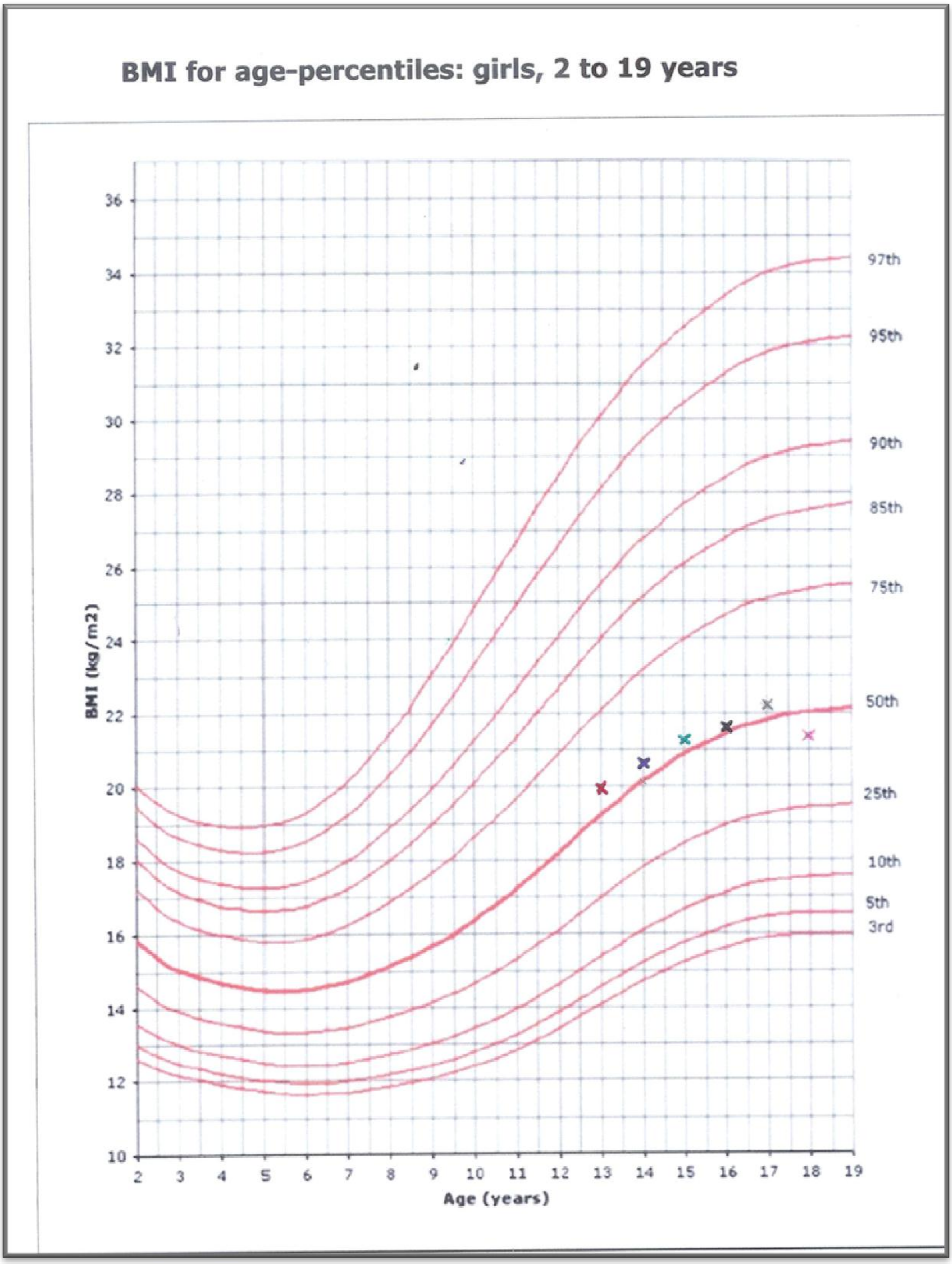

Figure 7: Comparisons of participants' mean BMI/age stratum vs. Saudi population (girls 2-19 years) charts

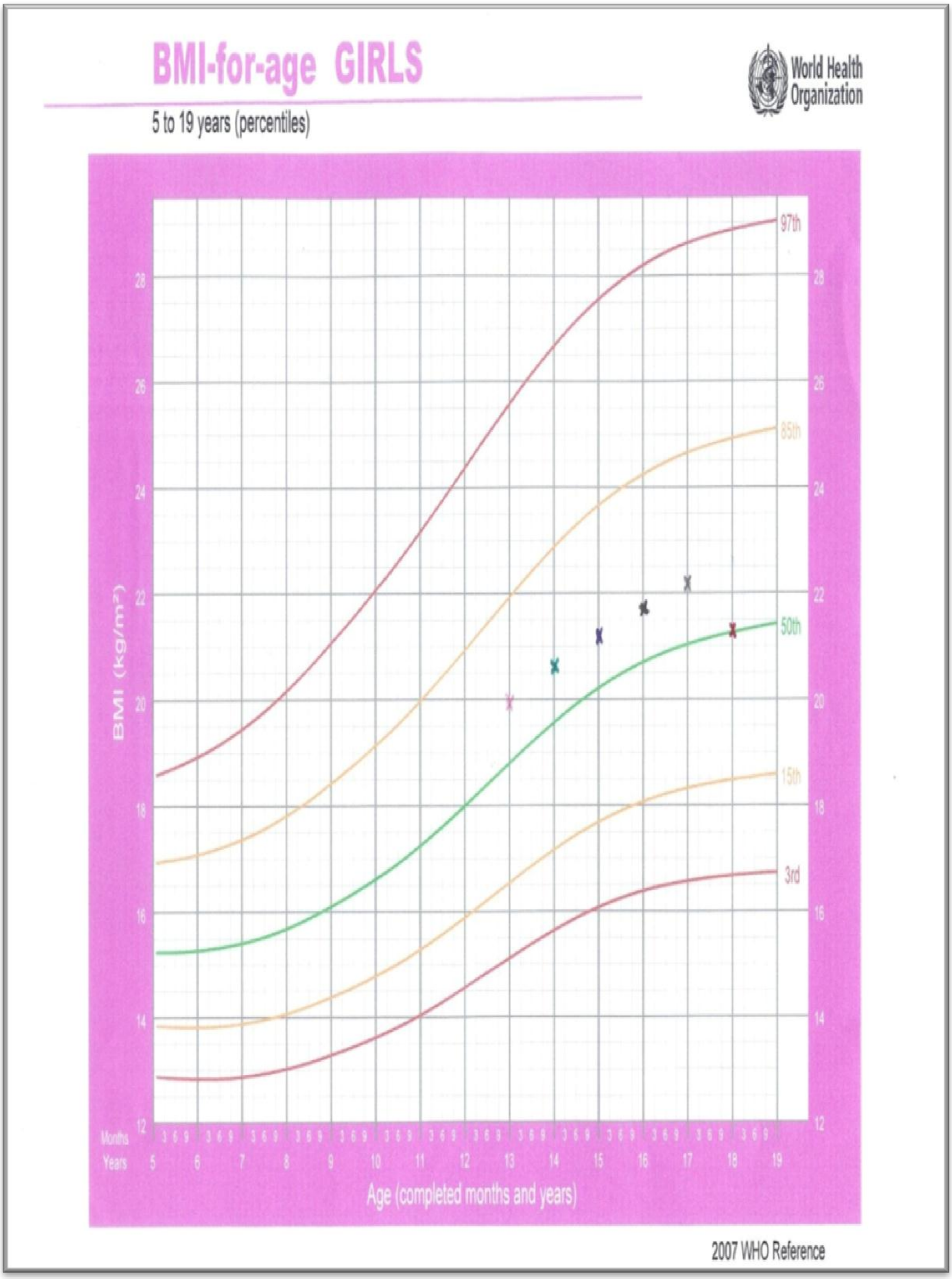

Figure 8: Comparison of participants' mean BMI (kg/m2)/age stratum vs. WHO reference population charts

4.2.4 Description of centralized fat status of participants

4.2.4.1 Waist circumference percentiles (WC) & waist-to-height ratio (WHtR)

The percentage of girls with waist-circumference (raw data) scores ≥90th percentile was the highest (9.7%) among 13-years old girls compared to other age groups. Girls who aged 17 years had the highest proportion (36.7%; 98 out of 370) of WC scores ≤10th percentile (Table 11).

The mean WC by age (excluding girls aged 18 years old) was compared with waist circumference percentile curves for British girls aged 5.0 ± 16.9 years (Figure 9). The comparison pointed out that the mean WC for Saudi girls in all ages (13 to 17 years), were above the 75th percentile.

Table 12 shows the mean baseline WC, height and calculated WHtR per age group. The mean WHtR values for all participants (calculated from raw WC and HT) was 0.465 (cut-off value ≥ 0.5).

Based on the 75th Percentile cut-off for WC, 80% of participants were below the 75th (n=1215) percentile and 20% were either on the 75th or above (n=304)., On the other hand, using the cut-off <0.5 for WHtR defined about 72% (n=1096) of participants as below the ratio.

Table 11: Comparison of mean WC for each age stratum with WC percentile curves for British girls aged 5.0 ± 16.9 years

Waist circumference group	Age for each stratum (%)*						Total=1519(%)
	13	14	15	16	17	18	
≤10th percentile	27(11.4)	55 (20.9)	53 (20.4)	49 (20.5)	98 (36.7)	88(34.2)	370(24.4)
>10thto≤75th percentile	131(55.3)	140 (53.2)	154(60.2)	139(58.2)	132(49.4)	149 (57)	845(55.6)
≥75thto≤90th Percentile	56 (23.6)	51 (19.4)	32 (12.5)	36(15.1)	28 (10.5)	15 (5.8)	218(14.4)
≥90thPercentie	23 (9.7)	17 (6.5)	17 (6.6)	15 (6.3)	9 (3.4)	5(1.9)	86(5.7)

*Age indicates the whole age group, e.g. 13.0-13.99 years, etc. Description done according to (Fernandez *et al*., 2004)

Table 12: WC, height & waist-height ratio (WHtR) for participants for each age stratum (raw data)

Age	N	Height (Mean ± SD)	WC (Mean ± SD)	Waist/Ht Ratio (Mean ± SD)
13	237	152.82 ± 7.08	71.66±11.41	.47±.066
14	263	154.14±6.96	71.59±11.09	.46±068
15	256	155.96±5.92	72.65±11.01	.47±.070
16	239	158.26±6.54	74.48±11.89	.47±.073
17	267	157.81±6.46	72.80±12.23	.46 ±.073
18	257	158.64±6.31	73.09±10.13	.46 ±.063

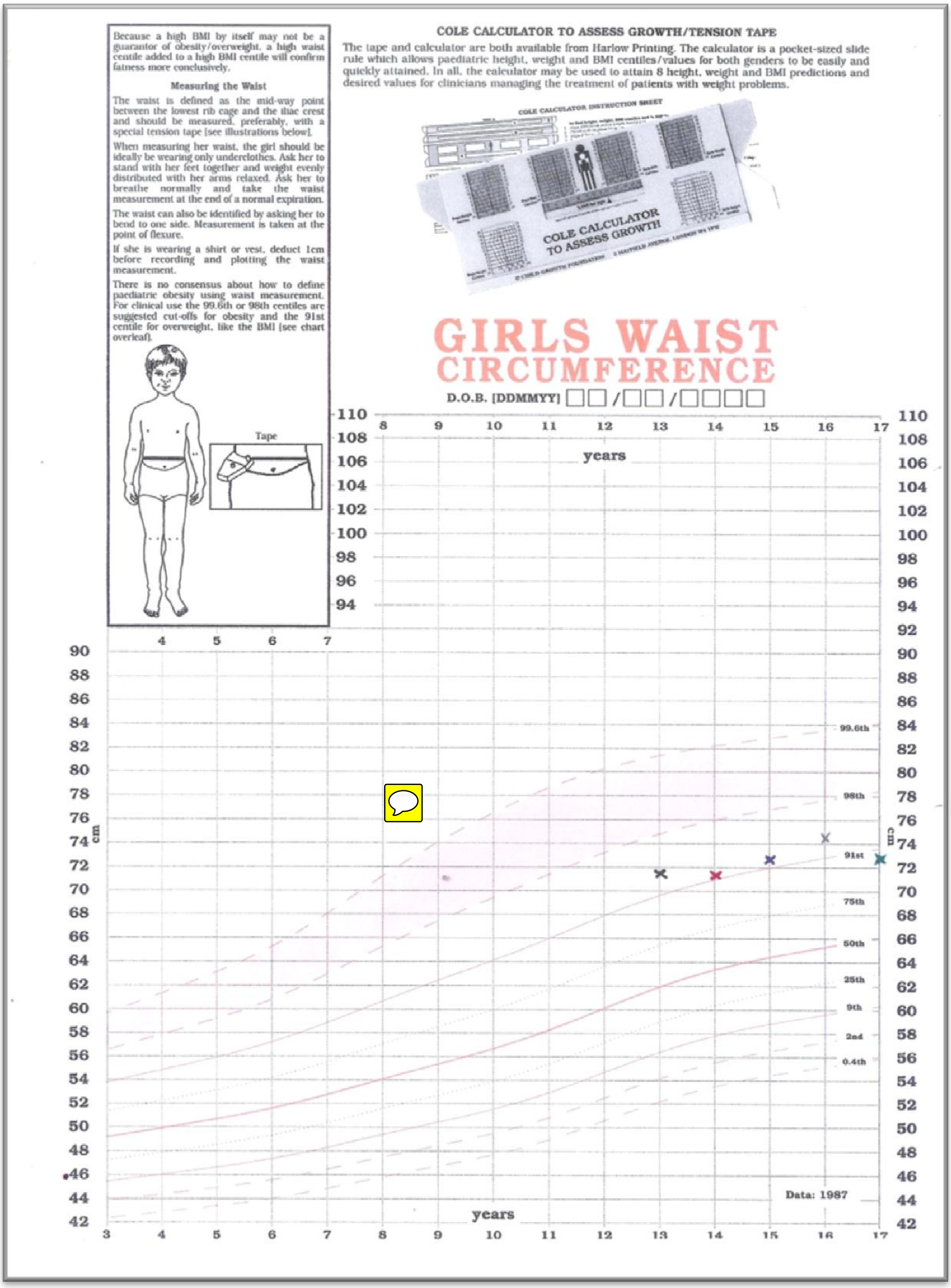

Figure 9: Comparisons of participants' mean WC stratum vs. UK 1990 population (girls 5-16.9 years) Charts

4.2.5 Biological and health status

Average age at menarche for participants (n=1343) was 12.59 year (SD 1.21), only 15.9% of the girls had started their menarche before age 12 years. Thirty-two percent of the girls reported that they were having medical problems and 22.5% of them were consuming vitamin and/or mineral supplements, mainly iron supplements.

4.2.6 Knowledge, attitudes and perceptions of health and figures

Jeddah girls appear to have a fairly accurate idea of their body size, and they seem able to perceive average (normal) body size as 74% of them thought that they were on their right weight and more than half (n=851) of the girls (56.4%) mentioned that they were watching their weight regularly. Eighty-four of the participants had positive perceptions about their health and 46.8% of them thought that they were consuming healthy foods. Of the whole sample, 33% were reading books and/or magazines and 43% of these readers thought that these influenced their food choice. The degree of this influence was mostly average (43.3%) and more likely to be related to advertisements (50.3%). Nearly half of the girls (57.5%) felt that TV watching may influence their food choice, and they thought that the influence was of moderate degree (43.4%). Although physical activity and physical education were not permitted in public schools and were not performed on a regular basis in some of the private schools, 63% of the girls reported that they would like to have physical education classes at school. Girls tended to think that they were performing (43.2%) enough physical activities and most of them (74%) rated themselves as performing an average level of physical activity in comparison with their peers, although only 32% linked the importance of physical activities to their health (Table 13).

Table 13: knowledge, attitudes, and perceived health & figure

Variables name (number of respondents) *Data reflects positive response	No (%)
Perceptions of body figure	
Do you watch your figure? (1510)*	851 (56.4)
How do feel about your figure? (1506)	
Too thin	153 (10.2)
about the right weight	1117 (74.2)
Too fat	236 (15.7)
Perceptions of healthy eating	
Do you consider yourself healthy compared to others your age (1506)*	1253 (83.7)
In your opinion, do you think that you eat healthy food? (1507)*	706 (46.8)
Perceptions of media influence on food choice	
Do you read books, magazines or comics daily? (1518)*	545 (36)
Do you think that your readings has an Influence on your food choices (1463)*	631 (43)
To what extent does reading influence your food choice? (1392)	
no influence	732 (52.6)
average influence	603 (43.3)
strong and important influence	57 (4.1)
If yes, is the influence related to magazine topics or advertisements	
food topics	492 (47.6)
advertisements	520 (50.3)
Both	21 (2)
Do you read or follow media concerning diet issues (1499)*	649 (43.3)
Do you think that TV watching has an influence on your eating behaviours (1505)*	866 (57.5)
Degree of the influence of TV characters (1497) **To what extent is the influence of TV characters on your eating behaviour?**	
No effect	719 (48)
medium	649 (43.4)
strong	129 (8.6)

Table 13: knowledge, attitudes, and perceived health & figures (continue)

Variables name (number of respondents) ***Data reflects positive response**	**No (%)**
Do you think that TV advertisements have an influence on your eating behaviours (1498)*	628 (41.9)
If yes, to what degree is the influence of TV advertisements (1509)	
strong	206 (13.7)
medium	17 (1.1)
weak	582 (38.6)
I don't know	704 (46.7)
Perceptions of physical activity at school and after school	
During holidays, how active are you in comparison to school days? (1511)	
less active	534 (35.3)
about the same	325 (21.5)
more active	652 (43.2)
Perceptions of physical activity in comparison to peers	
How active are you, in comparison to others your age and sex?(1501)	
below average	204 (13.6)
average	1112 (74.1)
above average	185 (12.3)
In general speaking, do you think that you perform enough exercise to keep healthy (1504)*	477 (31.7)
Would you prefer to have physical education classes at school? (1510)*	953 (63)

4.2.7 Food consumption, behaviours, and lifestyle

Table14 shows the frequency of food consumption in the total sample and the number of portions within each food group (vegetable, fruit, fat, milk, meat, and cereal and grains) in addition to frequency of extra food and drink items that were high in saturated fats, sugar and salt. Looking at the consumption rate in a week, most of the respondents reported a very low daily consumption of fruit and vegetables. Some of the girls reported either no intake of fruits (22%) or vegetables (27%) or an intake of one to two portions of fruit (46.5%) and 49% of vegetables in the previous week.

On a daily basis, more than 77% of the girls were consuming carbonated beverages, and most of the cited beverages were full sugar beverages (87%). More than half (55%) of the girls were adding sugar to their beverages (hot or cold beverages). On the other hand, 22% of the girls were using artificial sweeteners.

Of the whole sample, 75% of the girls reported skipping meals particularly breakfast. However, when they were asked whether they usually take breakfast before going to school, 60% of them reported that they were eating breakfast on a daily basis. About 90% of the girls were consuming snacks, 84% of snacks were either one or two snacks per day, and students at school (89%) usually ate the morning snacks. Participants cited more than one choice of snack items, e.g. pastries, sandwiches, chocolates or other confectionaries, donuts, and drink juices at school or after school. Most of the students (94%) had daily pocket money to buy snacks from schools. Half of the respondents (50%) ate late meals or snacks before they went to bed. About 49% of the food consumed by girls was homemade and 72% of the meals consumed outside home were fast food meals. The prevalence of smoking (cigarette or Shisha) among girls was only 3.2%. Of these smokers, (54%) reported themselves as regular smokers, and 46% were smoking on some occasions.

4.2.8 Dieting practices

Fifty-three percent of girls reported previous diets for weight reduction, 37.5% were actually on a weight reduction diet at the time of the survey. Fifty-six percent, of girls who were following a weight, reduction diet had failed to lose weight or their attempts for weight reduction were not successful. Only 20% of the participants had attempted to gain weight.

Table 14: Food and drink consumptions

Variables name (number of respondents)	No (%)
Consumption of vegetables/week (1478)	
None	414 (27.3)
Once or twice	749 (49.3)
Three times or more	315 (20.7)
Consumption of green salads with meals/week (1685)	
None	294 (19.4)
Once or twice	686 (45.2)
Three times or more	505 (33.2)
Consumption of fruits/week (1497)	
None	337 (22.2)
Once or twice	707 (46.5)
Three times or more	453 (29.8)
Consumption of meats/week (1499)	
None	199 (13.1)
Once or twice	702 (46.2)
Three times or more	598 (39.4)
Consumption of dairy products/week (1504)	
None	236 (15.5)
Once or twice	742 (48.8)
Three times or more	526 (34.6)
Consumption of cereals and grains /week (1507)	
None	25 (1.6)
Once or twice	459 (30.2)
Three times or more	1023 (99.2)
Consumption of desserts e.g. pudding, cake or chocolate cereals/week (1589)	
None	118 (7.8)
Once or twice	702 (46.2)
Three times or more	669 (44.0)
Consumption of oils and fats/week (1500)	
None	272 (17.9)
Once or twice	608 (40.5)
Three times or more	620 (41.3)

4.2.9 Physical activities

Eighty-seven percent of students used cars as the main transportation methods to and from school while only 8% walked to school. Adolescent girls reported performing some physical activities (59.2%) at school. Schools' activities were reported as of walking during break times (42%) or running (5.2%). However, sedentary activities such as sitting down, eating and talking to their friends during school breaks were reported by 41%. Only 40% of girls were involved in light activities after school, e.g. food preparations while 54% participated in washing up or cleaning the house. Other activities outside school, e.g. walking, shopping, bowling, horse riding and table tennis was reported by 48% of the participants. Moderate activities such as swimming, cycling, dancing, or competitive running as jogging was reported by 70% of the respondents and these activities were more likely to be performed two times or more per week (80%). Thirteen percent of the participants afforded to join fitness centres to perform exercises and physical activities, which was mostly performed once a week.

4.2.10 Social environment

Jeddah girls appear to be confident about their parents' body size based on the surveyed personal rating without using a body image visual tool. Seventy-nine percent of girls approximated that their mothers' weights were 'about the right'. About 16.2% thought that their mothers were too heavy. The rest reported thoughts of very lightweights of their mothers (3.5%). Fifteen percent of girls estimated their fathers' weights as 'too fat', 77% of the girls thought that their fathers' weights were 'about the right weight', and only 6% believed that their fathers were 'too thin'. Moreover, 47% of respondents reported parents' attempts to change weight either, for health (23.4%) or non-health-related reasons (22.6%). Forty-seven percent of the participants reported they were usually encouraged by their parents when they tried to change their weights, 21% were discouraged, and about 27% of parents other hand, 53% of girls reported that the size of their meals might be influenced by the presence of their peers and/or families.

4.2.10.1 Physical environment

Description of places where participants had access to food such as home, schools and outside homes (restaurants) were reported as follows: at home, 38% of girls had meals in a group with their families in the dining room or in the kitchen. Only 4% ate alone in their rooms and 54% were eating either alone or in a group with their families in front of the TV. At school, about 87% of students reported buying food from school while eating outside home was reported by 42% of participants who reported their eating as once a week outside home, 31% ate twice and 28% eat three times or more outside their homes.

Anthropometric

4.3 Main outcome Ia (BMI)

4.3.1 Associations between BMI categories and factors influencing nutritional status

4.3.1.1 Individual factors

The survey findings suggested that factors such as age of menarche, education level and type of school (private or public) were significantly related to weight status groups (Table 15).

Girls who had a BMI-for-age ≥85th percentile, indicated attaining of menarche before they reached the age of 12, and their self-reporting of medical problems was positively related to their overweight status (*P*=.02). Food vitamin and mineral supplements' consumption was not significantly related to weight status, but the type of supplements consumed such as iron was significantly associated with overweight status (*P*=.03) (Table 16). Findings suggested some associations with BMI status with regards to the importance attached to healthy eating and the satisfaction about body figures. Nineteen percent of overweight girls thought their weight was normal, compared to 81% of normal-weight girls (Table 17). Sedentary behaviours (reading and use of other media sources) were not associated with any particular weight status.

Table 18 presents food and drink consumption, food pattern, and dieting practices of participants in all groups. The consumption of different food groups (meat, milk, cereals and grains, vegetables or fruit) and carbonated beverages were not significantly associated with any weight status groups. However, overweight girls were less likely to report their snack consumption and their consumption of the sugar-sweetened carbonated beverages, compared to normal-weight girls. Underweight girls were less likely to get daily pocket money compared to other groups. Overweight girls were less likely to take time considering the type of food when hungry and girls' weights were more likely to be lower if they take time to consider the type of food they eat when hungry. Skipping breakfast was positively associating with overweight status (*P*= 0.02).

Both overweight and underweight girls have reported attempts to change their weights and their failure to change weight was significantly associated with their weight status. Following a special diet or asking for health professionals' advice to control undesired weight, were less likely to be reported by overweight girls compared to their normal-weight counterparts.

4.3.1.2 Environmental factors

Environmental factors that influence weight status of Saudi girls are listed in Table 19. Saudi girls in all weight groups were more likely to estimate their mothers' weight as ''about the right weight''. Whereas girls' perception about their fathers' weight, ''about the right weight'', was more likely to be reported by underweight group (*P*=.002). Parents' involvement with their daughters changing weights was significantly associated to all weight status groups. Overweight girls were more probable to eat outside compared to other groups (*P*= 0.014).

Table 15: Associations of weight categories with socio-demographic characteristics

Variables(number of respondents) *Data reflects positive response.		[BMI classification (WHO)]				
	Normal P≥5 to <85th	Underweight P <5th n (%)	*P* Values C to N**	Normal P≥5 to <85th	Overweight P≥85th n (%)	*P* Values C to N**
Age, years (1519)			*P*=.35			*P*=.06
13-15 (n=752)	445 (80)	111 (20)		445(69.4)	196 (30.6)	
16-18 (n=767)	490(82.2)	106 (48.8)		490 (74)	171 (26)	
Menarche age (1343)			*P*= .01*			*P*<.001*
<12	110(90.9)	11 (9.1)		110(54.5)	92 (45.5)	
≥12	728(81.9)	161 (93.6)		728(75.1)	241 (24.9)	
Education level (1519)			*P*=.04*			*P*=.01*
Intermediate	461(78.8)	124 (21.2)		461(68.8)	209(31.2)	
High	474(83.6)	93 (16.4)		474 (75)	158 (25)	
School sectors (1519)			*P*<.001*			*P*= .25
Public	699(78.8)	188 (21.2)		699(72.7)	263(27.3)	
Private	236(89.1)	29 (10.9)		236(69.4)	104(30.6)	
What is your nationality? (1519)			*P*= .52			*P*= .49
Saudi	578(80.7)	138 (19.3)		578(72.6)	218(27.4)	
Non-Saudi	357(82.3)	77 (17.7)		357(70.8)	147(29.2)	
Does your mother work? (1469)*	186(79.5)	48 (20.5)	*P*= .43	186(65.5)	98 (34.5)	*P*=.003*
Does your father work? (1415)*	864(81.8)	192 (18.2)	*P*=.59	864(72.3)	331 (27.7)	*P*=.82

***P* Value is significant at <0.05, C to N: *P* values were compared to normal for each weight status separately

Table 16: Associations of weight status with biological and health factors

Factors (No of respondents) * Data reflects positive response		[BMI classification (WHO)]				
	Normal P≥5 to <85th	Underweight P <5th n (%)	*P* Values C to N**	Normal P≥5 to <85th	Overweight P≥85th n (%)	*P* Values C to N**
Did you start menstruating?(1505)*	839(82.9)	173(17.1)	***P*<.001**	839(71.5)	335(28.5)	***P*= .54**
Do you have any known medical problems? (1501)*	291(83.1)	59 (16.9)	***P*= .23**	291 (68)	137 (32)	***P*=.02**
Do you take any food supplements? (1511)*	205(77.1)	61 (22.9)	***P*= .54**	205(73.5)	74 (26.5)	***P*= .45**
If yes, what type of food supplements (Vitamin C, Zinc, Ca, Iron, others (321)	193(76.9)	58 (23.1)	***P*= .38**	193(73.4)	70 (26.6)	***P*=.03**

***P* Value is significant at <0.05, C to N: P values compared to normal for each weight status separately

Table 17: Knowledge, beliefs, attitudes and perceptions based on weight status

Factors (No of respondents) *Data reflects positive response		**BMI classification (WHO)**				
	Normal P≥5 to <85th	**Underweight P <5th n (%)**	***P* Values C to N****	**Normal P≥5 to <85th**	**Overweight P≥85th n (%)**	***P* Values C to N****
Do you consider yourself healthy, compared to others your age? (1497)*	784(81.5)	178 (18.5)	***P= .62***	784(72.9)	291 (27.1)	***P= .059***
How do you rate your figure compared to others your age?(1506)			***P<.001***			***P<.001***
Too thin (153)	57 (38.8)	90 (61.2)		57 (90.5)	6 (9.5)	
about the right figure (1117)	808(87)	121 (13)		808(81.1)	188 (18.9)	
Too fat (236)	65 (94.2)	4 (5.8)		65 (28)	167 (72)	
In your opinion, do you think that you eat healthy?(1507) (negative perception)	480(83.8)	93 (16.2)	***P=.028***	480(67.8)	228 (32.2)	***P=.001***
Do you think that reading has an influence on your food choice? (1463)*	381(82.6)	80 (17.4)	***P= .16***	381(69.1)	170 (30.9)	***P=0.04***
To what extent does reading influence your food choice? (1392)			***P= .08***			***P= .35***
No influence	448(78.9)	120 (21.1)		448(73.2)	164 (26.8)	
Average influence	374(83.9)	72 (16.1)		374(70.4)	157 (29.6)	
Strong influence	34 (87.2)	5 (12.8)		34 (65.4)	18 (34.6)	

***P* Value is significant at <0.05, C to N: *P* values were compared to normal for each weight status separately

Table 17: Knowledge, beliefs, attitudes and perceptions based on weight status (continue)

Factors (No of respondents) * Data reflects positive response.		BMI classification (WHO)				
	Normal P≥5 to <85th	Underweight P <5th n (%)	*P* Values C to N**	Normal P≥5 to <85th	Overweight P≥85th n (%)	*P* Values C to N**
To what extent is the influence of TV characters on your eating behaviours? (1497)			*P*= .24			*P*=.014
No influence	448(79.6)	115 (20.4)		448(74.2)	156(25.8)	
Medium influence	400(82)	88 (18)		400(71.3)	161(28.7)	
Strong influence	72 (86.7)	11 (13.3)		72 (61)	46 (39)	
Do you think that TV watching has an Influence of on your eating behaviours?(1505)*	529(83.2)	107 (16.8)	*P*=.048	529(69.8)	229(30.2)	*P*= .07
Do you think that TV advertisements has influence on your eating behaviours?(1498)*	386(82.3)	82 (17.7)	*P*=.36	386(70.8)	159(29.2)	*P*=.51
How active are you, in comparison to others your age and sex? (1501)			*P*=.08			*P*=.003
Below average	103(75.2)	34 (24.8)		103(60.6)	67 (39.4)	
average	707(82.6)	149 (17.4)		707(73.4)	256(26.6)	
above average	113(78.5)	31 (21.5)		113(73.4)	41 (26.6)	
In General speaking, do you think that you perform enough exercise to keep healthy? (1504)*	309(33.3)	71 (33)	*P*=.09	309(33.3)	97 (26.8)	*P*=.12

***P* Value is significant at <0.05, C to N: *P* values were compared to normal for each weight status separately

Table 18: Food & drink consumption, food patterns, lifestyle & dieting practices based on weight status

Factors (No of respondents) * Data reflects positive response		BMI classification (WHO)				
	Normal P≥5 to <85th	Under-weight P <5th n (%)	*P-Value* C to N**	Normal P≥5 to <85th	Over-weight P≥85th N (%)	*P*- Value C to N**
Do you have a daily pocket money? (1512)*	887(82.1)	193(17.9)	***P*=.001**	887(72.1)	343(27.9)	***P*= 0.2**
Do you take time considering the type of food when hungry? (1494)*	573(81.4)	131(18.6)	***P*=.03**	573(74.1)	200(25.9)	***P*= .03**
Do you eat snacks between meals? (1514)*	836(81.4)	191(18.6)	***P*=0.5**	836(72.4)	318 (27.6)	***P*=0.02**
Do you normally take breakfast before you go to school? (NO)	539(80.4)	131(19.6)	***P*=0.5**	539(69.4)	238 (30.6)	***P*=0.02**
Do you drink fizzy drinks?* (1517)*	717(81.4)	164(18.6)	***P*=0.2**	717(71.1)	292 (28.9)	***P*=0.2**
What kind of fizzy drinks, do you mostly consume?* (1190)			***P*=0.2**			***P*<.001**
Full sugar	647(80.7)	155(19.3)		647(73.4)	235 (26.6)	
Diet	63(82.9)	13(17.1)		63 (51.6)	59 (48.4)	
Both	12(100)	0 (0.0)		12 (66.7)	6 (33.3)	
What type of food do you mostly consume? (1500)			***P*=0.27**			***P*=0.4**
Homemade food	448(80)	112 (20)		448(71.3)	180 (28.7)	
Food made outside home	143(84.6)	26 (15.4)		143(76.5)	44 (23.5)	
Fast food	331(80.9)	78 (19.1)		331(70.6)	138 (29.4)	
Have you ever tried losing weight? (1502)*	475(92.4)	39 (7.6)	***P*<.001**	475(62.6)	284 (37.4)	***P*<.001**
Have you ever been in a weight reducing diet before? (1502)*	302(92.6)	24 (7.4)	***P*<.001**	302(56.6)	232 (43.4)	***P*<.001**
Did you lose weight on the followed diet? (439)*	241(93.4)	17 (6.6)	***P*<.001**	241(57.1)	181 (42.9)	***P*<.001**
Did you ever try to gain weight?(1489)*	164(61.9)	101(38.1)	***P<.001***	164(84.5)	30 (15.5)	***P*<.001**
Are you following any special diet? (1494)*	116(85.3)	20 (14.7)	***P=0.2***	116(55.5)	93 (44.5)	**P <.01**

***P* Value is significant at <0.05, C to N: *P* values were compared to normal for each weight status separately

Table 19: Associations of weight categories with social/physical-environment factors

Factors (No of respondents) *Data reflects positive response		[BMI classification (WHO)]				
	Normal P≥5 to <85th n (%)	Under-weight P <5th n (%)	*P* Value C to N**	Normal P≥5 to <85th	Over-weight P≥85th n (%)	*P* Value C to N**
Physical Environment (places where girls eat or have access to food)						
Where do you usually eat? (1510)			***P*= .22**			***P*= 0.8**
Dining room	312(81)	73 (19)		312(72.2)	120 (27.8)	
Bed room	36 (90)	4 (10)		36 (65.5)	19 (34.5)	
Kitchen	42 (80.8)	10 (19.2)		42 (75)	14 (25)	
In front of TV	498(79.8)	126(20.2)		498(71.9)	195 (28.1)	
Different places	41 (91.1)	4 (8.9)		41 (71.9)	16 (28.1)	
Do you buy food from school canteen? (1514)*	810 (81.7)	182(18.3)	***P*=.32**	810(72.5)	308(27.5)	***P*=.33**
Eating outside home(1461)			***P*=.33**			***P*=.01**
Once	352(80.5)	85 (19.5)		352(67.7)	168(32.3)	
two times	296(81.5)	67(18.5)		296(76.9)	89(23.1)	
Three times	160(84.2)	30 (15.8)		160(74.8)	54 (25.2)	
> three times	91 (75.8)	29 (24.2)		91 (69.5)	40(30.5)	
Socio-environmental Variables(influence of family, peer, and friends on eating behaviours)						
When I try to change my weight, my parents (1433)			***P*=.049**			***P*<.001**
Encourage me	371 (78.9)	99 (21.1)		371(60.7)	240 (39.3)	
Discourage me	232(85.9)	38 (14.1)		232(82)	51 (18)	
Not caring	279(83)	57 (17)		279(80.9)	66 (19.1)	
In my opinion, my mother figure is classified as (1492)			***P*=0.04**			***P*<.001**
Too thin	29 (70.7)	12 (29.3)		29 (72.5)	11 (27.5)	
About the right	759(80.9)	179(19.1)		759(74.5)	260 (25.5)	
Too fat	131(86.8)	20 (13.2)		131(59)	91 (41)	
My father figure is classified as (1481)			***P*=.002**			***P*=.132**
Too thin	46(68.7)	21 (31.3)		46(63.9)	26(36.1)	
About the right	727(80.9)	172(19.1)		727(73.1)	268 (26.9)	
Too fat	135(88.8)	17 (11.2)		135(68.5)	62(31.5)	

***P* Value is significant at <0.05, C to N: *P* values were compared to normal for each weight status separately

4.4 Main outcome Ib (BMI)

4.4.1 BMI Z-scores

Graph 10 shows SPSS output histogram chart for distribution of Body Mass Index z-scores of Jeddah adolescent girls. The data were approximately normally distributed. The overall mean BMI z-scores of the participants were -0.0714 (SD± 1.51).

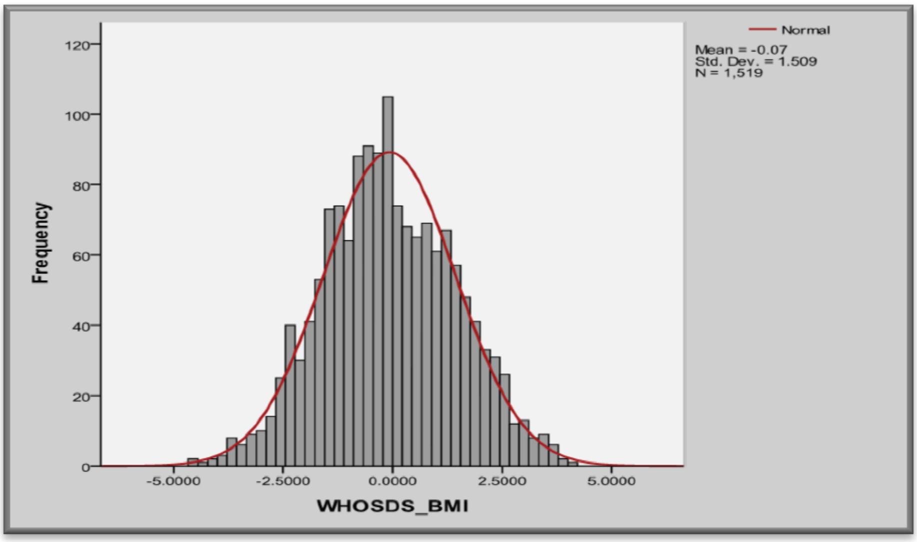

Figure 10 BMI Z score distribution of all participants based on WHO

4.2.4.2 Correlations between BMI z-scores and personal and environmental factors

4.2.4.2.1 Personal factors

Demographics

Comparisons of participants' mean BMI in all demographic characteristics across all levels showed no statistical significant differences except the differences in mean BMI across the two school sectors (*P*<.001) and the differences that were related to the existence of siblings in the house *P*= .026 (Table 20). BMI is higher among girls in private schools compared to those in public schools. Girls, who have siblings, are more likely to have lower BMI, compared to those who have no siblings.

Table 20: Differences in mean BMI & demographic profile

Variables	Mean BMI (z-Scores)		
		Comparison of BMI vs. each variable	
Demographic characteristics	**mean ± SD**	***t* Value†**	*****P* Value**
School Sectors		*t*(679.5)=3.98	*P*<.001**
Public (n=1150)	-.152±1.55		
Private (n=369)	.182 ±1.40		
	Family Size		
Having siblings		*t* (1501)=2.23	*P*= .026**
NO (n=14)	0.815±1.25		
Yes (n=1489)	- .092±1.52		

† Independent sample t test ** Sig: 2 tailed, P<0.05

Biological and health status

Two variables were found to show significant differences in the mean BMI, the consumption of vitamin and mineral supplements (*P*=.008), and participants reporting medical problems (*P*=.001). Means and standard deviations are presented in Table 21**.** BMI was lower among those who take vitamin and mineral supplements, compared to those who do not take supplements. Girls, who reported to have some medical problems, were more likely to have higher BMI compared to their counterparts who reported no medical problems.

Table 21: Differences in means of BMI according biological and health factors

Variables	Mean BMI (Z-Scores)		
		Comparison of BMI vs. Each Variable	
Health factors	**mean ± SD**	***t* Value†**	***P* Value****
Do you take any vitamin/mineral supplements		*t*(1509)=2.67	*P*=.008**
NO (n=1171)	.018±1.50		
Yes (n=340)	-.269±1.50		
Medical problem		*t*(1499)=3.38	*P*=.001**
NO (n=1014)	-.175±1.52		
Yes (n=487)	0.109±1.52		

† Independent sample t test **Sig: 2 tailed, P<0.05

Knowledge, attitudes, perceptions of health and nutrition status

Girls, who rated their weight as an average, were more likely to have higher BMI than girls who rated their weight as too thin or too fat. Findings were demonstrated by the ANOVA test (F= 324.4, P<.001). Mean BMI differed significantly across the levels ‘‘too fat’’, ‘‘too thin’’, ‘‘about the right weight’’ (P<.001). Girls who considered themselves as eating healthy were more likely to have a lower BMI (M = -0.260) than those who considered themselves eating unhealthy food (M = 0.091), t (1505) = 4.49, P<.001 (Table 22).

Girls who reported food choice influences by reading books and magazines, their mean BMI was significantly higher (M =0.024) than girls who reflected no influence (M =-0.170), t (1461) =2.39, P=.017. Additionally, BMI was higher among girls who rated strong influences on their food choice compared to those who rated average influences, F(2,139) =4.38, P=.013. Girls who had positive perceptions of their performance of exercise, were more likely to have lower BMI than girls who had negative perceptions, t (1467) =2.03, P=.042. All differences in the mean BMI according to factors that were related to girls’ concern, perceptions, attitudes, and knowledge are presented in Table 22.

Food & drink consumption, food patterns, lifestyle & dieting practices factors

Significant difference in BMI was noticed according to food consumption such as full-sugar carbonated beverages, attempts to lose weight, following a weight reduction diet and following of a special diet. Less significant differences were found according to skipping breakfast (P= 0.046) or attending fitness centres (P= 0.03). Girls who attempted to gain weight had a lower BMI than those who had never tried to gain weight (P<0.001), and girls who had higher BMI, were more likely to try losing weight compared to girls who had lower BMI. A higher BMI was noticed among breakfast skippers and sugar-sweetened carbonated beverages’ consumers, compared to those who take regular breakfast and those who were diet-carbonated beverages’ consumers (Table 23).

Table 22: Differences in means of BMI according to participants' knowledge & beliefs, attitudes and perceptions factors

Variables		Mean BMI (Z-Scores)			
		Comparison Across* Variable's Level		Comparison of BMI vs. Each Variable †	
	mean ± SD	*P Value***	F	*t* Value	*P* Value**
Girls perceptions about their figures		*P* =<.001**	*F* (2,1503)=324.4		
Too thin (n=153)	-1.744±1.37[1]	*P* =<.001** (Sig 1&3)			
About the right figure (n=1117)	- 0.199 ±1.27[2]	*P* =<.001** (Sig 1&2)			
Too fat (n=236)	1.526±1.19[3]	*P* =<.001** (Sig 2&3)			
Girls' perceptions about their healthy food consumptions				*t*(1505)=4.49	*P* <.001**
NO (n=801)	0.091±1.55				
Yes (n=706)	-0.260±1.48				
Girls' food choice influences by reading books and magazine				*t*(1461)=2.39	*P*=.017**
NO (n=832)	-0.170±1.49				
Yes (n=631)	0.024±1.58				
Degree of reading influences on food choice		*P*=.013**	F (2, 139)=4.38		
No influence (n=732)	-0.179±1.52[1]	*P*=.029** (Sig 1&2)			
Average influence (n=603)	0.035±1.51[2]				
Strong influence (n=57)	0.224±1.59[3]				

*One-way ANOVA, † Independent sample t test.1, 2, 3 presenting significant differences in mean BMI among levels (Tukey post hoc test)

**Sig: 2 tailed, *P*<0.05

Table 22: Differences in means of BMI according to participants' knowledge & beliefs, attitudes and perceptions factors (continue)

		Mean BMI (Z-Scores)			
Variables		**Comparison Across* Variable's Level**		**Comparison of BMI vs. Each Variable †**	
	mean ± SD	***P Value****	**F**	***t* Value**	***P* Value****
Influences of TV characters on eating behaviours		*P*=.003**	F (2,1494)= 8.168		
No influence (n=719)	1.498±1.49[1]	*P*=.006** (Sig 1&3)			
Medium influence (n=649)	-0.050 ±1.55[2]	*P* =<.001** (Sig 2&3)			
Strong influence (n=129)	0.039 ±1.51[3]				
Influences of TV watching on eating behaviours				*t*(844) =2.97	*P*=.006**
NO (n=639)	-0.212±1.51				
Yes (n=866)	1.478±1.54				
Performing enough exercise to keep healthy				*t*(1467)=2.03	*P*=.042**
NO (n=1001)	-0.029±1.55				
Yes (n=468)	-0.204±1.47				

*One-way ANOVA, † Independent sample *t* test 1, 2, 3 presenting a significant difference in mean BMI among levels (Tukey post hoc test). **Sig: 2 tailed, P<0.05

4.2.4.2.2 Environmental factors

Differences in the mean BMI according to variables that were related to family influences and places where food can be accessed are presented in Table 24. Results of one-way ANOVA showed a significant difference in mean BMI when eating outside the home environment, $F(3, 1457) = 2.686$ and $P = .045$. Higher significant differences in mean BMI were detected between parents' encouragements and discouragements in changing weights of their daughters (P =<.001) and between parents' encouragements and their non-involvement in these attempts ($P < .001$). A higher mean BMI was detected among encouraged girls compared to non-encouraged girls in changing weight.

Parents' attempts in changing weight indicated significant differences in their daughters' BMI in two levels: the 'no attempts in changing weight' and 'attempts in changing weight for health reasons' ($P < .001$), and the 'no attempts in changing weight' and 'attempts in changing weight for other reasons' ($P = .003$). A lower BMI was observed among daughters of parents who tried to change their weight, compared to parents who never tried. Moreover, a significant difference in mean BMI Z-scores according to girls' estimations of their parents' weight was demonstrated by the ANOVA test; mothers' weight estimation ($F = 11.714$, $P < .001$), and fathers' weight estimation ($F = 9.474$, $P = .018$). Girls who thought that their parents were too fat, their BMI was more likely to be higher than girls who thought that their parents were too thin or about the right weight.

Table 23: Differences in mean BMI according to food & drink consumption, food patterns, lifestyle & dieting practices factors

Variables	Mean BMI (Z-Scores)		
	Comparison of BMI vs. Each Variable †		
	mean ± SD	*t* Value	***P* Value
Eating behaviours, dieting practices& lifestyle			
Types of fizzy drink		*t*(1170)=4.86	*P* =<.001**
Full sugar (n=1037)	-0.132±1.53		
Diet (n=135)	-0.547 ±1.47		
Do you normally take breakfast before you go to school?		*t*(1512)=1.99	*P* =.046**
NO (n=908)	-.015±1.57		
Yes (n=606)	-.175±1.46		
Have you ever tried to lose weight?		*t*(1492)=6.73	*P* =<.001**
NO (n= 704)	-0.782±1.42		
Yes (n= 798)	0.548 ±1.33		
Have you been on a WT reducing diet before?		*t*(1212)=16.17	*P* =<.001**
NO (n= 929)	-0.518±1.43		
Yes (n= 558)	0.692 ±1.37		
If yes, did you lose weight on the followed diet?		*t*(986)= -9.152	*P* =<.001**
NO (n= 549)	0.179±1.54		
Yes (n= 439)	0.679±1.37		
Have you ever tried gaining weight?		*t*(1500)=18.70	*P* =<.001**
NO (n= 1194)	0.179±1.42		
Yes (n= 295)	-1.114±1.50		
Are you following any special diet now?		*t*(1492)=6.729	*P* =<.001**
NO (n= 1265)	-.185±1.49		
Yes (n= 229)	0.541±1.55		
Do you play sports or do PA at fitness Centres?		*t*(1495)=2.133	*P* =.033**
NO (n= 1303)	-0.118±1.50		
Yes (n= 194)	0.131±1.56		

† Independent sample t test **Sig: 2 tailed, P<0.05

Table 24: Differences in mean BMI and environmental (socio/physical) factors

Variables	**Mean BMI (Z-Scores)**		
	Comparison Across* Variable's Level		
Places of eating and family influences	**mean ± SD**	**F**	***P Value*****
Eating outside home		$F(3, 1457) = 2.686$	$P = .045$
Once (n=605)	-.189±1.55[1]		No sig diff
Twice (n=452)	-.176 ±1.48[2]		No sig diff
Three times or > (n=404)	0.484±1.58[3]		No sig diff
Girls' perceptions of their fathers' figures		$F(2, 1471) = 9.474$	$P = .017$
Too thin (n=93)	-0.205±1.79[1]		
About the right figure (n=1167)	-0.114±1.52[2]		
Too fat (n=214)	0.195±1.39[3]		$P = .018$ (Sig 2&3)
Girls' perceptions of their mothers' figures		$F(2, 1489) = 11.714$	$P = <.001$
Too thin (n=52)	-.186±1.69[1]		$P = <.001$(Sig 2&3)
About the right figure (n=1198)	-.151±1.49[2]		
Too fat (n=242)	0.362±1.55[3]		$P = .047$ (Sig 1& 2)
When I try to change my weight, my parents		$F(2, 1430) = 19.27$	$P = <.001$
Encourage me (n=710)	0.209±1.66[1]		$P = <.001$ (Sig 1&2)
Discourage me (n=321)	-.254±1.35[2]		$P = <.001$(Sig 1&3)
They don't care(n=402)	-.382±1.53[3]		
Have any of your parents ever tried to change weight?		$F(2,1483)=9.86$	$P = <.001$
NO (n=786)	-0.244 ±1.42[1]		$P = <.001$ (Sig 1&2)
Yes, for health reasons(n=356	0.129±1.66[2]		$P = .003$ (Sig 1&3)
Yes, for other reasons(n=344)	0.076±1.56[3]		

*One-way ANOVA, ** Sign *P* Value= <.05. 1, 2, 3 presenting a significant difference in mean BMIs among levels (Tukey post hoc test)

4.5 Main outcome II a (WC): WC at a cut-off of ≥75th

4.5.1 Associations of centralized fat status with other factors influencing the nutritional status of participants

4.5.1.1 Associations between body fatness (WC) and weight status

A significant association was found between the weight status of all groups and WC when using the cutoff at 75th percentile. Among adolescents classified as overweight and obese using BMI (defined by the WHO cut-offs), about 79% were above the WC's cut-offs, compared to their counterparts those categorized to be on their normal weight (21%) (Table 25)

Table 25: Associations between WC and weight status categories

Waist Circumference (cm), (n=1519)	[WC at 75th percentile cutoff point]		
	WC<75th (n=1215)	WC ≥75th (n=304)	*P* Values
Underweight (n= 217)	217 (17.9)	0 (0.0)	***P*<0.001***
Normal weight (n=935)	872 (71.8)	63 (20.7)	
Overweight & Obese (n= 367)	126 (10.4)	241 (79.3)	

4.5.1.2 Associations between WC and other factors

A higher percentage (56.2%) of girls of the younger age group were having WC scores in the ≥75th percentile compared to girls from the older group (43.8%). WC was highly associated with the type of school and girls from public schools were more likely to have larger waist size (65.9%), compared to their counterparts from the private schools (34%). Saudi girls were more likely to have higher WC, compared to non-Saudi nationals. Waist circumference measurements were noted to be significantly associated with girls' physical activity (Table 26). Girls with large WC thought that they were more active outside school compared to inside school, and they were performing more activities outside school. They were also more likely to consider themselves healthy and to report performance of moderate activities, compared to those who had lower waist size (<75th percentile).

Table 26: Comparisons of different factors according to waist circumference (75th percentile cut off point). Values are expressed in numbers & percentage

Variables (number of respondents)	[WC at 75th percentile cutoff point]		
*** Data reflects positive response**	**WC <75th n (%)**	**WC ≥75th n (%)**	***P* Values**
Age group (1519)			*P*<0.001
13-15 years (752)	223 (38.6)	529 (56.2)	
16-18 years (767)	355 (61.4)	412 (43.8)	

School sector(1519)			*P*=.007
Public (1150)	1067 (76.6)	83 (65.9)	
Private (369)	281 (23.1)	43 (34.1)	
Nationality (1515)			*P*=.02
Saudi (934)	334 (58)	600 (63.9)	
Non-Saudi (581)	242 (42)	339 (36)	
Working mothers (1469)*	125 (22.3)	207 (22.8)	*P*=.084
Attaining Menarche (1343)			*P*= 0.09
<12 years (213)	72 (13.8)	141 (17.2)	
≥12 years (1130)	451 (86.2)	679 (82.8)	
Do you have any known medical problems? (1501)*	177 (30.9)	310 (33.4)	*P*=.31
Do you eat snacks between meals? (1510)*	509 (88.5)	834(89.4)	*P*= 0.59

Table 26: Comparisons between different factors & WC (Continue)

Variables (number of respondents)	**[WC at 75th percentile cutoff point]**		
*** Data reflects positive response**	**WC <75th n (%)**	**WC ≥75th n (%)**	***P* Values**
During holidays, how active are you in comparison to school days? (1511)			*P*=0.005
Less active (534)	220 (38.3)	314 (33.5)	
About the same (325)	137 (23.8)	188 (20.1)	
More active (652)	218 (37.9)	434 (46.4)	
Do you normally perform any kind of physical activity outside school? (1484)*	369 (35.1)	673 (73.6)	*P*<0.001
Do you perform physical activities like: cycling, tennis, bowling, and horse-riding?(1476)*	141 (25)	294 (32.2)	*P*=.003
In general speaking, do you think that you perform enough exercise to keep healthy (1504)*	161 (28.1)	388 (33.9)	*P*=.006

WC at 75th percentile cutoff point

4.6 Main outcome IIb (WHtR): Waist-to-height Ratio at a cut-off of 0.5

4.6.1 Associations between WHtR and weight status categories

Of adolescent girls classified as having a normal weight using BMI, 73.6% had a WHtR below the cut-off. About 70% of those who achieved a BMI of ≥ 85th had a WHtR above the cut-off. Girls defined as underweight all had a WHtR below the cut-off. (Table 27)

Table 27: Associations between WHtR and weight status categories

	Waist-to-height ratio (WHtR)		
Weight status categories	**WHtR < 0.5 n (%)**	**WHtR >0.5 n (%)**	***P* Values**
Underweight (n= 217)	217 (19.7)	0 (0.0)	*P*<0.001*
Normal weight (n=935)	807 (73.6)	128 (30.3)	
Overweight & Obese (n= 367)	72 (6.6)	295 (69.7)	

*WHtR at 0.5 cutoff points

4.6.2 Associations between body fatness (WHtR) and other factors

The ratio of the waist circumference to height was associated with some personal thoughts about diet and health, behaviours, and environmental factors (Table 28). Girls, who express concern about their weight, are more likely to have greater WHtR compared to those are not concerned (52% vs. 48%). Girls, who had positive perceptions about their figures, were less likely to have greater WHtR compared to those had negative perceptions.

WHtR was higher (>0.5) among girls who were following special diets or been on reducing diets, compared to non-weight reduction' followers. Girls who rate their level of activity as about average in comparison to others, had low WHtR of <05.

Other determinants that were associated to WHtR included dieting practices, and media follow and concerns. Media followers were more likely to have greater WHtR, compared to non-followers. Girls who had greater WHtR had reported more attempts to lose weight. Moreover, girls of greater WHtR, were more likely to attain menarche at the age of 12 or after 12 compared to those of less WHtR (<0.5). Shared environment such as family and places of eating (outside the home environment were also related to participants WHtR. Girls with greater WHtR, were more likely to be encouraged by their parents to lose weight compared to their counterparts who had a lower WHtR.

Table 28: Associations of different factors with WHtR (cut off point=0.5)

	WHtR Cut-offs = 0.5		
Factors (No of respondents) * Data reflects positive response	**Waist-to-height ratio < 0.5 n (%)**	**Waist-to-height ratio >0.5 n (%)**	***P* Value***
School sector(1519)			*P*=.01
Public (1150)	849 (77.5)	301 (71.2)	
Private (369)	247 (22.5)	122 (28.8)	
Nationality (1515)			*P*=.83
Saudi (934)	672 (61.5)	262 (62.1)	
Non-Saudi (581)	421 (38.5)	160 (37.9)	
Attaining menarche (1343)			*P*<0.001
<12 years (213)	122 (12.7)	91 (24)	
≥12 years (1130)	842 (87.3)	288 (76)	
How often do you eat outside home/week? (1461)			*P*=0.01
One- (605) Two times (452)	412 (39) 332 (31.4)	193 (47.8) 120 (29.7)	
Three times or more (404)	313(29.6)	91 (22.5)	
Are you following any special diet now? (1494)*	141 (13)	88 (21)	*P*<0.001
Have you been in a WT reducing diet before? (558)*	319 (30)	239 (57)	*P*<0.001
Do you watch your figure? (1510)*			*P*=0.04
No (659)	458 (42)	201 (47.7)	
Yes (851)	631 (57.9)	220 (52.3)	
How do feel about your figure? (1506)			
Too thin (153)	148 (13.6)	5 (1.2)	
About the right weight (1117)	872 (80)	245 (58.9)	
Too fat (236)	70 (6.4)	166 (39.9)	
Have you ever tried losing weight? (798)*	478 (44)	320 (77)	*P*<0.001

**P* Value is significant at <0.05

Table 28: Associations of different factors with WHtR (cut off point=0.5) (Continue)

	WHtR Cut-offs = 0.5		
Factors (No. of respondents) * Data reflects positive response	**Waist-to-height ratio < 0.5 n (%)**	**Waist-to-height ratio >0.5 n (%)**	***P* Value***
Do you play sports or do PA at fitness centres? (1497)*	125 (11.5)	69 (16.7)	*P*=0.007
In general speaking, do you think that you perform enough exercise to keep healthy? (1504)			*P*=0.01
No (n=1001)	716 (66)	285 (68)	
Yes (n=468)	350 (32.3)	118 (28.2)	
Sometimes (9)	7 (0.6)	2 (0.5)	
I don't know (26)	12 (1.1)	14 (3.3)	
How active are you, in comparison to others your age and sex?(1501)			*P*=0.03
Below average	133 (12.3)	71 (16.9)	
Average	820 (75.8)	292 (69.7)	
Above average	129 (11.9)	56 (13.4)	
Do you think that TV watching has any influence on your eating behaviours? (1492)*	601 (55.3)	264 (63)	*P*=0.007
In my opinion my mother's figure is classified as: (1492)			*P*<0.001
Too thin (52)	38 (3.5)	14 (3.4)	
About the right weight (1198)	889 (82.7)	309 (74)	
Too fat (242)	148 (13.8)	94 (22.5)	
When I try to change my weight, my parents (1433)			*P*<0.001
Encourage me (710)	446 (43.6)	264 (64.5)	
Discourage me (321)	256 (25)	65 (16)	
Not caring and considering it personal (402)	322(31.4)	80 (20)	
Do you read or follow media concerning diet issues? (649)*	406 (37.6)	244(57.7)	*P*<0.001

**P* Value is significant at <0.05

Anaemia Status

4.7 Main outcome III (Anaemia)

4.7.1 Anaemia status and related determinants

4.7.1.1 Prevalence of anaemia defined by haemoglobin (HB) level

Anaemia prevalence was defined by haemoglobin (Hb) level (cut-off < 12.0g/dl) using two methods: capillary blood that was collected from the finger (FP) and venous (V) blood (Table 29). Anaemia prevalence among participants who were measured using a FP method was 40% (n=319 out of 797), while a lower prevalence of anaemia 29.4% (n=120 out of 408) was found among participants who were measured using the venous blood samples to perform a complete blood count test. The data on Hb concentration using the FP was normally distributed (mean=12.24 ±1.24 g/dL), while data based on venous blood revealed distributions that tend to be positively skewed in the population of this survey (mean=12.38±1.22g/dL) (Figure 11 & 12 show SPSS output for both distributions)**.**

Haemoglobin data (Table 30) of both tests were compared, and results showed a significant difference in results of haemoglobin level when using the finger prick and the venous blood approach with levels between the 10g and 12g/dl particularly. As described before, both measurements demonstrated good agreement (ICC = 0.87, 95%CI [0.845, 0.892])., On the other hand, prevalence of anaemia based on participants' reporting response (n=481) was about 10%, of which four participants (0.8%) reported to have thalassemia and 2.3% (n=11) reported to have sickle cell anaemia. Based on venous blood test (Table 31), anaemia was higher among the older age group (16-18 years); compared to younger grouped (13-15 years) but results did not reach statistical significance between the two groups. Anaemia was significantly more prevalent among those attending governmental sponsored schools (34%), compared to their counterparts in private schools (18%), *P*=.002. Although there was no significant association between anaemia prevalence and nationality, Saudi girls showed lower proportion of anaemia [(28%); n= 69 out of 249 of all Saudi], compared to non-Saudi girls [(32%); n=51 out of 159 of all non-Saudi]. Anaemia appeared not to be associated with weight status of participants, which was defined based on WHO categories in percentiles. However, results showed slightly higher prevalence of anaemia among both normal and overweight girls, compared to their underweight counterparts. Anaemia was more detected in menstruating [(30%); n= 110 out of 363 of all menstruating girls)] than non-menstruating girls [(24%); n= 10 out of 42 of all non-menstruating girls]. However, results did not reach significant relationship. There were no significant relationships between anaemia and food consumption or eating behaviours of participants. However, the prevalence of anaemia was significantly lower in vegetarian girls (P=.039), compared to their non-vegetarian counterparts.

Table 29: Prevalence of anaemia according to method of blood sample collection and analysis: FP & Venous Tests

Diagnosis of anaemia	Diagnosis of anaemia (FP) (n= 797)%	Diagnosis of anaemia (Venous) (n= 408)%
Anaemic	319 (40)	120 (29.4)
Non anaemic	478 (60)	288 (70.6)

Table 30: Haemoglobin (Hb) concentrations based on FP& V Blood Method

Haemoglobin Level	Minimum	Maximum	(mean ± SD)
Haemoglobin (gm/dL) (FP)	6.34	16.10	12.24 ±1.24
Haemoglobin (gm/dL) (V)	6.60	15.80	12.38 ±1.21

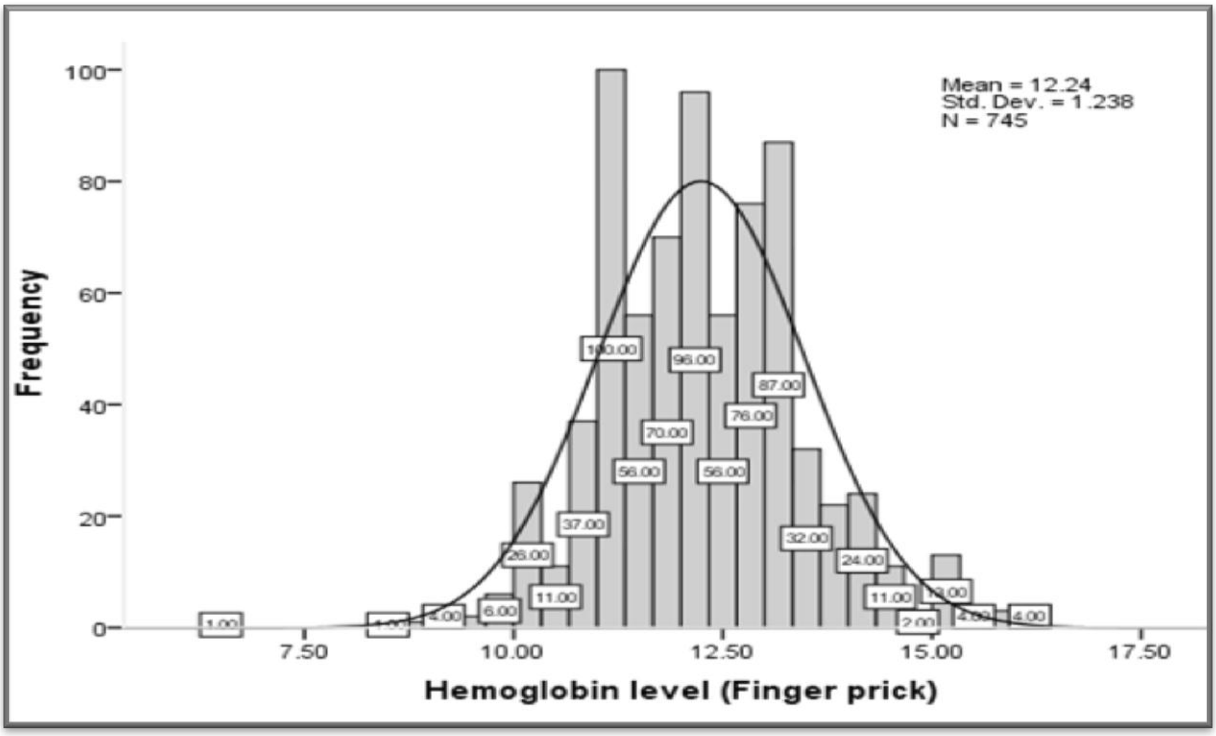

Figure 11: Haemoglobin distribution data: Finger prick

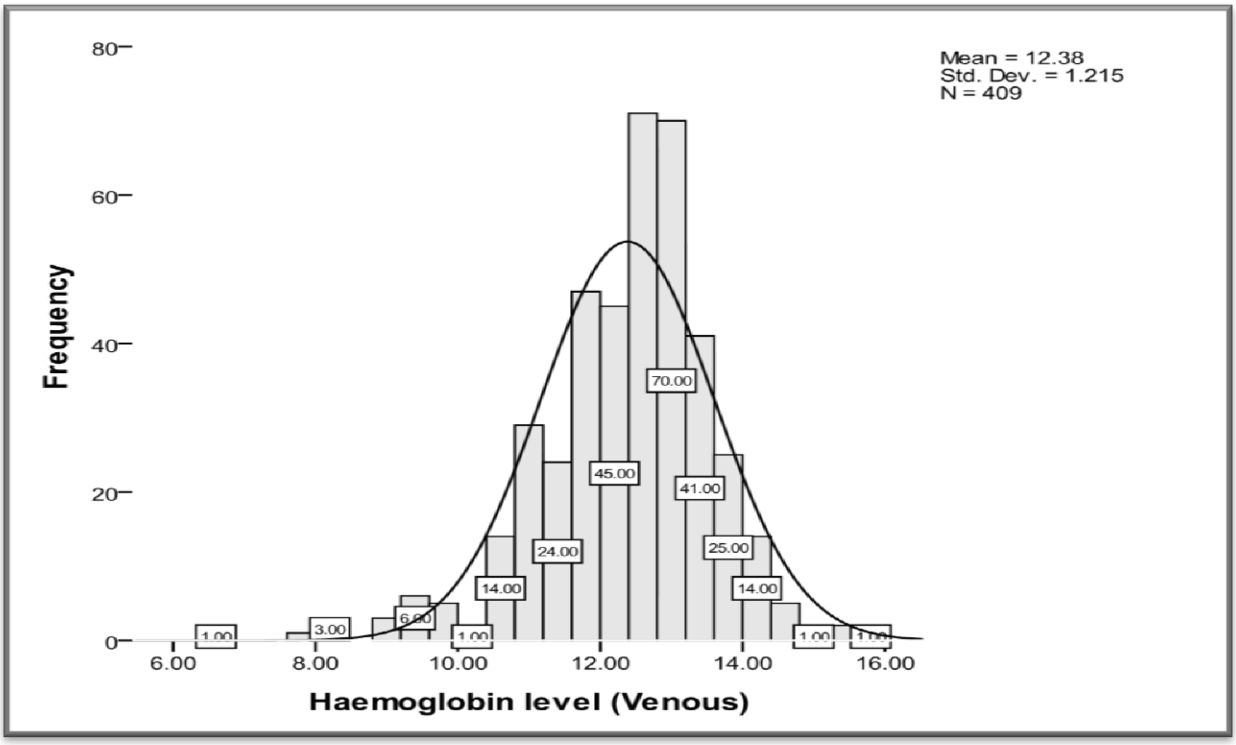

Figure 12: Haemoglobin distribution data: Venous blood

Table 31: Association between anaemia prevalence and characteristics of different subpopulations of Jeddah adolescent girls†

Anaemia measured by venous blood (Hb <12.0 g/dl)		
	Total Number of anaemic (%)	***P* Value***
Age group (408)		*P*= .41
13-15 years (237)	66 (28 %)	
16-18 years (171)	54(32 %)	
Nationality (408)		*P*= .34
Saudi (249)	69(28%)	
Non-Saudi (159)	51(32%)	
Type of school (408)		*P*=.002
Public (293)	99(34%)	
Private (115)	21(18%)	
Weight Status (408)		*P*= .88
Underweight (49)	13(3.2%)	
Normal (254)	75(18.4%)	
Overweight & Obese (105)	32 (7.8%)	
Menarche (405)		*P*= .38
Non-menstruating (42)	10(24%)	
Menstruating (363)	110(30%)	
Are you a vegetarian? (406)		*P*=.039
No (390)	118 (30%)	
Yes (16)	1(6%)	

**P* Value is significant at <0.05 † Anaemia prevalence defined by Venous blood test (n= 408)

Schools

4.8 Main outcome IV (School meals)

4.8.1 Assessment of governmental-sponsored & private schools' meals and snacks

Details for all score calculations of food and drink items provided by governmental sponsored schools & Al-Manarat private school using the NP for FSA are included in (Appendix XIII & XIV). Tables 32 & 33 present the overall score for all food and drink items that were provided by both sectors at days of school visits.

4.8.1.1 Results of analysis of public schools' menu using a NP showed the following:

Total Drinks [Water/Coffee/Tea/Fruit drinks/Carbonated beverages] (five items):

All drink items were found to have adequate data for FSA Nutrient Profiling scoring, and 100% of beverages were classified as non-HFSS beverages with nutrient profiling scores< 1.

Food products made of different ingredients including milk & milk products, vegetables/potatoes/savoury snacks, cereals & cereal products (12 items): Nine Items had adequate food labelling data to calculate the nutrient profiling score. The homemade recipes for stuffed grape leaves, pizza, and falafel were scored by using data from National Nutrient Database for Standard Reference (USDA). Falafel sandwich was considered as unclassifiable as it did not have adequate information to calculate its nutrient profiling scores. Five products (41.6%) were classified as non-HFSS, including Chocó-bar bakery, stuffed grape leaves, Labnah & Zatar bar, white cheese bar and white cheese puff. The rest six items (50%) including cheese sandwich, plain croissant, pizza, mini cheese crackers, mini salty crackers and ulker cubuk crackers were classified as HFSS.

Sugars/Preserves/Candy Snacks (four items): All were found to be HFSS.

4.8.1.2 Results of analysis of Al-Manart private schools' menu using a NP showed the following:

Total Drinks [Water/Coffee/Tea/Carbonated beverages](3 items): All included Adequate data for FSA (NP) scoring and 100% of beverages were classified as HFSS drinks because they scored for > 1. The scoring was based on the nutrition information labelled on each item.

Food products made of different ingredients including milk & milk products, vegetables/potatoes/savoury snacks, cereals & cereals products and vegetables (13 items): All products included adequate food labelling information to calculate its nutrient profiling scores. The exceptions were the cheese sandwich and chocolate donuts because nutritional values of both items were calculated from 'USDA National Nutrient Database for Standard Reference'. Most food items (84.6%) were classified as HFSS except two items (15.4% out of products): the popcorn and sweet corn where both classified as Non-HFSS.

Sugars/Preserves/Candy Snacks (three items): All were classified as HFSS (100%).

Table 32: The overall score for all food and drink items/public schools

Values per 100g for foods and 100 ml for drinks							
Brand/Product	**Kcal**	**Protein (g)**	**Sugar (g)**	**Sat. Fat (g)**	**Fibre (g)**	**Sodium (mg)**	**FSA Nutrient Profiling**
Chocó bar bakery	353	7.1	15.7	5.7	5.5	225.7	Non-HFSS
Cheese (sandwich)	334	17	1.8	8.7	1.4	556	**HFSS**
Croissant plain	432	10	3	6	6	340	**HFSS**
Stuffed grape leaves	349	4.4	3.5	0.9	5.3	795	Non-HFSS
Labnah & zatar bar	368	8.3	5	5	5	415	Non-HFSS
Pizza	280	11.73	3.2	5.2	1.7	624	**HFSS**
Falafel sandwich	333	13.3	N/A	2.4	N/A	294	*Unclassifiable*
White cheese bar	333	8.6	5.7	5.7	5.5	382.9	Non-HFSS
White cheese puff	332	8.9	5.7	5.7	5.5	382	Non-HFSS
Al-Rabie apple juice	30	0	7	0	0.5	6	Non-HFSS
Al-Rabie mango Juice	60	0	15	0	0.5	5	Non-HFSS
Al-Rabie mix nectar	60	0	15	0	1	10	Non-HFSS
Al-Rabie orange juice	30	0	8	0	0.5	10	Non-HFSS
Al-Rabie apple nectar	50	0	12	0	0.5	5	Non-HFSS
Bounty	470	4.1	47.3	21.4	1.8	30	**HFSS**
Dates bar	382	3	53.5	3	3	501.8	**HFSS**
Galaxy caramel	480	5.3	47.8	15.3	1	100	**HFSS**
Galaxy crispy	515	6.5	48.8	17.5	1.5	150	**HFSS**
Mini crackers cheese	486	8.6	14.3	10	3	514.3	**HFSS**
Mini crackers salt	467	6.7	13.3	3	1	1000	**HFSS**
Ulker cubuk cracker	415	6.8	0	3.1	0.7	900	**HFSS**

Table 33: The overall score for all food and drink items/AL-Manarat private school

	Values per 100g for foods and 100 ml for drinks						
Brand/Product	**Kcal**	**Protein (g)**	**Sugar (g)**	**Fat (g)**	**Fibre (g)**	**Sodium (mg)**	**FSA Nutrient Profiling**
Croissant cheese	414	9.2	11.35	10.63	2.6	360	**HFSS**
Croissant plain	406	8.2	11.26	11.66	2.6	345	**HFSS**
Chocolate donuts	412	6.67	35.11	4.67	1.2	345	**HFSS**
Pizza	276	11.3	5	5.08	2.26	555	**HFSS**
Popcorn	528	8.69	0.54	6.31	9.9	771	Non-HFSS
Sweet corn	98	3.2	4	0	3.2	4.8	Non-HFSS
Cheese (sandwich)	334	17	1.8	8.7	1.4	556	**HFSS**
Ulker biscuits	484	7	21	7	0	74	**HFSS**
Oreo biscuits	480	5.2	38.5	10	2.4	340	**HFSS**
Lays potato chips	500	7.9	0.6	13	5.4	700	**HFSS**
Cocktail nectar	60	0	15	0	1	10	**HFSS**
Apple nectar	50	0	12	0	0.5	5	**HFSS**
Orange nectar	51	0	12	0	0.5	3	**HFSS**
Twix	501	4.8	48.4	19	1	198	**HFSS**
Kit-Kat	518	6.25	49	17.7	1	54	**HFSS**
Chocolate wafer with nuts	500	6.6	30	11.3	3.4	580	**HFSS**
Chocolate Ice cream	216	4.72	25.36	6.8	0.9	76	**HFSS**
Vanilla Ice cream	207	3.5	21.22	6.79	0.7	80	**HFSS**
Strawberry Ice cream	192	3.2	4.43	5.19	0.9	60	**HFSS**

4.9 Main outcome V (school sector): The nutritional status of Jeddah girls in public and private schools

4.9.1 Description of the nutritional status of Jeddah girls in public and private schools

An independent-sample *t*-test was conducted to compare the mean BMI z- scores for public (n=1150) and private school girls (n=369) (see Table 34 for the mean BMI for each sector), and a significant difference was found in BMI scores. Mean BMI of private school attendees was higher than that of governmental ones. A chi-squared test indicated a significant association between school sectors and weight categories. The proportion of underweight, normal and overweight identified in the current sub-sample is presented in Table 35.

Table 34: BMI Z-scores (mean ± SD) for public and private schools girls

School Sectors	Mean± SD (Percentile)	Minimum	Maximum
Public (n=1150)	-0.161±1.55	-5.60	4.04
Private (n=369)	0.182 ±1.40	- 4.45	3.77

Table 35: The number (%) of underweight, normal, overweight & obese girls by school type

School sectors (No. of respondents)	[BMI Classification (WHO)]			Total n (%)
	Underweight n(%)	Normal n (%)	Overweight& obese n (%)	
Public	188 (16.3)	699 (60.8)	263(22.9)	**1150**
Private	29 (7.9)	236 (64)	104(28.2)	**369**
Total	**217**	**935**	**367**	**1519**

*Public school vs. private school significantly different: X2 =17.82, *P*<.001, df= 2

4.9.2 Factors affecting behaviours and the nutritional status of adolescent girls in both school sectors

4.9.2.1 Biological and health related factors

Survey's findings revealed a significant difference in menarche status among private and public schooling girls (Table 36). Girls from private schools were more likely to reach menarche earlier than those from public schools, a higher proportion of private school attendees reported to start menstruating compared to public school attendees. From the private sectors, more girls reported having medical problems compared to their counterparts from the public sectors.

Table 36: Biological and health status of Jeddah girls according to the school type

Variables	School Sector Public n (%)	 Private n (%)	*P* Value**
Starting menstruating (1505)			*P*<0.001
No (158)	138 (12)	20 (5.5)	
Yes (1347)	1004 (87.9)	343 (94.5)	
Attaining Menarche (1343)			*P*<0.001
<12 years (213)	137(13.7)	76 (22.2)	
≥12 years (1130)	842 (86.3)	266 (77.8)	
Do you have any known medical problems? (1501)			*P*=.04
No (1014)	782 (69)	232 (63.2)	
Yes (487)	352 (31)	135 (36.8)	

4.9.2.2 Food consumption and eating patterns of Jeddah student girls

The survey findings suggested some differences in food consumption and eating pattern for Jeddah adolescent girls between girls attending public and private schools (Table 37). For example, a significant difference in consumption of green salads was found between girls in both sectors. Girls in private schools were more likely to consume green salads for three times or more per week (42.5 vs. 31%) compared to their counterparts in public schools. However, looking at the consumption rate in a week and among all students, no significance differences in girls ‘vegetable (*P*=0.5) or fruit intake (*P*=0.67) were found. The consumption of carbonated beverages (full sugar) was significantly higher (*P*=0.001) among the public school girls (89%) compared to the private school girls (81%). Receipt of daily pocket money was high for girls in both sectors (94%), and no significance differences were found between the private sector group and the public sector group. Significantly, more private schoolgirls (43.2%) were trying to reduce their weight at the time of the study compared to public school girls (35.7%). A significant difference appeared (*P*=0.006) between the private school girls (59%) and the public school girls (51%) on their attempts to reduce weight.

4.9.2.3 Perceptions about (health and figures), attitudes, and knowledge

Reading of books, comics, and/or magazine of public school girls was significantly different from that of private school girls (*P*=0.032). It was higher among private school girls, compared to their governmental counterparts. The influences of this reading on food choice of participants were mostly rated as average influence, which was, significantly different (P=0.042) in both sectors (Table 38). The girls estimate to their weight was significantly different between the two groups (P=0.02). Twenty percent of the private school group estimated their weight as too fat, compared to 14% of the public school group while most of the girls in both sectors thought that they were about the right weight [71% (private) vs. 75% (public)]. Girls’ perception about their physical activity’s performance and if this performance is enough to keep them healthy was, significantly different (*P*<0.001) between public school girls (32%) and private school girls (28%). In addition, a lower percentage of private school girls rated themselves as more active during holidays compared to public school girls (41 vs. 50%). A significant different was found between the two groups (*P*<0.001).

Table 37: Food patterns, consumptions, and dieting practices by school sector

	School Sector		
Variables *** Data reflects positive response**	**Public** **n (%)**	**Private** **n (%)**	***P* Value****
Food patterns, consumption & dieting practices			
Vegetable consumption/week(1478)			*P*=0.50
None	325 (29)	89 (24.8)	
Once-twice	571 (51)	178 (49.6)	
Three times or more	223 (19.9)	92 (25.6)	
Green salad consumption/week (1485)			*P*<0.001
None	231 (20.6)	63 (17.4)	
Once-twice	541 (48.2)	145 (40.1)	
Three times or more	351 (31.3)	154(42.5)	
Fruits consumption/week (1497)			*P*=0.67
None	261 (23)	76 (20.9)	
Once-twice	534 (47)	173 (47.7)	
Three times or more	339 (29.9)	114 (31.4)	
Types of fizzy drinks(1190)			*P*=0.001
Full sugar	795(89.2%)	242 (80.9%)	
Diet	83 (9.3%)	52 (17.4%)	
Both	13 (1.5%)	5 (1.7%)	
Do you have a pocket money (1512) *	1078 (94.2%)	345 (93.8%)	*P*=0.733
Girls attempts of weight reduction(1502)*	580 (51%)	219 (59.4%)	*P*=0.006
Being on weight reduction diet (1487)*	400 (35.7%)	158 (43.2%)	*P*=0.01

Table 38: Perceived heath & figures, knowledge, and attitudes by school sector

	School Sector		
Variables *** Data reflects positive response**	**Public n (%)**	**Private n (%)**	***P* Value***
Girls' reading of books and magazine (1500)	367 (31)	212 (38.5)	*P*=0.03
Degree of influences of reading on food choice(1392)			*P*=0.042
Strong	44 (4.2)	13 (3.9)	
Average	439(41.5)	164(49.2)	
No influence	576(54.4)	156(46.8)	
Girls perceptions about their figures (1506)			*P*=0.02
Too fat	162 (14.2)	74 (20.2)	
about the right figure	856 (75.2)	261 (71)	
too thin	121 (10.6)	32 (8.7)	
Perception about performance of enough physical activities (1504)			*P*<0.001
No	770 (67.6)	231(63.3)	
Yes	366 (32)	102(27.9)	
Some times	3 (0.3)	32 (8.8)	
Perception about physical activities during holidays (1511)			*P*<0.001
Less active	441 (38.5)	93 (25.3)	
About the same	236 (20.6)	89 (24.3)	
More active	467 (40.8)	185(50.4)	

**P* Value is significant at <0.05

4.9.2.4 Sedentary behaviours, physical activities and other behaviours

Despite the omission of physical activities, and education at public schools, a significantly higher proportion of girls belonged to this sector (67%) reported their desire to have physical education classes in their schools compared to those in the private sector (50%). A significant difference (P<0.001) was found between the two groups. In addition, fewer of public schoolgirls reported inactive behaviour during school breaks, e.g. sitting, talking or reading (33%) compared to the girls in the private sector (66%), and more were taking the opportunity to do some activities at school, e.g. walking (60%), compared to girls in the private sector (26%). Significant differences in these behaviours were found between girls in the two sectors. Moreover, active transportation to and from schools were demonstrated by this study, among public students, compared to private students (Table 39). Additionally, a higher proportion of the public group reported an involvement in some activities after school such as food preparation or cooking and washing up or cleaning, compared to their counterparts in private schools (43 vs. 30) and (62 vs. 30), respectively. Significant differences in these activities were found as shown in sectors (Table 39).

On the other hand, the private schoolgirls were significantly, more active than the public schoolgirls. A higher proportion of girls belonged to private sector (17%) had reported being able to attend fitness centres compared to their matching group in public (12%) schools (P=0.02). In addition, a significant difference was found in the performance of moderate activities between the two groups (P<0.001). Seventy-nine percent of the private sector girls reported a performance of activities such as swimming, compared to 68% of the public school girls.

In other words, girls in private schools are more to be involved in sedentary activities such as watching TV or on a computer or computer games than public schoolgirls. Public girls are more likely to be involved in some activities' outside school such as food preparation, washing and cleaning up, compared to their counterparts in private schools.

Table 39: Sedentary behaviours and physical activities of Jeddah girls by school type

	School Sector		
Variables	**Public n (%)**	**Private n (%)**	***P* Value***
TV hours (screen time) (1455)			*P*=0.017
Less than 2hrs	221 (20.1)	51 (14.4)	
Two hrs and more	880 (79.9)	303 (85.6)	
Computer hours(1507)			*P*<0.001
Less than 2hrs	644 (56.4)	137 (37.4)	
Two hrs and more	497 (43.6)	229 (62.6)	
Involvement in very light activities e.g. food preparation or cooking (1503)			*P*<0.001
NO	612 (53.8)	238 (65)	
Yes	490 (43)	111 (30.3)	
Some times	35 (3.1)	17 (4.6)	
Involvement in light activities e.g. washing up or cleaning up (1512)			*P*<0.001
NO	414 (36.2)	250 (67.0)	
Yes	708 (61.9)	110 (29.9)	
Some times	22 (1.9)	8 (2.2)	
Doing shopping for food and groceries (1501)			*P*=0.002
NO	615 (54.2)	173 (47)	
Yes	507 (44.7)	182 (49.6)	
Some times	12 (1.1)	12 (3.3)	
What do you do during school breaks? (1512)			*P*<0.001
Sitting for talking or reading	382 (33.3)	241 (66)	
Standing	13 (1.1)	13 (3.6)	
Walking	690 (60.2)	95 (26.2)	
Running	177 (5.4)	35 (9.6)	

**P* value is significant at <0.05

Table 39: Sedentary behaviours and physical activities by school type (continue)

Variables	School Sector Public n (%)	Private n (%)	*P* Value*
Performance of moderate PA (swimming, dancing ...) (1484)			*P*<0.001
NO	363 (32.5)	79 (21.5)	
Yes	753 (67.5)	289 (78.5)	
Performance of moderate PA (cycling, tennis, squash ...) (1476)			*P*<0.001
NO	814 (73.4)	227 (61.9)	
Yes	295 (26.8)	140 (38.1)	
Performance of PA & sports at fitness centres (1497)			*P*=0.02
NO	999 (88.2)	304 (83.5)	
Yes	134 (11.8)	60 (16.5)	
Type of transportation to school (1518)			*P*<0.001
Car	986 (85.8)	338 (91.6)	
Walk	112 (9.7)	9 (2.4)	
School Bus	51(4.4)	22 (6.0)	
Preferences of physical education classes at school(1510)			*P*<0.001
No	185 (16.2)	113 (31)	
Yes	769 (67.2)	184 (50.4)	
I don't know	113 (31)	86 (18.6)	
Smoking (1513)			*P*=0.03
No	1116 (97.4)	349 (95)	
Yes	30 (2.6)	18 (4.9)	

**P* value is significant at <0.05

4.9.2.5 Environmental factors

Significant differences in places where girls from both groups eat or have an access to food were found in this subgroup comparison of this survey. Forty-four percent of the girls who belong to the private sector reported that they were eating in front of TV, compared to only 57.5% of the public school girls. A slightly lower number of private schoolgirls bought food from school compared to those from public school. Furthermore, a significant difference (*P*<0.001) was found between the two groups when eating outside the home environment (Table 40), with girls from public schools to eat more frequently outside home ($\geq$ three times/week), compared to girls in private schools.

Family influences, which measured (as described above) using girls' estimate of their parents' weight, parents' concern about the girls' attempts to change weight, and their own attempts to change their weight about differences between the two groups in school sectors. There were significant differences when comparing the three measures (*P*<0.001), (*P*<0.001), and (*P*=0.015), respectively. Among private schools, more girls estimated their mothers at too fat, compared to those in public schools (21 vs. 14.7%) while public school girls estimated more mothers being underweight (3.8 vs. 2.5%). A higher proportion of parents of the private school group encouraged their girls' weight change attempts (58 vs. 47%). In addition, a higher percentage of parents of the private school group had attempts to change their weight for either health reasons (31 vs. 22%) or other reasons (30 vs. 21%).

Table 40: Environmental influences of Jeddah girls by school sector

	School Sector*		
Variables	**Public n (%)**	**Private n (%)**	***P* Value***
Physical environment (places where girls eat or have access to food)			
Where do you usually eat? (1510)			*P*<0.001
Dining room	365 (31.9)	140 (38.1)	
Bed room	45 (3.9)	14 (3.8)	
Kitchen	40 (3.5)	26 (7.1)	
In front of TV	657(57.5)	162 (44.1)	
Different places	36 (3.1)	25 (6.8)	
Do you buy food from school canteen? (1514)			*P*=0.78
No	145 (12.7)	52 (14.1)	
Yes	1000 (87.3)	317(85.9)	
Eating outside home(1461)			*P*<0.001
One- two times	787(71.7)	270(74.3)	
Three times or more	311 (28.3)	93 (25.6)	
Socio-environmental Variables (influence of family, peer, and friends on eating behaviours)			
Parents' influences on their daughters' weight changes (1433)			*P*=0.001
Encourage	503 (46.7)	207 (58.3)	
Discourage	255 (23.7)	66 (18.6)	
Don't care	320 (29.7)	82 (23)	
Did your parents tried to change weight?(1486)			*P*<0.001
NO	648 (57.4)	138 (38.5)	
Yes, for health reasons	244 (21.6)	112 (31.3)	
Yes, for other reasons	236 (20.9)	108 (30.2)	
Mother' weight (girls estimate)			*P*=0.015
Too Fat	167 (14.7)	75 (20.9)	
About the right weight	923 (81.5)	275 (76.6)	
Too thin	43(3.8)	9 (2.5)	

**P* value is significant at <0.05

Media and food promotion: Media influences on eating behaviours and nutritional status of Jeddah adolescent girls

4.10 Main outcome VIa (screen time)

4.10.1 Sedentary behaviours and types of media used by participants

Table 41 shows some of the sedentary behaviours and daily media use observed among participants. Participants devoted the greatest proportion of media time to watching television and the screen time of participants for ≥ 2 hours was accounted for by 81% of respondents (n=1455). Computer time was used by few participants (n=1507) and the use for ≥ 2 hours was reported by 48% of participants. Surprisingly, almost two third of the participants were not interested in daily reading of books, magazines or comics, and only 38% (582 out of 1519) reported reading daily. About 39% of the girls, who were reading daily, spent ≥ 2 hours in reading books, magazines or/and comics. Approximately, 56 % (854 out of 1498) of the participants, who used to do their homework daily, spent two hours or more in doing their homework. Although some participants might be multitasking and use more than one medium at a time, this estimate would increase to more hours of sedentary behaviours per day. In the table below, the percentage of participants who spend ≥ 2 hours per day using media was reported separately for either each medium or type of activity.

Table 41: Sedentary behaviours and daily media use

Tool of entertainment/sedentary behaviour	Number	< 2 hours (%)	≥ 2 hours (%)
Watching TV and videos	1455	272(18.7)	1183(81.3)
Computer or computer games	1507	781 (51.8)	726 (48.2)
Homework	1498	644 (42.4)	854 (56.2)
Reading books, magazines or comics	582	358 (61.5)	224 (38.5)

4.10.2 Associations of screen time with other sedentary behaviour times

Associating screen time with other sedentary times (Table 42), showed a significant relationship with the time spent on computer or computer games and the time spent on homework (*P*= 0.001) and (*P*= 0.006), respectively. However, screen time was not significantly related to daily reading time. The proportion of participants who spent ≥ 2hours on computer (39.6) was higher for those who watch TV for ≥ 2 hours (40% vs. 51%) while lower for those who read or do homework daily for the same period. See Figure 13

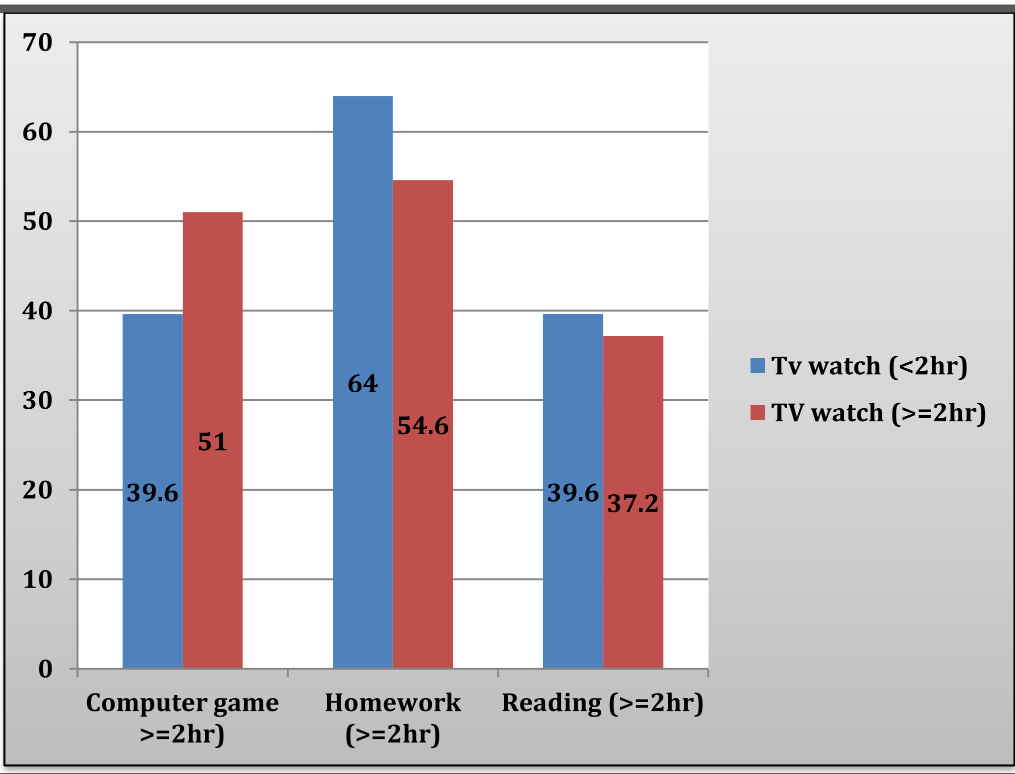

Figure 13 Screen time & other sedentary behaviour times

Table 42: Association between screen time & other sedentary behaviour times

Other behaviours and entertainment (n)	How many hours/day do you spend watching TV?		
	< 2 hours	**≥ 2hours**	***P* Value**
How many hours/day do you spend on computer or computer games? (1446)			*P*= 0.001
< 2 hours	163 (60.4)	576 (49)	
≥ 2hours	107 (39.6)	600 (51)	
How many hours/day do spend in reading (books, magazines and comics)? (549)			*P*= 0.65
< 2 hours	64 (60.4)	278(62.8)	
≥ 2hours	42 (39.6)	165(37.2)	
How many hours per day do you spend on doing your homework? (1439)			*P*= 0.006
< 2 hours	96 (36)	530(45.2)	
≥ 2hours	171 (64)	642(54.6)	

*P value is significant at <0.05

4.10.3 Media use, nutritional status and behaviours

As described above, screen time and computer use for ≥ 2 hours was significantly higher among girls who were attending private schools, compared to their counterparts in public schools. About 50% of participants, thought that their food choice was influenced by reading magazines and related their influences, particularly to advertisements (51%) rather than food topics in the preferred magazines (47%), and the rest of influence was related to both advertisements and food topics in magazines. In addition, the mean BMI was significantly higher in girls who thought that their food choice was influenced by the daily reading, compared to mean BMI of their counterparts who thought that the daily reading had no effect on their food choice.

Exploring the results on TV watching and beliefs about their influences on eating behaviours, data reflected that almost 58% (866 out of 1505) of the participants thought that TV by, one way or another, influenced their eating behaviours. Furthermore, participants who thought that TV watching was influencing their food choice had a higher mean BMI than those who did not believe on influence. Moreover, participants who were assessed as having a high waist-to-height ratio, were more likely to believe on the influence of TV watching on their food choice, compared to girls with lower WHtR. Fifty-two percent of participants rated the degree of their believed influence by TV watching (advertisements and programmes) as moderate to strong. On the other hand, 42% of the participants thought that TV advertisements, in particular, had an influence on their eating behaviours. The BMI of girls who thought that their food choice was strongly influenced by TV advertisements was higher, compared to those who rated their beliefs as either moderate or no influence at all. Moreover, 54% of participants reported that they were having their meals while watching TV. Finally, a significant difference in girls' overweight status was found according to participant's perceptions about influences of TV characters on their eating behaviours. About 34% of overweight girls, who thought that they were influenced by TV character, rated the influence as a strong one, 25% rated the influence as a medium influence and the rest of them thought they were not influenced at all.

4.10.4 Influences of TV viewing on nutritional status and other behaviours

The use of ≥ 2 hours per day as a cut off for screen time (which was developed based on the survey questionnaire) to evaluate significant relationships with other behaviours revealed, no statistical significant relationship between screen exposure and thinking about influences of the TV medium on food choice (P=0.2). A significant relationship was found between thinking of TV advertisements' influences on eating behaviour and screen time (P=0.04). Higher positive perceptions about the influences of TV advertisements was prevalent among 44% of participants who reported a daily exposure to TV for ≥ 2 hours, compared to those who reported an exposure of <2 hours (37%)(Table 43). Fifty-nine percent of the participants who reported positive perceptions about influences of TV were particularly influenced by TV advertisements (*P*<0.001).

Table 43: Screen time & girls' thoughts about influences of TV watching & TV adverts

How many hours per day do you spend watching TV?				
	Participants Response	**Less than 2 hours**	**Two hours or more**	***P* Value**
Do you think that watching TV has any influence on your eating behaviors?* (n=1505)	**No**	124(45.6)	489 (41.5)	*P*=0.2
	Yes	148(54.4)	690 (58.5)	
Do you think that TV advertisements have any influence on your eating behaviors?* (n=1498)	**No**	168(62.7)	656 (56)	*P*=0.04
	Yes	100(37.3)	516 (44)	

**P* Value is significant at <0.05

Clearly, data that was associated with TV viewing every day revealed that this behaviours was potential to influence some behaviour particularly eating behaviours in many ways. School-age adolescent girls (13-15 years) were exposed to TV for longer hours [(n=611 (51.6%)], compared to their counterparts from the older age group [n=572 (48%)], *P*=.01. Although sedentary activity replaces more active lifestyles, screen time for participants in the survey showed no statistical significant associations with a number of moderate and high activity levels. Even with light activities, e.g. washing up and cleaning, associations were found to be negatively associated with screen time (*P*=.002). Participants, who were on-screen for ≥ 2 hours (630 out of 1179), 53% of them reported performance of some light activities such as washing up and cleaning. Moreover, screen time had significantly affected participants' sleep hours (*P*=.002). Girls, who had longer TV time (77%), were more likely to have fewer sleeping hours, compared to those who were using screen for shorter time (67%). Table 44 shows associations of TV time with other behaviours. Nutritional status measures based on weight status (overweight and underweight), and measures that were used to define centralized fats (WC at 75th centiles cutoff) in participants, were not significantly associated with screen time except for WHTR (at >0.5 cutoffs), which was barely associated with screen time (P=0.05). Despite the significant relationships with weight status of participants, overweight & obese girls stated a higher exposure to TV for ≥ 2 hours (24%), compared to their underweight counterparts (15%). In addition, participants who had waist circumferences (WC) for ≥75th centiles, were more likely to have daily exposure to TV for ≥ 2 hours (63%), compared to their counterparts (37%) who had WC of <75th centiles. On the other hand, screen time was associated with some eating behaviours e.g. participants who were viewing TV for longer hours, were more likely (70%) to eat outside home for at least once or twice/week and less likely to eat three times or more outside their homes (29.6%), P=.013. In addition, types of food mostly eaten by participants was significantly associated with TV viewing (P<0.001). Young girls, who were watching TV for ≥ 2 hours/day, were more likely to prefer eating homemade food (46%) rather than fast food for example (39.5%). At the same time, girls who were watching TV for ≥ 2 hours (462 out of 1169) were more likely to eat fast food, compared to their counterparts who use screen for <2 hours/day (71 out of 268), P<0.001. Places were girls used to eat was significantly related to screen time (P<0.001). Girls, who were exposed to TV for ≥ 2 hours/day (696 out of 805), were more likely to eat in front of TV (59%), compared to those who were used to be exposed for <2 hours (42%) , (n=109 out of 805). Consumption of carbonated beverages was significantly related to screen time (P=.001) and was higher (80%) among those who used to view TV for ≥ 2 hours every day (71%), compared to those who viewed TV for < 2 hours/day. Furthermore, snacking or 'grazing' of food from the school canteen was significantly higher among girls who view longer hours of TV (89%), compared to girls viewing fewer hours of TV (83%), P=.012. Skipping meals was significantly related to screen time (P=.01). Participants, who were exposed to longer TV hours, used to skip more meals [n=877 (74.3%), compared to those who spent less time on TV [n=183 (67%)].

Table 44: Screen time and effects on nutritional status and behaviours

Nutritional status and behaviours	Screen Time(Number of respondents =1455)		
*** Data reflects positive response**	**< 2hours**	**≥ 2hours**	**P Values**
Age groups (1455)			*P*=.01
13-15 years (728)	117 (43)	611 (51.6)	
16-18 years (727)	155 (57)	572 (48.4)	
Wt status (1455)			*P*=0.46
Under weight (209)	33 (12)	176 (14.9)	
Normal weight (893)	174 (64)	719 (60.8)	
Overweight & Obese (353)	65 (23.9)	288 (24.3)	
WC at 75th cut-offs (1455)			*P*=0.24
<75th centiles (554)	112 (41.2)	442 (37.4)	
≥75th centiles (901)	160 (58.8)	741 (62.6)	
Waist-to-height ratio(1455)			*P*=0.05
WHtR <0.5	209 (76.8)	841 (71)	
WHtR >0.5	63 (23.2)	342 (28.9)	
Do you often feel hungry? (1438)*	85 (31.7%)	478 (40.9)	*P*=.006
Do you skip meals? (1060)*	183 (67.3)	877 (74.3)	*P*=.01
How often do you eat outside/week? (1402)			
One-two times (1013)	206 (80.4)	807 (70.4)	*P*=.013
Three times or more (389)	50 (19.5)	339 (29.6)	
Where do you usually eat? (1447)			*P*<0.001
Dining room (468)	119 (43.9)	349 (29.7)	
Bed room (58)	18 (6.6)	40 (3.4)	
Kitchen (58)	18 (6.6)	40 (3.4)	
In front of TV (805)	109 (40.2)	696 (59.2)	

P Value is significant at <0.05

Table 44: Screen time and effects on nutritional status and behaviours (continue)

Nutritional status and behaviours	**Screen Time(Number of respondents =1455)**		
*** Data reflects positive response**	**< 2hours**	**≥ 2hours**	**P Values**
Which kind of food do you mostly eat?(1437)			*P*<0.001
Homemade food (697)	161 (60)	536 (45.9)	
Food made outside home (207)	36 (13.4)	171 (14.6)	
Fast food (533)	71 (26.5)	462 (39.5)	
How many times did you eat fruits in the last 7 days ?(1435)			*P*=.039
None (323)	49 (18.1)	274 (23.5)	
Once-twice (688)	126 (46.7)	562 (48.2)	
Three or more (424)	95 (35.2)	329 (28.2)	
Do you drink fizzy drinks e.g. (Pepsi or cola)?(1453)*	193 (71.2)	950 (80.4)	*P*=.001
Do you buy food from school canteen? (1450)*	225 (82.7)	1045 (88.7)	*P*=.012
Do you normally go to bed early?(1452)			*P*=0.002
Yes	87 (32)	259 (22)	
NO	183 (67.3)	912 (77.3)	
Do you do any washing up or cleaning up in the house? (1499)*	176 (65.2)	630 (53.4)	*P*=.002

P Value is significant at <0.05

4.11 Main outcome VIb (thoughts about media influences on food choice)

4.11.1 Perceptions and response to TV food promotion and effects on nutritional status and other behaviours

Overall food consumption and habits that were related to television viewing time were also related to TV advertising exposure, e.g. consumption of carbonated beverages, type of food mostly preferred, eating outside home and places where young girls usually eat their meals (Table 45). In addition, a significant relationship was found between desserts' consumption and concerns about influences of advertising exposure (*P*=.035). Girls, who believed on influences of advertising exposure on their dietary pattern were more likely to consume desserts [n=299 (48.5%)] for ≥three times/week, compared to those who used to consume desserts once or twice [n=279 (45.2%)] or those who did not consume them at all in the previous week. Similarly, nutrition status using the three measures mentioned above was not significantly related to perceptions about influences of advertising exposure. Moreover, adolescent girls' participations in shopping for food was significantly related to perceptions of food advertisements' influences on food choice. Girls who thought that they were influenced by advertising exposure, were more likely to shop for food [n=316 (50.7%)], compared to those who did not consider this type of influence [n=294 (47%)], *P*=.002. Then again, some dieting practices were significantly related to concerns about powers of advertising exposure. For example, those who believed that they could be ruled by powers of TV advertisements were more likely to follow a special diet [n=114 (18.3%)] compared to those who did not believe in this power [n=113 (13.3%)], *P*=0.008. Girls who were concerned about advertising exposure, had attempted to lose weight [n=373 (59.5%)], compared to girls who did not consider the effect of TV advertisements on their eating [n=416 (49%)], *P*<0.001.

Table 45: Perceptions about TV adverts influences on eating behaviours and their effects on nutritional status and behaviours

Nutritional status and behaviours	**Do you think that TV advertisements has any influence on your eating behaviours**		
	NO	**Yes**	**P Values**
Weight status (1455)			*P*=0.45
Under weight (209)	132 (15.2)	83 (13.2)	
Normal weight (893)	535 (61.5)	386 (61.5)	
Overweight & Obese (353)	203 (23.3)	159 (25.3)	
WC at 75th cut-offs (1489)			*P*=0.75
<75th centiles (554)	334 (38.4)	236 (37.6)	
≥75th centiles (901)	536 (61.6)	392(62.4)	
Waist-to-height ratio(1455)			*P*=0.09
WHTR <0.5	643 (73.9)	439 (69.9)	
WHTR >0.5	227 (26.1)	189 (30.1)	
How often do you eat outside home/week?(1441)			*P*=0.01
One-two times (1045)	620 (75)	425 (69)	
Three times or more (396)	206 (25)	190 (30.9)	
Where do you usually eat? (1447)			*P*<0.001
dining room (468)	320 (36.9)	179 (28.7)	
bed room (58)	37 (4.3)	21 (3.4)	
Kitchen (58)	44 (5.1)	22(3.5)	
In front of TV (805)	438 (50.5)	370 (59.4)	
Which kind of food do you mostly eat?(1437)			*P*=0.004
homemade food (697)	459 (53.1)	273 (44.4)	
food made outside home (207)	116 (13.4)	94 (15.3)	
fast food (533)	290 (33.5)	248 (40.3)	

**P* Value is significant at <0.05

Table 45: Perceptions about TV adverts influences on eating behaviours and their effects on nutritional status and behaviours (continue)

Nutritional status and behaviours	**Do you think that TV advertising has any influence on your eating behaviours**		
*** Data reflects positive response**	**NO**	**Yes**	**P Values**
Do you drink fizzy drinks e.g. (Pepsi or cola)?(1453)*	652 (75)	503 (80.2)	*P*=0.02
How many times did you have desserts e.g. puddings, cake, or chocolate in the last 7 days? (1468)			*P*=.035
None	76 (8.9)	39 (6.3)	
Once-two	413(48.5)	279 (45.2)	
Three or more	362 (45.5)	299 (48.5)	
Are you following any special diet at present? (1475)*	113 (13.3)	114 (18.3)	*P*=0.008
Have you ever tried losing weight? (1482)*	416 (48.7)	373 (59.5)	*P*<0.001
Do you do any washing up or cleaning up in the house? (1499)*	366 (42.6)	316 (50.7)	*P*=.002
Do you do shopping for food and groceries or other items? (1482)	366 (42.6)	316 (50.7)	*P*=.002
No	482 (56.1)	294 (47.2)	
Yes	366 (42.6)	316 (50.7)	
Sometimes	11 (1.3)	13 (2.1)	

**P* Value is significant at <0.05

CHAPTER FIVE

Methods: Descriptive analysis of food advertised during the television programs Jeddah adolescent girls watch most

5.1 Chapter introduction

This section describes the second part of the study method that involves analysis of televised food/beverage advertisements of the most watched channels by Jeddah adolescent girls. This method attempts to fulfil the ninth objective of the thesis; *to quantify and classify the nature and extent of food advertisements being advertised on the television channels most watched by Jeddah adolescent girls.*

The methods developed in this part of the thesis was based on previous studies, the theoretical framework for this study and the results of the main survey.

5.2 General methods

In order to explore factors that are related to the fourth level of the study framework (Chapter 2), media and advertising factors were examined; television was used because it was considered the medium of most interest for adolescent girls in previous national studies and in the survey part of the present thesis. TV food/beverage advertisements were quantitatively analysed through an approach that was modelled, with permission from the main researcher (see Appendix IX), on the study of Galcheva et al., 2008). The study focused on food advertising directed towards Bulgarian children and the aim of the study was to examine the exposure of Bulgarian children, to television food advertising and to make a content analysis of the food/beverage advertisements during children's television programmes.

5.2.1 Design

We have looked at survey participants' response to questions that were designed to examine their exposure to television and to define the most-watched TV channels. The response to the questions 1) Do you watch TV? And 2) if, yes which are the main channels that you watch? Were initially screened using an excel spreadsheet (Figure 14) shows the type and frequency of TV channels viewed by Jeddah adolescents. Ninety-six percent (1452) of all participants considered television as the medium of most interest; 71% stated that they use computers and 34 % read books and magazines in addition to watching TV. The private free-to-air Arab satellite channels from the Middle East Broadcasting Centre (MBC) 1, 3 and 4 were the most viewed channels by participants. MBC1, which airs Arabic entertainment and hourly news to the Arab World, was the most viewed channel with a percentage of 60%. The second favourite channel was MBC4 (38%), and it offers a broad mixture of western television programming from United States and the United Kingdom, which includes comedy, drama series, news and magazines like. MBC3, a children's channel was chosen by 31% of the adolescent girls, mostly from the younger group (13-15 years old). As a result of the survey, MBC1, MBC3 and MBC4 were selected for recording.

A descriptive analysis of the advertisements during television programming was conducted immediately, two weeks after completing the survey data collection, to assess the advertisements in terms of frequency, duration, type, means and ways of delivering the message to the viewers. The analysis included advertisements that were aired during television programming from the three channels.

These advertisements were videotaped during the week 18 to 25 March 2009 and days from 27 to 29 October in 2009. The periods assessed for this study were chosen because there was no public or school holiday. This was done to ensure that the study timing reflect the actual period where adolescents were expected to watch television. The characteristics of product advertising in the overall sample were coded using the same coding system (Galcheva *et al*., 2008) with permission from the main author and modifications to the system were made according to the needs of the present study.

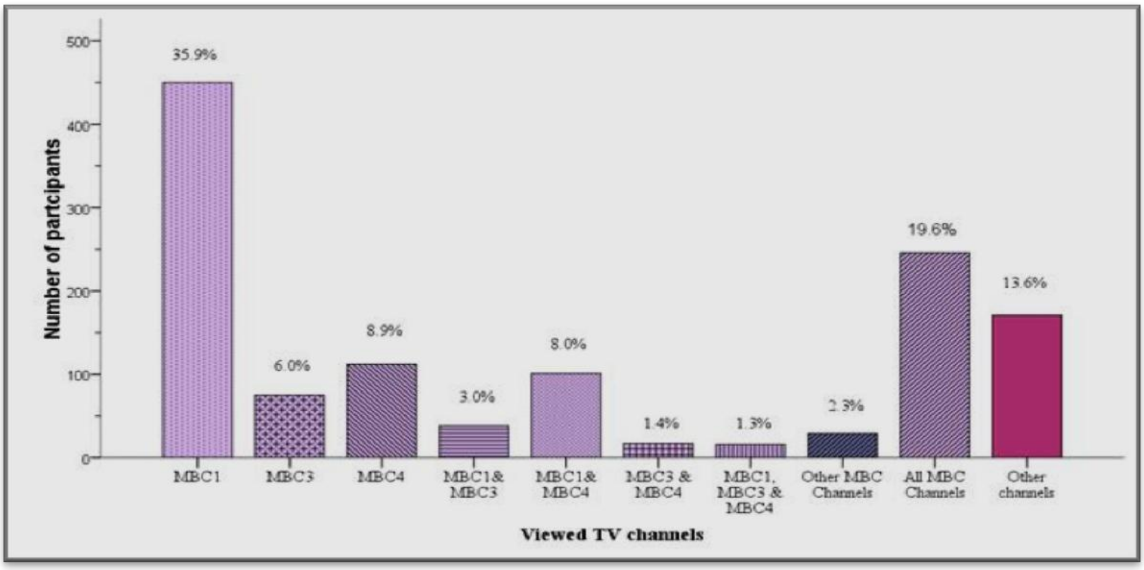

Figure 14: The types and frequency of TV channels viewed by Jeddah adolescents in 2009

5.2.1.1 Subjects and ethical approval

All television advertisements in three free-to air satellite channels were investigated, and no approval was necessary as no human subjects were involved in this analysis.

5.2.1.2 Sample

All advertisements during TV programming were screened and observed. This comprised a total number of 6,272 advertisements (4,973 advertisements in channels 1 & 4 and 1,299 advertisements in MBC 3). The sampling of advertisements was in two different periods with a seven-month gap. The first period was recorded directly after the field survey and included recording of 240 hours on two television channels (MBC1 & 4). The data was gathered in March 2009. Programming was recorded from 14:00 to 2:00 am on weekdays (Saturday through Tuesday, Jeddah central time) and from 14:00 to 14:00, on the following day during weekend days (Thursday and Friday) when school- adolescents are most available for TV viewing. The second period included was in October 2009 and was based on the findings of the main survey which revealed that the MBC3 for children was the third most watched channel and the preferable network channel of the younger group (13- 15 years old). The recording for both periods was in order to cover the spectrum and large number of advertisements of all age groups. In the sample of programming aired for the second period, the data gathered separately and included a recording of 48 hours (two weekdays and one weekend day). The pooled samples included a total of 288 hours and the same method of recording, and analysing was used for both periods. Table 46 shows number of viewers, total hours of recoding and the number and parentages of advertisements in each recorded MBC TV channel.

Table 46: Number of viewers, total hours of recoding and number and parentages of advertisements in each recorded MBC TV channel

TV Channel	Number of Viewers#*	Recorded time in hours	Number of advertised products*
MBC1	851 (60)	120	1784 (28)
MBC3	392 (31)	48	1299 (20.7)
MBC4	492 (38)	120	3189 (50.8)

Most of the survey participants are watching more than one channel
* Data reflects frequencies & (%) unless otherwise indicated

5.2.1.3 Inclusion and Exclusion Criteria

Criteria for selecting the data were as follows: All advertisements included in the programming were initially included in order to calculate the number, type and duration for aired advertisements. Afterwards, advertisements promoting television programming and religious matter advertisements were excluded in the advertisement analysis and only paid product advertisements were included in the analysis. Figure 15 shows the flow chart for sampling methods and data collection for the TV analysis study.

5.2.1.4 Data collection

Data collection was done using two processes:

1. The recording of TV networks

2. The viewing of TV programming and television advertisements' inside programming

Data's recording

Programmes on the three networks were videotaped using a Digital Satellite Receiver[17] and portable Universal Serial Bus (USB) hard drives (HD-500 GB). A specialized technician was used to ensure the clarity of recoding and to carry out the recording. Recording of MBC 1 & 4 took place at the same time using two identical Digital Satellite Receivers and a twin output LNB on the Satellite Dish while the recording for MBC3 was done separately using a Single Satellite Receiver. Details of recording procedure are included in (see Appendix XA)

Data Viewing

After completing the recording process, the researcher started the viewing process to prepare data for entry and analysis using an SPSS package. The recorded data was viewed using a number of steps. Details of viewing procedure are included in Appendix XB.

During the viewing process of each TV programme, details of name, duration, and type of programme (animation, show, TV game, children's serial/movie, general audience soaps/ serial, movies, educational programme, social programme, sports, news) were initially taken. Other information included the day of recording, the TV channel (MBC1, 3, or 4), the viewing hours- early morning (06:00-09:30), late morning (9:30-12:30), afternoon (12:30-18:30), night time (18:30-24:00), very early mornings (00:01-05:59) were also noted. Notes of breaks that include number of, time and location of each break (before, inside, or after the programme) in addition to the number of advertisements in each break were taken after. All advertisements were abstracted from the recorded data for each network, viewed individually, and their characteristics were analysed using several signs and codes. The viewing system was very flexible, which gave the researcher the facility to repeat viewing the programme and advertisement. This flexibility allowed full analysis of each advertisement.

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[17] Digital Satellite Receiver's brand is 'STORONG 4622XII'

As a pilot test, prior to actual data collection, commercials from these channels were observed to determine if additional signs or codes are needed to be added to the list. Before the list was refined and finalized. All signs and codes used are presented in (see Appendix XI).

5.2.2 Signs and codes

In order to identify the characteristics of televised food advertisements the following factors were evaluated:

- The marketing strategies used to appeal, persuade and stimulate the purchase request.
- The direction to specific age groups
- Human characters participating in the advertisements

Several signs and codes were used:

- The number of hours screened
- The name of product
- Length of each advertisement
- Time of screening
- Type of product (food/non-food)
- Type of the promoted food/drink (HFSS/non-HFSS) and food group
- Format (animated/non-animated/mixed)

Food marketers use different ways to reach consumers and to stimulate purchase of their brands. In order to assess some of these different ways and methods and to define how strong the advertisements can enhance audience 'desire' for the product, different signs and codes were used by this analysis and included the following:

- Composition and characteristics of product
- Novelty
- Association with premium and prizes
- Fun/happiness/smile
- Energy/sport/physical activity
- Movie heroes/ celebrities/music stars

- Lovely/magnificent taste
- Pleasure
- Love/emotions/kisses
- Healthy and good-looking appearance
- Weight
- Product associated with format /theme of the advertisement.

Character merchandising was referred by the Institute of Medicine, 2006 as 'the licensing of popular characters to promote many types of products'. In this analysis, character merchandising techniques were assessed based on human characters those participating in the advertisement and coded for apparent gender, age, race, eating behaviour (shown eating or not), and body size. The classification of each code is shown below:

- Actor/actors' age: child/adolescent/adult/all/child & adolescent/child & adult/adolescent & adult
- Actor/actors' gender: female/male/both
- Actor/actors' weight: underweight/poor physical appearance/normal weight/healthy physical appearance/overweight/obese/different weights were presented in the same advertisement
- Advert 'actor/character eating in the advert: Yes/No

Food marketers use different messages in advertisements to reach young consumers. A TV commercial, for example, might show children playing with a toy or eating a type of cereal without showing the name of the company that manufacturers these products which could easily let the viewer guess that the '' source'' of the message is the young person (The Institute of Medicine 2006). Signs and codes those types of the messages and their intent were assessed. Healthy messages included in the advertisement were assessed based on messages about ''fibre content'', ''addition of vitamins and mineral'', ''low calorie content, ''low or no fat'', ''sugar and/or salt content'', ''provision with natural essential nutrients'', or whether the advert "gave just a simple message''. All signs and codes for TV advertising analysis are presented in Appendix XI.

5.2.3 Food grouping

All food/drinks' advertisements were individually categorised into different groups, which were adapted from the food code list that was used in the British survey (1997) 'National Diet and Nutrition Survey: young people aged 4 to 18 years. Regrouping and modification to some food groups were made for the present study. Food and beverages were grouped by type. Grouping and codes for all food/beverages used in this study are presented in Table 47.

Food and beverages' products were classified to foods that are high in saturated fat, sugar or salt (HFSS) and non- HFSS according to the nutrient profiling (NP) model used by Food Standards Agency (FSA 2005). The NP model approach was chosen because it has been previously developed to help support the UK communications regulator[18]. Ofcom, consulted the broadcasting and advertising sectors to help achieve a rebalance in children's diets by reducing the amount of advertising that is rated by FSA model as HFSS and directed at children. The FSA model's classification for HFSS and non-HFSS was used in this study with modifications according to the need of the study was classified as follows: high-calorie sugar containing foods, high-calorie fat containing foods, high-calorie salt containing foods, high salt, others.

[18] Ofcom is responsible to regulate TV and radio sectors, fixed line telecoms, mobiles and the airwaves over which wireless devices operate in the UK.

Table 47: Types of commercial categories of food items

Type of Commercial Categories of Food Items	
Milk and milk products	Milk, yogurts, cheese, Ice cream, and coffee whitener
Fat/oils and fat spreads	Butter, margarines & oils
Meat, fish & poultry, egg, and their dishes products & dry beans cheese and nuts	Beef, lamb, chicken, burgers & kebabs, sausages, meat and pie pastries, chicken nuggets/fish sticks; hot dogs, peanuts butter/nuts
Fruit & vegetables, potatoes & savoury snacks	100% fruit juice, fruit/vegetables, fruit drinks (10% juice), salad and other raw vegetables, vegetables (not row), chips, fried and roasted potatoes and potatoes products, crisps & savoury snacks,
Sugars, preserves & confectionery	Sugars, jam, honey, chocolate, spread, gums, chocolate bars
Total Drink	Fruit drinks, carbonated beverages , water/ coffee/ tea
Fats, oils, and sugars, preserves & confectionery	Candy/snacks, regular cereal, healthy snacks, soft drink, juice/ energy drinks (not 100% fruit juices),chocolate syrup/ powdered, cakes/cookies/pastries, flavoured gelatine/pudding, oil/ butter/ cream
Miscellaneous	Soups, sauces, condiments (sauces, mayonnaise, ketchup, herbs, spices) & miscellaneous beverages & commercial toddlers food & drinks
Bread , cereals, rice and pasta	Whole grain or high fibre cereal, Canned and packaged pasta, Buns, cakes, pastries & fruit pies, Pasta, rice and other miscellaneous cereals & puddings
Infant and children milk formula	
Restaurant food	Healthy, Regular, Fast food
Combination meals	Breakfast, lunch, dinner

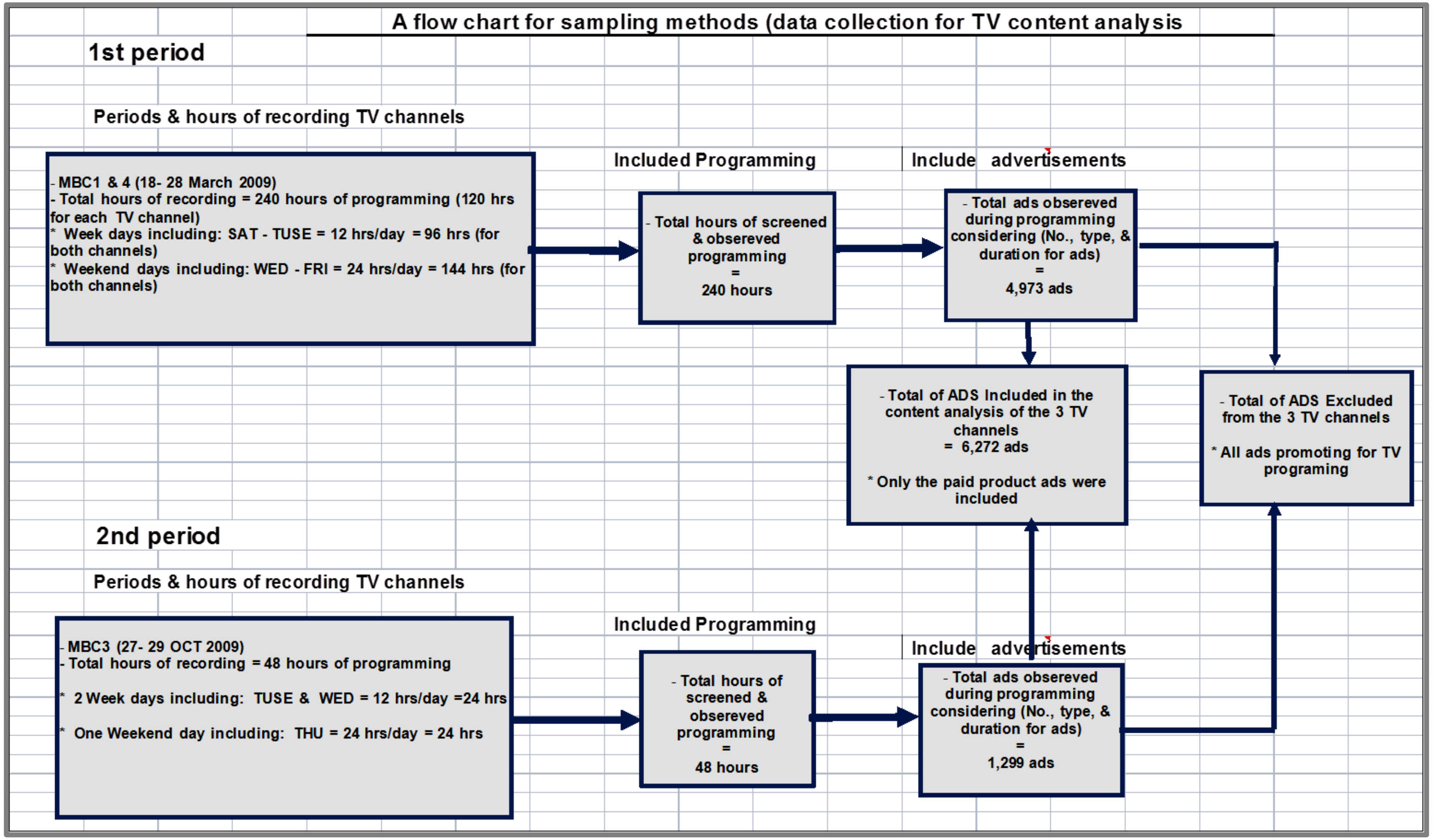

Figure 15: A flow chart for TV advertisements analysis sampling and data collection method

5.2.4 Data analyses

Data's management and analysis were performed using SPSS 18.0 (2009) and analysis was divided into two parts:

The first part of analysis included a description of all advertisements (n=6,272) to define their types (product advertisements as food, non-food or PSA[19], followed by a description of product advertisements and percentages to total number, types (food or non-food) and duration of advertisements which were identified in the sampled TV channels. Afterwards descriptive characteristics of food advertisements which involved coding of the aired food advertisements (n=1,106) was carried out. The frequencies and percentages of product advertisements devoted to food and beverages per hour on TV programming were calculated. Percentages and means for length of time of each food advertisement, its category, and time of transmission were calculated in each viewed channel individually, and the percentages were compared to determine the frequency of these adverts. Finally, the method of promotion of the product purchase, information provided with the product, and to whom it was targeted were also measured. Results were expressed as frequencies and percentages and were summarized in tables and graphs.

The second part of analysis targeted the nutritional analysis of the advertised foods to either HFSS or non- HFSS using the nutrient profiling (NP) model (described in Chapter 3). Data was obtained from Nutrition Facts Labels by visiting grocery stores, company websites and restaurants, and by calling company consumer relations departments per need. Variables included serving size (100 gm or ml), and its nutritional contents such as energy, saturated fat, total sugar and sodium in addition to the presence of fruits, vegetables and nuts in the food. Evaluation of another information provided for the product such as health claims will be considered if available. However, this information was evaluated while viewing advertisements.

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[19] PSAs : Public service announcements or advertisements

CHAPTER SIX

Results: Descriptive analysis of the extent and nature of food advertisements on Saudi TV channels

6.1 Chapter introduction

This chapter presents the main findings for the descriptive analysis study of television food advertisements in three popular TV Saudi channels. Results are grouped into two key sections: section one describes the extent and the nature of the advertised food. Section two draws on the nutritional analysis of the advertised food and beverages and their classification to either food high in saturated fat, salt and sugar (HFSS) or non- high in fat, salt and sugar (non- HFSS).

6.2 The extent and nature of broadcast advertisements on MBC channels

(Table 48) shows the duration of viewed programmes, slots for advertisements and advertisements included within the period of recording (288 hours). The mean duration of the advertisement was 26.5 seconds with a range of 2 to 740 seconds. The sampled programmes contained 6,272 advertisements, which were transmitted in 46.2 hours (166261 seconds). Product advertisements represented about 82% (n=5,150) while 18% (n=1,122) were either for TV promoting program advertisements or for public service announcements or advertisements (PSAs).

Table 48: Duration of programmes, slots (breaks) and advertisements in (288 hrs) of recording

	Minimum	Maximum	Mean± SD
Adverts duration in seconds	2.00	740.00	26.5 ± 25.2
Slots' duration in seconds	4.00	746.00	217.1± 111.7
Programme duration in seconds	240.00	16860.00	3453.6±1944.5
Programme duration in minutes	4.00	281.00	57.6 ± 32.4

Of the total number (5, 150) of the paid product advertisements, 17.6% (n=1,106) were for food/drink products, which corresponded to 6.96 hours/288 hours. Table 49 reflects the time allocated for each food category. The maximum duration was allocated for meat and meat product advertisements (82.5±43.3 seconds) while fruit and nut advertisements had the minimum broadcast time (16.3±6.5 seconds).

Table 49: Allocated time for each food category

Commercial categories of food items	Mean ± SD (seconds)	Minimum	Maximum
Cereals and cereal products	19.4±11.4	3.0	40.0
Milk and milk products (milk, yogurt, cheese, Ice cream, and coffee whitener)	23.8±15.9	3.0	73.0
Fat spreads (butter, margarine & oils]	17.7±14.0	6.0	35.0
Meat & meat products (beef, lamb, chicken, burgers & kebabs, sausages and meat pastries)	82.5±43.3	45.0	120.0
Vegetables, potatoes & savoury snacks	30.3±2.3	29.0	35.0
Fruits & nuts	16.3±6.5	12.0	30.0
Sugars, preserves & confectionery (sugars, jam, honey, choc. spread, gums, chocolate bars)	24.9±13.6	5.0	72.0
Total drink (fruit drinks)	22.3±13.0	5.0	35.0
Total drink (carbonated beverages)	27.1±6.7	10.0	40.0
Total drinks (water/coffee/ tea)	17.8±9.0	5.0	30.0
Miscellaneous (beverages)	10.6±8.0	5.0	30.0
Miscellaneous (soups)	21.7±7.7	10.0	36.0
Miscellaneous (sauces, condiments, mayonnaise, ketchup, herbs, spices)	36.8±9.5	25.0	60.0
Restaurant food	33.8±8.3	10.0	45.0

The most prevalent advertisements assigned to non-food included those for department stores, automobiles, and telecommunications services. The marketing strategies used different methods to stimulate the purchase of products, including the presence of a healthy and good looking character in the advert and showing characters while eating. General audiences were the most targeted by advertisers (61%), compared to only 15% of the targeted children and adolescents. Adults were featured in around 46% of advertisements, while 40% featured adolescents either alone or with other age groups. Children appeared in almost 29% of advertisements either alone or accompanied by characters from other age groups. Sixty percent of advertisements were presented with both genders, compared to 24% that were presented by females and 17% presented by males. Weight of featured characters was mostly average (89%) whereas only 2% of characters were either underweight or overweight, and a group of characters with different weights presented the rest of advertisements. Only 16% of characters were exposed eating. Table 53 presents detailed characteristics of televised food advertisements and strategies used in promotion.

6.2.1 Food promotion by (MBC 1, 3, & 4) TV channels

Food advertising (n=1,106) in the three TV channels revealed that about 43% of food advertisements were aired on MBC4, 31% on MBC1 and 25.6% on MBC3 (Table 50). About 70% (n=773) of the food advertisements was aired during weekdays while 333 (30%) was aired during weekend days. About 2.0 % (n=27) of the adverts were aired before the start with the programme, while 92% (n=1,022) were aired inside programming and 57advertisements (5.2%) were broadcasted after programmes. There is a significant relationship between the type of program and food advertising directed to different targeted groups (P<001), more food advertising during soaps, serials or movies was directed to general audiences (48.3%, n=681), P<.001 than to children and adolescents, followed by advertisements presented during show programmes (21%, n=294), P<001, e.g. talk show programmes. Younger groups could be exposed to about 18% of the food/drink advertisements when watching animation programmes and to about 3.3% of food advertisements whether they were viewing children serials or movies. The amount of food/drink advertisements during different types of programming is presented in Figure 16. Most of the food advertising (45%) was broadcasted during programming at the time between 6:30pm and 12:00 midnight, 37% were aired between 12:30pm and 6:30pm. Few food advertisements were screened in during morning times as shown in Figure 17.

Table 50: Proportion of food advertisements on each TV channel

TV channel No. of all adverts (food and non-food)	Proportion of food adverts (%)
MBC1 (1784)	343 (31)
MBC3 (1299)	284 (25.6)
MBC4 (3189)	479 (43.3)

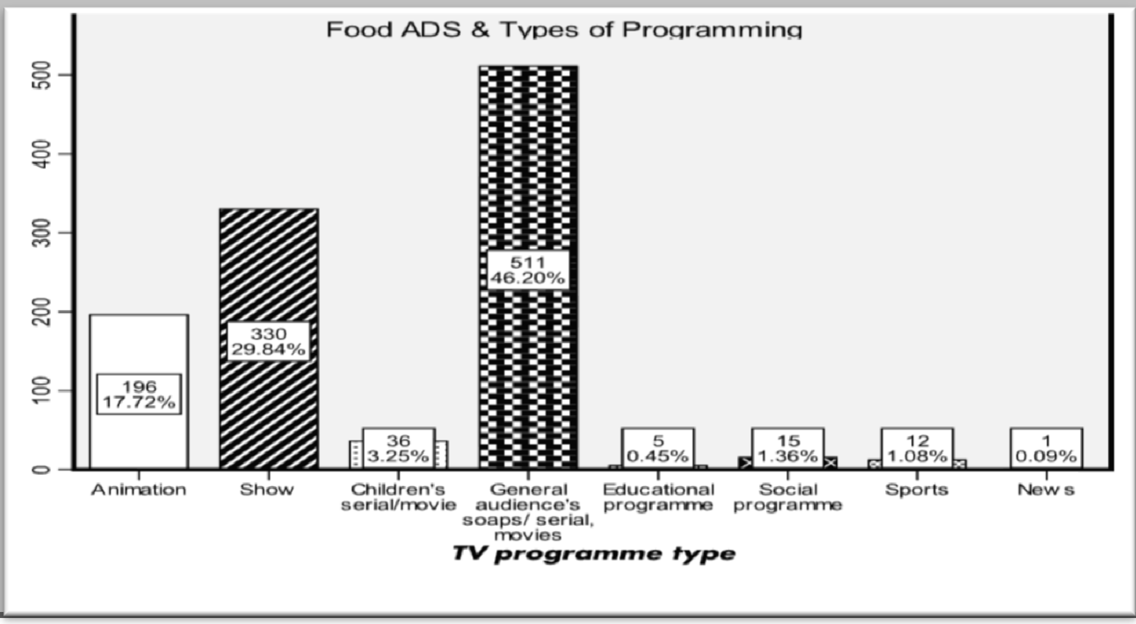


Figure 16: Proportion of food adverts during programming

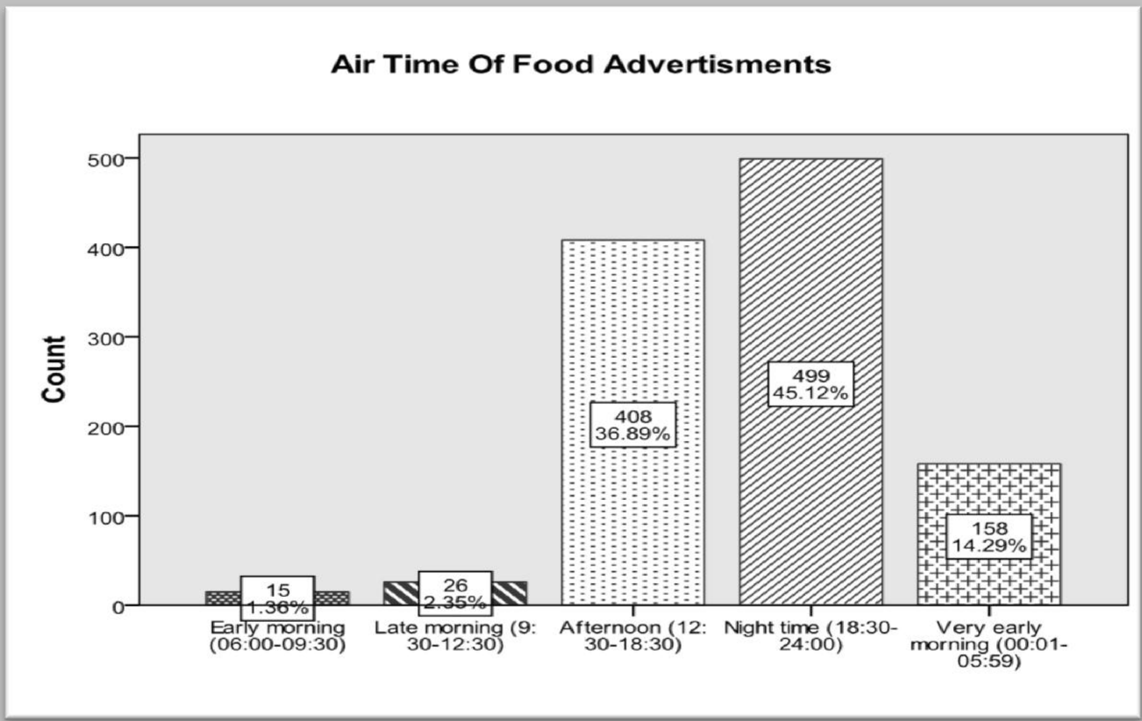


Figure 17: Proportion of food advertisements according to air times

6.2.2 Food and drink items promoted by MBC channels

The leading categories of food advertised in the three channels included milk and milk products (19.4%, n=214), followed by sugars, preserves & confectionery n=198((18%, n=). The proportion of total beverages such as water, tea and coffee was 13.3% and for cereals and their products was 11.9%, n=131. Carbonated beverages and fruit drinks shared almost the same percentage of advertisements 4.4%, n=49 and 4.7%, n= 52 respectively. There were 83 advertisements for restaurants and advertising for fast-food outlets was higher (83%, n=59), compared to regular or traditional food restaurants (17%, n=12). Other items represented around 5% of the advertisements or less for each one (Table 51).

The three MBCs channels were significantly different in promoting food items (*P*<0.001). Overall, the comparison revealed that cereals & cereal products' advertising was mostly transmitted by children's channel MBC3 (53%), compared to MBC1 (29%) and MBC4 (17.6%). Most of the fruit drink advertising (67.3%) was on MBC3 with no advertising for carbonated beverages. MBC4 was the most likely channel to advertise carbonated beverages (59.2%), compared to MBC1 (40.8%). Fast-food outlets were about three times more likely to be advertised in MBC4 (76.6%), compared to 23% on MBC1 with no advertising in MBC3. Table 52 shows the frequency of advertising of all food categories on each TV channel.

Table 51: Distribution of food advertisements across food categories

Commercial categories of food items	Number of adverts
Food type [n=1,102 (99.6%)]	
Cereals & cereal products	131 (11.9)
Milk & milk products	214 (19.4)
Fat spreads (butter, margarines & oils)	39 (3.5)
Vegetables, potatoes & savoury snacks	27 (2.5)
Fruit & nuts	62 (5.6)
Meat & meat products (beef, lamb, chicken, burgers & kebabs, sausages and meat and pie pastries)	4 (0.4)
Sugars, preserves & confectionery (sugars, jam, honey, gums, chocolate spread, chocolate bars)	198 (18)
Total drink (fruit drinks)	52 (4.7)
Total drink (carbonated beverages)	49 (4.4)
Total drinks (water/ coffee/ tea)	147 (13.3)
Miscellaneous (beverages)	42 (3.8)
Miscellaneous (soups)	20(1.8)
Miscellaneous sauces, condiments (sauces, mayonnaise, ketchup, herbs, spices)	6(0.5)
Infant and children milk formula	47(4.3)
Restaurant food [n= 71(5.8)]	
Fast food outlets	59 (83)
Traditional food restaurants (non-fast foods)	12 (17)

Table 52: Food categories of adverts in each TV channel

Commercial categories of food items (n)	MBC1 (%)	MBC3	MBC4
Food type [n=1102 (99.6%)]			
Cereals & cereal products (131)	38 (29)	70 (53.4)	23 (17.6)
Milk & milk products (214)	46(21.5)	78 (36.4)	90 (42.1)
Fat spreads (butter, margarines & oils) (39)	38(97.4)	0 (0.0)	1 (2.6)
Vegetables, potatoes& savoury snacks (27)	11(40.7)	0 (0.0)	16(59.3)
Fruit & nuts (62)	8 (12.9)	4(6.5)	50 (80.6)
Meat & meat products (beef, lamb, chicken, burgers & kebabs, sausages and meat and pie pastries)	0 (0.0)	4 (100)	0 (0.0)
Sugars, preserves & confectionery (sugars, jam, honey, gums, chocolate spread, chocolate bars)(198)	54(27.3)	53 (26.8)	91 (46)
Total drink (fruit drinks) (52)	5 (9.6)	35 (67.3)	12 (23.1)
Total drink (carbonated beverages) (49)	20(40.8)	0 (0.0)	29 (59.2)
Total drinks (water/coffee/tea) (147)	71(48.3)	0 (0.0)	76 (51.7)
Miscellaneous (beverages) (42)	4 (9.5)	38 (90.5)	0 (0.0)
Miscellaneous (soups) (25)	8 (32)	0 (0.0)	17 (68)
Miscellaneous sauces, condiments (sauces, mayonnaise, ketchup, herbs, spices) (17)	11(64.7)	2(11.8)	4 (23.5)
Infant and children milk formula (47)	23(48.9)	0 (0.0)	24 (51.1)
Fast food outlets (64)	15(23.4)	0 (0.0)	49 (76.6)

6.2.3 The characteristics of televised food advertisements and techniques used in advertising

Food and beverage advertisements included some health-related messages, e.g. addition or fortification of the product with vitamins and minerals (37%), the provision of natural essential nutrients (25%), and the inclusion of simple health messages was noted (29%). The character's body size appeared to be mostly (91%) average and this was based on the researcher's evaluation. Only a small proportion of overweight characters were noted (0.4%) while none of the characters could be evaluated as underweight. Most of the advertisements featured both genders (73.4%). However, a higher proportion of female actors (24%) presented advertisements, compared to male actors (17%). Adults (46%) presented most of the advertisements, with a small proportion presented by children (0.5%). Adolescents (11%) presented adverts either alone or in combination with other age groups. The majority of advertisements (67%) targeted general audiences, the total promoted advertisements that were directed to children or adolescents was significantly higher (28%) than those directed solely to adults (5.3%). Different marketing strategies were used to stimulate the purchase request of the young viewers as follows: advertisments were mostly animated and presented by cartoon characters. Often, they were presented with identification of sponsorship, price incentives, free gifts and celebrity endorsment. Showing characters while eating was common in 85% of the aired adverts. The second most frequent marketing method was to associate advertisements with excellent taste (24.5%), while physical activity or pleasure had a share of 12%. All the creative methods and techniques used by food promoters in the three TV channels are listed in Table 53.

Table 53: Characteristics of televised food advertisements and techniques used in advertising

Food advertisement variable [n= (%)]	No. (%)
Health related information (n= 627) 57%	
Increased fibre content	1 (0.2)
Addition of vitamins/minerals	231 (36.8)
Low calorie content	12 (1.9)
Low or no fat content	45 (7.2)
Provision with natural essential nutrients	157 (25)
Gave just a simple health message	181 (29)
Apparent character body size [n= 806 (73%)]	
Underweight	0 (0.0)
Average weight	735 (91.2)
Overweight	3 (0.4)
Different weights	68 (8.4)
Apparent character gender [n= 806 (73%)]	
Male	140 (17.4)
Female	74 (24.1)
Both	592 (73.4)
Apparent character age [n= 827(75%)]	
Child	4 (0.5)
Adolescent	88 (10.6)
Adult	376 (45.5)
Child & adolescent	38 (4.6)
Child & adult	196 (23.7)
Adolescent & adult	9 (1.1)
All ages	116(14)
Targeted audiences [n=1100 (99.5%)]	
Children	300 (27)
Adolescents	4 (0.4)
Adult	59 (5.3)
General audiences	737 (67)
Basis of the main product information provided during advertising [n=1039(94%)]	
Physical qualities	247 (23.8)
Novelty	112 (10.8)
Composition and characteristics of product	567 (54.6)
Association with premium and prizes (cards, stickers and electronic games)	113 (10.9)
Toys	86 (7.8)

Table 53: Characteristics of televised food advertisements and techniques used in advertising (continue)

Food advertisement variable [n= (%)]	No. (%)
General methods used to stimulate the purchase of the product [n=1100 (99.5%)]	
Fun/happiness/smile	104 (9.5)
Energy/sport/physical activity	128 (11.6)
Pleasure	129 (11.7)
Love/emotions/kisses	42 (3.8)
Celebrity/ Movie or music heroes or stars	1 (0.1)
Music/songs/dancing	13 (1.2)
Lovely magnitude taste	269 (24.5)
Healthy and/or good looking appearance	100 (9.1)
Presence of prize or premiums	97 (8.8)
Actor/actress or character shown eating [n=736(66.5)]	

6.2.4 Comparisons of food advertisements' characteristics directed to young people and other groups

Clearly, the extent and nature of food advertising directed to [20] young people (either those included in children programmes or specific products for young group in adult programmes) was statistically different from those directed to other age groups (general audience or adults), *P*<.001 (Table 54). The average number of breaks per program, number of adverts per break and the meantime for advertisements during programming was significantly lower for the younger group compared to other age groups' *P*<.001.

[20] Young people refer to children and adolescents in the present study.

Table 54: Food advertisements' characteristics directed to young people and other groups

Variable	Target group (Mean± SD)			
	Young	Adults	*t* Value	*P* Value*
Number of adverts' breaks per TV programming	3.49±1.88	4.82±2.43	*t*(1098) = 8.64	<.001
Number of adverts per break	8.84±3.93	9.50±3.50	*t*(497.5)=2.580	<.001
Duration of advertisement	17.3±11.85	25.03±13.56	*t*(1407) = 9.21	<.001

**P* Value is significant at <0.05

6.2.5 Food categories directed by age group

There were some major differences between the food commercials broadcast to young people, and those marketed to other age groups. The most frequently publicized food category for young people was regular and sugary cereals and their products [n= 85 (28%)], compared to only 46 advertisements (5.8%) advertised to either a general audience or adults. Similarly, fat spreads, vegetables, fruit, fruit juices, carbonated beverages, or fast-food outlets did not target young people, specifically and these brands were only directed to general audiences. Fruit drinks (10% fruit juices or from concentrated) were highly advertised to young people n=35 (11.5%), compared to those directed to other groups n=17 (2.1%).

Candies and chocolate bars were more likely to be advertised to young people (67.5%), compared to other viewers (50.5%). Table 55 shows all food categories directed to each age group.

Table 55: Food categories directed to young people and other age groups

Type of advertised food/drink (n=)	Targeted audiences [n=1100] Adverts to young people No (%)	Adverts to other groups No (%)
Food/drink categories (1100) *		
Cereals & cereal products (131)	85 (28)	46 (5.8)
Milk & milk products (214)	73 (17.7)	141 (24)
Fat spreads (butter, margarines & oils) (39)	0 (0.0)	39 (14.9)
Fruit & nuts (62)	0 (0.0)	62 (7.8)
Meat & meat products (beef, lamb, chicken, burgers & kebabs, sausages and meat and pie pastries)	2 (0.7)	2(0.3)
Sugars, preserves & confectionery (sugars, jam, honey, gums, chocolate spread, chocolate bars) (198)	52 (17.1)	144 (18.1)
Total drink (fruit drinks) (52)	35 (11.5)	17 (2.1)
Fruit juice (18)	0 (0.0)	18 (17.8)
Total drink (carbonated beverages) (49)	0 (0.0)	49 (6.2)
Total drinks (water/ coffee/tea) (147)	0 (0.0)	147 (18.5)
Miscellaneous (beverages) (42)	38 (12.5)	4 (0.5)
Miscellaneous (soups) (25)	0 (0.0)	20 (2.5)
Miscellaneous sauces, condiments (sauces, mayonnaise, ketchup, herbs, spices) (17)	4(1.3)	2 (0.3)
Infant and children milk formula (47)	8 (4.9)	39 (4)
Fast food outlets (64)	0 (0.0)	64 (8)
Fast food/beverage items	2 (28.6)	57 (89.1)
Candies/chocolate bars (193)	52 (67.5)	141 (50.5)
Fruit/vegetables (40)	0 (0.0)	40 (39.6)
Crisps & savoury snacks (27)	7 (26)	20 (74)

6.2.6 Characteristics of food advertisements directed to different age groups

The marketing strategies used to appeal, persuade and stimulate viewers were statistically different (*P*<.001) according to the targeted age group. For example, when adverts were directed to young consumers, the most common and popular associations found were with the composition and characteristics of product (68.7%), compared to 49.9% (*P*<.001) of those directed to other groups. Association with premium, prizes or cards and the display of toys during product promoting was more likely to be used in advertising aimed at children and adolescents as 15.3% and 14.8 % respectively compared to other groups. On the other hand, food promotion to adults or general audience was more likely to be associated with excellent taste [n=217 (27.3)], compared to 10% of advertisements targeted at the young group. Food advertising to young people was more likely to show characters eating while promoting the advert [n=230 (95.4)], compared to other advertisements that were not directed to the young group [n=506 (79.8)]. All advert characters included in the examined MBC channels according to their directions to different age groups are presented in Table 56.

Table 56: Characteristics of food advertisements directed to both young people and other groups

	Targeted audiences [n=1100 (99.5%)]		
Characteristics of food advertisements(n=)	**Adverts to young people No (%)**	**Adverts to other groups No (%)**	***P* Value**
Format of the advertisements (1100)			***P*<0.001***
Animated	180 (59.2)	132 (16.6)	
Non-animated	60 (19.7)	589 (74)	
Mixed	64 (21.1)	75 (9.4)	
The location of food adverts(1100)			***P*<0.001***
Before the programme	3 (1.0)	23 (2.9)	
Inside the programme	263 (86.5)	754 (94.7)	
After the programme	38 (12.5)	19(2.4)	
Actor/actress or character shown eating (875)	230 (95.4)	506 (79.8)	***P*<0.001***
Health related information (n= 627)			***P*<0.001***
Increased fibre content	0 (0.0)	1 (0.2)	
Addition of vitamins/minerals	151 (71.2)	80 (19.3)	
Low calorie content	0 (0.0)	12 (2.9)	
Low or no fat, sugar, and/or salt content	0 (0.0)	45 (10.8)	
Provision with natural essential nutrients	37 (17.5)	120 (28.9)	
Gave just a simple health message	24 (11.3)	157 (37.8)	
Apparent character body size (n= 1105)			***P*=0.042***
Underweight	0 (0.0)	3 (0.3)	
Average weight	189 (95.9)	813 (89.5)	
Overweight	1 (0.5)	6 (0.7)	
Different weights	7 (3.6)	86 (9.5)	
Apparent character gender (n= 806)			***P*<0.001***
Male	13 (7.3)	127 (20.3)	
Female	1 (0.6)	73 (11.6)	
Both	165 (92.2)	427 (68.1)	

Table 56: Characteristics of food advertisements directed to both young people and other groups (continue)

	Targeted audiences [n=1100(99.5%)]		
Characteristics of food advertisements	**Adverts to young people No (%)**	**Adverts to other groups No (%)**	***P* Value**
Basis of the main product information provided during advertising (n=1037)			
Physical qualities	20 (7.6)	225 (29)	
Novelty	22 (8.4)	90 (11.6)	
Composition and characteristics of product	180 (68.7)	387 (49.9)	***P*<0.001***
Association with premium and prizes (cards, stickers and electronic games)	40 (15.3)	73 (9.4)	
Energy/sport/physical activity	82 (27)	46 (5.8)	
Pleasure	0 (0.0)	129 (16.2)	
Love/emotions/kisses	0 (0.0)	42 (5.3)	
Celebrity/movie or music heroes or stars	0 (0.0)	34 (3.2)	
Music/songs/dancing	0 (0.0)	13 (1.6)	
Lovely magnitude taste	52 (10.2)	217 (27.3)	
Healthy and/or good looking appearance	31 (10.2)	69 (8.7)	
Weight	0 (0.0)	36 (4.5)	
Presence of prize or premiums	40 (15.3)	73 (9.4)	
Toys	45 (14.8)	41 (5.2)	

6.3 Nutritional analysis of the advertised foods based on HFSS or non-HFSS using nutrient profiling (NP) model

Among the 1,106 food adverts, 65 food and drink items were analysed on the three MBC channels. Table 57 presents the results of analysis for 65 advertised food and drink items. Forty-two percent (n=27) of the adverts were classified to either HFSS or non-HFSS, while the rests of adverts were unclassified due to the unavailability of the item in the local market or missing/incomplete nutrition labeling. Seventy percent of the classified items were HFSS food while the rests were non- HFSS.

1. **Total drinks [water/coffee/tea/carbonated beverages]: (16 items)**

Out of the 16 drinks, only eight products were found to have adequate data for FSA Nutrient Profiling scoring. Fifty-percent of the scored products was found to be Non-HFSS drinks as having nutrient profiling scores< 1. The Non-HFSS products included Lipton's tea, green tea, Maxwell house coffee, and Nestle water.

2. Milk & milk products [milk/yogurt/cheese/Ice cream/coffee whitener]: (13 items)

A 100% of the 13 items of milk and dairy products did not have adequate food labeling information to calculate the nutrient profiling scores.

3. **Vegetables/potatoes/savory snacks: (two items)**

Only one of the two items included had adequate information on the food label to calculate the score, and it was found to be HFSS (scored 13)

4. **Cereals & cereals' products: (10 items)**

Except for Kellogg's corn flakes and rice (both scored 0), all cereals and cereals' products had scored > 4 and were considered as HFSS products.

5. Sugars/preserves/candy snacks: (13 items)

Only 39% of these products had full information on the food labeling and the Wregley's Extra chewing gum was the only item that had scored < 4 to be considered as Non-HFSS.

6. Miscellaneous: (five items)

Goody mayonnaise was the only product that had adequate information to calculate its nutrient profiling score, and it scored 12 points (HFSS)

7. Fat: (two items)

The information required for nutrient profiling were available for one item only, and it scored 10 (HFSS)

8. Fruit & Nuts: (three items)

Peanut's butter was the only product that has all required information to calculate the nutrient profiling score and was found to be Non-HFSS.

9. Meat: (one item)

Some of the required information was not included on the labeling.

Table 57: Advertised items on MBC channels

Brand/Product	Kcal	*Protein (g)*	*Sugar (g)*	*Fat (g)*	*Fibre (g)*	*Sodium (mg)*	*FSA Nutrient Profiling*
	Values per 100g for foods and 100 ml for drinks						
7 up	36	0	9	0	0	NA	**HFSS**
Coca cola	42	0	10.7	0	0	0	**HFSS**
Lipton chai latte	423	10.6	67	7	0	634	**HFSS**
Lipton green tea	<1	0	0	0	0	0	Non-HFSS
Lipton tea (jar)	1	0	0	0	0	0.01	Non-HFSS
Maxwell house coffee	78	11.2	0	0	0	37	Non-HFSS
Miranda	51	0	NA	0	0	NA	*Unclassifiable*
Mountain dew	NA	NA	NA	0	0	NA	*Unclassifiable*
Mousy	NA	NA	NA	0	0	NA	*Unclassifiable*
Nestle water	0	0	0	0	0	16	Non-HFSS
Pepsi	42	0	11	0	0	NA	*Unclassifiable*
Pepsi max	0	0	0	0	0	NA	*Unclassifiable*
Sprite	48	0	12	0	0	7	**HFSS**
Sun cola	53	0	13	0	0	NA	*Unclassifiable*
Sun top drink (orange)	57	0	NA	0	0	NA	*Unclassifiable*
Tang (orange)	388	0	92	0	0.4	280	**HFSS**
Actimil	NA	2.9	NA	NA	NA	NA	*Unclassifiable*
Activia	63	3.9	4.2	2	0	54	*Unclassifiable*
Almarai flavored milk	72	2.8	NA	NA	NA	NA	*Unclassifiable*
Almarai labnah	196	7	NA	NA	NA	NA	*Unclassifiable*
Almarai milk chocolate	86	3	NA	NA	NA	NA	*Unclassifiable*
Coffee mate	35	NA	NA	1.8	0	NA	*Unclassifiable*
Danao	NA	NA	NA	NA	NA	NA	*Unclassifiable*
Danette	NA	NA	NA	NA	NA	NA	*Unclassifiable*
Haagen dazes ice cream	270	5	21	11	NA	70	*Unclassifiable*
Kraft cheddar	228	13.5	NA	NA	NA	NA	*Unclassifiable*
Kraft cream cheese	313	10	1.2	20	NA	1290	*Unclassifiable*
La vache quirit	283	10	NA	NA	NA	NA	*Unclassifiable*
Nido	507	24	NA	NA	NA	NA	*Unclassifiable*
Doritos	490	6.2	3.4	12	3	800	**HFSS**
Lays chips (classic)	520	7	NA	NA	3.5	700	*Unclassifiable*
Betty crocker cake	280	3.88	25	2.8	0.61	340	**HFSS**
Chocolate cake moist	279	4.4	25	3.03	0.48	360	**HFSS**
Coco pops	387	5	35	1	2	300	**HFSS**
Corn flakes	378	7	8	0.2	3	500	Non-HFSS
Indomi	467	10	4	8	3	1600	**HFSS**

Table 57: Advertised items on MBC channels (continue)

Brand/Product	Kcal	*Values per 100g for foods and 100 ml for drinks* Protein (g)	Sugar (g)	Fat (g)	Fibre (g)	Sodium (mg)	FSA Nutrient Profiling
Nestquik cereal	379	7.8	35	1.6	6.7	510	**HFSS**
Oreo biscuits	480	5.2	38.5	10	2.4	3.4	**HFSS**
Rice	333	6.7	0	0	0	0	Non- HFSS
Toya noodles	475	9	8	9	4	1000	**HFSS**
Twistos	453	7.6	4.7	4.1	3	600	**HFSS**
Cadbury	518	7.7	46	15	0.4	142	**HFSS**
Family sugar powder	400	Nil	NA	NA	NA	NA	*Unclassifiable*
Ferrero Rocher	NA	NA	NA	NA	NA	NA	*Unclassifiable*
Flake chocolate 1+10+10+1	506	9.4	61.8	16.6	0.4	158	**HFSS**
Galaxy chocolate 1+10+10+1	548	NA	55	20	0	100	*Unclassifiable*
Kinder beuno 1+NA	571	9.2	NA	NA	NA	NA	*Unclassifiable*
Kinder country chocolate	556	8.9	NA	NA	NA	NA	*Unclassifiable*
Kinder surprise	NA	NA	NA	NA	NA	NA	*Unclassifiable*
Merci chocolate 1+10+10+0	565	7.3	47.3	21.1	NA	70	*Unclassifiable*
Snickers chocolate 1+10+10+2	499	9	46.7	11	1.2	200	**HFSS**
Twix 1+10+10+1	492	4.8	48.2	13.8	1.5	170	**HFSS**
Ulker chocolate	NA	NA	NA	NA	NA	NA	*Unclassifiable*
Wregleys extra 0+0+0+0	149	0	0	0	0	0	Non- HFSS
Goody mayonnaise 2+10+0+5	688	11.4	0.3	10.78	0	486	**HFSS**
Ketchup 0 +0+5+10	107	1	23.6	0	0.6	1200	**HFSS**
Maggi chix stock	220	2.5	NA	NA	NA	1850	*Unclassifiable*
Maggi mushroom soup	NA	NA	NA	NA	NA	NA	*Unclassifiable*
Maggi soup	285	9.5	NA	NA	NA	NA	*Unclassifiable*
Alarabi oil	NA	NA	NA	NA	NA	NA	*Unclassifiable*
Noor oil 2+8+0+0	884	0	0	9	0	0	**HFSS**
Chiquita banana	NA	NA	NA	NA	NA	NA	*Unclassifiable*
Goody peanuts butter	625	25	9.4	9.4	6.25	406	Non- HFSS
Tropicana juice	134	NA	NA	NA	NA	NA	*Unclassifiable*
Sadia chicken nuggets	261	13	NA	NA	NA	783	*Unclassifiable*

CHAPTER SEVEN

General Discussion

7.1 Introduction

The overall objective of the study was to study the eating behaviours of a population of Saudi adolescent females, factors influencing these behaviours and the nutritional status of the studied population. In this thesis, a broad scope of growth status including adiposity, anaemia status and factors influencing the eating patterns, lifestyle and nutrition status of 13-18-year-old girls in Jeddah was examined. In addition, a broad analysis of school meals, food advertisements and media issues and their impact on food choice and nutritional status have been investigated.

7.2 Summary of the thesis

Results of the study show clearly that the growth patterns and prevalence of overweight status in addition to food patterns and other lifestyle behaviours of Jeddah adolescent girls do not differ from other Saudi girls. Twenty percent of Jeddah young girls were centrally obese (when WC at 75th percentile was used), and 28% could be categorised as centrally obese when WHtR at 0.5 was used. Unhealthy frequent dieting, high-energy between-meal food intake (particularly fast foods), with low intake of fruit and vegetables and a high consumption of fizzy drinks that was related to meals outside the home were among the most prevalent behaviours. In addition, erratic eating behaviours such as skipping meals, especially breakfast and limited physical activity were found to be prevalent among the study group. Based on haemoglobin concentrations' values using both capillary blood from the finger and venous blood, 40% and 29% of participants were anaemic by WHO criteria, respectively. Moreover, only 10% (n= 48) of anaemic schoolgirls were aware of being anaemic.

Meals provided in schools, in both governmental and private sectors were found to be high in fat, sugar and salt (HFSS). Some significant associations between eating behaviours and nutritional status were found among the independent and outcome factors such as weight status, fat distribution status, anaemia status, school type and media influences on food choice.

The girls had some concerns about the effects of media on their food choices, and television was the preferred medium for these girls, and was considered as an important source of nutrition and health information for them. Part of the study involved the collection of original data focusing on the extent and nature of food advertisements on the most popular TV channels among the study group. Comparisons were made with international studies and reviews since no national data was available at the time of comparison. The results confirmed that there is a considerable amount of food advertising transmitted through the studied TV channels. Television was considered the main, important tool used by food marketers in Saudi Arabia, who used different methods to persuade the purchased products. In addition, results showed that the promoted food and drink items were mainly HFSS with a low rate of fruit and vegetables' advertisements.

7.3 Limitations, strength and challenges

7.3.1 Limitations

Sample size

A random sampling procedure was followed to recruit schools from the four regions in Jeddah, and then random selection of one class, in each grade level, in the selected schools was followed. The participation rate was greater than 100 percent (108.5%), and results in the present study can be considered representative of 13-18-years-old adolescent girls living in the urban regions of Jeddah. Although random sampling at the individual level would have been methodologically, a better method to recruit the study population from classes, the research team used a one-stage cluster sample and all students in the randomly selected classes were considered as a sample. A one-stage cluster sampling was utilised because it was used in previous school-based national studies, e.g. (Fayssal *et al*., 2007); the sampling period was restricted to three months and the method reduced the average cost and time for the research team and school staff per interview. However, there is no evidence that the procedure used in this study would introduce any measurable selection bias, as the sample size was large and the analyses were done assuming that the participants were individually randomised and not clustered. Additionally, according to the study findings, the sample of the study was a relatively homogenous group in terms of demographics, which allowed examination of the factors related to eating patterns and lifestyle behaviours among the different subgroups such as weight status, centralised fat status, and concerns of media status with a more accurate approach.

The inhabitants of Jeddah city come from different ethnic backgrounds. They are quite similar to the general Saudi population, since the city receives permanent migrations only not from the neighbouring regions or cities but also from all over the country, including suburban or rural Saudi areas. Therefore, this made this study, representative of Jeddah adolescent girls in different regions in the country. We thus considered that this study could provide information on growth and nutrition status in addition to eating behaviours that are representative of Saudi adolescent girls. The study also highlighted eating patterns of Saudi adolescents and the factors influencing them. However, the application of the findings of this study is limited specifically to the adolescent girls' population. A large population with the addition of adolescent boys would be more practical, which could allow comparisons according to gender differences.

The design and use of the self-reported questionnaire

Researchers use self-reported dietary intakes, eating habits and lifestyles as elements of nutritional assessments. Using self-assessment surveys in some parts of the present study, particularly surveys to assess the weekly frequent consumption of food items (that was based on the food groups and other food items such as desserts, ice creams, puddings and chocolates) can predispose to inaccuracy of the actual item consumption (Krall & Dwyer, 1987). This was noticed when the pre-testing of the questionnaire was conducted prior to the actual survey. In addition, participants misreported some other questions at the time of pre-testing of the questionnaire. Therefore, the questionnaire was amended following the pre-testing process concerning questions' wording, response categories, questions' order and instructions, within which the questions were confirmed as being clear, concise and not ambiguous (as mentioned in chapter three). Moreover, under reporting of some food items were also observed among overweight and obese girls, compared to their normal-weight counterparts. This is in agreement with previous research (Vance *et al*., 2009). Inaccuracies in self-reported dietary energy intake data were also recognized compared with other methodologies such as doubly labelled water (DLW) (Vance *et al*., 2009). In order to eliminate inaccuracies and to make sure questions were understood and answered accurately; data collectors reviewed all completed responses with participants during the survey. In order to accomplish the present survey's goals, the questionnaire included two types of response formats, the closed-ended and open-ended formats. The response formats to open-ended questions were specified using groupings to answers according to participants' answers to questions. In this study, the use of open-ended questions could be of simpler to use because the number of potential responses where large. In addition, this format could shorten questionnaire response time for the respondents. However, the survey used more close-ended formats, compared to the open-ended format. This is because the use of the open-ended questions may not be truly reflective of responses by participants with fewer writing skills, which was noticed during the pilot study and the pretesting of the questionnaire. On the other hand, the use of the close-ended questions in this survey allowed for responses in standard categories. Responses were also easier to code and analyse.

Data collection on anaemia

Anaemia status measurement was based on both objective and subjective data because using direct measures of haemoglobin alone in this study might not necessarily reflect the status of nutrition-related anaemia in the population. Although both haemoglobin and haematocrit values were measured as direct indicators for anaemia on a subpopulation group (n=408 out 1519) who were measured for haemoglobin using venous blood, several other laboratory tests that specifically indicate iron deficiency anaemia were needed to determine iron status. These include, Ferritin, Serum transferrin receptor concentration, Transferrin saturation, mean cell volume, Red cell distribution width, and Erythrocyte protoporphyrin (CDC 1998), but this was unfeasible in the present study due to the cost and resources needed to accomplish it. The prevalence of anaemia based on the haemoglobin and haematocrit values (venous blood technique) was 29.4% among the subpopulation of 408 students, but anaemia can be caused by factors other than iron deficiency. In addition, these anaemic students might have genetically determined anaemia that is common in a Saudi population, e.g. sickle cell anaemia and thalassemias as reported by some epidemiological studies (Chapter 2). About 2.3% (n=11 out of 481) of participants who reported medical problems, reported to have sickle cell anaemia and 0.8% (n=4 out of 481) reported to have thalassemias. Therefore, if iron deficiency anaemia were assessed using haemoglobin concentration values only without eliminating from the sample those girls who have a genetic anaemia, the survey's results would be probably positively biased in regard to proportion of anaemia related to simple iron deficiency (Benoist *et al*., 2008). In order to decrease this bias, those who were diagnosed as anaemic based on direct measures and who also self-reported to have hemoglobinopathies such as sickle cell anaemia or thalassemia minor as diagnosed by a physician were excluded from the analysis. These subjective measures could introduce room for error, but the same approach was used by a previous national study on a similar population (Abalkhail and Shawky 2002). We believed by using this approach (after excluding those reported sickle cell anaemia or thalassemias) that hemoglobinopathies were not the main contributors to anaemia in this sample. However, further studies among Jeddah young females investigating and comparing iron deficiency and other causes of nutrition-related anaemia status in this population is important to confirm the reported prevalence in this study.

A lesson learned from conducing data for anaemia in this survey is that in order for the nutritional-related anaemia to reach its full diagnosis (particularly when it is conducted on a vulnerable population group such as adolescent girls), surveys should be more inclusive in collecting information on iron status. In addition, it should be integrated with other data, including diagnosis of hemoglobinopathies or other nutrition-related deficiencies such as folic acid and vitamin B12 deficiencies.

This research is a call for school health officials, nutritionists, dieticians and researchers to collect comprehensive information on iron status when conducting research on this group. This particularly applied to the health centres at female schools that have anaemia-screening programmes going on at present. As recommended by (WHO 2005), iron deficiency anaemia and its potential consequences on schoolgirls should be prevented and treated. We recommend that the decision-makers in these health centres to do primary screening tests using capillary from the finger which is using at the moment and do further full screening tests for those who shown to have low haemoglobin values. Despite the national pre-marital screening program that is going on in Saudi Arabia to define genetic disorders, including the sickle-cell gene and the thalassemia (El-Hazmi 2004), additional screening for sickle-cell trait and thalassemia should be included in-field studies. Programmes that are school based should include the use of haemoglobin electrophoresis to distinguish between nutritional and genetic anaemia and to determine the frequencies of hemoglobinopathies in Saudi girls' schools. Iron dietary intakes and bioavailability of dietary iron sources consumed by the participants should be investigated and included in assessment, especially for girls at high schools. This is in order to ensure that these adolescents will have enough iron reserves before getting married and begin pregnancy since the depleted iron reserves could place them and their developing foetuses at risk for suboptimal health and development in the future (Alton 2005). Furthermore, educational and intervention school programmes should be implemented to improve awareness on healthy food habits to prevent nutritional anaemia among these girls.

7.3.2 Strength and Challenges

1. This study has generated imperative data, which can generate some recommendations for managing nutrition-related problems in adolescent girls in Saudi Arabia, including obesity and anaemia. It could help Saudi government to realize the next steps in implementing preventive strategies throughout schools and community-based programmes involving both education and intervention. In addition, it helps to define actions at different levels to be undertaken that include:

(I) Interventions focus both on behaviour change and on environmental change, which can promote healthy food choice and lifestyle of adolescents.

(ii) Regulations of the media and advertising directed to children and adolescents.

(iii) Structure of homes, schools and other institutional environments so that healthy behaviours and optimal nutrition can be achieved.

(iv) Initiation of a nutritional monitoring and surveillance system.

(v) Research promotion based on the gathered baseline information to proceed to the public health nutrition in this subgroup of the general population.

2. A novel aspect of this study is the in-depth investigation of the individual, family and other environmental factors and their impact on food choice and nutritional status of Saudi young girls living within the city of Jeddah. The process of investigation was guided by the theory of the present study. The theory also helped in developing some recommendations to improve adolescents' nutritional status in Saudi Arabia.

2. Since there is no Saudi data on the extent and content of television, food advertising has been assessed in the present study. The study presented the first descriptive analysis of television advertising viewed by Saudi adolescent girls, and other researchers in the region have not previously carried out the data collected and analysed.

3. The study is the first to analyse the actual school meals and snacks provided by governmental and private sectors using the UK nutrient profiling.

4. To our knowledge, this is the first study ever to use the WHtR to evaluate central obesity and demonstrate such findings. Therefore, the values for WHtR provided in this study, in addition to the percentile WC, could help to establish national criteria for determining central obesity based on these simple anthropometric measurements.

5. Most of nutritional surveys among adolescents in the Eastern Mediterranean Region have focused on public schools only (Musaiger 2011). This survey included both public and private schools.

The present section discusses the most important findings from both studies and how they relate to previous research findings, potential issues arising from the study's design and method, and implication of the research and ideas for future related research and intervention.

The discussions of the results of this study have been categorised into three main parts:

The nutritional status of Jeddah adolescent girls based on BMI status, WC, WHtR and anaemia status and factors influencing the eating behaviours and nutritional status of the participants;
The nature of school meals and their impact on Jeddah adolescent girls' eating patterns, behaviours and nutritional status; and
The nature and extent of food advertising on Saudi TV channels and media use and concerns, and their impact on Jeddah adolescent girls' food choice and nutritional status.

7.4 Nutritional status of Jeddah adolescent girls

7.4.1 Growth status

In developing countries undergoing rapid economic growth such as Saudi Arabia, a nutrition transition is observed, with a progressive change of patterns of nutrition-related diseases, which allow both under-nutrition and over-nutrition to co-exist (WHO 2005).

Using the 2007 WHO BMI reference data, the prevalence of overweight and underweight in Jeddah adolescent schoolgirls was recognized. The present findings of BMI status demonstrated that about 14% of Jeddah girls are underweight, 11% are overweight and 13.5% are obese. Comparison of prevalence data in this study with those from a national population (n= 19, 317) that was carried on in 2005 by (El-Mouzan *et al*., 2007) showed a lower prevalence of overweight status among Jeddah girls (10.6% vs. 23.1%) and a higher prevalence of obese status (13.5% vs.

11.3%). The national data of EL-Mouzan, and his colleagues used the same reference data that was used in the present study. EL-Mouzan data included children and adolescents from different regions of Saudi Arabia of which 49% were girls. However, the data did not include a population from Jeddah city, so the present finding could be a baseline of prevalence rates for underweight, overweight and obesity in Jeddah adolescent girls. Within Jeddah, girls aged 14-16 years showed the smallest increase in the prevalence of obesity in a study occurring between 1994 and 2000, compared to their male counterparts (Abalkhail 2002). However, other recent studies in various areas of Saudi suggested different prevalence rates of overweight status Figure 18.

Compared to recent studies and national data, the recent study found that Jeddah has the lowest rates of overweight (BMI> 85th percentile) compared to other parts of the country. Concerning obesity (BMI> 95th percentile), the prevalence among current population was lower than Collision and AlDossary populations in 2010 (Collison *et al.,* 2010) & (Al-Dossary *et al.,* 2010) and higher than the other localised populations (El-Hazmi and Warsy 2002), (El Mouzan *et al.,* 2010) & (Mohamed and Fayad 2011), Figure 18.

A prevalence of underweight status was demonstrated by the present study as 14.4%, which is higher than the demonstrated prevalence in Riyadh population (Collison *et al.,* 2010). This could be referred to the fact that Jeddah's populations are coming from different ethnic groups, which could affect the urbanicity and modernization at the city level, and consequently, affect knowledge and concerns about body image. As mentioned above, body size competition is also well-known among young girls. In addition, media concerns of body image were demonstrated in the present study.

The majority of researchers commonly use the body mass index to classify overweight and obesity in adolescents. However, some researchers considered BMI as just a proxy measurement of body fatness. In the current study, waist circumference (WC) was used to measure central obesity. Waist circumference is a generally accepted measure of central obesity, which is an important risk factor for a number of diseases such as cardiovascular disease (CVD). In comparison to the UK female population (12-17 years old), Jeddah adolescents had a higher WC among all compared ages. This could be due to genetics and environmental differences between UK population and Middle East (Hatipoglu *et al*., 2007). There is a dearth of information regarding the use of WC in evaluating body fatness of young girls in Saudi Arabia. Based on the cut-off point of 75th percentile as high WC (Savva SC 2010), 20% of Jeddah girls had a WC greater than or equal to the 75th percentile. However, a recent Saudi study that has measured anthropometrics among Riyadh children and adolescents from both genders included waist circumference, found that 12% (527 out of 4400 girls) had a high WC (≥ 75th percentile) (Collison *et al*., 2010). Moreover, the same study, has demonstrated mean WC among three age groups of 4400 girls as follows: 66.30 cm for girls aged 10-13, 70.77cm for girls in the age group of 14-16 and 70.89cm for those who aged 17-19 years old (Collison *et al*., 2010). In a master's degree thesis, using WC in assessing 126 girls from Riyadh city aged 14-18 years, the mean WC was 66.6±10.5 (AL DISI, 2008). Thus, the present study demonstrated that Jeddah girls have a higher WC measure (72.7±11.33), compared to their counterparts in Riyadh city from both studies. The difference between the results in both Riyadh studies and the current study might be due to the inclusion of different age groups in (Collison *et al*., 2010), and the small sample size for AL DISI study.

Waist to a height ratio (WHtR) was used as another Index of Central Obesity (ICO) in the present study. WHtR was used because it was previously proposed as a more useful parameter for central obesity (Ashwell and Browning 2011). In ICO–waist for height, height is taken into consideration; and in 2006, a British study concluded that WC should be less than half of height for preventing cardiovascular risk (McCarthy and Ashwell 2006). Moreover, ICO–WHtR has been shown to strongly, correlate with insulin resistance among children (Manios *et al*., 2008). The index (with a mean boundary value of 0.5) was considered as a more useful clinical screening tool and measure for abdominal obesity than WC, particularly, when different age, gender or ethnic subpopulations was considered (Ashwell and Browning 2011). The present study has included Saudi and non-Saudi girls with two different age groups, and the use of WHtR could be a useful predictor to evaluate central obesity of the two groups. Twenty-eight percent of the present study's population had a WHtR greater than or equal to 0.5. These participants would be categorised as having central obesity if this single 0.5 WHtR cut-off was considered. This is in line with our findings that only 20% of Jeddah girls had a high WC at the >75th percentile. However, there was no national data available on WHtR to compare with our findings.

A number of health behaviours were related to Saudi girls' WC and/or WHtR. However, most of the determinants were not associated to both WC and WHtR. Lower SES (using a school type as an indicator), was the only determinant that showed similar results for WC and WHtR. Public scholars had a larger WC, and WHtR compared to private scholars. The second determinant that was significantly related to both indicators was girls' positive perception about their performance of physical activity. However, results were not similar, as girls who considered they performing enough exercise to keep healthy, were more likely to have greater waist size and lower WHtR, compared to those who had negative perceptions of their performance of physical activity. Other health behaviours were related to girls' WC and WHtR differently. For example, WC was more likely to be associated with factors related to physical activities while other determinants such as dieting practices, media concerns and attaining menarche were significantly associated with WHtR. The results are in contrast to other results that were demonstrated by international research in children and adolescents where a number of determinants were similarly associated with both indicators (Lehto *et al.,* 2011) & (Mushtaq *et al.,* 2011). To define central obesity and their determinants in Saudi young population, it might be more useful to use both indices. This could define the prevalence of central obesity and determinants more comprehensively.

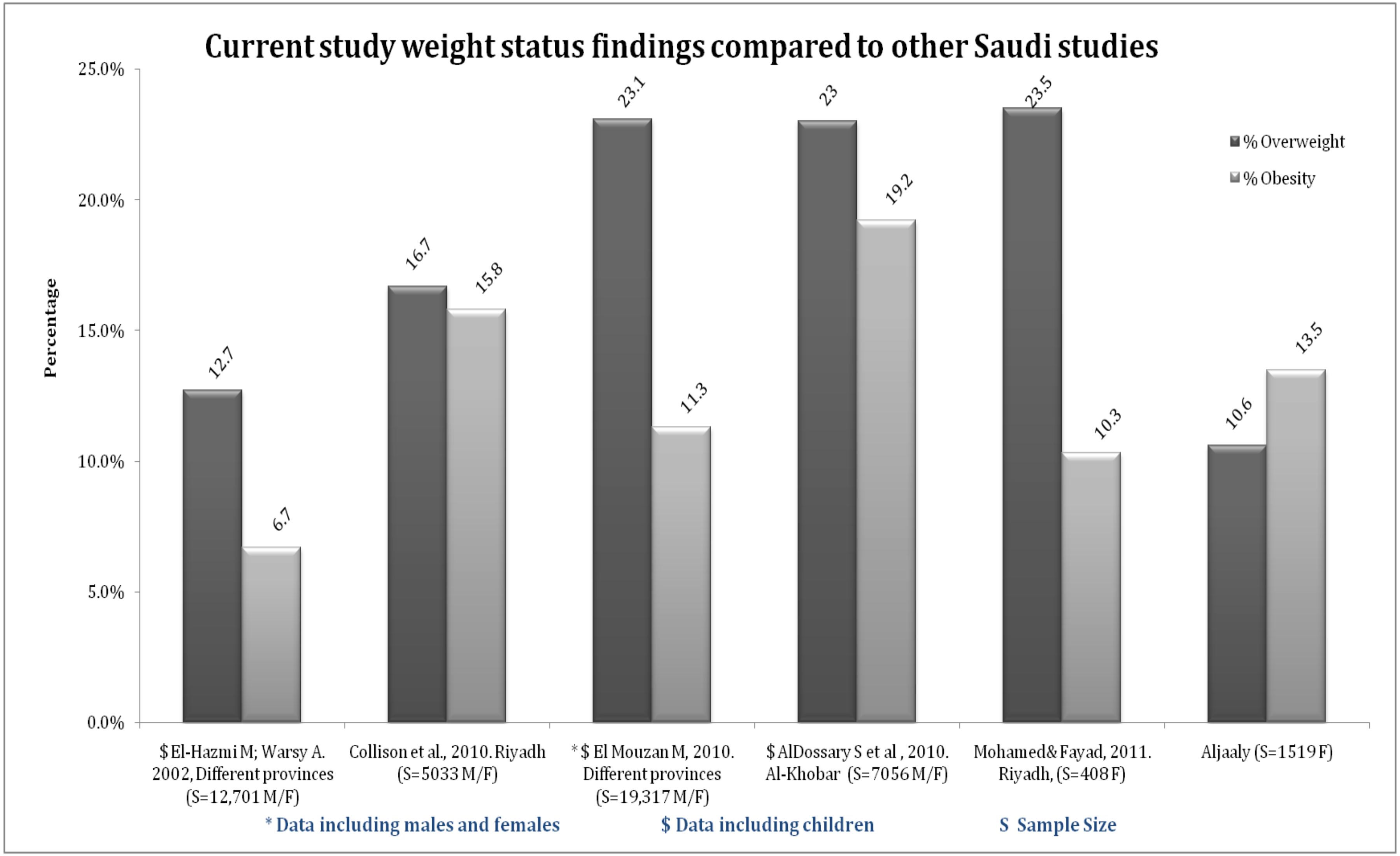


Figure 18: Findings of overweight status in the present study compared to other Saudi studies

7.4.2 Anaemia status

Despite the favourable socioeconomic status of the present population, anaemia is considered as an important public health problem among Jeddah schoolgirls. The 29% (venous blood test) to 40% (finger blood test) of adolescent girls who were anaemic by the WHO definitions of anaemia (Hb<120 g/L) (Benoist *et al*., 2008), classify Jeddah intermediate and high schoolgirls as having a moderate-to-severe public health problem of anaemia (20-39.9% and > 40%), respectively. Anaemia prevalence did not statistically differ by age group, nationality (Saudi or non-Saudi) and other socio-demographic factors such as maternal working status and family size or affluence. However, anaemia was significantly more prevalent among governmental school attendees, compared to their private school attendees. This was in agreement with the study of (Abalkhail and Shawky 2002). This trend could reflect the effect of socio-economic differences between the two populations based on the school type. The youngest and eldest reported ages at menarche in this study were 9 and 16 years respectively, and anaemia was marked more in menstruating than non-menstruating girls. This was in agreement with (Abalkhail and Shawky 2002). However, statistically it did not reach a significant difference. In addition, anaemia did not statistically differ by body mass index, which is consistent with previous Saudi studies. Eating practices were found to affect adolescents' risk of anaemia, particularly iron deficiency. However, in the present study, a number of factors related to eating behaviours were not associated with anaemia. In addition, anaemic girls did not report any differences in physical activity patterns, compared to their non-anaemic counterparts. The only factor related significantly to anaemia status was vegetarianism (P=.039). Theoretically, vegetarians have a lower dietary intake of biologically available iron, and the present study demonstrated that the vegetarian group has better iron status than the non-vegetarian group.

7.5 Factors influencing the nutritional status of the participants

BMI & centralized fat status of Jeddah adolescent girls

Despite the increasing prevalence of overweight and obesity in Saudi adolescents, the number of factors demonstrated by international research to be significant in determining the types of foods this group eats has not been extensively examined by Saudi studies. These studies were mostly cross-sectional in nature and examined bivariate relationships between adolescent overweight and individual and/or family risk factors. Socioeconomic status such as parental work and education were also considered. Studies in Saudi Arabia have also examined physical inactivity and a family history, in addition to, television use and diet (Alwan & Zamakhshary 2009). However, these risk factors often do not occur in isolation, and the ecological system theory used for this study emphasizes the importance of considering the individual as well as the environment within which the adolescent girls exist. Behavioural choices are made within the broader social environment, including the family and friends, community and the societal environment. The present study showed a strong association between a number of factors and both weight status (overweight weight and underweight) and fat status of Jeddah adolescent girls. These associations include factors that are related to participants' unique environment such as biological factors, eating habits and lifestyle, and factors those related to the shared environment such as family, places where they access food and societal influence.

7.5.1 Socio-demographic characteristics

Family income, size & affluence

Socio-demographic and socio-economic data in the present study showed that in general more than half of the participants' families aged 14-18 years had a relatively high monthly income (>7500 SR). This is in accordance with results of a previous study conducted in the Eastern Province of Saudi Arabia which, found that 22% of families have a monthly income of more than 7000 SR and 36% had an income of >10.000 SR per month (Al-Saeed *et al.,* 2006). In the Central region of Saudi Arabia, (AL DISI 2008), found that about 46% of her Riyadh population (n=126 girls 14-18 years), came from families with a monthly income of more than 6000 SR. Half of the present participants' families were living in independently owned apartments or villas and more than 50% had live-in domestic workers in their houses. No differences were found in overall demographic data, including family income (for families of 14-18-years girls), family affluence or size from the family, between the normal and overweight groups or the normal and underweight groups.

Nationality

In addition, comparison of the three weight categories by nationality showed statistically no significant difference in the rates of underweight, normal or overweight between Saudi (62%) and non-Saudi girls. The findings were confirmed by the results of (Al-Dossary *et al.,* 2010). Their results revealed that weight status of adolescents who live in the Eastern province of Saudi Arabia were not significantly associated with nationality (Saudi & non-Saudi). The insignificant differences in the prevalence of weight status groups based on socio-demographics, mainly among Saudi and non-Saudi girls in this study could point to the role within the environment such as the community where this group has access to food (e.g. in schools, restaurants, or at home).

Age

The prevalence rates of overweight and underweight were not significantly associated with age groups, P=.06 and P=.35 respectively. This was in agreement with (Fayssal *et al.,* 2007), who studied a group of boys and girls (n=1454) from three of the five provinces in Saudi Arabia, including Jeddah city. The studied subjects were in the age range 12-19 years. Fifty-four percent of participating girls had no significant differences in BMI status according to their age while a significant difference according to age was found among boys in the same study. The results are in agreement with data from the Central region that demonstrated no differences in BMI according to age group among girls (Collison *et al.,* 2010). The results contrast with data from the Eastern of Saudi Arabia where overweight status increased progressively with age (Al-Dosary *et al.*, 2010).

The study of Collison *et al.,* (2010) incorporated WC measurements, in addition to, BMI and the study allowed for evaluation of differences in WC according to age among the participating girls. The results showed a significant increase in WC with increasing age. The results conflict with results of the present study which showed a significant difference (P<.001) in WC between the two studied age groups, but waist size was greater among the younger group who aged 13-15 years than girls aged 16-18 years.

School Type (as an indicator of SES)

Concerning overweight status, a significant difference was found between girls who were attending governmental sponsored or private schools. This indicates that socio-economic class based upon the school type has an influence on overweight among private and public schoolgirls in Jeddah. Different findings were reported on another study by Al-Saeed, who found that private schooling, in addition to, other indicators for socioeconomic class based on scores related to father's work, occupation and family income had no influence on overweight status (Al-Saeed 2006). The literature is inconsistent as there are reports of obesity being more prevalent among low socioeconomic class than high SES. For example, studies in industrialized countries showed that children from families with lower socioeconomic status suffer from excess weight compared to those from high SES (Langnase *et al.,* 2002). Yet in the present study, overweight status was less prevalent among public school attendees compared to private school attendees. A higher number of underweight girls was observed at public schools. Sixteen percent of underweight students were attending public schools compared to 7.9% at private schools.

Mean BMI z-scores of private schoolgirls based on the WHO reference population was significantly higher than that of public schoolgirls (P<.001) which confirm that lower socio-economic class based on the school type is associated with underweight status of Jeddah public schoolgirls. Besides, significant differences in waist size (at 75th percentile) and waist-to-height ratio (at 0.5) were demonstrated by the present study between girls who were attending public and private schools, and again showed the influence on girls coming from public schools who were more likely to have greater WC and WHtR, compared to their counterparts in private schools. However, other Saudi epidemiological studies on the area of centralized fats, based on both WC and WHtR and their associations with socio-economic status, were not available for comparison of our results. Our data points towards a need for further studies on adolescent girls and the effect of socio-economic status of central adiposity, using both WC and WHtR measures.

Mothers' occupation

In comparison to unemployed mothers, employed mothers have reported less time for meal preparation. Employed mothers also tend to have different eating patterns at work, which influence food preferences and meal planning at home (Story *et al.,* 2002). However, in the Saudi community, the presence of domestic workers from other countries with different culture and background are mostly responsible for food preparation even if the mother is not working. In the present survey, the majority of mothers were unemployed, and mother's employment status was reported only by 23% (n=332) of the participants. Abalkhail and Shawky (2002) reported a smaller proportion of Jeddah working mothers (12.8%). This showed an increase in mothers' employment in Jeddah. Moreover, this employment rate is considered higher than in other regions like Riyadh. For example, AL DISI in 2008 reported less than 18% of working mothers in Riyadh. Mothers' work status was associated with girls' weight status, and daughters of employed mothers were more likely to be overweight compared to unemployed mothers.

7.5.2 Biological and health status

Anthropometric indices such as BMI and WHtR were found to be significantly associated with biological factors such as attainment of menarche, having medical problems and mineral/vitamin supplements. Characteristics such as urban dwelling, those with higher socioeconomic status and better house quality and facilities have been demonstrated to attain earlier menarche (Adair 2001).

Average age at menarche among participants was 12.6 year with SD of 1.2, which is earlier than that reported fourteen years ago by EL-Dosoky and Al-Amoudi (1997) between Jeddah adolescents of the same age group. These differences might be due to environmental variations between both populations. Age at menarche could be affected by both present and past nutritional status. However, this data only reflects the present nutritional status of the girls due to the cross-sectional nature of the study. Although the present participants were asked to report their age at menarche as age in years and months, most girls have reported their age at menarche as age in whole years only and the data about age at menarche may not be very precise. Therefore, in the present study, the cross-sectional methodology with self-reported age at menarche could be submitted to various biases.

Attaining menarche was reported by about 90% of the present sample population. Based on the school type as an indicator for SES, the present survey demonstrated an earlier onset of menarche in the private schooling girls compared with the public schooling girls. All populations of the present study were urban. A higher proportion of girls who had not started menstruating at the time of the survey were among the underweight group, compared to other groups. In addition, underweight girls reported later onset of menarche ($\geq$12 year), compared to other groups. This is in agreement with literature as under-nutrition is associated with the later onset of menarche (Rogol *et al.,* 2000).

A barely significant difference in attaining menarche (P= .54) between overweight and normal-weight girls was demonstrated in the present study. A significant difference (P<.001) in the onset of menarche in the overweight group compared with the normal-weight group was also publicized. A higher number of overweight girls started menstruating at the age of 12 or after 12, compared to the underweight group. At the age of less than 12, higher proportion of girls (43.2%) who attained menarche were overweight compared to underweight girls (5.2%). On the other hand, 64% of those attained menarche at $\geq$ 12 had normal weight. However, among the overweight girls, a higher proportion of girls reported attainment of menarche at the age of <12 (43.2%) than at the age of $\geq$ 12 (21.3%). This is in disagreement with other international studies as the higher, the BMI, the lower is the age at menarche (Goon *et al.,* 2010) and (Acharya *et al.,* 2006). On the other hand, girls who attained menarche at the age of $\geq$12, had greater WC and WHtR compared to those who attained menarche at the age of <12 (76% vs. 24% respectively).

About one-third of participants reported having medical problems. Reporting of medical problems was significantly associated with a higher BMI, and overweight girls reported more medical problems compared to their underweight counterparts. The majority of overweight girls reported medical problems such as allergy, asthma, anaemia, and gastrointestinal disturbances.

Consumption of vitamin and mineral supplements is common among adolescents. The use of some of these supplements (e.g. multivitamin tablets, vitamin C and iron tablets) was reported by adolescents aged 11 to 18 years for reasons such as health, prevention of illness, sports performance, parental control, energy and poor diet (O'Dea 2003). Consumption of vitamin and mineral supplements by participants of the present survey, particularly iron supplements, was significantly associated with mean BMI z-scores (P=.008). The mean BMI was significantly higher (M=-0.269±1.5) among those who was using vitamin and mineral supplements, compared to those who were not consuming them (M= 0.018±1.5). Overweight girls were more likely to take iron supplements than other weight groups. The study also demonstrated a higher prevalence of anaemia status among the overweight girls [n=32(7.8%)], compared to the underweight group [n=13 (3.2%). However, no associations between iron status and iron supplement consumption was noticed among the present participants. The high consumption of iron supplements among the overweight group (43%) could be attributed to advertising and marketing of vitamin and mineral supplements, since the study has revealed that overweight participants had more reliance on media and advertising, and more concerns about the influence of media on their food choice. In addition, a higher exposure to screen time by the same group (24.3%), compared to their underweight counterparts (14.9%), was observed. However, information about the effect of media on the consumption of food supplements such as vitamins and minerals was not examined in this thesis and should be studied in further research.

7.5.3 Adolescents' knowledge, attitudes, and perceptions (psychosocial factors)

Participants' knowledge

More than one-third of participants reported reading books, magazines and comics. In addition to that, more than 40% of the participants are influenced by these sources in choosing their food. More than 40% reported concerns about the media in relation to information about diet issues. Al-Almaie (2005) also reported considering media as the main source of knowledge about health and disease on 1331 adolescent girls in Al-Khobar Area, Eastern Province of Saudi Arabia. The study aimed to assess the level and sources of knowledge about food and healthy diets among boys and girls in intermediate and high schools. In the same study, the main source of knowledge about health and disease reported by the female respondents were television, which was reported, by 61% of girls, followed by magazines that were reported by 39% of girls, and daily newspapers were reported by 34% of girls. However, a weak association between nutrition knowledge and dietary behaviours in adolescents was confirmed in another study (Axelson *et al*., 1985). In the present study, differences in nutrition and health knowledge were noted between overweight girls and their underweight counterparts, indicating that overweight girls were more likely to be affected by reading books, magazines and comics. Furthermore, girls with a greater WHtR were more likely to read or follow media concerning diet issues, compared to their counterparts who had lower WHtR (<0.5).

Perceptions of body image

Previous studies have confirmed that adolescent girls' perceptions of body weight affect their nutritional status (Ojala *et al.,* 2007). The majority of Jeddah adolescent girls had positive perceptions of their body image (74%) and health status (84%) in comparison to their friends and more than half of participants reported watching their figures regularly. The present study thus did not support previous research suggesting that adolescents under the age of 18 are unhappy with their body size. Girls with positive perceptions about their figures were more likely to have lower WHtR of less than 0.5, compared to those with negative perceptions. On the other hand, 5.8% of underweight girls thought that they were too fat, 8% had attempts to lose weight and 7% were on actual weight reduction diets at the time of the survey. This could reflect the possibility of the existence of nutrition disorder diseases such as anorexia nervosa, which was beyond the scope of this thesis; however, we recommend that such nutrition-related problems to be investigated in future research.

In addition, the family's attitude towards girls' weight change was demonstrated to play an important role in the present survey. Thus, family encouragement for girls to change weight was positively associated with girls' BMI and WHtR status in all groups. Overweight girls were more likely to be encouraged by their parents to change weight compared to normal weights (39% vs. 60.7%). Parents of underweight girls were also more likely to encourage their daughters to change their undesirable weight compared to normal weights' girls.

Other family influences that could influence girls' body dissatisfactions are girls' thoughts about their parents' body figure. Overweight girls and girls with higher WHtR were more likely to think that their mothers are too fat. Underweight girls and those with lower WHtR thought that their mothers were too thin compared to their normal weight and those with lower WHtR counterparts, respectively. All these patterns indicate that family influences are strong and play a role in girls' body satisfaction and decisions to change their weight.

Dieting practices

Dieting practices, particularly 'weight control behaviours' are highly prevalent among girls in developed countries, compared to their male counterparts. It is also considered as one of the important driving forces that significantly affects young girls' nutritional status. The behaviour could include different techniques such as fasting for long hours, taking diet pills, vomiting and the use of laxatives. In addition, other healthful behaviours practiced by adolescent dieters could be included (Story *et al.,*2002). The present study intended to document the prevalence of changing weight behaviour in Jeddah young girls, to examine associations with nutritional status according to these practices. To our knowledge, no recent study has addressed this issue in Jeddah adolescent girls, and information are limited or absent from other regions in the country.

The desire to change weight, particularly 'weight reduction' was demonstrated by this survey as common among more than half of Jeddah young girls. About one-third of girls were actually trying to lose weight at the time of the survey. On the other hand, 20% (mainly underweight girls) were trying to gain weight. The findings of this survey demonstrated highly significant differences according to z-scores BMI, weight status and WHtR according to dieting practices of participants.

The desire to lose weight among Jeddah girls may be related to peering competition and dieting to fit into fashionable dresses. The peer competition is chiefly in social events and parties where girls congregate or where female family members are present at social events, and looking for wives for their sons. In addition, a slim body shape is very important in preparation for marriage and a slim bride can reflect her attractiveness, which is the same as in Western countries. This could also refer to media influence, and the present sample has demonstrated a high exposure to media. Concerns about media influences on food choice were highly observed among participants. The study has showed that some girls [15% (n=229 out of 1494)] solicit the help of health professional when they plan to change their weight.

Perceptions of healthy eating

Positive self-perceptions of one's own healthy eating has been considered as good predictors of eating behaviours in adolescents (Gracey *et al.,* 1996), The present survey suggested the importance attached to girls' negative concerns about their own healthy eating as a determinant of BMI status at all levels. Overweight girls' negative perceptions of healthy eating were strongly (P<.001) associated with their weight status while a lower level of significance (P=0.02) was related to girls' underweight status. Overweight girls were less likely to report believes on their healthy eating habits, compared to normal weight girls (32% vs. 68%). On the other hand, underweight girls reported positive thoughts of their healthy eating.

Performance of physical activity

Participants reported concerns related to physical activities. For example, a high proportion of Jeddah girls thought that they were more active in comparison to peers and friends. Commonly, they reflected the same levels of physical activities in holidays, in comparison to school days, and most of the participants considered they perform enough exercise to keep them healthy. The study also showed there were some differences in girls' nutritional status according to girls' perceptions of physical activity patterns. Students, who considered that they were performing enough exercise for their health, were significantly characterised to have a lower mean BMI z-scores, lower WC values and a WHtR <0.5 compared to those believed they were not performing enough exercise. The overweight girls were also more likely to consider their levels of physical activity as an average in comparison to others in the same age, compared to underweight girls. Girls with a higher WHtR, were less likely to rate their performance of physical activity as an average, compared to those with a lower WHtR. However, it is important to note that when looking at the actual performance of physical activities at different levels among participants, girls who reported playing sports at fitness centres (13%) had significantly higher WHtR of >0.5, compared to those who had no access to fitness centres. Girls with greater waist size were more likely to perform physical activities outside the school environment, and to perform moderate activities such as cycling and swimming, compared to those with lower WC at the 75th percentile.

Moreover, findings confirmed no significant associations with nutritional status based on other indices such as BMI status or WHtR and the rest of physical activity levels or other behaviours such as smoking. This is in agreement with Fayssal *et al.,* (2007), who found that physical activity at different levels and smoking habit did not significantly relate to BMI on the 12-19 years-old population from three different provinces, including the Western province of Saudi Arabia.

7.5.4 Food and drink consumption, food patterns, behaviours, and lifestyle

In common with other national and international adolescent girls, Jeddah girls' eating patterns were characterised by skipping breakfast by ¾ of Jeddah teen girls and a high frequency of soft drink consumption (mainly sugar-sweetened) by 90% of girls. In addition, consumption of snacks was reported by 90% of participants and mostly categorised as HFSS food. In addition, a high frequency of meals consumed outside the home, mainly in the form of fast food was prevalent among 72% of girls, and visits to fast-food restaurants were reported at an average of once-twice and three-four a week by 42% and 31%, respectively. This was accompanied by a decrease in reported weekly consumption of fruit and vegetables that was either referred to as rarely or never consumed in an average week. However, Jeddah adolescents in general were previously found to prefer vegetables and fruit in their diet compared to those from Northern and Eastern regions (Fayssal *et al.,* 2007). Comparisons of both results might indicate a possibility of misreporting by present respondents, and the literature concluded that adolescents are less interested to give accurate reports compared to other age groups (Frances *et al.,* 2008). Additionally, inconsistent eating times were also noted among half of the Jeddah girls (e.g. eating before going to bed). These observations tend to substantiate results of other studies, which shows that the quality of children's and adolescents' diets in Saudi Arabia in common with most parts of the world decrease over time, possibly due to a socio or physical environmental influences (Story *et al.,* 2002). The present thesis examined some impacts on these types of behaviours related to increasing exposure to external influences such as schools and advertising. Findings demonstrated that healthy foods such as fruit and vegetables were not available in schools and were rarely to be advertised by media. At the same time, availability of foods such as fruit and vegetables in the country should not be considered as a barrier in affording them because they are considered inexpensive, particularly those purchased from local markets. Besides, this study has confirmed that in terms of socio-economic status based on school type, no differences in the frequency of fruit and vegetables' consumption.

Eating outside and fast food consumption

Frequency of fast food use has been reported to positively correlate with the overall quality of diet and barriers to healthy choice, and frequency of eating at fast-food restaurants, could affect consumption of fruit and vegetables (French *et al.,* 2001). The current study indicated that fast food was consumed by Jeddah schoolgirls at the level of one-two times, three times, or more a week. This frequency of consumption agrees with data from a similar urban population in the capital of Saudi Arabia, in which a frequency of 4.5 a week was reported by schoolchildren (10-19 years old) in Riyadh (Collison *et al.,* 2010). The reason for this similarity in consumption may lie in the fact that both populations come from cities that are characterised by an affluent lifestyle and infrastructure, including the availability of drivers in the house and the availability of a various number of fast-food outlets. In the present study, having a driver who can buy and bring this type of food to home or drive girls to restaurants that provide fast food, was reported by more than one-third of participants and some families were noted to keep more than one driver in the house. It is also notable in this survey that the mean BMI z-scores increase when the frequency of consumption of outside home food increases. In addition, eating outside the home 'even once a week' was more likely to be prevalent among overweight girls and girls with higher WHtR compared to normal weight and girls with lower WHtR.

Fast food meals are usually accompanied with carbonated beverages and a link between sugar-sweetened soft drink consumption and obesity in children been reported by epidemiological studies (Zamakhshary and Al Alwan 2009) & (Rodriguez-Artalejo *et al.,* 2003). Among Saudi children, (Collison *et al.,* 2010), reported a positive correlation of sweetened carbonated beverages with total sugar intake and total energy intake. In this study, a frequency of soft drink consumption (mainly sugar-sweetened) appeared to be associated with mean BMI z scores of girls, so girls who were consuming full-sugared carbonated beverages were more likely to have a higher mean BMI, compared to diet fizzy drink consumers. It is noteworthy that the study confirmed that the majority of Jeddah girls (94%) did not appear to have financial barriers to purchasing snacks or fast food since they had daily pocket money and consumption of snacks were prevalent among all girls regardless of their weight status.

Skipping meals and snack consumption

Skipping meals, particularly breakfast was described by (Sigulem *et al.*, 2000), to be high among 10% to 30% of adolescents from both United States and Europe and was associated with other lifestyle factors such as infrequent exercise and dieting or concerns about body weight. However, the current survey proved a much higher prevalence of skipping breakfast (75%) among Jeddah adolescent girls. Overweight girls were more likely to skip breakfast compared to the normal-weight group.

BMI z-scores of Jeddah girls were found to be lower among girls who reported regular consumption of breakfast, compared to those who were skipping breakfast. Overweight girls were more likely to report a lower consumption of snacks than their normal-weight counterparts (28% vs. 72 %) were. This is because others usually accuse overweight girls for consuming more food, so they underreport their actual food intake.

7.6 Social determinants of adolescents'' eating behaviours and nutritional status

7.6.1 Physical environmental influences (community settings)

7.6.1.1 Schools

In her review that aimed to present a conceptual framework for understanding factors influencing adolescents eating behaviours in 2002, Mary Story has considered that the physical environment within the community 'particularly schools' influences accessibility and availability of adolescent foods, and they are considered the most influential in affecting food choice of adolescents. In addition, in Saudi Arabia, public schoolgirls are not engaged in any sport activity at school, and the World Health Organization (2002) has associated inequalities in education with the main determinants of health, such as the quality of the environment and health-related behaviour, such as nutrition. Differences in food habits and physical activities in terms of school type (public and private), were demonstrated in this study. The regulations and policies in providing school meals and access to physical activities are different in both sectors. However, these differences might be partly due to socioeconomic inequalities, which were based on the school type as an indicator of socioeconomic status of the respondents.

The present study is the first in Saudi Arabia to use the nutrient profiling system (NP) in analysing school meals and snacks. As presented above, the NP used in this study was developed by the UK FSA for processed foods in school and has introduced both in primary schools in 2008 and secondary schools in 2009 (Simpson *et al*., 2006). The analysis of actual snack and beverage menus served in Jeddah school canteens showed that most of the provided snacks and meals (in the academic year 2008-2009), in both sectors, were HFSS foods. Snacks provided in governmental schools were including a higher proportion of non-HFSS items such as un-sugared-juices (100% juice) and cheese bars, compared to those provided by the assessed private school. However, the availability of healthy choices such as fruit and vegetables were very low in both sectors. The first School Canteen Survey in Dubai (Zain 2008) reported similar findings. The report was released in 2010 noting that almost half of the schools do not offer fresh fruit to students as a food choice. Looking at the situation in the United Kingdom, the UK government has banned all HFSS foods (including crisps, carbonated beverages and chocolate) from school meals and vending machines since September 2006 (Department for Education and Skills departmental 2005). Governmental-sponsored schools in Saudi Arabia provide the same menus in both educational levels, while each private school has its own menu and arrangement in providing meals and snacks. Some private schools have contracts with more than one restaurant to deliver daily meals to students based on their selected choice of meals on the previous day. Girls those not order from these restaurants can purchase food available in canteen that also provided by different fast food establishments (personal observations & contacts with students and teachers). It is important that school canteens should take an active role in providing nutritious food and beverages. In addition, the use of nutrient NP to assess schools' meals and snacks, periodically in schools, could encourage all caterers to provide healthier food items.

Fast-food restaurants and outlets are located in-school neighbourhood, and they are widely visited by students immediately after school. Both school sectors do not provide carbonated beverages, and vending machines are not located in all schools. However, school administrators have no control on what girls bring into school. Moreover, vending machines are located around many schools, in particular 'the governmental sponsored ones, and minutes after leaving school, students can access this machines and purchase food and beverages from them. The majority of the items purchased from vending machines include food and beverages, which are mostly carbonated beverages, candies, chocolate and salty snacks.

It appears from the data presented here, that food habits of Jeddah girls are formed or influenced at school and around the school. Students have access to money, to school canteens, vending machines and fast-food outlets near school, which might create a temptation to buy a range of foods that, could be less healthy. About 86% of students bought food from schools with no difference in terms of school type or in having daily pocket money. These results coincide with Abalkhail and Shawky (2002), who found that most Jeddah adolescent girls were not taking breakfast at home, and they relied on snacks available at school canteens.

No significant relationship was found between private or public schooling and girls' weekly consumption of fruit and vegetables. Despite the non-significant relationship, public students were more likely not to take any portion of fruit or vegetable over the course of a week, compared to their private student counterparts, and higher proportion of private students reported that they consumed vegetables three times or more in the previous week than did public students (26% vs. 20%). These results are in agreement with (Musaiger *et al*., 2005), who found in a similar population from Jeddah city that consumption, was lower among girl students from the governmental schools, compared to students from private schools (19% vs. 23%). This behaviour may be due to the very low availability of these food items in school canteens and the lack of nutrition and health education in schools, particularly in public schools. The only difference in the two groups in the present study was in the type of carbonated beverages consumed, so girls from public schools were more likely to consume full-sugared carbonated beverages, compared to their counterparts from private schools (89% vs. 81%). This might be due to the widespread belief among some Saudi girls who consumption of non-sugared beverages helps in weight reduction. It also could be due to the more access to nutrition and health education in private schools. Despite the significant difference in the type of fizzy drink consumed, a higher proportion of girls from private schools was consuming carbonated beverages, compared to girls from public schools. This is compatible with Musaiger *et al.,* (2005), who noted that one-third of the girls consumed carbonated beverages in a daily basis (23% in governmental schools compared to 29% in private schools, and the consumption was mainly, related to their meals outside the home. The present study confirmed that the girls from private schools eat more frequently (one-two times/week) outside home, compared to those in public schools.

Furthermore, girls' wishes and attempts to reduce weight were significantly more prevalent among girls from the private sector, compared to those from the public sector. This might be due to the higher proportion of overweight girls in the private sector. Moreover, this could be related to perceptions about the right body image given that girls from public schools were significantly more likely to have a positive perception about their body figures, and a higher proportion thought that they had a good body shape, compared to their counterparts from private schools.

Girls from private schools were more likely to think that they and their mothers are too fat, compared to girls from public schools. Their parents were also significantly more likely to have many attempts to lose weight, and they were more likely to encourage their daughters to lose weight, compared to girls from public schools.

Schooling type was significantly associated with knowledge of girls, particularly from media sources (*P*=0.03) and private schooling girls were reading more books and magazines than public schooling ones, though knowledge alone is not enough to motivate girls to implement healthy eating patterns (French *et al.,* 1999). Obesogenic diets can be rectified through better cooking, higher-quality food and direct action in schools, which was applied by Oliver when he took responsibility for training and education of both staff running school meals and children across many schools in Britain (Jamie's School Dinners, 2005). Despite the fact that physical education classes were only included in private schools' curriculum, girls from public schools were more likely to prefer having physical education classes at school, compared to girls from private schools.

Although girls in public schools were not engaged in sporting activities at schools, they had significantly been more positive perceptions of their performance and levels of physical activities, compared to their counterparts in private schools. This could be due to their higher involvements in light activities such as food preparation or cooking and cleaning after school. In addition, activities at school in the form of walking and the frequent use of school stairs were noted among the group. The study's findings also demonstrated that girls in public schools are more likely to walk to school, compared to their counterparts in private schools. Private schooling girls were more likely to be involved in physical activities that rated to be moderate to high activities such as swimming and sports at fitness centres. At the same time, they spent more hours on television and computer. They were also more involved in food shopping for family groceries than their counterparts from public schools. Looking at the type of physical activities performed by both groups, we can say that girls from private schools are more likely to perform physical activities that are more affordable by those with higher socio-economic status, compared to those from low SES. Thus, the significant differences in physical activity performance could be related to the socio-economic status of participants rather than to the access to physical activities at schools. Musaiger and colleagues reported in 2005 that, among 512 Saudi adolescent girls in Jeddah, 40% of adolescents in governmental schools do not perform any type of physical activities while 60% of adolescents in private schools were performing different types of physical activities. The last decade has witnessed an increase in participation in physical activity among governmental schoolgirls in Jeddah city, regardless of the restrictions in schools, and this could be due to the increased awareness from other sources such as the media. The findings of the present study demonstrated that media and commercialism affect all Jeddah adolescents, irrespective of their schooling type.

7.6.2 Macro-system influences (societal)

7.6.2.1. Media and food advertising

The survey study verified that Saudi adoelscents are living in a media saturated environment of all kinds. In addition, the media was regarded as one of the important sources of health information by respodents of the present study.

Although the mass media was found to reach Saudi adolescent audiences through both channels of communication, print and electronic media, the focus in this thesis was on television, the source of a societal force that has brought the larger world into Saudi homes, as an environment and an individual source through free-to-air commercial satellite channels. The study presented the first descriptive analysis of television advertising viewed by Jeddah adolescent girls, and the data collected and analysed has not been previously carried out by others in the region (to our knowledge). In addition, no self-reported data was collected, so the data collected was objective and not subject to bias. The analysed period is a defined time, occurring only in the period between 18 to 25th of March 2009 and a weekend of the October 2009. However, only a portion of the television advertisements on TV was viewed; therefore, this is only an estimate of what may be actually seen by an adolescent girl viewer.

Based on the television channels viewed by adolescents aged 13 through 18, the results showed that Saudi adolescent girls could see up to 21-aired product advertisements over 9.6 minutes in every hour of programming. Among total non-programme content time, food and drink-related products accounted for roughly 18% of advertising exposure (n=6,272). This compares to 13% of total advertising time for the food seen by children in the United Kingdom in the same year (Ofcom 2009). Of the total 1106 food and drink advertisements, 70% of the analysed food advertisements were for products that were high in fat, sugar or sodium (HFSS), or low in nutrients. Compared to the USA Batada *et al.,* (2008), the proportion of HFSS foods in the present study is less promoted (70% vs. 90%). The researcher was not able to analyse most of the advertisements (58%) because most of the products had no list of ingredients or nutritional breakdown on their labels, which confirm the importance of including such legislation in Saudi Arabia like in other countries such as European countries. The present study showed that only 27% of food advertisements directed to Saudi children, and adolescents contained health and/or nutrition or physical activity messages, compared to 50% of Batada *et al.,* 2008' study. Analysis that was conducted on the content of school meals showed that school meals have very high HFSS content as well and some food items also are not including any nutrition facts in their labels. Most of the advertised food and drink items on the studied Saudi TV channels are items that are within the reach of adolescents own purchasing power. Some of the advertised items were also provided by school canteens in both sectors, which confirm the power of media in Saudi Arabia. More interesting, participants who were viewing TV for longer hours were more likely to buy food from school canteens, compared to their counterparts who watch TV for less than two hours/day. Most of the advertisements (92%, n=1022) were aired inside programming. There is evidence showing interrupted commercials are more effective than uninterrupted ones because viewers, particularly young ones may give closer attention to the advertisement before deciding to ''click'' away from it (Zufryden *et al*., 1993). About 45% of the food advertising broadcast inside popular programming among the audience in either late afternoon to midnight period or late at night, and the survey showed that most of the partcicpants go to bed late at night. Weight of characters who were presenting advertisements was mostly average (89%), and the survey results showed that Jeddah girls accurately perceive average (normal) body size.

Fast-food restaurant advertisements were found to make up 76.6% of advertised food in MBC4, compared to only 23% of their advertising on MBC1 with no advertising in MBC3. The older group (16-18 years), mostly viewed MBC1 and four. The use of local language in advertising increases the effectiveness of the communication (Stewart 1994). In the present study, some of the international fast food brands such as McDonald's or KFC were advertised in the national Arabic language.

As mentioned above, there are about 25 Saudi snacks' producers and half of them are located in Jeddah. The most popular produced snacks in Saudi Arabia are savoury snacks. This is in addition to some types of confectionaries and chocolates (Department of Commerce and Department of Agriculture 2011). The present study noted that the highest proportions of advertisements were devoted to sweets, beverages and confectionery, which accounted for 18% while cereal advertisements made up 11.9% and were mostly broadcasted to children in MBC3 (children's channel). MBC3 was the most viewed channel by our younger group of girls (13-15 years), who were also more exposed to screen time ($\geq$2 hours or more), compared to their 16-18-years counterparts. The finding of the proportion of fast food and cereal products (mostly pre-sugared) was similar to finding in USA (Powell *et al.,* 2007).

A significant difference was found in the promotional techniques and channels used by food marketers between those directed to children and young people, and those directed to adults. Promotional techniques used to presuade children and adolescents were as follows: advertisments were mostly animated and presented by cartoon characters. Often, they were presented with identification of sponsorship, price incentives, free gifts and celebrity endorsment. This is in agreement with the promotional methods found in other studies that were conducted in developing countries. The evidence also defined that marketers in developing countries to follow the same methods used in developed countries (Cairns *et al*., 2009). However, participants of this survey are expected to watch significant levels of adult programmes. (Ofcom 2004), found that most of the television advertising seen by children is outside children's airtime.

7.6.2.2 Media effects on eating behaviours and nutritional status

Previous international research, particularly in Europe, including the United Kingdom and in the USA has comprehensively studied and reviewed the evidence on the impact of food advertising on children and adolescents' food choice. However, few studies have investigated the media effects on eating behaviours of Saudi and other Arabian Gulf States' adolescents. Of this research, limited studies have looked at the association between screen time and obesity while most studies on obesity have relatively ignored the media influence on eating behaviours and nutritional status of adolescents.

The current evidence has illustrated that food promotion has a significant impact on food choice, consumption and purchase of children and adolescents. In addition, developing countries, including Saudi Arabia are following the same methods of marketing used by developed countries (Cairns *et al.,* 2009). Livingstone and Helsper (2004), have recommended that studies aim to evaluate the impact of food advertising on adolescents' food choice, should not be interpreted alone, and to consider the possibility of their interacting with other factors in both personal and environmental levels. Therefore, in a trial to follow the advice of experts, and to compare the present thesis' findings with the current evidence, results of two studies (survey and descriptive of TV adverts) were integrated. The actual results relating to the extent and nature of the promoted food items, was compared with the survey's results that looked at girls' self-reports of concerns about media influence on their food choice. Questions that were designed to solicit information regarding media (books, magazines, computer and computer games and TV viewing) and girls thought about their effect on eating behaviours and nutritional status of Jeddah young girls, especially through the use of food advertisements was used in this integration. Screen time, thought about influences of TV advertising and TV characters on eating behaviours were considered, in particular.

7.6.2.3 TV- viewing

Television viewing has been used in many studies as a separate and main outcome to assess food promotion exposure. However, this thesis used both television viewing and concerns about food advertising in shaping food patterns and other lifestyle behaviours as outcome measures. The study demonstrated a number of statistically significant associations between thoughts of influences of food advertising on food choice or television viewing and respondents' behaviours and dieting practices. However, no statistically significant associations were related to weight status, adiposity or anaemia.

Both television viewing and concerns about food advertising on food choice were significantly associated with preferences for carbonated beverages, P=.001 and P=0.02 respectively. Therefore, girls exposed to television or had positive views of TV advertising were more likely to consume carbonated beverages. In addition, eating outside home for three times or more per week, and eating in front of the television was significantly associated with screen time, P=.013 and P<0.001, respectively. They are more likely to be prevalent among girls of higher television exposure (>2 hours) or those with stronger perceptions about food promotion compared to girls of less exposure to screen time (<2 hours) or girls with less influence by media. On the other hand, TV advertising followers were more likely to follow and practice different types of dieting. They are also more likely to be involved in food shopping and groceries and to consume desserts, sweets and chocolates, compared to non-followers. Cairns *et al.,* (2009) have conducted a review of the evidence on the extent, nature and effects of food promotion to children in both developed and developing countries. The evidence from her study indicated media food promotion as significantly having an impact on eating behaviours and food patterns of children and adolescents. She also concluded that TV watching has the potential to influence outcomes in many ways such as its replacement of other physical activities, and associations with food habits such as snacking. The present study could support the previously reviewed evidence with a number of findings. Firstly, long exposure to screen time per day was significantly associated with other sedentary leisure-time behaviours (e.g. computer use and time spent on homework), so girls who watch more TV, use computers more but spend less time on homework. This was also compatible with Dietz and Gortmaker (1985) who found that young persons who were engaged in less physical activity watched more TV per week (Dietz and Gortmaker 1985). Additionally, and significantly, girls that spend more time on TV watching, have fewer hours of sleep and descriptive analysis for TV advertisements demonstrated that the majority of food advertising was in the period from 6:30pm to midnight (after-school viewing or prime time). Furthermore, girls who keep themselves busy with household work such as cleaning up and washing up are less interested or have less time for TV watching. Moreover, girls who viewed TV for longer periods felt hungrier and consumed fruit less frequently, compared to their counterparts who were less exposed to the screen. In addition, only 5.6% of food advertised on the studied MBC channels was devoted for fruit.

Despite the significant relationships, girls who were exposed to screen time for two hours or more and girls who were influenced by TV promotion were more likely to be overweight (BMI>85th centiles), had higher WHtR of >0.5, compared to those who were less exposed to screen time or those who reported fewer concerns about TV promotion.

Thesis findings and the theoretical framework

In this section, the thesis findings are discussed in the context of the theoretical framework that was adapted from Story (2008), (figure 19). Each component of the individual, micro- and macro-systems, is discussed separately. Furthermore, these factors are linked to the various nutrition-related problems accordingly. This was done to enhance our understanding of the implications of these factors for the nutritional status of Jeddah adolescent girls. Moreover, it would help to inform policy aimed at addressing these problems among adolescents.

At the individual level, factors include SES, age and general health status. Other factors include irregular breakfast intake, fast food and snack consumption and dieting practices. Moreover, nutrition knowledge, perceptions of body image and healthy eating, TV use, physical activity, and sedentary activity are included. These factors were consistent with the elements of the theoretical framework provided at the individual level.

At the micro-system levels, factors comprise immediate social and physical environments that include variables specific to family/peers (influence on meals size), parents (parents' body size, parents' attempts to change weight, parents' concern about their daughter weight status, and parents' work status). Other factors related to the home environment (places where girls eat), outside homes (restaurants), school food and environment, and outside school (competitive food).

At the macro-system levels, the model also supports the broader impact of the macro systems such as media and food advertising; school meals provided, regulations in excluding physical activities from public schools, cultural norms that prevent girls from performing a healthy lifestyle such as outdoor physical activity and non-regulated food advertisements on Jeddah adolescent girls. Societal characteristics were found to play important roles in the development of some eating behaviours and weight status of the girls.

Figure 19 presents a conceptual framework that illustrates the main factors influencing Jeddah adolescent girls (individual and multiple layers of environmental factors, which in combination, they affect the eating behaviours of Jeddah adolescents and consequently, affect their nutritional status).

The conceptual model posits that the prevalence of current weight status (overweight and underweight) results from the environment in which these girls live. In addition, these various influential factors within the environment may vary based on different factors such as SES based on school type, nationality, knowledge, attitude, health status, eating patterns, screen time and other lifestyles. Some other risk factors were related to anaemia status. Risk factors that are related to the explored nutrition-related problems by the present thesis are presented in figures 20 and 21.

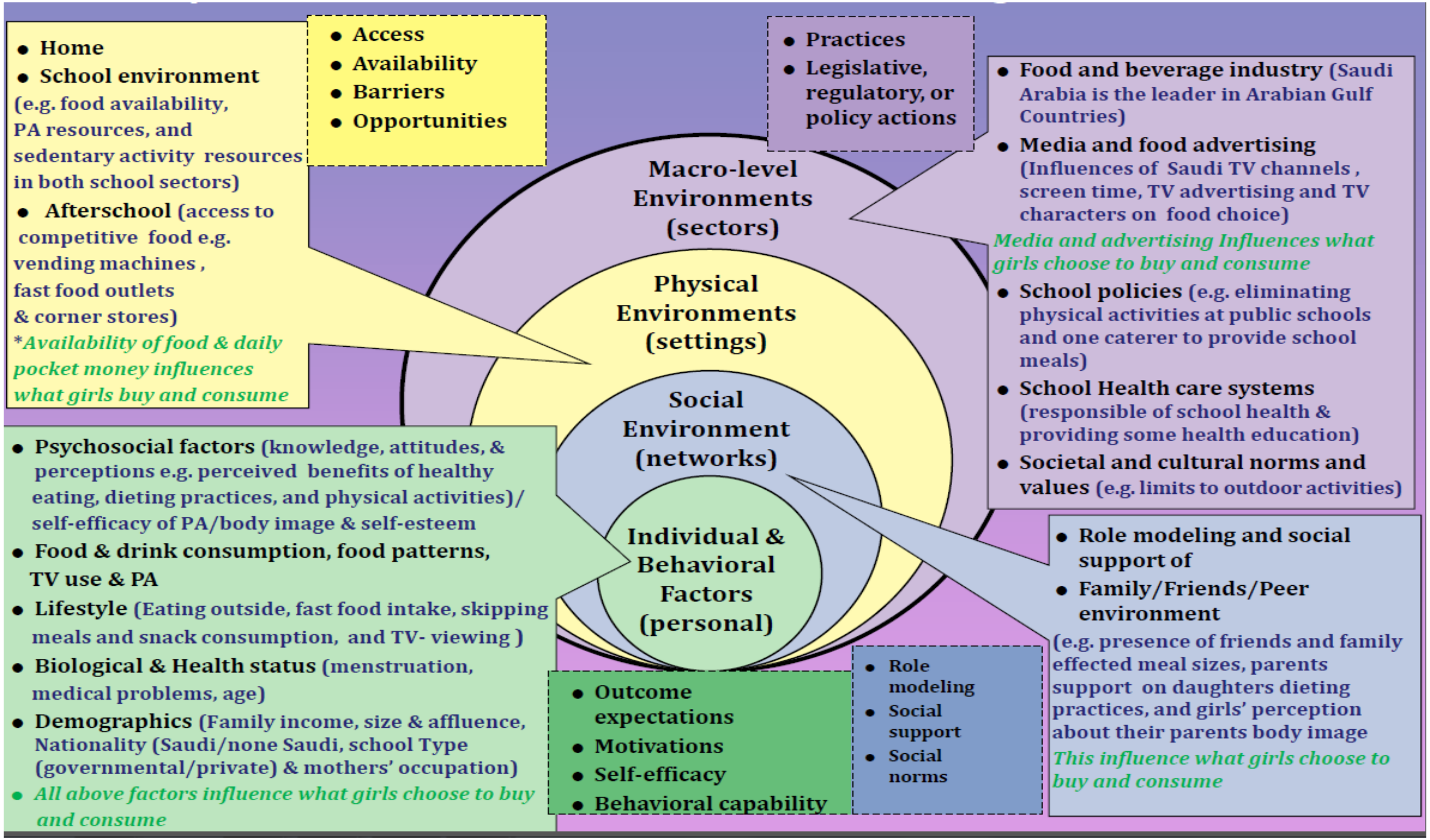


Figure 19: A Theoretical Framework Depicting the Multiple Influences on Jeddah Girls Eating behaviours in Saudi Araibia

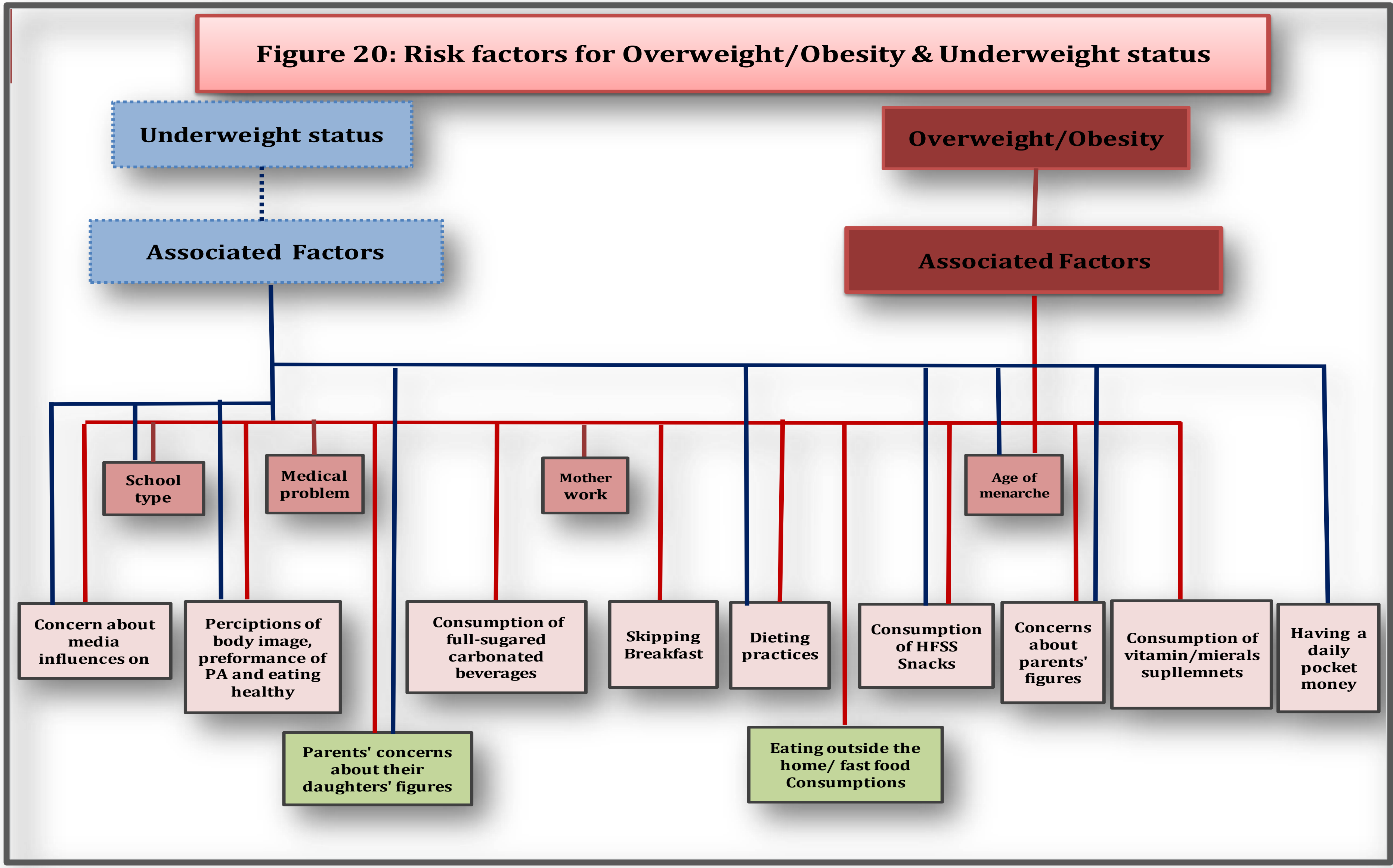
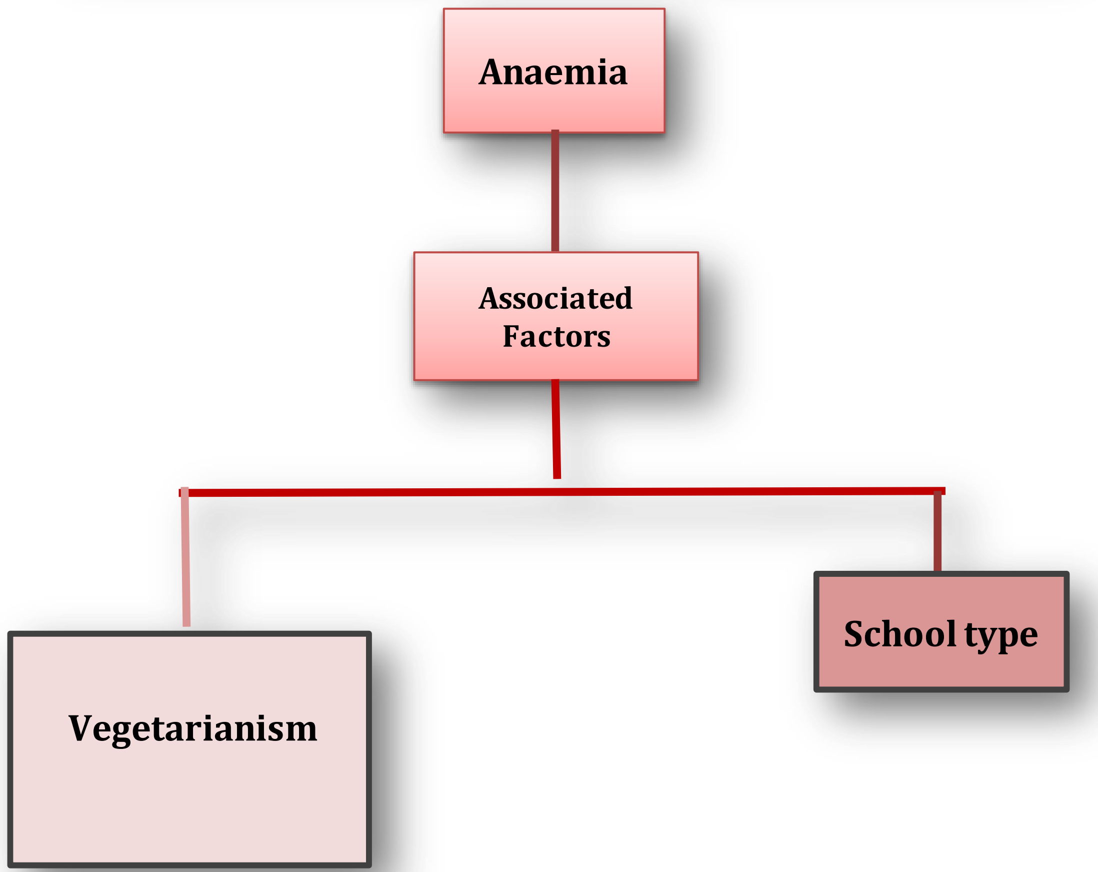


Figure 20: Risk factors for Overweight/Obesity & Underweight status
Underweight status
Associated Factors
Overweight/Obesity
Associated Factors
School type
Medical problem
Mother work
Age of menarche
Concern about media influences on
Perciptions of body image, preformance of PA and eating healthy
Consumption of full-sugared carbonated beverages
Skipping Breakfast
Dieting practices
Consumption of HFSS Snacks
Concerns about parents' figures
Consumption of vitamin/mierals supllemnets
Having a daily pocket money
Parents' concerns about their daughters' figures
Eating outside the home/ fast food Consumptions

Figure 21: Risk factors for anaemia status



CHAPTER EIGHT

Conclusions and Implications

8.1 Conclusion

This thesis revealed several findings that have public health implications. Twenty-nine percent of participants were anaemic, 24% were overweight or obese (20% were centrally obese), and 14% were underweight. These public health problems are the consequence of multiple factors that work at the individual, micro and macro-system levels. This was evident by the findings that the majority (75%) of adolescent girls, who skipped breakfast, also eat a low number of vegetables and fruits with a high consumption of HFSS snacks (90%), full-sugared carbonated beverages (87%) and fast food (72%). The media, which was an important source of nutrition information to these adolescents, influenced these eating behaviours. In addition, the media were advertising HFSS food/beverage items. Participants were also concerned with the media influence on their food choice, they were insightful about their body image (74%) and had appropriate negative perceptions of their healthy eating (53%). Added to this, media regulations directed to young groups in Saudi Arabia are lacking.

The majority of participants were physically inactive at school and outside school. This behaviour was supported by the absence of any source of physical education or activity in the governmental sponsored schools (limited physical activities in private schools). This reflects the role of the macro-system in contributing to the negative behaviours and lack of availability of physical activities for adolescents. In addition, micro-system (school meals and snacks) provides HFSS food and beverages adding to the negative environment available in the schools.

Moreover, Saudi culture and socioeconomic profile are characterised by the sedentary lifestyle and high economic level allowing pocket money to facilitate and encourage unhealthy food choice and lifestyle.

Food consumption and eating behaviours of Jeddah adolescents whether because of affordability, availability, convenience, preference or other reasons such as social, lifestyles, and cultural is not consistent with the dietary pattern that is optimal for their health. These food patterns and the other environmental reasons are associated with the burden of some nutrition-related disease.

8.2 Implications and Recommendations

Based on the main findings, several implications and recommendations are presented here at the individual, micro and macro-systems levels.

- **At the individual level**, the prevalent nutritional related problems (anaemia, overweight and underweight) imply immediate interventions by individual themselves, their families, schools and health professionals. This calls for focused targeted programmes that aim to identify nutrition-related problems as early as possible. Prevention should start from the early age of girls at the kindergarten stage by educating and modifying the behaviour of girls and their parents about healthy food choices. In addition, educational classes should be included in adolescent girls' schools, to enhance their knowledge and perceptions about body image, healthy eating and the importance of physical activities in their life. These preventive efforts should take into consideration the influence of culture and societal norms in order to develop culturally sensitive programmes when tackling these issues. There is also a need to prepare clear guidelines on how to prevent and control weight problems among adolescent girls, targeting education and health workers and other related professionals.

- Comprehensive and multisectoral programmes directed towards combating nutrition-related problems (overweight, underweight and anaemia) should be applied by Saudi government. These programmes should include schools and education through the mass media.

- Lessons developed by other countries such as the United Kingdom that targeted interventions, and prevention programmes should be considered by the country of Saudi Arabia. For example, Weight Watchers and the programme (MEND "Mind, Exercise, Nutrition… Do it!"). These programmes take into consideration cultural and socio-economic aspects of weight management as well as nutrition and exercise, and a different focus is needed if programmes are introduced into other cultures. In the future, nutrition and dietetic professionals in Saudi Arabia can expect to use their expertise in guiding the establishment of strategies and evaluating programmes. This will enable the promotion of optimal adolescent growth, in addition to nutrition and health, while preventing weight problems. The data collected here, and findings could be used as a basis for preparing materials for nutrition-related problems' interventions in Saudi Arabia.

From the research point of view, national-base studies on overweight and underweight status among pre-schoolers, schoolchildren, and adolescents should be carried out in Saudi Arabia. Several factors should be considered when planning for such studies, including the following:

1) The use of standardised cut-offs for measuring weight status.
2) In addition to BMI, researchers should include sensitive indicators such as waist circumference, to measure obesity.
3) The use of standardised questionnaire will allow for comparison of data between different regions in Saudi Arabia.
4) The questionnaire should include information related to dietary habits, physical activity and lifestyle of participants. Further efforts should include other individual factors when investigating nutrition-related problems (e.g. including questions in future surveys to evaluate if the severely underweight girls are suffering from eating disorders.
5) The focus should be on both, private schools and public schools.

Furthermore, there is a need for longitudinal follow up cohort studies to assess the course of nutrition-related problems, and to draw stronger evidence-based associations of these problems with other socio-demographic and health profiles (clinical and biochemical profiles).

- **At the micro-system level,** the influence of the family and immediate physical environment of girls' schools in Saudi Arabia should be targeted for prevention and intervention to improve their nutrition knowledge, to encourage uptake of standardised international guidelines of healthy school meals. In addition, public health education using school venues, media and leaflets could help in distributing proper information about healthy eating and lifestyle for both adolescents and their families.

Future research should include families and schools as they influence adolescent eating behaviours and lifestyles. For example, research on knowledge among overweight and underweight parents could help to examine the home environment that adolescents live in. This should include long-term follow-up and evaluation to assess the degree of commitment and implications of standardised guidelines assigned to tackle nutrition-related problems and prevent later chronic health problems.

- **At the macro-system level,** media and lack of physical activities at girls' schools as regulated by the government work hand in hand against the international recommendations concerned with food advertising and provision of healthy physical environment by the government. Therefore, Saudi government is recommended to follow and adapt international guidelines with a culturally sensitive approach in order to join the international community effort in tackling nutrition-related problems. Furthermore, a national action across departments and sectors should be taken, to re-balance the food system and reduce the burden of diet-related disease among adolescents in Saudi Arabia.

From the research point of view, ongoing follow-up studies are imperative to evaluate the application of policies and procedures concerning the guidelines and regulations about nutrition-related problems and their prevention.

Barriers to implications and recommendations

In order to achieve goals and recommendations presented in this thesis, explicit policies are needed at the country level. This will be only achieved through a combination of policies involving various sectors at various levels of responsibility. To achieve goals, a number of obstacles should be considered:

1. Governments play a large role, extending from their influence over the physical environments in which adolescent live and access food, and regulations that influence adolescent choices of food, drinks and physical activity. In order to achieve goals of this study, policy makers need to reach these recommendations, read them and go through them.
2. The food industry and their advertising partners should cooperate with other institutions and sectors such as schools and health sectors, to control the types and quantities of HFSS products they produce and market.
3. Since schools should provide nutrition education, healthy meals and environments. The Saudi government should control schools those provide HFSS food or accept sponsorship from companies selling these products. This is because providing such food, will undermine classroom lessons and provide a confusingly poor example.
4. In addition, family and cultural factors contribute many barriers to healthier eating and lifestyle. For example, some families do not like to change their eating habits such as eating together.

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Appendix I: Ethical Approval (UCL)

UCL RESEARCH ETHICS COMMITTEE
GRADUATE SCHOOL OFFICE

UCL

Dr Therese Hesketh
Institute of Child Health
UCL
30 Guilford Street
London
WC1N 1EH

12 December 2010

Dear Dr Hesketh

Notification of Ethical Approval
Ethics Application: 1773/001: Assessment of nutritional status of adolescent girls in Jeddah, Saudi Arabia

I am pleased to confirm that in my capacity as Chair of the UCL Research Ethics Committee, I have approved your study for the duration of the project. However, I would suggest that the Information Sheet should state that the project has been approved by the UCL Research Ethics Committee and the King Abdul-Aziz University.

In giving approval I assume that all measurements etc will be taken by female staff. The questionnaire is designed to determine the socio-economic status of the participants. The parents should therefore have the opportunity to fill in the sections on salary etc which are not appropriate for a 13 year old. Nor should they be asked questions about their parents' attempts to lose weight. Is a question about ice skating in Saudi Arabia relevant? I suggest the questionnaire needs to be examined to ensure it is culturally relevant and acceptable and not a US copy. Perhaps this requires separate questionnaires.

Approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form'.

The form identified above can be accessed by logging on to the ethics website homepage: http://www.grad.ucl.ac.uk/ethics/ and clicking on the button marked 'Key Responsibilities of the Researcher Following Approval'.

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

   Reporting Non-Serious Adverse Events.
   For non-serious adverse events you will need to inform Ms Helen Dougal, Ethics Committee Administrator (h.dougal@ucl.ac.uk), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

   Reporting Serious Adverse Events
   The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

Yours sincerely

Sir John Birch
Chair of the UCL Research Ethics Committee

Cc: Elham Aljaaly, Institute of Child Health, UCL

UCL Research Ethics Committee, c/o The Graduate School, North Cloisters, Wilkins Building
University College London Gower Street London WC1E 6BT
Tel: +44 (0)20 7679 7844 Fax: +44 (0)20 7679 7043
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Appendix II: Ethical Approval (KAAU)

KINGDOM OF SAUDI ARABIA
Ministry of Higher Education
KING ABDULAZIZ UNIVERSITY
Faculty of Applied Medical Sciences

المملكة العربية السعودية
وزارة التعليم العالي
جامعة الملك عبدالعزيز
كلية العلوم الطبية التطبيقية

Ref. FM / /8
Date : / /

الرقم ....
التاريخ : / / ١٤ هـ
المرفقات ....

ETHICS AND RESEARCH COMMITTEE

To: Mrs. Elham Al-Jaaly, PhD Candidate

From: Dr. Essam H. Jiffri, Chairman, Ethics and Research Committee

Date: Sunday, 19 October 2008 G

Re: Research Proposal (Assessment of Nutritional Status of Adolescent Girls In Jeddah, Saudi Arabia)

Dear Mrs. Elham Al-Jaaly,

The above titled, project in fulfilment of your PhD degree in The Centre for International Health and Development at the Institute of Child Health in the University College London, has been discussed in the Ethical Committee Meeting held on Saturday, 18 October 2008.

The Ethics and Research Committee has reviewed your research proposal which will involve a cross-sectional survey which will be carried out in Jeddah city in Saudi Arabia during the academic year 2008/2009. The following sections of your research proposal were reviewed in relation to ethical aspects:

1- Research objectives
2- Methodology: including study design and data collection (data from anthropometric measurements, self-reported questionnaire, and haematological examinations)
3- Study components and outcome variables: including demographics, nutritional status, eating behaviours, physical activities level and other life style factors
4- Information letters and consent forms to be provided to parents and recruited students

I am pleased to say that the Committee was satisfied in relation to its ethical aspects.

We wish you all the best in your project.

Yours sincerely

[redacted]

Dr. Essam H. Jiffri

Chairman, Ethics and Research Committee

جامعة الملك عبدالعزيز
كلية العلوم الطبية التطبيقية
APPLIED MEDICAL SCIENCES
KING ABDULAZIZ UNIVERSITY

ص.ب ٨٠٣٢٤ جـدة ٢١٥٨٩ برقياً: جامعة عبدالعزيز فاكس: ٦٤٠٠٠٠٠/٢٠١٧١ ☎ ٦٤٠٠٠٠٠/٢٠٢١٣

Appendix III: Information for Parents

A study of the factors affecting nutritional status and eating behaviours in Saudi Arabian adolescent girls

Information for Parents

Why am I doing the survey?

There is much research into the nutritional status of adolescents and nutrition-related problems in many countries in the world but there is very little done in the country of Saudi Arabia. We need to know about the nutritional status of our adolescents because their food habits, physical activities and other life style factors affect their own future health and that of their children.

What is this study about?

This is the first stage of the study and the study is considered a good step where your daughter will be helping me to assess the nutritional status of Jeddah adolescents in her age group. This stage is crucial to the rest of the study and the information she will provide me with, in addition to, the measurements that will be done on her will help to assess the nutritional status of this group. It could also help to identify the nutrition-related problems among our adolescent's girls.

Where are we doing the study?

Intermediate and high schools for girls from Jeddah city

When will we be doing the study?

We will be doing the study during the first term of the academic year, 2008/2009

What will your daughter have to do?

Fill in the questionnaire. This will include information about socio-demographic status, eating behaviours, knowledge, and attitudes about nutrition and health, physical activities and lifestyle. She will be measured for her height, weight, waist circumference and haemoglobin. Her haemoglobin will be measured by either a fingerprick or a venepuncture blood test. The fingerpricks or (fingersticks) are small superficial wounds that provide venous blood for haemoglobin test. The procedure can be painful but is quick. We will need to use only one drop of blood for this technique, which will then be inserted into a machine that provide us immediately with readings of haemoglobin levels. The venepuncture blood test is an invasive procedure and intravenous and is obtained for venous blood. This procedure is more painful than the fingerprick test but is more accurate and well-qualified phlebotomists will perform it.

What happens afterwards?

We hope that the information we obtain from this survey will help us to assess the nutritional status and to investigate the nutrition-related problems of adolescent girls in Jeddah city. It also could help us to explore factors that influence their nutritional status. Moreover, we hope that the results will be of great help to the decision makers to plan and develop healthy suitable programmes for this age group and to call for further studies needed.

Who is doing the study?

Elham Al-Jaaly as part of her PhD programme at the Centre for International Health and Development (CIHD), Institute of Child Health (ICH) University College London (UCL)

Ethical Approval

The ethical committees at UCL in London and King Abdul-Aziz University in Jeddah city approve the research.

Thank You

First investigator: Elham Al-Jaaly

Appendix IV: Consent Form

Factors affecting nutritional status and eating behaviours in Saudi Arabian adolescent girls

Researcher: Elham Al Jaaly

You are invited to take part in the research "Factors affecting nutritional status and eating behaviours in Saudi Arabian adolescent girls". This is to be submitted in partial fulfilment of the requirements of PhD research at Centre for International Health and Development (CIHD), Institute of Child Health (ICH), University College London (UCL).

- I understand and fully agree to voluntarily take part and cooperate with the researcher after explaining to me the nature and purpose of the research
- I understand that I need to complete and return questionnaire, which asks about my demographics, eating habits, nutrition and health knowledge, physical activities and lifestyle
- I understand that the research team will also measure my height, weight, waist circumference and my haemoglobin level
- I understand that all information obtained from me will be in strict confidence, although information gained during the study may be published

I have read and fully understood the above conditions and for any valid reason I can withdraw my participation in this project

Name: ___________ Signed: _________ Date: ____________

Parent/guardian Name: ________ Signature: ________ Date: ________

Principle teacher Name: ________ Signature: ________ Date: ________

* To maintain the confidentiality and to provide you with results of blood sample, you will be allocated with a reference number.

Appendix V: Approval for GSHS Questionnaire's Adaptation

Dear Elham,

You are most welcome to use and modify the GSHS for your research. Good luck with your studies. Best wishes. Leanne Riley.

Leanne Riley

Team Leader Surveillance

Dept Chronic Diseases and Health Promotion

WHO Geneva, Switzerland

----- Original Message -----

From: Elham Aljaaly <e.aljaaly@ich.ucl.ac.uk>

To: Riley, Leanne

Cc: [redacted]

Sent: Tue Aug 05 16:23:35 2008

Subject: GSHS questionnaire

Dear Leanne Riley,

School Health and Youth Health Promotion

My name is Elham Aljaaly, a PhD research student at the Centre for International Health and Development (CIHD), the Institute of Child Health (ICH), University College London (UCL). I am aiming to assess the nutritional status of Saudi adolescent girls in Jeddah City, Saudi Arabia and I would like to take the permission of the School Health and Youth Health Promotion, to adapt some questions from the questionnaire 'Global School-based Student Health Survey '(GSHS). The questions that I would like to adapt are related to food consumptions, daytime physical activity, and smoking habits. Adapting these types of questions will help me to assess the nutritional status of adolescent girls in Saudi Arabia, which is part of my PhD research project.

Thank you very much for your cooperation and support

Appendix VI: Approval for Theoretical Framework Adaptation

Elham,

This model is very similar to the one in Annual Review of Public Health. I have not cited it with studies with adolescents. It really is the same one in Annual Review of Public Health so you could cite that reference and say it is modified from that article. The new model is really modified from the one I did in JADA.

Elham AlJaaly wrote:

> **Dear Professor Story,**

> Thank you very much for your response, permission, and I think I will go
> for your recent model' An Ecological Framework Depicting the Multiple
> Influences on Children's & Teens Eating' because the other part of my
> Research is to highlight some intervention programmes and policy
> Strategies to promote the nutritional status of Saudi adolescents and me
> would like to ask you a favour to send me the link for any studies
> done on adolescents using this model as I've read your review
> 'Creating Healthy Food and Eating Environments: Policy and Environmental
> Approaches' and I found it very useful to explain your model.
> Thank you very much for your time and support

> Dear Elham,

>> Thank you for your note. You have my permission to use the model and
>> adapt it. Attached are also two additional models I developed based on?
>> The 1996 model that you could use if you so desire. Best wishes on your
>> PhD study.

>> Mary Story PhD, RD

>> Professor, Division of Epidemiology and Community Health

>> School of Public Health

>> University of Minnesota

>> 1300 S 2nd St., Suite 300

>> Minneapolis, MN 55454

>> 612-626-8801

>> 612-624-9328 (fax)

>> story@epi.umn.edu

>> Elham Aljaaly wrote:

>>> **Dear Professor Mary Story,**

>>> My name is Elham Aljaaly; I am a PhD research student at the University

>>> College London (UCL), institute of Child Health (ICH) at the Centre for

>>> International Health and Development (CIHD). I am doing a PhD

>>> project that aim to assess the nutritional status of adolescent

>>> Girls at Jeddah City in the Kingdom of Saudi Arabia

>>> I would like to take your permission to adapt your 'Conceptual Model

>>> For Factors Influencing Eating Behaviour of Adolescents that has been

>>> developed in 1996' to use it as a 'Theoretical Framework' for my PhD research;

>>> In order to, assess the eating behaviours and nutritional status of

>>> Adolescent girls in Saudi Arabia because according to my Literature Review particular in this filed,

>>> I found your model very helpful and matching to most of my research objectives.

>>> Thank you for your cooperation and support

>>> My address is:

>>> Centre for International Health and Development,

>>> 30 Guilford St,

>>> London WC1N 1EH,

>>> UK

>>> Fax No.: 02074042062

>>> Main operator: 02072429789 ext: 2299

>>> My Mobile Number is [redacted]

Appendix VII: Study Variables & Measures

Demographics/socio-economic variables			
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
1	**Number part**	Code no. of participant	
2	**School_ Name**		
3	**School_ Area**	Geographical location of schools	Four geographical groups: North, Centre, South-East, South West
4	**School_ Sector**	Type of School	Two categories: private, public
5	**Age**	In years	Age measured in years
6	**Age_ group**	Age group	Two groups: 13-15 & 16-18 years old
7	**Age_ O_menst**	Date of menarche	students will print the date they started menstruation
8	**AgeOmenstnew_ Cat**	Age of menarche groups	Two categories:<12 & equal or >12 years
9	**Education_ level**	Education intermediate or high	Two levels of education: intermediate & high
10	**School code**		School code number
11	**Nationality**	Nationality	Two categories: Saudi & Non-Saudi
12	**Family_ Income**	What is the approximate household total intake per month (including income from all sources for all members living with you)	Six categories: not applicable, <1500 SR, 1500-3500 SR, 350(-5500 SR, 5500-7500 SR, >7500 SR

Appendix VII: Study Variables & Measures: Demographics/socio-economic variables (continue)

NO	VARIABLE NAMI	LABEL	INDICATORS
13	**Siblings No.**	How many siblings in the family?	Four categories: one , two, three, more than three
14	**Sequence_family**	Your sequence among siblings	Five categories: 1st, 2nd, third, after the third, last
15	**Parents_alive**	Is your parent alive or not?	Four categories: both alive, father only, mother only, both died
16	**Live_wih**	With whom do you live?	Four categories: both parents, father only, mother only, others
17	**House type**	What type of house do you live in	Four categories: apartment, traditional house, compound, Villa
18	**Res_status**	What is the residential status?	Three categories: owned, rented, company provided
19	**Family_car**	Do you have a family car?	Two categories: Yes, NO
20	**No_Cars**	No of cars	Three categories: one car, two cars, more than two cars
21	**Driver**	Do you have a driver?	Two categories: Yes, NO
22	**No_Drivers**	No. of drivers	Three categories: one driver, two drivers, more than two drivers
23	**Housemaid**	Do you keep a house maid?	Two categories: Yes, NO
24	**No_Maids**	No. of house maid?	Three categories: one maid, two maids, more than two maids
25	**Mother_ work**	Does your mother work?	Two categories: Yes, NO
26	**Father_ work**	Does your father work?	Two categories: Yes, NO

Appendix VII: Study Variables & Measures (continue)

Growth & health status variables			
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
27	**Weight**	Weight in kg	WT is measured in kilograms
28	**Height**	Height in cm	HT is measured in centimeters and transformed in meters
29	**Waist circumference**	Waist circumference in cm	WC is measured in centimeters
30	**BMI**	Body Mass Index (Kg/m2)	$Weight_{(Kg)}/(Height_{(m)})^2$
31	**BMI_CLASS**	Body Mass Index Classification	Three groups: underweight, normal, overweight & obese
32	**WHOSDS_BMI**	BMI Z-scores	BMI Z-scores
33	**Hgb**	Haemoglobin in gm/dl	Value of haemoglobin
34	**Anaemia**	Anaemia Status	Anaemia defined as blood haemoglobin <12.0 g/dl (WHO)
35	**Start_ Menst**	Did you start menstruating?	Two categories: Yes, NO
36	**Feel_ hungry**	Do you often feel hungry?	Two categories: Yes, NO
37	**Med _problems**	Do you have any known medical problems?	Two categories: Yes, NO
38	**Med _problems**	If yes, what type of medical problems?	Seven categories: diabetes, hypertension, allergy, asthma, osteoporosis, cardiovascular diseases, others
39	**Vit/Min_ supplements**	Do you take any vitamins/minerals supplements?	Two categories: Yes, NO
40	**Type_ supplements**	If yes, what kind of supplements?	Seven categories: multivitamin, iron, Vitamin C, zinc, calcium, more than one type, others

Appendix VII: Study Variables & Measures (continue)

	Perceptions, knowledge, attitudes variables		
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
41	**Figure_ watch**	Do you watch your figure?	Two categories: Yes, NO
42	**Figure_ feeling**	How do feel about your figure?	Three categories: too fat, too thin, about the right weight
43	**Healthy_ Considered**	Do you consider yourself healthy compared to others your age?	Two categories: Yes, NO
44	**Reading**	Do you read books, magazines or comics daily?	Two categories: Yes, NO
45	**Influence _ readings on food choice**	Do you think that reading has an influence on your food choice?	Two categories: Yes, NO
46	**Extent _ influence _readings_ foodchoice**	If yes, to what extent does reading influence your food choice?	Three categories: strong and important influence, average influence, no influence
47	**Influence_ relation_ to _media**	If yes, is the influence related to magazine topics or advertisement?	food topics, advertisements, both
48	**Media_ follow**	Do you read or follow media concerning diet issues?	Two categories: Yes, NO
49	**TV watching-influence**	Does TV watching have an influence of on your eating behaviours?	Two categories: Yes, NO
50	**Degree _TV_ influence**	If yes, to what extent is the influence?	Three categories: strong, medium, no effect
51	**TV characters-influence**	Do you think that TV characters have an influence of on your eating behaviours?	Two categories: Yes, NO
52	**TV ads-influence**	Do you think that TV advertisements have an influence on your eating behaviours?	Two categories: Yes, NO
53	**Degree _TV ads_ influence**	If yes, to what extent is this influence?	Four categories: strong, medium, week, I don't care

Appendix VII: Study Variables & Measures (continue)

Perceptions, knowledge, attitudes variables (continue)			
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
54	**Eat_ Healthy**	In your opinion, do you think that you eat healthy food?	Two categories: Yes, NO
55	**PA_ Holidays**	During holidays, how active are you in comparison to school days?	Three categories: Less active, about the same, more active
56	**Enough_ Exercises**	In general speaking, do you think that you perform enough exercise to keep healthy?	Two categories: Yes, NO
57	**Enoughexcercise_holidays**	Do you perform enough physical activities during holidays in comparison to school days?	Three categories: less active, about the same more active,
58	**Active._ compare**	How active are you, in comparison to others your age and sex?	Three categories: Below average, about average, above average
59	**Ph_ education_ classes**	Would you prefer to have physical education classes at school?	Two categories: Yes, NO

Appendix VII: Study Variables & Measures (continue)

Eating Behaviours and Life Style Variables			
Food & drink consumption variables			
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
60	**No_ Vegetables**	How many times did you eat vegetables last 7 days?	Three categories: none, one - two times, three times or more
61	**No_ greensalads**	How many times did you eat green salad with meals in the last 7 days?	Three categories: none, one- two times, three times or more
62	**No_ fruits**	How many times did you eat fruits in the last 7 days?	Three categories: none, one - two times, three times or more
63	**No_ Meat**	How many times did you eat meat in the last 7 days?	Three categories: none, one - two times, three times or more
64	**No_ dairy_ product**	How many times did you take dairy products e.g. (Milk, cheese) in the last 7 days?	Three categories: none, one - two times, three times or more
65	**No_ Grains & Cereals**	How many times did you take grains and cereals e.g. (bread, pasta, rice, cereal) in the last 7 days?	Three categories: none, one - two times, three times or more
66	**No_ desserts**	how many times did you have desserts e.g. pudding, cake or chocolate in the last 7 days	Three categories: none, one - two times, three times or more
67	**No_ Fats**	How many times did you take fats or used fats for cooking in the last 7 days?	Three categories: none, one - two times, three times or more
68	**No_ ice-creams**	How many times did have ice-cream in the last 7 days?	Three categories: none, one - two times, three times or more
69	**Kind_food**	Which kind of food do you mostly eat?	Two categories: homemade food, fast food
70	**Kind_ Meat**	Which kinds of meat do eat mostly often?	Two categories: red meat or its products, white meat such as fish, turkey or chicken
71	**Fizzy. drinks**	Do you drink fizzy drinks e.g. (Pepsi or Cola)?	Two categories: Yes, NO

Appendix VII: Study Variables & Measures (continue)

Food & drink consumption variables (continue)			
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
72	**Kind_fizzy_drink**	If yes, what kind of fizzy drinks?	Two categories: full sugars, diet drinks
73	**Drinks_ often**	Which of the following do you drink often?	Four categories: water, fruit juice, soft drinks, hot drinks
74	**No_ cups_ water**	How many cups of water do drink/day?	Five categories: none, one cup, 1-3 cups, 4-6 cups, 7 cups or more
75	**Add_ sugar**	Do you usually add sugar to your drinks?	Two categories: Yes, NO
76	**No_ sugar_ spoons**	If yes, How many sugar spoons/day?	Four categories: one, two, more than two, more than three
77	**Sweeteners**	Do you use any type of sweeteners such as artificial sweeteners?	Two categories: Yes, NO
Time & convenience variables			
78	**Pocket_ money**	Do you have pocket money?	Two categories: Yes, NO
79	**Food_ preparation**	Are you involved in food preparation or cooking at home?	Two categories: Yes, NO
80	**Food_ Shopping**	Do you do shopping for food and groceries or other items (e.g. clothes, toys)?	Two categories: Yes, NO
81	**School_ food**	Do you buy food from school canteen?	Three categories: Yes, no, sometimes
82	**Con_ food_ type**	Do you take time consider the food you eat?	Two categories: Yes, NO

Appendix VII: Study Variables & Measures (continue)

Eating patterns & lifestyle variables			
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
83	**Vegetarian**	Are you a vegetarian?	Two categories: Yes, NO
84	**Skip_ Meals**	Do you skip any meal?	Two categories: Yes, NO
85	**Meal_ Skipped**	If yes, which meal do you skip?	Four categories: breakfast, lunch, dinner, breakfast and dinner
86	**Brk_ Consumption**	Do you normally take breakfast before you go to school?	Two categories: Yes, NO
87	**Snacks_ Consumption**	Do you eat snacks between meals?	Two categories: Yes, NO
88	**Favourite _Snack**	What is the favourite snack between meals you have?	Eleven categories: sandwich, potato crisp, chocolate, biscuits, fruits, donuts, pizza, nuts, etc.
89	**Eating_ Late**	Do you eat before going to bed?	Three categories: Yes, no, some times
90	**Eating_ Separate_ plate**	When eating in group, do you eat in separate plates?	Two categories: Yes, NO
91	**Smoking**	Do you smoke (a cigarette/Nargila (Shisha)?	Two categories: Yes, NO
92	**NO_ Cig/hours_ Shisha**	If yes, do smoke regularly or only in some occasions e.g. when with friends?	Printed by respondents
Dieting practices variables			
93	**WT _Losing _Attempts**	Have you ever tried losing weight?	Two categories: Yes, NO
94	**WT_ Gain_ Attempts**	Have you ever tried gaining weight	Two categories: Yes, NO

Appendix VII: Study Variables & Measures (continue)

Dieting practices variables (continue)			
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
95	**WT_ Reducing _Diet**	Have you been in a WT reducing diet before?	Two categories: Yes, NO
96	**Lost_ WT _ On_ Diet**	Did you lose weight in it?	Two categories: Yes, NO
97	**Special_ diet_ Follow**	Are you following any special diet at the moment?	Two categories: Yes, NO
Physical activity variables			
99	**Go _bed_ Early**	Do you normally go to bed early?	Two categories: Yes, NO
100	**Getup_ Early**	Do you normally get up early?	Two categories: Yes, NO
101	**Transportations_ Type**	Which type of transportation do you use fo school and apart from school?	Three categories: car, walk, public transport
102	**PA_ at_ School**	Do you usually do any kind of PA at school?	Two categories: Yes, NO
103	**PA_ School_ Breaks**	What do you usually do at school breaks?	Three categories: sitting down, standing or walking around, running or other PA
104	**Reading_ Hours**	How many hours/day do spend in reading books, magazines, or comics?	Two categories: less than 2 hour/day, Or 2 hrs o more/day
105	**Homework_ Time**	How many hours per day do you spend on doing your homework?	Two categories: less than 2 hour/day, Or 2 hrs o more/day
106	**TV_ Hours**	How many hours/day do you spend watching TV or video?	Two categories: less than 2 hour/day, Or 2 hrs o more/day
107	**Playing_ Computer/ Computer_ Games**	How many hours/day do you spend on Computer or computer games?	Two categories: less than 2 hour/day, Or 2 hrs o more/day
108	**Light_ PA _Outside_ School**	Do you normally perform any kind of physical activities outside school e.g. walking, shopping, bowling, horse riding, and table tennis?	Two categories: Yes, NO

Appendix VII: Study Variables & Measures (continue)

Physical activity variables (continue)			
NO	VARIABLE NAME	LABEL	INDICATORS
109	Light_ PA_ Hours	If yes, how often do you perform this activities/week?	Four categories: < one hour/ day, 1-3 hrs/day, 3-6 hrs/day, > 6 hrs
110	Moderate_ PA_ Performance	Do you do any washing up or cleaning	Two categories: Yes, NO
111	Moderate_ PA _Hours	If yes, how often do you perform this activities/week?	Four categories: < one hour/ day, 1-3 hrs/day, 3-6 hrs/day, > 6 hrs
112	Moderate/heavy_ PA_ Performance	Do you do activities like swimming, cycling, tennis squash, ice-skating, sailing or boating, basketball, dancing, or competitive running	Two categories: Yes, NO
113	Moderate/heavy_ PA_ Hours	If yes, how often do you perform this activities/week?	Four categories: < I hour/ day, 1-3 hrs/day, 3-6 hrs/day, > 6 hrs/day
114	PA_ Fitness_ Centre	Do you play sports or do physical activities at fitness centres?	Two categories: Yes, NO
115	PA_ time_ Performance	If yes, how often do you perform these activities per week?	Four categories: < one hour/ day, 1-3 hrs/day, 3-6 hrs/day, >6 hrs
Social environmental variables			
116	Mealsize_ Friend	Is your meal size affected by the presence of friends or family?	Two categories: Yes, NO
117	Mother_ Figure	In my opinion, my mother is:	Three categories: too fat, too thin, about the right weight
118	Father_ Figure	In my opinion, my father is:	Three categories: too fat, too thin, about the right weight

Appendix VII: Study Variables & Measures (continue)

Physical environmental variables			
NO	**VARIABLE NAME**	**LABEL**	**INDICATORS**
119	**Parent_ WT_ Loss**	Have any of your parents tried to change his/her weight? Why?	Three categories: Yes, no, due to medical advice, Yes, due to other reasons
120	**Family_ Encouraged**	When I'm trying to change my weight, my parent:	Three categories: encourage me, discourage me, they do not care
121	**Eating-places_ at_ home**	Where do you usually eat?	Four categories: dining room, bed room. kitchen, in front of TV
122	**Eat_ out**	How often eat outside/week?	Three categories: once, twice, 3 times, more than three times
123	**Type_ school_ food**	If yes, what type of food?	Eleven categories: sandwich, potato crisp, chocolate, biscuits, fruits, donuts, pizza, nuts, ice-cream, more than one choice, others

Appendix VIII a: Translation of the questionnair by Univeristy of Khartoom, Sudan

The covering letter for the translation of questionnair by the Translation & Arabian Unit at Univeristy of Khartoom

University of Khartoum
Faculty of Arts
Translation & Arabicization Unit
Khartoum - Sudan - P.O. Box 321
Tel: 784845

جامعة الخرطوم
كلية الآداب
وحدة الترجمة والتعريب
الخرطوم - السودان ص.ب 321
تلفون: 784845

ترجمة طبق الأصل من اللغة الإنجليزية

تقويم الوضع الغذائي للفتيات المراهقات بجدة ، بالمملكة العربية السعودية

أجازه كل من:

1. د. نازك إي م. مصطفى ، رئيسة قسم صحة الأغذية و سلامتها ، بجامعة الخرطوم
2. أستاذ/ عزالدين آدم ، الأستاذ بقسم الوبائيات ، بكلية الصحة العامة بجامعة الخرطوم

ختم جامعة الخرطوم ، كلية الصحة العامة و الوبائية

رقم المرجع:	تاريخ التسجيل (تاريخ المقابلة) ..../..../........	
تاريخ الميلاد:	الوزن:	الارتفاع: .... سم
اسم المدرسة:	رمز المدرسة	رمز الفصل: ....
رمز المنطقة:	منطقة السكن:	اسم من أجرى المقابلة: ....

جامعة الخرطوم
كلية الآداب
وحدة الترجمة والتعريب

الاستبانة

استبانة في الحمية الغذائية : و تشتمل على أسئلة تتعلق بالوضع الاجتماعي و الاقتصادي ، و مستوى التعليم و السلوك الغذائي و ضروب النشاط البدني و غير ذلك من عوامل نظام الحياة

القسم (أ) : معلومات عامة:

ما مستوى التعليم؟ ثانوي ( ) عالٍ ( )	
عدد الإخوان و الأخوات: الإخوان: .... الأخوات:	مرتبتك بين أشقائك؟ ....
مع من تعيشين؟ والديك جميعاً ( ) والدك فقط ( ) والدتك فقط ( ) آخرين: ( )	
هل ما يزال والداك على قيد الحياة؟ كلاهما حي ( ) حي أبوك ( ) حيةّ أمك ( ) كلاهما متوفى	
ما نوع البيت الذي تعيشين فيه؟ شقة ( ) بيت تقليدي ( ) مجمّع ( ) فيللا ( )	
ما هو وضعك السكني؟ ملك ( ) إيجار ( ) ملك مشاع ( )	
هل لك سيارة عائلة؟ نعم ( ) لا ( ) إذا كانت الإجابة بنعم ، فكم منها لديكم؟ .... و ما نوعها؟	
هل لديكم سائق؟ نعم ( ) لا ( ) و إذا كانت الأجابة بنعم فكم عددهم؟	
هل لديكم خادمة؟ نعم ( ) لا ( ) و إذا كانت الأجابة بنعم فكم عددهن؟	
ما هي وظيفة كل من والديك أو ولي أمرك؟ الأم: .... الأب: .... ولي الأمر:	

جامعة الخرطوم
كلية الآداب

2

القسم (ب): الكمية الغذائية المأخوذة و السلوك الغذائي:

1. هل ترين أنك تتمعتين بالصحة مقارنة بالطالبات الأخريات اللاتي في سنك؟

نعم ( ) لا ( )

2. هل تستغرقين قدراً من الوقت تتفكرين فيه في نوعية الطعام الذي تتناولينه حينما تكونين جائعة؟

نعم ( ) لا ( )

3. هل لوجود الأصدقاء و أفراد الأسرة في الأكل معك أثر في حجم وجبتك ؟

نعم ( ) لا ( )

4. هل يكثر شعورك بالجوع؟

نعم ( ) لا ( )

5. كم مرةً تأكلين خارج بيتك؟

مرة واحدة ( ) مرتين ( ) 3 مرات ( ) أكثر من 3 مرات ( )

6. هل تفوتين أي وجبة ؟

نعم ( ) لا ( )

7. و إذا كانت الإجابة بنعم فأي الوجبات تفوتينها؟

نعم ( ) لا ( )

8. هل عادةً ما تتناولين إفطارك قبل ذهابك إلى المدرسة؟

نعم ( ) لا ( )

9. هل تتناولين أكلاتٍ خفيفة بين الوجبات؟

نعم ( ) لا ( )

10. و إذا كانت الإجابة بنعم فكم عدد الأكلات الخفيفة التي تتناولينها في اليوم؟

واحدة ( ) اثنتان ( ) ثلاث ( ) أكثر من ثلاث ( )

11. و أي الأكلات الخفيفة تفضلين تناولها بين الوجبات؟

سندوتشات (جبنة و البض و الهامبيرجر و غيره) ( )

شرائح البطاطا ( ) الشيكولاتة ( ) البسكويت ( )

الفاكهة ( ) دونات ( ) البيتزا ( ) مكسرات ( )

آيسكريم ( )

3

12. هل تأكلين في وقتٍ متأخر قبل النوم؟

نعم ( ) لا ( )

13. عندما تأكلين مع مجموعة من الناس ، هل تفضلين الأكل في أطباق منفصلة؟

نعم ( ) لا ( )

14. أيهما تفضلين أكله من الطعام؟

الطعام المصنوع بالبيت ( ) الطعام الجاهز ( )

15. أين تأكلين عادةً؟

في غرفة الطعام ( ) في غرفة النوم ( ) في المطبخ ( ) أمام التلفاز ( )

16. هل أنت نباتيةٌ ؟

نعم ( ) لا ( )

17. كم مرةً أكلتِ خُضَراً (مثل الجزر و الخيار و البسلة و الكرنب) في السبعة أيام الأخيرة الماضية ؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

18. كم مرةً تضمنتْ وجباتُك سلطةً خضراء في السبعة أيام الأخيرة الماضية ؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

19. كم مرةً تضمنتْ وجباتُك فاكهةً في السبعة أيام الأخيرة الماضية ؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

20. كم مرةً تضمنتْ وجباتُك لحماً في السبعة أيام الأخيرة الماضية ؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

21. أي اللحوم تفضلين أكله كثيراً؟

لحوم حمراء (و منتجاتها كالبيرقر و لحم البقر و لحم الجمل) ( )

لحوم بيضاء كالفراخ و الديك الرومي ( )

سمك ( )

22. كم مرةً تضمنتْ وجباتُك منتجات ألبان (كاللبن و الجبن و الكريم و و الزبادي) في السبعة أيام الأخيرة؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

23. كم مرةً تضمنتْ وجباتُك المواد الكاربوهايدراتية (مثل الخبز أو الحلويات أو الباسطة أو الأرز أو الحبوب) في السبعة أيام الأخيرة الماضية؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

24. كم مرةً تناولت تحلية (مثل المهلبية و الكيك و الشكولاتة) في السبعة أيام الأخيرة الماضية ؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

25. كم مرةً تناولت دهوناً أو استخدمتها في الطبخ (كالزبدة أو السمن أو الزيت النباتي) في السبعة أيام الأخيرة الماضية ؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

26. كم مرةً تناولت الآيس كريم في السبعة أيام الأخيرة الماضية ؟

و لا مرة ( ) مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

27. أي المشروبات التالية تتناولينه أكثر؟

الماء ( ) عصير فواكه ( ) مشروبات غير مسكرة ( ) مشروبات ساخنة ( )

28. هل تتناولين مشروبات غازية ، كالبيبسي أو الكولا؟

نعم ( ) لا ( )

29. و إذا كانت الإجابة بنعم ، فأي هذه المشروبات الغازية تشربينه؟

كامل السكر ( ) خال من السكر ( )

30. هل عادةً ما تضيفين سكراً إلى ما تتناولين من مشروبات؟

نعم ( ) لا ( )

31. هل تستخدمين أي نوع آخر من المواد المحلية مثل المحليات الصناعية؟

نعم ( ) لا ( )

32. و إذا كانت الإجابة بنعم ، فهل حدث أن استخدمتها في السبعة أيام الأخيرة الماضية؟

مرة واحدة ( ) مرتين ( ) أكثر من 3 مرات ( ) أكثر من 6 مرات ( )

33. كم كوباً من الماء تشربين في اليوم؟

كوباً واحداً ( ) 1–3 أكواب ( ) 4–6 أكواب ( ) 7 أكواب فأكثر ( )

34. هل تملكين مال نثرية يومية؟

نعم ( ) لا ( )

35. هل تشترين طعامك من كانتين المدرسة؟

نعم ( ) لا ( )

36. و إذا كانت الإجابة بنعم ، فأي أنواع الطعام تشترينه؟

5

بيتزا ( ) اللوز ( ) آيسكريم ( ) أخرى"الكتابة طباعةً" ( )

37. هل في أيك أنك تأكلين طعاماً صحياً؟

نعم ( ) لا ( )

38. هل تتبعين أي نظام حمية غذائية في الوقت الراهن؟

نعم ( ) لا ( )

39. هل حدث أن حاولت إنقاص وزنك قط؟

نعم ( ) لا ( )

40. هل حدث أن حاولت زيادة وزنك قط؟

نعم ( ) لا ( )

41. هل كنت تتبعين نظاماً غذائياً لتخفيف الوزن؟

نعم ( ) لا ( )

42. و هل حقاً خففتِ وزنك باتباعه؟

نعم ( ) لا ( )

43. هل تقرأين أو تتابعين وسائل الإعلام التي تخاطب قضايا الوزن و الحمية الغذائية؟

نعم ( ) لا ( )

44. هل تنظرين أو تراقبين إلى شكلك؟

نعم ( ) لا ( )

45. كيف تنظرين إلى شكلك؟

سمنة مفرطة ( ) نحافة مفرطة ( ) الوزن المطلوب تقريباً ( )

46. هل تدخنين (السيجارة أو الشيشة)؟

نعم ( ) لا ( )

47. هل تتناولين أي بدائل غذائية؟

نعم ( ) لا ( )

48. و إذا كانت الإجابة بنعم ، فأي هذه البدائل تتناولين؟

فايتمين مركب ( ) حديد ( ) فاتيمن ج ( ) زنك ( ) كالسيوم ( )

49. هل دخلت في طور الدورة الشهرية؟

نعم ( ) لا ( )

6

50. و إذا كانت الإجابة بنعم ، ففي أي سنِّ عمرك؟
في .... سنة و ...... شهراً

القسم ج : النشاط البدني و النظام الحياتي؟

51. هل عادةً ما تنامين مبكرةً؟
نعم ( ) لا ( )

52. هل عادةً ما تستيقظن مبكرةً؟
نعم ( ) لا ( )

53. أي وسائل المواصلات تستخدمينه عادةً للذهاب إلى المدرسة و الرجوع منها إلى البيت ، أو تذهبين إلى المدرسة و ترجعين منها ، و كيف تتحركين في ما سوى ذلك؟
بالسيارة ( ) مشياً ( ) بالمواصلات العامة ( )

54. هل تقرأين يومياً كتباً أو مجلاتٍ أو رسوم مصورة؟
نعم ( ) لا ( )

55. و إذا كانت الإجابة بنعم ، فكم من الساعات تنفقين يومياً في قراءتها؟
أ. أقل من ساعة في اليوم. ( )
ب. من ساعة إلى ساعتين في اليوم ( )
ت. أكثر من ساعتين في اليوم ( )

56. كم من الساعات تنفقين يومياً في أداء الواجبات المنزلية؟
أ. و لا مرة ( )
ب. أقل من ساعة في اليوم. ( )
ت. من ساعة إلى ساعتين في اليوم ( )
ث. أكثر من ساعتين في اليوم ( )

57. كم من الساعات تنفقين في مشاهدة التلفاز يومياً؟
أ. و لا مرة ( )
ب. أقل من ساعة في اليوم. ( )

7

ت. من ساعة إلى ساعتين في اليوم ( )
ث. أكثر من ساعتين في اليوم ( )

58. كم من الساعات تنفقين في ألعاب الكومبيوتر يومياً (كألعاب البليستيشن أو غيرها من الألعاب الإلكترونية)؟
أ. و لا مرة ( )
ب. أقل من ساعة في اليوم. ( )
ت. من ساعة إلى ساعتين في اليوم ( )
ث. أكثر من ساعتين في اليوم ( )

59. كم من الساعات تنفقين يومياً أما الحاسوب؟
أ. و لا مرة ( )
ب. أقل من ساعة في اليوم. ( )
ت. من ساعة إلى ساعتين في اليوم ( )
ث. أكثر من ساعتين في اليوم ( )

60. كم مرة تستخدمين الدرج أو السلّم (10 درجات) يومياً سواءً أكان بالمترل أو بالبيت؟
أ. و لا مرة ( )
ب. أقل من ساعة في اليوم. ( )
ت. من ساعة إلى ساعتين في اليوم ( )
ث. أكثر من ساعتين في اليوم ( )

61. هل عليك إعداد الطعام أو طهيه بالبيت؟
نعم ( ) لا ( )

62. هل تمارسين أي أعمال غسيل أو نظافة بالبيت؟
نعم ( ) لا ( )

63. هل تتسوقين أو تذهبين إلى السوق لشراء الطعام و المأكولات و خلافه من المواد؟
نعم ( ) لا ( )

64. هل عادةً ما تمارسين أي نوع من النشاط الجسمي بالمدرسة؟

نعم ( )　　　　لا ( )

.65 ماذا تفعلين بالمدرسة في أوقات الفسحات ؟

أ. تجلسين (للكلام أو القراءة أو الكل) ( )

ب. تقفين أو تتمشين ( )

ت. تجرين أو تزاولين ضروباً أخرى من النشاط ( )

.66 كيف يكون نشاطك في أيام العطلات مقارنةً بأيام الدراسة بالمدرسة؟

أ. أقل نشاطاً

ب. ذات القدر من النشاط

ت. أكثر نشاطاً

.67 هل عادةً ما تزاولين أي نوع من أنواع النشاط الجسمي خارج المدرسة ، كالمشي مثلاً و السباحة و الرقص و الألعاب البهلوانية؟

نعم ( )　　　　لا ( )

.68 و إذا كانت الإجابة بنعم ، فكم مرة تزاولين هذا النوع من النشاط في الأسبوع؟

أ. أقل من ساعة

ب. من ساعة إلى ثلاث ساعات

ت. من ثلاث إلى ست ساعات

ث. أكثر من ست ساعات

.69 هل تزاولين نشاطاً آخر كالتنس و كرة السلة و تنس الطاولة و ركوب الخيل و التزحلق على الجليد و قيادة الزوارق؟

نعم ( )　　　　لا ( )

.70 و إذا كانت الإجابة بنعم ، فكم مرة تزاولين هذا النوع من النشاط في الأسبوع؟

أ. أقل من ساعة

ب. من ساعة إلى ثلاث ساعات

ت. من ثلاث إلى ست ساعات

ث. أكثر من ست ساعات

.71 هل تزاولين ألعاباً رياضيةً أو تقومين بنشاطٍ جسمي بمراكز اللياقة؟

نعم ( )　　　　لا ( )

9

72. و إذا كانت الإجابة بنعم ، فكم مرة تذهبين لذلك؟
أ. مرة في الأسبوغ
ب. مرتين في الأسبوع
ت. 3–4 مرات في السبوع
ث. أكثر من خمس مرات في الأسبوع

73. و عموماً ، هل ترين أنك تقومين بتمارين رياضية كافية للمحافظة على صحة جسمك؟
نعم (   )   لا (   )   ليست لدي فكرة (   )

74. كيف تقدرين نشاط جسمك مقارنةً بمن هن في سنك و جنسك؟
دون المتوسط (   )   حوالي المتوسط (   )   فوق المتوسط (   )

75. هل تفضلين أن تتلقي دروساً في التربية البدنية بالمدرسة؟
نعم (   )   لا (   )   ليست لدي فكرة (   )

10

Appendix VIIIb: Questionnaire

Factors affecting nutritional status and eating behaviours in Saudi Arabian adolescent girls

Reference number: ________

Enrolment Date (interview date): ____/____/_______

Date of Birth _____________

Weight _______(kg)

Height ______ (cm)

Name of School __________

School code ______________

Class code ______________

District code ____________

Area of living _____________

Name (Optional) ________________

Name of interviewer ______________

Nationality ____________________

Section A: General Information

Educational level? ☐ Intermediate ☐ Secondary

Number of brothers and sisters?

Brothers ☐ Sisters ☐ Your sequence among your siblings?

With whom do you live?

Both parents ❑ Father only❑ Mother only ❑ ❑ Other (specify)________

Are parents alive?

Both alive ❑ Father alive ❑ Mother alive ❑ Both died ❑

What type of house are you living in?

Apartment ❑ Traditional house ❑ Compound ❑ Vila ❑

What is your residence status?

Owned ❑ Rented ❑ Company provided ❑

Do you have a family car Yes ❑ No ❑

If yes, how many ____________ What type_____________________

Do you have a driver? Yes ❑ No ❑ If yes, how many______

Do you keep a housemaid? Yes ❑ No ❑ If yes, how many______

What are your parents/ guardian occupations?

Mother____________ Father_______________ ,or Guardian____________

What is the approximate household total intake per month (including income from all sources for all members living with you):

Not applicable❑ <1500 SR❑ 1500-3500 SR ❑ 3500 -5500 SR ❑

5500-7500 SR ❑ >7500 SR ❑

Section (B): Dietary Intake and Food Habits

1. Do you consider yourself healthy in comparison with others your age?

Yes ❑ No ❑

2. Do you have any known medical problem?

Diabetes mellitus, hypertension, allergy, asthma, osteoporosis, thalassemias, cardiovascular diseases, sickle cell anaemia, chronic gastrointestinal disease, anaemia, hyperlipidemia, thyroid gland disorder, others

3. Do you take time considering the type of food you eat, when you are hungry?

Yes ❑ No ❑

4. Is your meal size affected by the presence of friends or family members?

Yes ❑ No ❑

5. Do you often feel hungry?

Yes ❑ No ❑

6. How often do you eat outside your home?

Once❑ Twice❑ 3 times❑ More than three❑

7. Do you skip any meal?

Yes ❑ No ❑

8. **If yes, which meal does you skips.**

   Breakfast ❑ Lunch ❑ Dinner ❑

9. **Do you normally take breakfast before you go to school?**

   Yes ❑ No ❑

10. **Do you eat snacks between meals?**

    Yes ❑ No ❑

11. **If yes, how many snacks do you normally eat per day?**

    One-snack ❑ two snacks ❑ three snacks ❑ More than three snacks ❑

12. **What is the favorite snack between meals you have?**

    Sandwiches (cheese, eggs, hamburger, others) ❑ Potato crisps ❑

    Chocolate ❑ Biscuits ❑ Fruit ❑ Donuts ❑

    Pizza ❑ Nuts❑ Ice cream ❑

    Others (please print) --------------------------------------

13. **Do you eat late before going to bed?**

    Yes ❑ No ❑

14. **When eating in a group, do you eat in separate plates?**

    Yes ❑ No ❑

15. **Which kind of food do you mostly eat?**

    Homemade food ❑ Fast food ❑ Food made outside home❑

16. **Where do you usually eat?**

    Dining room ❑ Bedroom ❑ kitchen ❑ In front of the TV ❑

17. **Are you a vegetarian?**

    Yes ❑ No ❑

18. **How many times did you eat vegetables e.g. (carrots, cucumber, peas, and cabbage) in the last 7 days?**

None ❑ one time ❑ two times ❑ more than 3times ❑ more than 6 times ❑

19. How many times did you eat green salad with meals in the last 7 days?

None ❑ one time ❑ two times ❑ more than 3times ❑ more than 6 times ❑

20. How many times did you eat fruits in the last 7 days?

None ❑ one time ❑ two times ❑ more than 3times ❑ more than 6 times ❑

21. How many times did you eat meat in the last 7 days?

None ❑ none time ❑ two times ❑ more than 3 times ❑ more than 6 times ❑

22. Which kind of meat do you eat most often?

Red meat or (its products as burgers) as beef, lamb, camel ❑

White meat as chicken, turkey ❑ Fish ❑

23. How many times did you take dairy products e.g. milk, cheese, cream, yogurt in the last 7 days?

None ❑ one time ❑ two times ❑ more than 3times ❑ more than 6 times ❑

24. How many times did you take carbohydrates e.g. bread, pasta, rice or cereals in the last 7 days?

None ❑ one time ❑ two times ❑ more than 3times ❑ more than 6 times ❑

25. How many times did you have desserts e.g. pudding, cake, or chocolate in the last 7 days?

None ❑ one time ❑ two times ❑ more than 3times ❑ more than 6 times ❑

26. How many times did you take or use fat for cooking e.g. Butter, ghee, or vegetable oil in the last 7 days?

None ❑ one time ❑ two times ❑ more than 3times ❑ more than 6 times ❑

27. How many times did you have ice creams in the last 7 days?

None ❑ one time ❑ two times ❑ more than three times ❑ more than 6 times ❑

28. Which of the following do you drink most often?

Water ❑ Fruit juice ❑ Soft drinks ❑ Hot drinks ❑

29. Do you drink Fizzy drinks e.g. (Pepsi or cola)?

Yes ❑ No ❑

30. If yes, what kind of fizzy drinks?

Full sugar ❑ diet drinks ❑

31. Do you normally add sugar to your drinks?

Yes ❑ No ❑ If yes, how many spoons______

32. Do you use any other type of sweeteners such as artificial sweeteners?

Yes ❑ No ❑

33. If yes, how many times did you use them in the last 7 days?

One time ❑ two times ❑ more than three times ❑ more than 6 times ❑

34. How many Cups of water do you drink/day?

1 cup ❑ 1-3 cups ❑ 4-6 cups ❑ 7 cups or more ❑

35. Do you have daily pocket money?

Yes ❑ No ❑

36. Do you buy food from school canteen?

Yes ❑ No ❑

37. If yes, what type?

Sandwiches ❑ Potato crisps ❑ Chocolate ❑ Biscuits ❑ Donuts ❑ Pizza ❑ Nuts ❑ Ice cream ❑ Fruit ❑

Others (please print) ❑

38. in your opinion, do you think that you eat healthy food?

Yes ❑ No ❑

39. Are following any special diet now?

Yes ❑ No ❑

40. Have you ever tried losing weight?

Yes ❑ No ❑

41. Have you ever tried gaining weight?

Yes ❑ No ❑

42. When I'm trying to change my weight, my parent:

Encourage me ❑ discourage me ❑ they do not care ❑

43. Have any of your parents tried to change his/her weight? Why?

No ❑ Yes, due to medical advice❑ Yes, due to other reasons ❑

44. Have you been in a weight reducing diet before?

Yes ❑ No ❑

45. Did you lose weight on it?

Yes ❑ No ❑

46. Do you read or follow media concerning diet issues?

Yes ❑ No ❑

47. Do you watch your figure?

Yes ❑ No ❑

48. How do you feel about your figure?

Too fat ❑ Too thin ❑ about the right weight ❑

49. in my opinion, my mother is:

Too fat ❑ Too thin ❑ about the right weight ❑

50. in my opinion, my father is:

Too fat ❑ Too thin ❑ about the right weight ❑

51. in my opinion, my mother is:

Too short ❑ too tall ❑ about the right height ❑

52. in my opinion, my father is:

Too short ❑ too tall ❑ about the right height

53. Do you smoke (a cigarette/ (Nargila) Shisha)?

Yes ❑ No ❑

54. If yes, how many cigarette/week?

.... (Please print).

55. Do you take any food supplements?

Yes ❑ No ❑

56. If yes, what kind of supplements?

Multivitamins ❑ Iron ❑ Vitamin C ❑ Zinc ❑

Calcium ❑ Others (please print) ❑

57. Did you start menstruating?

Yes❑ No❑

58. If yes, at what age?

-------------- Years and ---------months.

Section (C): Physical Activity, Life Style & Media influences

1. **Do you normally go to bed early?**

   Yes ❑ No ❑

2. **Do you normally get up early?**

   Yes ❑ No ❑

3. **Which form of transport do you normally use when travel to and from school and apart from your journey to and from school?**

   Car ❑ Walk ❑ Public transport ❑

4. **Do you read book, magazine or comics daily?**

   Yes ❑ No ❑

5. **If yes, how many hours per day do you spend on reading them?**

   Less than an hour a day ❑

   1 to 2 hours a day ❑

   More than 2 hours a day ❑

6. **Do you think that reading has an influence on your food choice?**

   Yes ❑ No ❑

7. **If yes, to what extent does reading influence your food choice?**

   Strong and important influence❑ average influence❑ no influence❑

8. **If yes, is the influence related to magazine topics or advertisement**

   Food topics❑ advertisements ❑ both❑

9. How many hours per day do you spend on doing your homework?

None ❑

Less than an hour a day ❑

1 to 2 hours a day ❑

More than 2 hours a day ❑

10. How many hours per day do you spend watching TV or Video?

None ❑

Less than an hour a day ❑

1 to 2 hours a day ❑

More than 2 hours a day

11. What is the most viewed channel by you?

…………………………………Please print

12. Does TV watching have an influence of on eating behaviours?

Yes ❑ No ❑

13. If yes, to what extent is this influence?

Strong ❑ medium ❑ no effect ❑

14. Do TV characters have an influence of on eating behaviours?

Yes ❑ No ❑

15. Do TV advertisements have an influence on your eating behaviours?

Yes ❑ No ❑

16. How many hours per day do you spend playing computer games (play station or other electronic games)?

a. None ❑ 1 to 2 hours a day ❑

b. More than 2 hours a day ❑ Less than an hour a day ❑

17. How many hours per day do you spend on Computer?

a. None ❑

b. Less than an hour a day ❑

c. 1 to 2 hours a day ❑

d. More than 2 hours a day ❑

18. How often do you use the staircase (approx 10 steps) at school each day?

e. None ❑

f. Once ❑

g. twice ❑

h. three or more ❑

19. Are you involved in food preparation or cooking at home?

Yes ❑ No ❑

20. Do you do any washing up or cleaning up in the house?

Yes ❑ No ❑

21. Do you do shopping for food and groceries or other items (e.g. clothes, toys)

Yes ❑ No ❑

22. Do you usually do any kind of physical activities at school?

Yes ❑ No ❑

23. What do usually do at school breaks?

Sitting down (talking, reading or eating) ❑ Standing or walking around ❑

Running or performing other physical activities ❑

24. During holidays how active are you in comparison to school days?

a. Less active ❑

b. About the same ❑ More active ❑

25. Do you normally perform any kind of physical activities outside school e.g. walking, horse riding, and shopping, bowling, table tennis?

Yes ❑ No ❑

26. If yes, how often do you perform these activities per week?

a. Less than 1 hour ❑

b. 1 to 3 ❑

c. 3 to 6 hours ❑

d. More than 6 hours ❑

27. Do you perform other activities like e.g. Swimming, cycling, tennis, squash, ice-skating, sailing or boating, basketball, dancing, or competitive running as Jogging?

Yes ❑ No ❑

28. If yes, how often do you perform these activities per week?

a. Less than 1 hour ❑

b. 1 to 3 hours ❑

c. 3 to 6 hours ❑

d. More than 6 hours ❑

29. Do you play sports or do physical activities at fitness centres?

Yes ❑ No ❑

30. If yes, how often do you attend?

Once a week ❑ twice a week ❑ 3-4 times a week ❑

5+ times a week ❑

31. In General speaking, do you think that you perform enough exercise to keep healthy?

Yes ❑ No ❑ I have no idea ❑

32. How active are you, in comparison to others your age and sex?

Below average ❑ about average ❑ above average ❑

33. Would you prefer to have physical education classes at school?

Yes ❑ No ❑ I have no idea ❑

Appendix IX: Permission for TV study model adaptation

Subject:	TV food advertising
From:	[redacted]
Date:	Mon, December 15, 2008 10:52 am
To:	"Elham Aljaaly" <e.aljaaly@ich.ucl.ac.uk>
Priority:	Normal
Read receipt:	sent
Options:	View Full Header | View Printable Version

Dear Elham,

I prepared our study protocol as clear as it was possible. I hope that you can use it, even if you decide to make some modifications.

The first attached file is the protocol with all the signs we tried to define in the recorded ads. I made some explanation and gave you some examples. The second file is a protocol of our study with one of our videotaped ads, which could make it easier to understand some of the signs.

For the statistical analysis, we used SPSS, 15.0. We applied Frequency and Descriptive analyses, ANOVA, correlation and regression analyses.

In our article, you can find these methods and the way we have used them.

If you need more information or find something not well defined, I will try to explain it.

I hope that the provided information will help you with your research.

Good luck!

Best regards,

Sonya

Appendix X: Procedures for data recording & viewing

A. Data recording procedure for TV channels

Recording of programming was carried out by a specialized technician using the following steps:

1. The portable hard-drive was connected to the Digital Satellite Receiver via a USB cable
2. The digital satellite receiver was switched on and the connected hard-drive was defined to digital satellite receiver.
3. The digital satellite receiver was programmed based on a serious of technical steps:

   By pressing: ►Menu….. **OK**…… USB…….**OK**…..Time Manager (to set the specified time dates which were set up from 14:00 to 2:00 am on weekdays and for 24 hrs on weekends days).

   By pressing: Then, choosing for example: N1…. **OK** …… choose the state (Daily)….. **OK**….. Choosing the date… **OK**… choosing the start time….**OK**… chooses the end time…. OK…choosing the channel, (MBC1)…OK …chooses the record on… O**K**……. choosing the power off (This is set when recording is on and needs to make sure the recording is on process even if nobody is using the Digital Satellite Receiver for watching

B. Appendix Xb: Data viewing procedure for TV channels

Viewing of programming was carried out by the researcher using the following steps:

- The portable hard-drive was connected to the Digital Satellite Receiver via USB cable.
- The Digital Satellite Receiver was switched on to recognize the connected hard-drive following the steps below:

  Pressing ►Menu….. **OK** ……USB……**OK**……..File list……….**OK**……..choosing the director which the records are stored on……. **OK**……..choosing file according to date appeared on each file…… **OK**
- On this stage, details about the file will appear on the preview screen as: 1) Size in megabytes, 2) Duration in hours, and 3) the current viewing time.
- Finally, pressing of….. **OK**……. button will allow viewing a full screen with the file name and date.

Appendix XI: Signs and codes for TV content analysis

No.	Variable name	Label
1	**Station**	Name of TV Station
2	**Rec_day**	Day of recording
3	**PRO_ID**	Programme identification number
4	**PROG_NAME**	Name of Programme
5	**Air_time**	Air time or viewing hours
6	**Prog_type**	TV programme type
8	**Prog_duration**	Duration of the programme in minutes
8	**Ads_spot**	Number of TV advertisement (slots) spots during the viewed programme hours
9	**Ads_spot_duration**	Duration of the TV ads spots in seconds
10	**Ads_numb_per_spot**	Number of the ads in the spot
11	**Ads_name**	name of the ad
12	**Ads_duration**	Advertisement duration in seconds
13	**Ad_format**	Format of the advertisement
14	**Ad_type**	Type of the advertised product
15	**Adv_aired_location**	Where was the adv broadcasted
16	**Non_food**	Commercial Categories of Non-food Items
17	**Food_categ**	Commercial Categories of food Items
18	**Oils_sugars_ads**	Fats, oils, and sugars
19	**Bread_ads**	Bread, Cereal, rice and pasta
20	**Meat_ads**	Meat, poultry, fish, dry beans, eggs, cheese and nuts

Appendix XI: Signs and codes for TV content analysis (continue)

No.	Variable name	Label
21	**Comb_meals**	Combination meals
22	**Rest_food**	Restaurant food
23	**Fru_veg**	Vegetables, potatoes & savoury snacks
24	**Food_group**	Food group of the advertised product
25	**Health_info**	Health-related information
26	**Product_info**	Basis of the main product information provided to children
27	**Associations**	The most common and popular appeals/ associations
28	**Marketing_meth**	Marketing methods
29	**Target_aud**	Targeted audience
30	**Actor_age**	Age of the actor or character in the advertisement
31	**Actor_gender**	Gender of the actor or character in the advertisement
32	**Actor_weight**	Weight or physical appearance of the actor or character in the advertisement
33	**Actor_eating**	Actor or character shown eating

Appendix XII: A sample menue for school meal and snacks for public schools

Gulf Catering Company KaKo Project - Jeddah

School Daily Issue Sheet

District : EAST	Route No : 12	Invoice No. : 822668	Date : 11/03/2009
School : 1087	G 1	Name : EAST-12-G57 (57 n)	NOS : 565

Sr.No. رقم التسلسل	Item Name اسم الصنف		Selling Price سعر البيع	Opening Stock رصيد افتتاحي	Issue اصدار	Return المرتجع	Closing Stock رصيد ختامي
1	Choco Bar Bakery	فطيرة الشوكولاته	1.00	0	14		
2	Cream Cheese Sandwich	ساندويتش جبنة	1.00	0	7		
3	Croissant Plain	كروسان سادة	1.00	0	49		
4	Grape Leaves	ورق عنب	3.00	0	10	2	
5	Haris Drink	عصير وجبة الحارس	0.00	0	2		
6	Haris Sandwich	ساندويتش وجبة الحارس	0.00	0	4		
7	Labnah & Zatar Bar	فطيرة لبنة وزعتر	1.00	0	7		
8	Pizza Large	بيتزا كبير	2.00	0	24		
9	Tamiah Sandwich	ساندويتش طعمية	1.00	0	7		
10	White Cheese Bar	فطيرة الجبنة	1.00	0	55		
11	White Cheese Puff	بريك بالجبنة	1.00	0	81		
12	Al Rabie Apple330 ml	عصير الربيع تفاح330مل	2.00	126	0		123
13	Al Rabie Mango 330 ml	عصير الربيع مانجو330مل	2.00	78	0		65
14	Al Rabie Mix330ml	عصير الربيع مشكل 330 مل	2.00	36	0		28
15	Al Rabie Orange 330ml	عصير الربيع برتقال330	2.00	36	0		33
16	Al Rabie Apple Nectar 200ml	عصير تفاح الربيع 200مل	1.00	351	0		218
17	Al Rabie Orange Nectar 200ml	عصير برتقال الربيع 200مل	1.00	783	0		679
18	Bounty Fun Size19.7 g	باونتي فن سايز	1.00	245	0		217
19	Date Bars 1 x 48	بسكويت بالتمر	1.00	56	96		147
20	Galaxy Caramel	جالكسي كراميل	1.00	630	0		569
21	Galaxy Crispy	جالكسي كرسبي	1.00	633	0		519
22	Mini Crackers Cheese 22gms	ميني كركرز-الجبنة	1.00	96	0		96
23	Mini Crackers Pizza 22gms	ميني كركرز - البيتزا	1.00	62	0		62
24	Mini Crackers Salt 22gms	ميني كركرز-الملح	1.00	48	0		48
25	Nova Water 0.6 Litres	ماء نوفا 600مل	1.00	759	0		567
26	Tiffany Break 35gms 1*24		1.00	1320	0		1073
27	Ulker Cubuk Kraker 30g	أولكر كوبيك كراكر 30جم	1.00	34	0		18

Total Bakery Value In SR ~~[illegible]~~ 298

Badge No: Unknown

Unknown

Sign:

[redacted]

Sign:

Sign:

Total Cash Received from Salesman = SR 1258

SR 1 x = 528	SR 10 x 28 = 280	SR 50 x 2 = 100	SR 200 x =
SR 5 x = 62 = 310	SR 20 x = 2 = 40	SR 100 x =	SR 500 x =

Appendix XIII: Analysis for school menu of the govermental-sponsered schools using NP

Sheet 1: Total A points

Serial No.	Item name	Points	Energy(kJ)	Sat Fat (g)	Total Sugar (g)	Sodium(mg)
1.	Choco bar bakery 1+5+3+2	11	353	5.7	15.7	225.7
2.	Cream cheese sandwich	20	313	20	1.2	1290
3.	Croissant plain 1+5+0+3	9	432	6	3	340
4.	Grape leaves Rice (stuffed with rice)		97 349	0.9 NA	3.5 NA	795 NA
5.	Labnah &Zatar bar 1+4+1+4	10	368	5	5	415
6.	Pizza large		280	5.2	3.2	624
7.	Tamiah sandwich (falafel)		333	2.4	NA	294
8.	White cheese bar 0+5+1+4	10	332.7	5.7	5.7	382.9
9.	White cheese puff 0+5+1+4	10	331.5	5.7	5.7	382
10.	Al-Rabie mango 0+0+3+0	3	60	0	15	5
11.	Al-Rabie mix Nectar 0+0+3+0	3	60	0	15	10
12.	Al-Rabie orange 0+0+1+0	1	30	0	8	10
13.	Al-Rabie apple Nectar 0+0+2+0	2	50	0	12	5
14.	Bounty 1+10+10+0	21	470	21.4	47.3	30
15.	Dates bar 1+2+10+5	18	381.8	3	53.5	501.8
16.	Galaxy caramel 1+10+10+1	22	480	15.3	47.8	100
17.	Galaxy crispy 1+10+10+1	22	515	17.5	48.8	150
18.	Mini crackers cheese 1+9+3+10	23	485.7	10	14.3	514.3
19.	Mini crackers salt 1+2+2+10	15	466.7	3	13.3	1000
20.	Ulker cubuk cracker 1+3+0+9	13	415	3.1	0	900

Appendix XIII: Analysis for school menu of govermental-sponsered schools using NP (contiune)

Sheet 2: Total C Points

Serial No.	Item name	Points	Fruit, Veg & Nuts (%)	NSP Fibre (g)	Or AOAC Fibre ‘ (g)	Protein (g)
1.	**Choco bar bakery 0+5+4**	*9*	*0*	*NA*	*5.5*	*7.1*
2.	**Cream cheese sandwich**	*5*	*0*	*NA*	*NA*	*10*
3.	**Croissant plain 0+5+5**	*10*	*0*	*NA*	*6*	*10*
4.	**Grape leaves (stuffed with rice)**	*NA*		*NA*	*5.3*	*4.4*
5.	**Labnah &Zatar bar *0+5+5***	*10*	*0*	*NA*	*5*	*8.3*
6.	**Pizza large 0+1+5**	*NA*	*NA*	*NA*	*NA*	*11.73*
7.	**Tamiah sandwich (falafel)**	*333*	*NA*	*NA*	*NA*	*13.3*
8.	**White cheese bar 0+5+5**	*10*	*0*	*NA*	*5.5*	*8.6*
9.	**White cheese puff *0+5+5***	*10*	*0*	*NA*	*5.5*	*8.9*
10.	**Al-Rabie mango 0+ 0+0**	*0*	*100*	*NA*	*0.5*	*0*
11.	**Al-Rabie mix Nectar 0+1+0**	*1*	*30*	*NA*	*1*	*0*
12.	**Al-Rabie orange 5+ 0+0**	*5*	*100*	*NA*	*0.5*	*0*
13.	**Al-Rabie apple Nectar 0+0+0**	*0*	*30*	*NA*	*0.5*	*0*
14.	**Bounty 0+1+2**	*3*	*30 calc*	*NA*	*1.8*	*4.1*
15.	**Dates bar 1+3+1**	*5*	*53*	*NA*	*3*	*3*
16.	**Galaxy caramel *0+1+3***	*4*	*0*	*NA*	*1*	*5.3*
17.	**Galaxy crispy 0+1+4**	*5*	*0*	*NA*	*1.5*	*6.5*
18.	**Mini crackers cheese *0+3+5***	*8*	*0*	*NA*	*3*	*8.6*
19.	**Mini crackers salt 0+1+4**	*5*	*0*	*NA*	*1*	*6.7*
20.	**Ulker cubuk kraker 0+0+4**	*4*	*0*	*NA*	*0.7*	*6.8*

Appendix XIII: Analysis for school menu of govermental-sponsered schools using NP (contiune)

Sheet 3: Overall score

Serial No.	Item name	Total A Points	Total C Points	Score A-C
1.	Choco bar bakery 0+5+4	11	9	2
2.	Cream cheese sandwich	20	5	15
3.	Croissant plain 0+5+5	9	10	-1
4.	Grape leaves	NA	NA	NA
5.	Labnah &Zatar bar *0+5+5*	10	10	0
6.	Pizza large			
7.	Tamiah sandwich			
8.	White cheese bar 0+5+5	10	10	0
9.	White cheese puff *0+5+5*	10	10	0
10.	Al-Rabie mango 0+ 0+0	3	0	3
11.	Al-Rabie mix Nectar 0+1+0	3	1	2
12.	Al-Rabie orange 5+ 0+0	1	5	-4
13.	Al-Rabie apple Nectar 0+0+0	2	0	2
14.	Bounty 0+1+2	21	3	20*
15.	Dates bar 1+3+1	18	5	13
16.	Galaxy caramel *0+1+3*	22	4	21*
17.	Galaxy crispy 0+1+4	22	5	17
18.	Mini crackers cheese *0+3+5*	23	8	15
19.	Mini crackers salt 0+1+4	15	5	10
20.	Ulker cubuk kraker 0+0+4	13	4	13*

Appendix XIV: Analysis for school menu of AL-Manarat private school using NP: Sheet 1: Total A points

Serial No.	Item name	Points	Energy(kJ)	Sat Fat (g)	Total Sugar (g)	Sodium(mg)
21.	Croissant cheese 1+10+2+3	16	414	10.63	11.35	360
22.	Croissant chocolate					
23.	Croissant plain 1+10+2+3	16	406	11.66	11.26	345.27
24.	Chocolate Donuts 1+4+7+1	12	412	4.67	35.11	345
25.	Pizza 0+5+1+6	12	276.3	5.08	5	554.8
26.	Popcorn 1+1+0+8	10	528	6.31	0.54	771
27.	Sweet corn 0+0+0+0	0	97.6	0	4	4.8
28.	Cheese 1+10+0+6 & French bread 0+0+0+7	16 7	403 289	21.10 0.5	0.52 2.56	621 650
29.	Ulker Biscuits 1+6+4+0	11	484	7	21	74
30.	Oreo Biscuits 1+9+8+0	18	480	10	38.5	0.34
31.	Lays Potato Chips 1+10+0+7	18	500	13	0.6	700
32.	Cocktail Nectar 0+0+3+0	3	60	0	15	10
33.	Apple Nectar 0+0+2+0	2	50	0	12	5
34.	Orange Nectar 0+0+2+0	2	51	0	12	3
35.	Twix 1+10+10+2	22	501	19	48.4	198
36.	Kit-Kat 1+10+10+0	21	517.7	17.7	49	54.2
37.	Chocolate Wafer with nuts 1+10+10+6	26	500	11.3	30	580
38.	Chocolate Ice cream 0+6+5+0	11	216	6.8	25.36	76
39.	Mango Ice cream					
40.	Vanilla Ice cream 0+6+4+0	10	207	6.79	21.22	80
41.	Strawberry Ice cream 0+5+4+0	9	192	5.19	4.43	60

Appendix XIV: Analysis for school menu of AL-Manarat private school using NP (continue)

Sheet 2: Total C Points

Serial No.	Item name	Points	Energy(kJ)	Sat Fat (g)	Total Sugar (g)	Sodium(mg)
1.	Croissant cheese 1+10+2+3	16	414	10.63	11.35	360
2.	Croissant chocolate					
3.	Croissant plain 1+10+2+3	16	406	11.66	11.26	345.27
4.	Chocolate Donuts 1+4+7+1	12	412	4.67	35.11	345
5.	Pizza 0+5+1+6	12	276.3	5.08	5	554.8
6.	Popcorn 1+1+0+8	10	528	6.31	0.54	771
7.	Sweet corn 0+0+0+0	0	97.6	0	4	4.8
8.	Cheese 1+10+0+6 & French bread 0+0+0+7	16 7	403 289	21.10 0.5	0.52 2.56	621 650
9.	Ulker Biscuits 1+6+4+0	11	484	7	21	74
10.	Oreo Biscuits 1+9+8+0	18	480	10	38.5	0.34
11.	Lays Potato Chips 1+10+0+7	18	500	13	0.6	700
12.	Cocktail Nectar 0+0+3+0	3	60	0	15	10
13.	Apple Nectar 0+0+2+0	2	50	0	12	5
14.	Orange Nectar 0+0+2+0	2	51	0	12	3
15.	Twix 1+10+10+2	22	501	19	48.4	198
16.	Kit-Kat 1+10+10+0	21	517.7	17.7	49	54.2
17.	Chocolate Wafer with nuts 1+10+10+6	26	500	11.3	30	580
18.	Chocolate Ice cream 0+6+5+0	11	216	6.8	25.36	76
19.	Mango Ice cream					
20.	Vanilla Ice cream 0+6+4+0	10	207	6.79	21.22	80
21.	Strawberry Ice cream 0+5+4+0	9	192	5.19	4.43	60

Appendix XIV: Analysis for school menu of AL-Manarat private school using NP (continue)

Sheet 3: Overall score

Serial No.	Item name		Total A Points	Total C Points	Score A-C
1	**Croissant cheese**	*16*	*7*	*9*	**HFSS Food**
2	**Croissant chocolate**				
3	**Croissant plain 1+5+0+3**	*16*	*7*	*9*	
4	**Chocolate Donuts**	*12*	*5*	*7*	
5	**Pizza**	*12*	*8*	*4*	
6	**Popcorn**	*10*	*10*	*0*	**HFSS Food**
7	**Sweet corn**	*0*	*4*	*-4*	**HFSS Food**
8	**Cheese & French bread sandwich**	*16* *7*	*5* *7*	*11* *0*	
9	**Ulker Biscuits 11-(4-4)**	*11*	*4*	*11*	
10	**Oreo Biscuits**	*18*	*6*	*12*	
11	**Lays Potato Chips**	*18*	*9*	*9*	
12	**Cocktail Nectar 0+0+3+0**	*3*	*1*	*2*	
13	**Apple Nectar 0+0+2+0**	*2*	*0*	*2*	
14	**Orange Nectar 0+0**	*2*	*0*	*2*	
15	**Twix 22-(2-2)**	*22*	*2*	*22*	
16	**Kit-Kat 21-(4-3)**	*21*	*4*	*20*	
17	**Chocolate Wafer with nuts**	*26*	*7*	*19*	
18	**Chocolate Ice cream 11-(2-2)**	*11*	*2*	*11*	
19	**Mango Ice cream**				
20	**Vanilla Ice cream**	*10*	*2*	*8*	
21	**Strawberry Ice cream**	*9*	*1*	*8*	

Appendix XV: Analysis for food adverts (MBC 1, 3 & 4) using NP

Serial No.	Item name	Points	Energy(kcal)	Sat Fat (g)	Total Sugar (g)	Sodium(mg)
Total Drinks [Water/Coffee/Tea/Soft Drinks]						
1.	**7 up**		*36*	*0*	*9*	*NA*
2.	**Coca Cola 0+0+2+0**	*2*	*42*	*0*	*10.7*	*0*
3.	**Lipton chai latte 1+6+10+7**	*24*	*423*	*7*	*67*	*634*
4.	**Lipton green tea 0+0+0+0**	*0*	*<1*	*0*	*0*	*0*
5.	**Lipton tea (jar) 0+0+0+0**	*0*	*1*	*0*	*0*	*0.01*
6.	**Maxwell house coffee 0+0+0+0**	*0*	*78*	*0*	*0*	*37*
7.	**Miranda**		*51*	*0*	*NA*	*NA*
8.	**Mountain dew**		*NA*	*0*	*NA*	*NA*
9.	**Moussy NA**		*NA*	*0*	*NA*	*NA*
10.	**Nestle Water 0+0+0+0**	*0*	*0*	*0*	*0*	*16*
11.	**Pepsi**		*42*	*0*	*11*	*NA*
12.	**Pepsi Max**		*0*	*0*	*0*	*NA*
13.	**Sprite 0+0+2+**	*2*	*48*	*0*	*12*	*7*
14.	**Sun Cola**		*53*	*0*	*13*	*NA*
15.	**Sun top drink (orange)**		*57*	*0*	*NA*	*NA*
16.	**TANG (orange) 1+0+10+3**	*14*	*388*	*0*	*92*	*280*
Milk & Milk Products [mil/Yogurt/Cheese/Ice Cream/coffee Whitener]						
17.	**Actimil**		*NA*	*NA*	*NA*	*NA*
18.	**Activia 0+1+0+0**	*1*	*63*	*2*	*4.2*	*54*
19.	**Almarai flavored milk**		*72*	*NA*	*NA*	*NA*
20.	**Almarai labnah**		*196*	*NA*	*NA*	*NA*
21.	**Almarai milk chocolate**		*86*	*NA*	*NA*	*NA*
22.	**Coffee mate**		*35*	*1.8*	*NA*	*NA*

Appendix XV: Analysis for food adverts (MBC 1, 3 & 4) using NP

Sheet.1: Total A Points

Serial No.	Item name	Points	Energy(kcal)	Sat Fat (g)	Total Sugar (g)	Sodium(mg)
Vegetables/Potatoes/Savory Snacks						
23.	Danao		*NA*	*NA*	*NA*	*NA*
24.	Danette		*NA*	*NA*	*NA*	*NA*
25.	Haagen Dazs Ice Cream (e.x. Vanilla) ½ cup 0+10+4+0	*14*	*270*	*11*	*21*	*70*
26.	Kraft cheddar		*228*	*NA*	*NA*	*NA*
27.	Kraft cream cheese 1+10+0+10	*20*	*313*	*20*	*1.2*	*1290*
28.	La Vache Quirit		*283*	*NA*	*NA*	*NA*
29.	Nido		*507*	*NA*	*NA*	*NA*
30.	Doritos 1+10+0+8	*19*	*490*	*12*	*3.4*	*800*
31.	Lays chips (classic)	*11*	*520*	*NA*	*NA*	*700*
Cereals & Cereals Products						
32.	Betty Crocker cake 0+2+5+3	*10*	*280*	*2.8*	*25*	*340*
33.	Chocolate Cake Moist 0+3+5+3	*11*	*279*	*3.03*	*25*	*360*
34.	Coco Pops 1+0+7+3	*11*	*387*	*1*	*35*	*300*
35.	Corn flakes 1+0+1+5	*7*	*378*	*0.2*	*8*	*500*
36.	Indomi 1+7+0+10	*18*	*467*	*8*	*4*	*1600*
37.	Nesquik cereal 1+1+7+5	*14*	*379*	*1.6*	*35*	*510*
38.	Oreo Biscuits 1+9+8+0	*18*	*480*	*10*	*38.5*	*3.4*
39.	Rice 0+0+0+0	*0*	*333*	*0*	*0*	*0*
40.	Toya noodles 1+8+1+ 10	*20*	*475*	*9*	*8*	*1000*
41.	Twistos 1+6+1+10	*17*	*453*	*4.1*	*4.7*	*600*

Appendix XV: Analysis for food adverts (MBC 1, 3 &4) using NP

Sheet.2: Total C Points

Serial No.	Item name	Points	Fruit, Veg & Nuts (%)	NSP Fibre (g)	Or AOAC Fibre ' (g)	Protein (g)
Total Drinks [Water/Coffee/Tea/Soft Drinks]						
1.	7 up 0+0+0	0	0		0	0
2.	Coca Cola 0+0+0	0	0		0	0
3.	Lipton chai latte 0+NA+5	5	0		0	10.6
4.	Lipton green tea 0+NA+0	0	0		0	0
5.	Lipton tea (jar)0+0+0	0	0		0	0
6.	Maxwell house coffee 0+5	5	0		0	11.2
7.	Miranda 0	0	0		0	0
8.	Mountain dew NA	0	0		0	NA
9.	Moussy NA	0	*0*		*0*	*NA*
10.	Nestle Water 0+0+0	0	0		0	0
11.	Pepsi 0	0	0		0	0
12.	Pepsi Max 0	0	0		0	0
13.	Sprite 0+NA	0	0		0	0
14.	Sun Cola	0	0		0	0
15.	Sun top drink (orange)	0	0		0	0
16.	TANG 0+0	0	0		0.4	0
Milk & Milk Products [mil/Yogurt/Cheese/Ice Cream/coffee Whitener]						
17.	Actimil		0		NA	2.9
18.	Activia 0+2	2	0		NA	3.9
19.	Almarai flavored milk		0		NA	2.8
20.	Almarai labnah		0		NA	7
21.	Almarai milk chocolate		0		NA	3
22.	Coffee mate 0	0	0		0	NA

Appendix XV: Analysis for food adverts (MBC 1, 3 &4) using NP
Sheet.2: Total C Points (contiue)

Serial No.	Item name	Points	Fruit, Veg & Nuts (%)	NSP Fibre (g)	Or AOAC Fibre ' (g)	Protein (g)
Milk & Milk Products [mil/Yogurt/Cheese/Ice Cream/coffee Whitener] Continue						
23.	Danao		25		NA	NA
24.	Danette		0		NA	NA
25.	Haagen Dazs Ice Cream (e.x. Vanilla) ½ cup 0+3	3	0		NA	5
26.	Kraft cheddar 0+5	5	0		NA	13.5
27.	Kraft cream cheese 0+5	5	0		NA	10
28.	La Vache Quirit 0+5	5	0		NA	10
29.	Nido NA +5	5	0		NA	24
Vegetables/Potatoes						
30.	Doritos	6	0		3	6.2
31.	Lays chips 3+4	7	0		3.5	7
32.	*Cereals & Cereals Products*					
Savory Snacks						
33.	Betty Crocker cake 0+0+2+	2	0		0.61	3.88
34.	Chocolate Cake Moist 0+0+2	2	0		0.48	4.4
35.	Coco Pops (Kellogg's) 0+2+3	5	0		2	5
36.	Corn flakes (Kellogg's) 0+3+4	7	0		3	7
37.	Indomi 0+3+5	8	0		3	10
38.	Nesquik cereal 5+4	9	0		6.7	7.8
39.	Oreo Biscuits 0+2+3	5	0		2.4	5.2
40.	Rice 0+0+4	4	0		0	6.7
41.	Toya noodles 0+4+5	9	0		4	9
42.	Twistos 0+2+5	7	0		3	7.6

Appendix XV: Analysis for food adverts (MBC 1, 3 &4) using NP
Sheet.2: Total C Points (contiue)

Sugars/Preserves/Candy Snacks						
43.	**Cadboury 0+0+4**	4	0		0.4	7.7
44.	**Family sugar powder**		0		NA	Nil
45.	**Ferrero Rocher**		NA		NA	NA
46.	**Flake chocolate 0+0+5**	5	0		0.4	9.4
47.	**Galaxy chocolate 0+NA+NA**	0	0		0	NA
48.	**Kinder beuno 0+NA+5**	5	10.5		NA	9.2
49.	**Kinder Country Chocolate NA+5**	5	0		NA	8.9
50.	**Kinder surprise NA**		0		NA	NA
51.	**Merci chocolate 0+NA+4**	4	0		NA	7.3
52.	**Snickers chocolate 0+1+5**	6	24		1.2	9
53.	**Twix 0+1+2**	*3*	*0*		*1.5*	*4.8*
54.	**Ulker chocolate**		NA		NA	NA
55.	**Wregleys Extra 0**	0	0		0	0

Appendix XV: Analysis for food adverts (MBC 1, 3 &4) using NP
Sheet.2: Total C Points (contiue)

Serial No.	Item name	Points	Fruit, Veg & Nuts (%)	NSP Fibre (g)	Or AOAC Fibre ‘ (g)	Protein (g)
Miscellaneous						
56.	Goody mayonnaise 0+0+5	5	0		0	11.4
57.	Ketchup 5+0+0	5	NA		0.6	1
58.	Maggi chix stock		0		NA	2.5
59.	Maggi mushroom soup		NA		NA	NA
60.	Maggi soup 0+NA+5	5	0		NA	9.5
Fat						
61.	Alarabi oil		NA		NA	NA
62.	Noor oil 0	0	0		0	0
Fruits & Nuts						
63.	Chiquita Banana		NA		NA	NA
64.	Goody peanuts butter 5+5+5	15	>80		6.25	25
65.	Tropicana juice 5+NA+0		NA		NA	NA
Meat						
66.	Sadia Chicken Nuggets		0		NA	13

Appendix XV: Analysis for food adverts (MBC 1, 3 & 4) using NP

Sheet.3: Overall score

Serial No.	Item name	Score A	Score C	Total
Total Drinks [Water/Coffee/Tea/Soft Drinks]				
1.	7 up			
2.	Coca Cola	2	0	2
3.	Lipton chai latte	24	5	19
4.	Lipton green tea	0	0	0
5.	Lipton tea (jar)	0	0	0
6.	Maxwell house coffee	0	5	-5
7.	Miranda	NA	NA	NA
8.	Mountain dew	NA	NA	NA
9.	Moussy	NA	NA	NA
10.	Nestle Water	0	0	0
11.	Pepsi	NA	NA	NA
12.	Pepsi Max	NA	NA	NA
13.	Sprite	2	0	2
14.	Sun Cola	NA	NA	NA
15.	Sun top drink (orange)	NA	NA	NA
16.	TANG	14	0	14
Milk & Milk Products [milk/Yogurt/Cheese/Ice Cream/coffee Whitener				
17.	Actimil	NA	NA	NA
18.	Activia	NA	NA	NA
19.	Almarai flavored milk	NA	NA	NA
20.	Almarai labnah	NA	NA	NA
21.	Almarai milk chocolate	NA	NA	NA
22.	Coffee mate	NA	NA	NA

Appendix XV: Analysis for food adverts (MBC 1, 3 & 4) using NP
Sheet 3: Overall score (contiue)

Serial No.	Item name	Score A	Score C	Total
Vegetables/Potatoes/Savory Snacks				
23.	Danao	NA	NA	NA
24.	Danette	NA	NA	NA
25.	Haagen Dazs Ice Cream	NA	NA	NA
26.	Kraft cheddar	NA	NA	NA
27.	Kraft cream cheese	NA	NA	NA
28.	La Vache Quirit	NA	NA	NA
29.	Nido	NA	NA	NA
30.	Doritos	19	6	13
31.	Lays chips	NA	NA	NA
Cereals & Cereals Products				
32.	Betty Crocker cake	10	2	8
33.	Chocolate Cake Moist	11	2	11*
34.	Coco Pops (Kellogg's)	11	5	6
35.	Corn flakes (Kellogg's)	7	7	0
36.	Indomi	18	8	10
37.	Nesquik cereal	14	9	5
38.	Oreo Biscuits	18	5	13
39.	Rice	0	4	-4
40.	Toya noodles	20	9	11
41.	Twistos	17	7	10
Sugars/Preserves/Candy Snacks				
42.	Cadbury	22	4	22*
43.	Family sugar powder	NA	NA	NA
44.	Ferrero Rocher	NA	NA	NA

Appendix XV: Analysis for food adverts (MBC 1, 3 & 4) using NP : Sheet 3: Overall score (contiue)

Serial No.	Item name	Score A	Score C	Total
45.	Flake chocolate	22	5	17
46.	Galaxy chocolate	NA	NA	NA
47.	Kinder beuno	NA	NA	NA
48.	Kinder Country	NA	NA	NA
49.	Kinder surprise	NA	NA	NA
50.	Merci chocolate	NA	NA	NA
51.	Snickers chocolate	23	6	17
52.	Twix	*22*	*3*	*21**
53.	Ulker chocolate	NA	NA	NA
54.	Wregleys Extra	0	0	0
Miscellaneous				
55.	Goody mayonnaise	17	5	12
56.	Ketchup	NA	NA	NA
57.	Maggi chix stock	NA	NA	NA
58.	Goody mayonnaise	17	5	12
59.	Maggi mushroom soup	NA	NA	NA
60.	Maggi soup	NA	NA	NA
Fat				
61.	Alarabi oil	NA	NA	NA
62.	Noor oil	10	0	10
Fruits & Nuts				
63.	Chiquita Banana	NA	NA	NA
64.	Goody peanuts butter	18	15	3
65.	Tropicana juice	NA	NA	NA
Meat				
66.	Sadia Chicken Nuggets	NA	NA	NA

Appendix XVIa: Sample1 of school snack item with (Nutrition Facts)

Appendix XVIb: Sample2 of school snack item with (Nutrition Facts)

Appendix XVII: Population, country profile & indicators in Saudi Arabia

Population/Profile/Indicators	Value
Population/demographics	
***Population 2010 (Total Saudis/non-Saudis)**	27,136,977
***Population 2010 (Saudis)**	18,707,576(68.9%)
***Saudi females**	49.1%
***Population growth rate among the population in 2004 and 2010 census**	3,2 %
***Population under 15 years for both genders (2007)**	32.5%
***Female population under 15 years (2007)**	36.1%
***Population (15-65 years) for both genders (2007)**	64.7%
***Female population (15-65 years) (2007)**	(60.8%)
***Population (>65 years) for both genders (2007)**	2.8%
***Female population(>65 years) (2007)**	3.1%
***Average age of marriage (2007)**	25.2 years
# Ethnic groups: Arab & Afro-Asian (of total Saudi population)	90% &10% resp.
Health Indicators	
****Prevalence of undernourishment in total population (%) (2010)**	<5
ǂ Health expenditure/capita (US$) (2009)	714
*****Under-five mortality (per 1,000 live births)(2010)**	18
ǂ Rate and infant mortality (per thousand live births) 2009	14
ǂ Death Rate (2009)	4
****Life expectancy at birth (years) (2010)**	73.3
# Life expectancy for males/females	74/78 resp.
ǂ Urban Development (improved sanitation facilities, urban (% of Urban population with access) (2008)	100%

Source Data based on: *Central Department of Statistics & Information, SA **International Human Development Reports ***The World Bank, ǂ Ministry of Health Portal, SA # U.S, Department of State

Appendix XVII: Population, country profile& indicators in Saudi Arabia (continued)

Population/Profile/Indicators	Value
Education Indicators	
****Adult literacy rate for both sexes (% aged 15 and above) (2009)**	86%
****Combined gross enrolment ratio in education (both sexes) (%)(2010)**	78.5
****Expenditure on education (% of GDP) (%)(2010)**	5.7
****Internet users (per100 people) (2010)**	31.5
****Mean years of schooling (of adults) (years) (2010)**	7.8
****Expected Years of Schooling (of children) (years) (2010)**	13.5
ǂ Gross enrolment rate in primary education % for both gender (2009)	99
ǂ Literacy rate, youth female (% of females ages 15-24) (2009)	97%
Income Indicators	
****GDP per capita (2008 PPP US$)**	24,208
****GNI per capita (2008 PPP US$) LN**	10.1
****Household final consumption expenditure per capita PPP (constant 2005 international $)**	4,664

Source Data based on: *Central Department of Statistics & Information, SA **International Human Development Reports ***The World Bank, ǂ Ministry of Health Portal, SA # U.S, Department of State

Appendix XVIII: List of publications & presntations

1. Been an invited speaker at ‘Children’s TV in the Arab World’ conference/London-2010
2. Been an invited speaker at ‘Saudi International Conference (SIC)’/Mancheter-2010
3. Been invited to do a national workshop for Saudi students and their families on ‘Food Marketing Directed to Children and Adolescents and Influences on Food Choice’/University of Brighton, June 2009

   Been an invited speaker at ‘The National Marathon for Saudi female’/University of Sheffield, June 2010’

   Title: ‘Physical Activity and Saudi Adolescent females”
4. Abstract accepted at the ‘1st International conference on Nutrition and Growth’ scheduled to take place in Paris, France, March 1- 3, 2012.

   Title: "The weight status of Saudi adolescent girls using the 2007 WHO reference data"
5. A Peer Review Publication in the International Journal of Food, Nutrition and Public Health (IJFNPH).

   Title: ‘’ Overweight and its Determinants in Adolescent Girls in Jeddah City, Saudi Arabia"

Appendix XIX: Abstract of author's presentaion (TV study) at 'Children's TV in the Arab World' conference/London-2010

Appendix XXX: Abstract of author's presentaion (Survey study) at 'Saudi International conference'/Mancheter-2010

Appendix XXXI: Abstract accepted at 1st International conference on Nutrition and Growth scheduled to take place in Paris, France, March 1- 3, 2012

Appendix XXXII: Abstract of the paper ‘ Overweight and its Determinants in Adoelscent Girls in Jeddah City, Saudi Arabia’ published in the ‘International Journal of Food,Nutriton and Public Health (IJFNPH)’, Vol. 4, No.2, 2011