Development of a Saudi Food Frequency Questionnaire to evaluate the risk of CVD and T2DM in Saudi and British nutritionists and investigating its reliability and effectiveness

Kholoud Mohammed Faleh

Department of Chemical Engineering

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ABSTRACT

Globally, non-communicable diseases (NCDs) such as cardiovascular disease (CVD), type two diabetes mellitus (T2DM) and chronic respiratory disease are a leading cause of death. These diseases result in the death of around 2.8 million people each year, worldwide (WHO, 2012a).

Western dietary habits and food supplies have resulted in the increased consumption of foods which are unhealthy. The consumption of unhealthy foods which are high in salt, saturated fats, low in fibres and vitamins have a major impact on the health of a person, which then increases the risk of various NCDs diseases such as CVD and T2DM. In terms of the Saudi Arabian population, this trend has caused an increase in the number of Saudi people who are now overweight and obese. Also, not enough dietary surveys have been carried out in KSA and thus the data available is not sufficient to explore the eating habits of the Saudi population. This research aims to develop and validate a culture-specific FFQ for dietary habits of the Saudi people to examine the risk factors associated with T2DM and CVD. Nutritionists were targeted as the sample group because they might have better eating habits than the public (Washi, 2000). In addition, general public members were also targeted to better understand the eating habits of a majority of Saudi people. Participants from both groups in the UK were also solicited. The study aimed to establish a baseline of self-reported behaviour for the sample group in KSA which can be followed in the future. Data was also collected on other related issues such as BMI and physical activity levels.

The study achieved an estimated 47.7% response rate with the use of social media to acquire data. The study established a valid, reliable FFQ for the Saudi population, which allows for collecting sufficient data on the risk factors related to CVD and T2DM. The FFQ proved as a good tool in establishing a baseline for Saudi nutritionists and public for future cohort measurements.

Comparing the results of the FFQs for screening the risk factors of CVD and T2DM in Saudi population showed an interesting trend. The analysis showed that there is a greater ratio of population who are smokers, overweight, obese and inactive in Saudi Arabia as compared to the British living in the UK. Hence, the implementation of important policies and intervention programmes is highly recommended in KSA. Awareness schemes to increase the community's knowledge about CVD and T2DM risk factors is necessary to

encourage nutritionists and specifically young adults in KSA to adopt healthy balanced diets while promoting physical activity and avoiding harmful activities.

Dedication

To my parents Amirah, Mohammed, my family, Ahmad, Mohsen and Yunus.

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Abbreviation

BMI	Body Mass Index
BP	Blood Pressure
CAD	Coronary Artery Disease
CF	Cereal Fibre
CHD	Coronary Heart Disease
CI	Confidence Interval
CRP	C-reactive protein
CVD	Cardiovascular Disease
DBP	Diastolic Blood Pressure
DHA	Docosahexaenoic Acid
FFQ	Food Frequency Questionnaire
FPG	Fasting Plasma Glucose
GBP	Great British Pound
GDP	Gross Domestic Product
GI	Glyceamic Index
GL	Glyceamic Load
HCPC	Health & Care Professions Council
HEPA	Health Enhancing Physical Activity
IHME	Institute for Health Metric and Evaluation
IPAQ	International Physical Activity Questionnaire
KSA	Kingdom of Saudi Arabia
LDL	Low density Lipoprotein
MET	Metabolic Equivalent of Task
MetS	Metabolic syndrome
MOH	Ministry of Health

MTI	Actigraph accelerometer
MUFA	Mono Unsaturated Fatty Acid
N-3	Omega-3 Fatty Acids
NCDs	Non-Communicable Diseases
NICE	National Institution for Health and Care Excellence
NHS	National Health Services
NSW	New South Wales
PUFA	Poly Unsaturated Fatty Acid
RR	Relative Risk
SAR	Saudi Riyal
SFA	Saturated Fatty Acid
SHIS	Saudi Health Interview Survey
SNS's	Social Networking Sites
T2DM	Type 2 Diabetes
UK	United Kingdom
WHR	Waist Hip Ratio
WHO	World Health Organization

CHAPTER 1- INTRODUCTION

1.1 Global Perspective on Food, Nutrition and Health

There is a significant amount of evidence available which validates the detrimental effects of poor diet on the long-term health of an individual including the resulting consequences such as being overweight or obese (Valdes *et al.*, 2005). The relationship between the cause and its effect is very straightforward to comprehend. Proper nutrition, balanced diet and regular physical activity can all contribute to the basic principles of maintaining a healthy lifestyle both, physically and mentally (WHO, 2003).

The term 'Nutritionist' is derived from the word nutrition and is given as a title for a person who is employed either in the food industry, an educational institution or performs research that requires the individual to apply their scientific knowledge of food in the context of the impact on health. In KSA (Kingdom of Saudi Arabia), nutritionist is a title given to a person who possesses a degree in nutritional science from a public health school or home economic school. Whereas, a dietitian is a title given to a person who studies clinical nutrition in an applied medical science school. Although both types of people can work in an educational institution, a food industry, research places, hospitals, a clinical nutrition graduate is only able to provide food or formula for people in high intensive care (KAU, 2017). In KSA, nutritionists and dietitians require a license from the Saudi Commission for Health Specialties, in order to work in health-related field such as hospitals (Health Practice System, 2011). In the UK, nutritionists are the people who have studied nutrition science. They can work in food manufacturing, supermarket chains, health education, media, journalism specialising in health and nutrition or as dietetic assistants. To become a dietitian, a bachelor's (BSc) in nutrition graduate should have more qualifications either via a postgraduate diploma or through a master's in dietetics

(The University of Nottingham, 2017). Dietitians are qualified health professionals who help to assess, diagnose and treat dietary and nutritional problems. They are regulated by law and governed by ethical codes and practices. They can work for the NHS, industries educational institutions, private practices, media and carry out research. Dietitians can advise and influence food and health policies from government to local communities and individuals (The British Dietetic Association, 2014). All dietetics courses require a supervision practice including NHS observation, where the people demonstrate clinical and professional ability before being eligible for registration with Health & Care Professions Council (HCPC). HCPCs exist to protect the public and only those professionals who meet their standards are registered with them (The British Dietetic Association, 2014).

Most studies have shown that obesity is a very common problem worldwide. The National Institutes of Health put a guideline, to define obesity based on the Body Mass Index (BMI). This value is the ratio of a person's body weight (in kilograms) divided by the person's height (in square meters) (Poirier *et al*., 2006; Sowers, 2003). Obesity is known as a medical condition or state which can be defined as a body mass index equal or greater than 30 (Al-qarni, 2016; Al-Quwaidhi *et al*., 2014; Ogden *et al*., 2014; Poirier *et al*., 2006; Sowers, 2003). Worldwide obesity has doubled since 1980s. In 2008, 1.4 billion adults were overweight or obese. 8 years later, in 2016, the overweight and obesity rate increased to 1.9 billion worldwide (WHO, 2018). In addition, approximately, 58% of diabetes and 21% of ischaemic heart disease and 8–42% of certain cancers worldwide are attributable to a body mass index (BMI) over 21 (Al-qarni, 2016). Amongst the several factors which promote obesity, the key aspects involve genetic, metabolic, behavioural and environmental effects (Al-qarni, 2016; Kumosani *et al*., 2011). However, the rapid increase of obesity is associated directly to environmental and behavioural factors rather than genetic and metabolic factors (Kumosani *et al*., 2011; Mahmood and Aurlkumaran, 2012). The rapid modifications that occur because of urbanisation, industrialisation, economic evolution and market globalisation affect dietary habits and lifestyle (WHO, 2003). For instance, the obesity rate in the urban areas tends to be higher as compared to the rural areas. This is probably due to a number of reasons such as, high intake of diets involving increased fat content and the adoption of inactive lifestyles (Al-qarni, 2016). With increasing affluence and industrialisation, food becomes more available and more diverse, with easier access for everyone. It is worth mentioning that the type of food which is most accessible tends to be the processed food, which is high in calories and thus reflects negatively on eating habits and an individual's weight (Al-qarni, 2016).

1.2 The global burden of chronic diseases

The life expectancy of the European population has increased from 1998-2010, where the increases is observed as 2.7 years for men and 2.3 years for women, through the decade (OECD, 2012).

Additionally, there has been a considerable decrease in the numbers of deaths related to infectious diseases (Cohen, 2000). On the other hand, the prevalence and deaths related to chronic diseases have risen substantially. Furthermore, other developing countries also show a similar trend thus reflecting that these trends might be associated directly to the industrialisation, urbanisation and the improvement of the income (Elia *et al*., 2013). For instance, in KSA, between 1998 and-2010, the life expectancy has risen by 3.3 years for both, men and women (The World Bank, 2017).

Non-communicable diseases (NCDs) are chronic diseases and patients with such diseases often suffer for a long term while showing slow health improvements. NCDs are not contagious which confirms that they are not passed from one person to another. These occur due to the implementation of poor dietary habits and unhealthy lifestyles which are both very important factors in the promotion of these diseases (WHO, 2013). NCDs are preventable diseases as there is a great amount of scientific evidence available which shows the strong relation between dietary intakes and NCDs. This section provides a general over-view of the existing situation and developments in NCDs at a global level, specifically those that have a connection to diet and nutrition.

Globally, NCDs have been proven to be the leading cause of deaths. According to the WHO, the important risks for developing NCDs included high cholesterol, hypertension, being overweight or obese, lack of physical activity and inadequate consumption of fruits and vegetables along with smoking (Al-Hazzaa *et al*., 2012). In 2015, NCDs accounted for 71.6% of deaths in KSA (The World Bank, 2017).

1.3 Obesity Epidemic and Related Diseases

In KSA, statistical results amongst adults show that about 35.6% of the population is obese, 16.7% is affected by diabetes and these figures are increasing each year (Musaiger, 2011b).

Between 1990 and2010, the number of disability adjusted life years (DALYs) changes in percentage showed that diabetes became the fourth leading cause of death with a percentage change of 190%. There are three main factors that account for the disease burden in KSA; high body mass index, dietary risks and high fasting plasma glucose (GBD, 2010).

The situation in the United Kingdom is similar, since obesity is rising every year.

Over half of the women (57%) and 66% of men were overweight or obese in 2016.

Obesity prevalence increased from 15% in 1993 to 26% in 2016 (Baker, 2018).

There are considerable negative impacts of obesity in general, and especially on cardiovascular health. Obesity has been proved to be one of the main risk factors for heart failure, T2DM, hypertension, and coronary heart disease (Greenberg and Obin, 2006; Lavie *et al*., 2009; Poirier *et al*., 2006).

Subclinical inflammation is related to T2DM, metabolic syndrome and CVDs. Obese individuals are more likely to suffer from higher level of inflammatory and insulin resistance compared to lean individuals (Derosa *et al*., 2013). However not all obese individuals develop T2DM (Eckel *et al*., 2011). T2DM is related to the decrease in pancreatic B-cell function and mass, resulting in inadequate insulin production (Al-Goblan *et al*., 2014). Studies suggest that there is a link between obesity and T2DM involving pro-inflammatory cytokines, deranged fatty acid, insulin resistance and cellular processes such as mitochondrial dysfunction and reticulum stress (Al-Goblan *et al*., 2014; Eckel *et al*., 2011; Rogowski *et al*., 2010). Obese individuals develop resistance to insulin which discourages the control of blood glucose levels. Hence, insulin resistance is the key cause factor for T2DM (Qatanani and Lazar, 2007). Diabetic patients are twice more likely to die from heart diseases or strokes than people without diabetes (Lutsey *et al.*, 2007). Increased adipose tissue mass in obese individuals elevates inflammation markers such as IL-6, IL-10, tumor necrosis factor (TNF) and may lead to insulin resistance, atherogenesis and vascular injury (Lau *et al*., 2005). However, weight loss can help decrease inflammation marks (Derosa *et al.*, 2013, Clader *et al*., 2011). Subclinical inflammation is related to metabolic syndrome, T2DM (Hu *et al.*, 2004, Pradhan *et al.*, 2001) and CVD (Libby and Ridker, 2004).

1.4 The Saudi Nation

KSA occupies 80% of the Arabian Peninsula, which is 830.000 square miles, or about 2.150.000 sq. km. Although there are different regions around the kingdom, the overall main feature of the country shows is diverse kinds of arid desert (MOFA, 2014). As it is composed of deserted areas, the weather is very hot, especially in the summer period. The average temperature in the mid of summer (mid-April- mid October) may reach up to 122° Fahrenheit, which is about 50° Celsius but, in the winter, it could fall below freezing conditions in the mountainous areas. However, on the coastal regions, humidity is very high which is increasing because of the heat effects (MOFA, 2014).

The total population of KSA in 2013 was about 33million while the total population in 2010 was 27.4 million. The annual growth rate of Saudi population is 1.8% (Worldometers, 2018) and the population is predominantly young where 30% is under the age of 15 years (WHO, 2012-2016).

KSA has witnessed enormous improvements in the last 30 years, especially socioeconomic development, education, health, environment and housing, which further resulted in the adoption of western nutritional habits and lifestyle. In 2002, the United Nations Development Programme (UNDP) ranked KSA, 71, globally, as medium-term development in their annual global human development report. In 2016, the UNDP ranked KSA 38, globally (UNDP, 2016). KSA has the greatest resources of petroleum globally where oil revenues make up to 80-90% of the country’s fiscal income (WHO, 2012-2016). Urbanisation, economic development and increased wealth leads to nutrition transition. Nutrition transition is the change in diet and energy expenditures that correspond with the demographic, economic and epidemiological changes. Table (1-1) show the gross domestic product of KSA between 1970 to 2000.

Table (1-1) Gross domestic Product of KSA 1970 to 2000 (Trending economic, 2017)

GDP in producer's value	1970	1974	1979	1985	1990	1995	1999	2000
In current Riyals	16.9	120.8	326.2	310	392	478.7	535.4	649.3
In constant 1994 Riyals	132.8	258.7	379.2	328	400	452.7	470.5	492.6
Percentage from oil sector	46.3	57.2	46.2	18.1	29.2	32.6	30.3	31.7

1.5 Saudi's health status and lifestyle

There has been a rise in longevity in the recent years. The occurrence of communicable diseases in KSA has decreased significantly, with an associated decline in mortality and morbidity from communicable diseases. There were some diseases out breaks and communicable diseases, which were causing major health illnesses back in the 1970s, but they are no longer considered to be causing high risks to health such as infectious diseases (WHO, 2006). On the other hand, the changes that have occurred in the lifestyle lead to increased risk of NCDs such as diabetes and cardiovascular disease (WHO, 2006). In KSA, NCDs accounted for 78% of the deaths in people aged between 30and 70 years, in 2012.

1.6 Relative risk

RR or risk ratio is the likelihood of an incident to occur, such as the development of a disease in an exposed group to the likelihood of the incidence occurring in a non-exposed group (Akobeng, 2005; Simon, 2001). The study of RR requires the examination of two dichotomous variables, one variable is used for measuring the groups, group 1 and group 2 and the other variable measures the incidence (occurred vs not occurred) (Akobeng, 2005;

Schechtman, 2002). The advantage of RR is that it is being stable through populations with different baseline risks which are useful when combining results of different trails in a meta-analysis. However, RR does not reflect the baseline risk of the subjects with the outcome being measured (Eggar, 1997; Simon, 2001). Also, RR does not consider the subject's risk of getting the intended outcome without intervention. Thus, RR does not provide a true reflection of how much advantage the subject would obtain from the intervention as they are unable to differ between small and large treatment impacts (Last, 2001; Akobeng, 2005).

1.7 Risk score calculation

Multivariate risk prediction equations are developed to estimate the risk of non-communicable diseases such as CVD, CHD, T2DM. These equations are derived based on large prospective cohort studies or randomised trials. The equations estimate people's risk of a disease, based on the assessment of multiple risk factors (Abuelkarem *et al*., 2009; Sheridan *et al.*, 2003).

However, risk calculators have limitations such as, the calculators include only a few risk factors, they are mostly based on middle aged groups or males only, they use logistic regression models that require fixed follow up periods e.g. 5 or 10 years and they need to be validated either using prospective methods which may take long times (Moons *et al*., 2012) and are validated only in limited populations, where careful consideration is required when generalising their result on a wider region of population (Abuelkarem *et al.*, 2009; Sheridan *et al*., 2003).

There are many CVD and T2DM validated risk calculators available on the internet. A further discussion of risk calculators is provided in chapter 2 section 2.4, table (2-3).

1.8 Rationale for the Research

In 2013, a survey was undertaken in KSA to research the BMIs of individuals over the age of 14. 28.7% of the Saudi's were recorded as obese (BMI of over 30). Majority of women were obese (33.5%) than men (24.1%) (Memish *et al*., 2014). In addition, the mortality rate caused by cardiovascular disease among Saudis was estimated at 46% (WHO, 2014c).

The number of fast food restaurants in KSA is increasing which in turn has encouraged the population to consume more fast foods than ever before. In 2014, the sales of fast food restaurants in KSA reached 21.2 billion SAR. The most common single fast food sales in the capital city of KSA Riyadh is MacDonald's, with a value share of 9% in 2014 and 18% value share of chain fast food products (Fast-food in KSA, 2014). Changes in the eating habits of the Saudis have replaced traditional food with foods such as burger, pizza, fried food that are rich in fat and free sugar in complex carbohydrate.

Furthermore, there is lack of research in food types consumed by the Saudi population. The main aim of this work is to establish a validated Saudi Food Frequency Questionnaire (FFQ) and establish a baseline for Saudi nutritionists for longitudinal comparisons in the future such as the Nurses study introduced in 1976 by Dr Frank Speizer. This was a large and detailed study carried out in the USA on Nurses' dietary fat intake and the risk of coronary heart diseases among females. The long-term study started in 1976 and was funded by the National Institutional of Health. In 1989, a second study followed up the original participants, who allowed the researcher to track their health over an extended period of time and correlated that with their lifestyle changes. (Kyungwon *et al*., 2005). The purpose was to investigate the long-term consequences of using oral contraceptives that were prescribed for hundreds of millions of women. The researchers chose nurses because they thought that a nursing education might increase their ability to respond with high accuracy to the questionnaires. In 1976, 121,700 nurses aged between 30-55 years participated in the original study. For the second study in 1989, 16,000 female nurses participated in the study. The questionnaire asked about their health, medical information, diet and lifestyle. Women with any pre-existing diseases such as diabetes, cancer, CVD were excluded at baseline. Participants who did not answer 10 or more dietary questions, had very high or low energy food intake (less than 500 kcal or more than 3500 kcal a day) were excluded as well. Therefore, the total number of participants was 84,941 females after exclusions (Hu *et al*., 2001b).

There were 61 food items included in the FFQ in 1980. Food items were added in the follow up questionnaires and the total numbers of the questions were further increased to 120 in 1984, 1986 and 1990. The participants were asked about the amount of their intake from each type of food through the past year. Their consumption of nutrients was computed by multiplying the nutrients content of the food by the frequency of the intake of each food item. Non-dietary factors such as smoking, menopausal status, body weight, physical activity level and the use of postmenopausal hormone therapy were obtained in 1980 and were updated two years later (Hu *et al*., 2001b). The respondents were divided into risk categories according to BMI, physical activity, smoking and drinking habits (Hu *et al*., 2001c, Hu *et al*., 2001b).

Such studies are needed for observing changes in general Saudi diet and lifestyles since no data is currently present as no such studies in KSA have been conducted earlier. Hence, this research has been designed to initiate a baseline for future studies to address significant problems in KSA.

1.9 Conclusion

Globally, NCDs are a leading cause of deaths. Prevalence and deaths due to NCDs have increased substantially. In 2001, 62% of the deaths in the Gulf States were linked to cardiovascular diseases. Obesity is an increasing problem in KSA and it is mostly associated to T2DM and CVD.

Saudi lifestyle and dietary habits have changed massively in the last 30 years, as unhealthy dietary habits and inactive lifestyles have become more common between children and adolescents. Consumption of fast foods including junk foods is increasing in KSA while branches of fast food restaurants are becoming increasingly distributed in many larger cities of KSA. In 2012, ministry of health in KSA issued a dietary guideline, symbolically dubbed “Healthy Food Palm’’ (Ministry of Health portal, 2017). Compared to KSA, food policy in the UK has a long history, since 1970s, when scientists and journalists started questioning processed food impact on health (Lang *et al.*, 2016). In the UK, the health policy focuses on obesity and healthy eating such as change for life programmes, nutrition labelling or traffic light system and advice on physical activity level is extensive and has engaged some of the population (Department of Health, 2015).

Thus, there is an immense need to gather data on the eating habits and lifestyle of Saudi citizens so that follow up studies can track the changes in their eating habits and NCD’s. Hence, this study mainly aims on developing a validated Saudi FFQ and establishing a baseline for Saudi nutritionists to follow them up in the future.

CHAPTER TWO- LITERATURE REVIEW

A significant amount of research carried on the lifestyle of people living in KSA has indicated that unhealthy diets and physical inactivity were in general correlated with high BMI in Saudi children, adolescents and adults **(**Abolfotouh *et al*., 2012; Abou-Zeid *et al*., 2009; Ahmed *et al*., 2014; Al-Ghamdi, 2013; Al-Hazzaa *et al*., 2014; Al-Hazzaa *et al*., 2012; Al-Mohaimeed *et al*, 2015; Al-Nakeeb *et al*., 2012; Al-Qahtani *et al*, 2013; Al-Rethaiaa *et al*., 2010; Alsaif *et al*., 2002; Al-Shahrani and Al-Khaldi, 2013; Alam, 2008; Amin *et al*., 2012; Alzahrani *et al*., 2016; Collison *et al*., 2010; Desouky *et al*., 2014; Elbadawi *et al*. 2015; El-Hazmi and Warsy, 1997; Horaib *et al*., 2013; Mahfouz *et al*., 2008; Memish *et al*, 2014). KSA has experienced tremendous lifestyle changes in the recent decades. The discovery of oil in the Arabian Gulf region in 1960s resulted in economic growth, increase in wealth and income per capita. This response led to rapid changes in the Saudi lifestyles and culture, which further increased the mechanisation in the last quarter century. Therefore, this change resulted in changes in the eating styles and gave rise to physical activity (DeNicola *et al*., 2015). This ease of life shifted the Saudis from working largely by hand at agricultural sites to living an inactive lifestyle, as most of the population moved from rural to urban areas, which now includes 84% of the population (DeNicola *et al*., 2015; WHO, 2012-2016). In terms of health care, the total spending on health is 4.6% of the gross domestic product. The country has a modern health care system and the Ministry of Health expenditure represents 6.8%. That is about 174.0 US dollars per capita (WHO, 2012-2016).

Inhabitants residing in urban areas have a higher prevalence of hypertension (Al-Nozha *et al*., 2007), coronary artery disease (Al-Nozha *et al*., 2004a), metabolic syndrome (Al-Nozha *et al*., 2005b) and diabetes (Al-Nozha *et al*., 2004b; Al-Nuaim, 1997) as compared to people living in rural areas. Also, obesity prevalence is higher amongst the female in the urban population (Al-Nuaim, 1997; Al-Shammari *et al*., 2001). In addition, the occurence of overweight and obesity in adolescents in urban areas is higher than in rural areas (Amin *et al*., 2012).

Moreover, food consumption patterns have changed dramatically in the Eastern Mediterranean countries during the last four decades. Calorie-dense foods and sweetened beverages are becoming easily accessible to children and adults. According to a national study by Moradi-Lakeh *et al.* (2016), Saudi adults consume 44.2g of red meat, 4.8g processed meat, 115.5ml sugar sweetened beverages (SSB) daily. The dietary guideline recommendation of the US Department of Agriculture was met by only 5.2% of subjects for fruits, 7.5% for vegetables, 31.4% for nuts, 44.7% for fish and 85.7% for red meat. High consumption of SSB was greater among low-income families than high-income families. Among the younger participants, the intake of SSB, processed meat and processed food was higher as compared to the older age groups, which may be because of nutrition transition (Moradi-Lakeh *et al*., 2016).

Nowadays, most adolescents in KSA have easy access to restaurant food or fast foods and this reduces the intake of home-cooked foods (Al-Hazzaa *et al.*, 2011). In addition, modern lifestyle has contributed greatly in reducing the total energy expenditure. To elaborate, the economic improvements started in 1950s upon the discovery of oil in KSA, when most people were more likely to have had limited nutritional resources. Since then Saudis started having an increased access to imported and processed foods, most of which are poor in vitamins, fibre, minerals and are high in fats, sodium and sugars (Ng *et al.*, 2011). Moreover, it has also been noticed that urbanisation has an impact on physical inactivity (Mcallister *et al*., 2009). About three decades ago, the Saudi population had adopted healthier practises. These included walking and cycling for everyday activities such as commuting to educational institutions or travelling to work. However, nowadays with advancements in the country, most people use motor vehicles to commute. It is worth mentioning that the extreme weather conditions of the country have also contributed to using motor vehicles for daily commute. Most regions of the country are very hot with weather conditions becoming extremely harsh, especially during the afternoon times when most schools, educational institutions and workplaces are dismissed for home time. Hence, the use of motor vehicles became a necessity. (Al-Hazzaa *et al.*, 2012). In addition, based on the country's regulation there are many guidelines which need to be followed, especially for women. In KSA, women are usually required to follow a proper dress code and may not be able to move around freely. Hence, these factors may limit their physical activity (Alqout and Reynolds, 2014). Evidence suggests that exercising and eating balanced diet helps in maintaining the normal BMI (18.5- $\leq$25 kg/m^2) (Annesi, 2012). Also, processed food consumption has increased. In 2014, 48% of the imported foods in KSA were processed food and they accounted for 9.1 billion USD (Hussey, 2016). According to Ng and colleagues, the United Arab Emirates and KSA have the highest incidence rate and increase of hypertension in the Arabian Gulf. This could be based on the fact that most of the foods that are available in these countries are pre-packaged and processed, and these types of foods are high in sodium and fat (Ng *et al.*, 2011). Developing countries maybe affected negatively with this type of health issue since there is no policy for managing the prevention of chronic diseases related to obesity. Instead, these countries remain focused on problems concerned with undernutrition (WHO, 2003).

2.1 NCD's and related risk factors

NCDs are widespread diseases and are rising rapidly among people worldwide. They account for significant premature death and morbidity; and have a considerable influence on health care costs. Diabetes, cancer, cardiovascular diseases and chronic respiratory disease represent a significant proportion of the global NCDs burden and they are the sole reason for around 80% of world deaths (WHO, 2013). NCDs lead to around the deaths of 36 million people annually. Nearly one fourth of worldwide NCD-related deaths occur before the age of 60. World Health Organisation has predicted that NCDs in 2020 will be growing significantly by over 20% in Africa, South-East Asia and the Eastern Mediterranean region. However, it is worth mentioning that they also estimated and forecasted that there will be no increase in the European region (WHO, 2010). Deaths from NCDS increased between 1990 and 2010 by under 8 million to approximately 34.5 million (Lozano *et al*., 2012).

Diabetes and obesity are showing worrying trends since they are not only affecting a large population; but are also starting to appear in people much earlier than before (WHO, 2003). Also, another concern is the number of deaths caused by NCDs. In 2008 cardiovascular diseases accounted for 17 million or 48% of the total deaths, followed by cancer (7.6 million), respiratory diseases (4.2 million) and diabetes (1.3 million) (WHO, 2013).

Research shows that there are four main unhealthy behaviours which are strongly related to non-communicable diseases. These are; the use of tobacco, unhealthy diets, increased consumption of alcoholic beverages and physical inactivity (Paneni and Cosentino, 2015). Such behaviours may cause a considerable health damage and changes in physiology. These behaviours can be very harmful as they can increase blood pressure, increase the possibility of being overweight or obese, and cause hyperglycaemia and hyperlipidaemia (Paneni and Cosentino, 2015). In terms of the figures of deaths which are related to NCDs factors, increased blood pressure is responsible for 13% of global death, followed by tobacco use (9%), physical inactivity (6%), increased blood glucose (6%) and overweight and obesity (5%) (WHO, 2010).

2.1.1 Smoking and NCD's

Globally, 6 million deaths each year are attributed to tobacco use and figures may increase to 8 million deaths annually by 2030. Smoking cigarettes is the leading cause of death in the USA. It is responsible for 480,000 deaths per year, which includes more than 41,000 deaths that are caused from second-hand smoke exposure (Centres for Disease Control and Prevention, 2017). There is significant evidence linking the exposure of tobacco to several health issues, such as oral and other cancers, heart disease and hypertension (Centres for Disease Control and Prevention, 2017; WHO, 2010). The disease risk associated with smoking depends on the duration and intensity of smoking (Al-Nozha *et al*., 2009). Smoking increases the risk of CVDs which includes coronary heart disease and stroke. The nicotine which is consumed while smoking stimulates the body to release adrenaline. This in turn makes the heart beat faster which then increases the blood pressure (BHF, 2016). Being a smoker or experiencing a smoky atmosphere may expose the body to carcinogenic compounds. Tobacco contains 50 chemicals are known to be cancer-causing (WHO, 2010). The nurses' health study cohort reported that the most important single factor for CHD was based on smoking cigarettes (RR=5.48) for participants smoking 15 cigarettes or more in a day. Furthermore, smoking 1-14 cigarettes in a day triples the risk of CHD in people who smoke as compared to non-smokers (Stampfer *et al*., 2000).

According to a review article, the occurrence of smoking habits among young adolescents in KSA is high. It ranges between 2.4 to 52.3% (median = 17.5%) and it is higher among men than women. Smoking among school students is 12-29.8% (median 16.5%) while smoking among adults is 11.6-52.3% (median 22.6%). The occurence of smoking among men in KSA is 13-38% (median 26.5%) and among women is 1-16% (median 9%) (Bassiony, 2009). Al-Nozha and colleagues (2009) reported similar findings; where smoking was significantly more prevalent among males than females with ratios being

18.7% and 7.3%, respectively. Another study conducted in Riyadh to determine the prevalence of smoking among dental students at King Saud University (AlSwuailem *et al.*, 2014) revealed that smoking was significantly higher in male than female; i.e. 27.6% of males and 2.4% of females were smokers. Most smokers smoke shisha (51.5%), followed by the mixture of tobacco and shisha (25%). Students who smoked cigarettes accounted for 23.5% (AlSwuailem *et al.*, 2014). Alshaikh *et al.*, (2016), reported the prevalence of smoking among Saudi females within the range of 1.1%- 9.1%.

Akl *et al*. (2011) reported that the ratio of smoking shishas increased in the Gulf region. In KSA, 7.4% of the women over 30 years smoke tobacco. However, women find consuming shisha more prestigious and fashionable as compared to smoking cigarettes and due to the fact that smoking shisha is considered socially entertaining (Merdad *et al*., 2007). It could also be based on the reasoning that shisha has a distinctive sweet scent and taste compared to cigarettes (AlSwuailem *et al*., 2014). In addition, smoking among female university students was significantly associated to families with high incomes (Merdad *et al*., 2007).

To elaborate the mechanism of a shisha, it consists of a hose pipe with a mouth piece from which the smoker inhales (into the lungs) the smoke produced from the burning of the substances present in the ingredients of the shisha (BHF, 2017; Rawas *et al*., 2012). Shisha consists of a high concentration of nicotine, heavy metals, carbon monoxide and tar, which puts shisha smokers at a high risk of harmful diseases such as cancer, CVD and respiratory diseases (AlSwuailem *et al*., 2014; Taha *et al.*, 2010). Although smoking shisha is more common amongst people from the Middle Eastern and Asian community, it has also become popular among all groups worldwide (BHF, 2017). The tobacco used in shisha is sweetened with molasses sugars or fruits that make the smoke aromatic than the smoke produced by cigarettes (BHF, 2017; Rawas *et al*., 2012).

Smoking was more common in urban Saudis living in the northern, eastern and western regions than another region. This could be because of the cultural transition of smokers whilst visiting urban areas (Al-Nozha *et al*., 2009).

In the UK, 9.6 million adults are smokers (i.e. 19%), where 20% of the smokers are males while 17% are females (Ash, 2016). In KSA, a slightly lower overall proportion (17.1%) of the adults are smokers, but the distribution between genders is different to the UK with 3% of the females and 26.8% of the males smoking. The youth form 70% of the population in KSA. 8.9% of the youth in KSA are smokers, where 13% are males and 5% are females (WHO, 2015b).

2.1.2 Unhealthy diet and fast food

Diet represents the kinds of food a person consumes, and diets play a major role in the development of NCDs (Paneni and Cosentino, 2015). Research on the relationship between diet and two NCD's, CVD and T2DM, is studied in more detail in sections 2.2.2 and 2.3.3, respectively. However, studies suggest that red and processed meat, fruit and vegetables also have an impact on NCDs.

Currently, KSA accounts for 75% of fast food consumption in the Gulf. The country is also the site of 29 of overall 60 fast food companies in the region (Dauo, 2009). Fast-foods are foods which are readily available and can be served immediately (Sumaedi and Yarmen, 2015). They are inexpensive, can be eaten in the restaurant premises or delivered at the desirable location (Seo *et al*., 2011). Fast-foods include pizza, fried chicken, hamburger, French fries and doughnuts (Seo *et al*., 2011). There are also Mediterranean fast foods which include kebab, falafel and shawarma (Shori *et al*., 2017). Several studies found that ratio of fast food consumption is higher among younger people, comparatively (Abdullah *et al*., 2015; Moore *et al*., 2009; Pereira *et al*., 2005; Shori *et al*., 2017). A peer reviewed article by Anderson *et al.* (2011) revealed that young males within the age group of 18-24 years are consuming more fast food than the older males or females. Furthermore, people who eat less fruits and vegetables or are less engaged in physical activities were more likely to eat in fast food restaurants at a regular basis. Shori *et al*. (2017) found that over 50% of the Saudi females who consume fast food once a week or more were overweight or obese.

Eating out at places such as a restaurant has been considered as a major contributor to obesity (Anderson *et al*., 2011; Shori *et al*., 2017), weight gain (Pereira *et al*., 2005) and further promoting physical inactivity (Al-Hazzzaa *et al*., 2014). A population-based prospective study over a time span of 15 years following up the study of Pereira *et al.* (2005) showed that there was a strong association between the consumption of fast foods (more than twice a week) and weight gain (P=0.005) along with insulin resistance (P=0.008) for those individuals who frequently consumed fast foods as compared to those who consume these foods less than once a week. This might be because of the availability of a larger portion size of the meal, high energy food, wide range of selections or preferred taste of the food. It is well-known that fast foods are poor in nutrients and contain high caloric ingredients, fats, saturated fats, and are commonly served and consumed with sugar-sweetened drinks (Anderson *et al*., 2011; Fleischhacker *et al*., 2011). Feskens and Kromhout (1990) found a positive relation between fasting glucose test and consumption of saturated fat r=0.132, (P<0.01).

According to Anderson and Masta (2008), analysis of a USA national representative sample of 3-day food records established that eating in fast food restaurants increases the intake of energy by 200 to 300 kcal above the typical meal which the person would eat at home usually. The energy intake in restaurant was increased by about 24 kcal, lower than a fast food restaurant but still slightly higher than eating at home (Masta, 2008).

A typical fast food meal is very high in calories, sodium, saturated fat and sugar. The meat is typically fried, often dressed in mayonnaise and served with fries and soft drinks. These foods are responsible for a great change in nutrition transition via the structure and composition of traditional diet to Westernised diet (Kearney, 2010).

Nutrition transition involves increase intake of fats and specifically saturated and trans-fats, animal-based products, sugars, cholesterol and sodium along with a reduced intake of unrefined cereal and fibres (Afolabi *et al*., 2013; Askari Majabadi *et al*., 2016). The frequent consumption of fast foods is associated with cardiovascular diseases and death in a metropolitan population (Daniel *et al*., 2010). Similar results were found in another study as well (Alter and Eny, 2005), where it was revealed that the mortality and admittances for intense coronary syndromes were greater in regions with higher numbers of fast food premises ($p < 0.001$) (Alter and Eny, 2005).

Another factor may be associated with high intake of fast foods in food deserts. Food desert is a term used to describe dense urban areas where people do not have access to healthy, high quality and fresh foods (Donald, 2013; Whelan *et al*., 2002). People with low income, young children, working mothers and single parent tend to experience the phenomenon of food desert. Food desert is associated with weight gain and obesity in children in the USA (Donald, 2013).

In KSA, major cities such as Riyadh, Jeddah and Dammam have high number of fast-food restaurants. A cross-sectional study by Amin *et al.* (2008) indicated that overweight and obesity amongst teenagers in KSA was associated with urban areas RR 1.8(95% CI: 1.3-

2.6, P=0.01), working mothers 1.8(95% CI: 1.34-2.55, P=0.014) and consuming food away from home >3 times/week RR 1.7(95% CI: 1.28-2.42, P=0.03).

2.1.2.1 Fruit and vegetable intake

Adequate consumption of fruits and vegetables decreases the risk of cardiovascular diseases, colorectal cancer and stomach cancer. Approximately, 2.8% of global deaths can be attributed to low consumption of fruits and vegetables. There is much scientific evidence confirming that consumption of increased amounts of high-energy foods, such as processed foods which are high in fats and sugars, can lead to obesity compared to low-energy foods such as fruits and vegetables (WHO, 2003). Several studies have found a reverse relation between the fruit and vegetable consumption and being in the normal BMI in KSA (Abdul-Mageid *et al*., 2011; Amin *et al*., 2012; Horaib *et al*., 2013). Other studies found that consumption of vegetables have an effective role against T2DM (Midhet *et al*., 2010a) and obesity (Al-Hazzaa *et al*., 2012), as mentioned in section 2.3.3.2 below.

2.1.3 Alcohol consumption

One of the four unhealthy behaviours associated with NCD's reported by Paneni and Cosentino, (2015) was high alcohol consumption.

There is a strong association between alcohol consumption and NCDs, especially leading to cancer, CVD, diabetes and Pancreatitis, (Parry *et al*., 2011; WHO, 2016). Alcohol consumption is one of the main reasons for causing NCDs. Alcohol is identified as a leading risk factor for disability and death worldwide, accounting for 5.1% of disability adjusted life years (DALYs) and 5.9% of deaths (WHO, 2016).

Alcohol consumption is directly associated to several cardiovascular related issues involving haemorrhage strokes, atrial fibrillation and hypertensive disease (Parry *et al*., 2011). Globally, alcohol intake was estimated in 2015 at 6.3 litres of pure alcohol per person aged 15 years and older (Parry *et al*., 2011).

However, in KSA, the consumption of alcohol is forbidden legally thus this unhealthy behaviour should not be held responsible for contributing to the occurrence of NCDs in KSA. Alcohol cannot be sold in supermarket and cannot be found in public. However, there might be Saudis who live abroad and can find alcohol available easily therefore changing their eating and drinking habits.

2.1.4 Physical inactivity and NCD's

Lack of physical activity is the fourth leading risk factor for causing death; it accounts for approximately 2.1% of the global disability- adjusted life years (DALYs) each year. The risk of all-cause mortality in a physically inactive person rises by up to 20-30% compared to those who are engaged in 30 minutes of moderate intensity physical activity during most days of the week (WHO, 2010).

Sedentary behaviours are becoming very common, particularly among children and youth. For example, 60% of Saudi children and 71% of young people are not engaged in any physical activity for a sufficient duration of time, which is recommended by Physical Activity Guide line for American 2008 (Al-Hazzaa *et al.*, 2011). Al-Hazzaa (2004) reported that a change in lifestyle in KSA has resulted in the adoption of a sedentary behaviour which then leads to increasing the risk of CHD. Vigorous physical activity was inversely associated with overweight and obesity among adolescents in KSA (Al-Hazzaa *et al*., 2012). In KSA, physical inactivity among children and adults ranges between 43.3-99.5%. In addition, 53.4% of the men in KSA are at a high risk of developing CHD because of sedentary behaviour (Al-Hazzaa, 2004). The adoption of physical inactivity among women in KSA is between 53.2% - 98.1% (Alshaikh *et al*., 2016). Similar results have been reported by Al-Nuaim and colleagues (2012) as well. It has been found that the rates of physical inactivity among women were higher than men with 81% of the women being inactive as compared to 35.7% of the men. Kalaf *et al*. (2016) found similar results and concluded that 74% of the female participants in the study were physically inactive. Hence, Saudi women have a high risk of CVD due to obesity and physical inactivity, which is also a result of sociocultural restrictions. Several studies have confirmed that males in KSA are more active than females (Abou-Zeid *et al*., 2009; Al-Hazzaa *et al*., 2012; Al-Hazzaa *et al*., 2014; Al-Moraie, 2014; Al-Nuaim *et al*., 2012; Midhet *et al*., 2012). Further, physical inactivity is associated with overweight and obesity in KSA (Al-Hazzaa *et al*., 2012; Allam *et al*., 2012; Al-Nuaim *et al*., 2012; Elbadawi *et al*., 2015; Mahfouz *et al*., 2011; Memish *et al*., 2014), which can then be associated to the risk of developing CVD, (Alqarni., 2016; Alquaiz *et al*., 2014; Ibrahim *et al*., 2014; Khattab *et al*., 1999) hypertension (Al-Hamdan *et al*., 2010; Koura *et al*., 2012) and T2DM (Midhet *et al*., 2010a). Midhet *et al*. (2012) found a strong association between inactivity and T2DM AOR 2.5(95% CL: 1.2-5.0). It was established that physical inactivity was significantly associated with high intake (i.e. ≥ 5serving / week) of fast-food AOR 1.58(95% CI: 2.162.95, P<0.001), sugar sweetened drinks AOR 1.51(95% CI: 1.20-1.90, P<0.001), energy drinks AOR 1.69(95% CI: 1.14-2.49, P=0.009) and cake and doughnuts intake AOR 1.47(95% CI: 1.11-1.94, P=0.007) (Al-Hazzaa *et al*., 2014). These unhealthy eating habits and food preferences are all able to reinforce the risks of NCDs.

2.1.5 Overweight, Obesity and NCD's

Obesity has many adverse effects on haemodynamic and cardiovascular structure and role. It raises the total blood volume and cardiac output, where cardiac workload is higher in obese subjects. Obese patients have a greater cardiac output but a lower level of total peripheral resistance at any given level of arterial pressure. Most of the growth in cardiac output with obesity is associated in stroke volume, however because of increased sympathetic activation, heart rate is often mildly increased as well. Obese patients are more likely to be hypertensive than slim patients, and weight gain is typically associated with rises in arterial pressure (Lavie *et al*., 2009). The risk factors for obesity in KSA can be linked to family history, genetic factors, dietary patterns, eating habits, hypertension, sedentary behaviour and marital status (Alqarni, 2016). There is also a high prevalence of overweight and obesity in KSA especially among females. According to a national study, females were 28% overweight, 28.8% obese and 4.7% morbidly obese. Whereas, males were 33.4% overweight, 21.6% obese and 2.5% morbidly obese. Hence, females were observed to have a high prevalence of obesity than males (Memish *et al*., 2014). Al-Haramlah *et al*. (2015) found in their national study that more than half of the Saudi women are obese.

Consumption of fast foods (Al-Ghamdi, 2013; Al-Qahtani *et al*., 2013; Al-Rethaiaa *et al*., 2010; Al-Zahrani *et al*., 2016; Amin *et al*., 2012; Elbadawi *et al*., 2015; Collison *et al*., 2010), soft drinks (Alam, 2008; Amin *et al*., 2012; Al-Hazzaa *et al*., 2012; Collison *et al*., 2010) and high fat intake (Abdul-Megeid *et al*., 2011) were all associated with overweight and obesity in KSA. In addition, central obesity, overweight and obesity in adolescents are also linked with eating breakfast less than 3 days a week, consuming vegetables less than 3 days a week, (Al-Hazzaa *et al*., 2012) being a female in KSA (Al-Almaie, 2005; Mahfouz *et al*., 2011) and lack of physical activity (Mahfouz *et al*., 2011; Abou-Zeid *et al*., 2009).

Obesity in KSA is found to increase with age and usually reaches a peak around the age group of 40-50 years (Ahmed *et al.*, 2014; Al Haqwi *et al*; 2015; Al-Haramlah *et al.*, 2015; Al-Nozha *et al.*, 2005a; AlSaif *et al.*, 2002, Al-Saleem *et al.*, 2013; Al-Shammari *et al.*, 2001; Memish *et al.*, 2014; Ng *et al.*, 2011). Results of several investigative studies (Ahmed *et al.*, 2014; Al-Daghri, 2011; Al Haqwi *et al*; 2015; Al-Malki *et al.*, 2003; Al-Nozha *et al.*, 2005a; Alqurashi *et al.*, 2011; Al-Saleem *et al.*, 2013; Al-Shammari *et al.*, 2001; El-Hazmi and Warsy, 1997- 2000; ElMouzan *et al.*, 2012; Mahfouz *et al.*, 2011; Memish *et al.*, 2014; Ng *et al.*, 2011; Osman and AL-Nozha, 2000) showed that overweight and obesity states were significantly related to the gender, where females were found to be more obese and overweight and also the marital status (Al-Daghri *et al.*, 2014; Al-Haqwi *et al.*, 2015; Al-Malki *et al.*, 2003; Al-Shammari *et al.*, 2001). This could be attributed to many socio-economic cultural reasons such as recurrent pregnancies, general inactivity, fewer available facilities for physical activities for women as compared to men in KSA (Mahfouz *et al.*, 2011). Also, one of the major reasons is due to the fact that in KSA, women usually have domestic help and thus depend on house maids to carry out daily chores which further discourages them from engaging in any sort of physical activity (Mahfouz *et al.*, 2011).

Metabolic syndrome (MetS) may be related to the global epidemic of diabetes and obesity. Metabolic syndrome is a cluster of conditions, caused by the abnormal levels of glucose, blood pressure, lipids (such as triglycerides and high-density lipoprotein) and excess body fat around the waist (Church, 2011; Harris, 2013). Individuals with MetS have a common pathophysiological symptom such as insulin resistance, which is related to excess fat around the waist. Excess periomental or visceral fat (central obesity) is predictive of MetS and increases the risk of CVD (Sowers, 2003). Central obesity is associated with insulin resistance, hyperinsulinemia, T2DM, hypertension, dyslipidaemia, albuminuria, pro-inflammatory, prothrombotic (Sowers, 2003). There are a number of hypothesis mechanisms for MetS, but the most accepted of these is insulin resistance with fatty acid flux. Other mechanisms involve low grade chronic inflammation and oxidative stress (Harris, 2013). The waist circumference is a proximate index of intra-abdominal fat mass and total body fat. It can be used as an indicator for cardiovascular disease risk and other chronic diseases (WHO, 2000). For European people, the waist circumferences should be not more than ≥ 102 cm for men and ≥ 88 cm for women. For Asians, the ranges should be not more than ≥ 90 cm for men and ≥ 80 for women as people in Asian community are at a higher risk of diabetes and other chronic diseases when compared to white people (Harris, 2013). Individuals who have MetS have an increased risk of developing diabetes, chronic kidney disease and CVD (Harris, 2013; Poirier *et al.*, 2006). In addition, for existing patient with diabetes and CVD, MetS raises the risk of further complications (Harris, 2013).

2.1.5.1 BMI and risk of CVD

There is a strong link between CVD and lack of physical activity and obesity. In the nurse’s study, which was initiated in 1980, 88,393 nurses were followed up for 20 years, aged between 34-59 years. All the participants were free from CVD, diabetes and cancer. The results of the study showed that overweight and obesity were significantly associated with the increased risk of CHD, while increasing levels of physical activities was found to have a positive impact on reducing the risks of CHD ($P<0.001$) (Li *et al.*, 2006).

Women with BMI ≥ 40 had 5-fold increased risk of CHD. For each BMI unit increment, risks of CHD were increased by 8% (95% CI, 7% to 9%) (Li *et al.*, 2006). Women who were in their healthy weight BMI between 18 – 24.9 kg /m^2 and were physically active doing moderate to vigorous physical activity, which required 3 or more metabolic equivalent per hour (≥3.5h/wk) had a CHD relative risk, RR, of 2.48 (95% CI: 1.84-3.34). Whereas, for women who were obese with BMI ≥ 30kg/m^2 and were physically inactive (i.e. with low physical activity, <1h/wk), had a CHD RR of 3.44 (95% CI, 2.81-4.21) (Li *et al*., 2006).

Overweight and obesity states are a major risk for causing CVDs amongst Saudis (Alqarni., 2016; ALquaiz *et al*., 2014; Ibrahim *et al*., 2014; Khattab *et al*., 1999). Obesity increases blood volume and cardiac output which is caused by the increased metabolic requirement induced by excess body weight. (Poirier *et al*., 2006).

2.1.5.2 BMI and risk of T2DM

Overweight and obesity are also the major risk factors for insulin resistance and T2DM (Elhadd *et al*., 2007) in KSA (Alqarni, 2016; Bahijri *et al*., 2016; DeNicola *et al*., 2015). Around 80-90% of people with T2DM are overweight or obese. Fats accumulate in the muscles and beta cells, which decreases the body cells' sensitivity to insulin and this can further cause insulin resistance. Eventually, the pancreas will be exhausted by secreting more insulin which helps at the first stages to keep the blood glucose in the normal level. However, with time, the pancreas will increase secretion of insulin to use the glucose for energy requirements which can lead to a condition called impaired fasting glucose. This occurs when there is not enough insulin to reduce the fasting glucose levels but not enough to be T2DM (Elia *et al*., 2013; Thompson *et al*., 2014).

According Colditz *et al*., (1990), in the II nurses' study there was a relation between non-insulin dependent diabetes and high body mass index. The study included 121,700 women in the United States, aged between 30-55 years. They were followed up for 8 years. In 1984, they were sent the questionnaires which consisted of investigative questions about height and weight. The respondents were also asked to provide information about their health, especially if they suffer from serious diseases such as diabetes, coronary heart disease or cancer or have had these diseases since the last questionnaire sent to them two years earlier. Furthermore, participants were asked to provide their body weight when they were 18 years old and their weight in 1982. The participants were also asked about their family history for diabetes. BMI was then used to assess the nutritional status of these participants (Colditz *et al*., 1990).

It is also well-known that the rate of diabetes rises steadily with heavier weight. For instance, women weighing over 70 kg have a 24-fold risk in contrast to women weighing less than 55 kg. Colditz and colleague (1990), found that there was no relation between height and the risk of diabetes, overall. The relative risk of diabetes is raised for females with BMI higher than 22 kg/m^2 and is especially pronounced for women with BMI over 25 kg/m^2. The proportional hazards (incidence or hazard rate) relative risk of diabetes is 2.1 for women with BMI between 22-22.9 kg/m^2 as compared to women with BMI less than 22 kg/m^2. The proportional hazards relative risk is 3.5 (95 percent) for women with BMI within the range of 23-23.9 kg/m^2. Women with a BMI within the range of 25-26.9 kg/m^2, have more than 5-fold raised risk of diabetes. The relative risks were steady across age strata and did not change during the follow up. The attributable risk of diabetes also increased with BMI of 22 kg/m^2 or over. For BMI of 25-26.9 kg/m^2, the attributable risk (i.e. the average of diabetes between female with a BMI 25-26.9 kg/m^2 minus the average between females with BMI less than 22 kg/m^2) is 72.1 cases per 100.000 person-years. This increases with rising BMI. Females with a BMI of 33 kg/m^2 or over 98% of the ones diagnosed with diabetes are due to obesity. For the overall cohort, 90.4% of diabetes diagnoses are referred to BMI more than 22 kg/m^2. The study also examined the impact of obesity at early ages, so Colditz and colleague (1990), calculated the BMI of the participants at age 18. They found that with a BMI of 29 kg/m^2 or more at an age of 18 years compared to the participants with BMI of 19 kg/m^2, the age adjusted relative risk of diabetes is 6.1 (95 percent CI 4.7-7.9). Furthermore, they found that BMI at age of 18 years is strongly correlated with current BMI (r =0.52), which show a positive relation between current BMI and BMI at age 18 years. After controlling for age and follow up period in proportional hazards model, the relative risk for BMI of 29 kg/m^2 is 0.8 (95 percent CI 0.6-1.1). In this example, the impact of current BMI is mainly unaltered, which suggests the dominance of current BMI over the BMI at an age of 18 years (Colditz *et al*., 1990).

Hu *et al*. (2001c) conducted a longitudinal study that tracked a set of female nurses over 16 years. The study indicated that the major risk factor for T2DM is high BMI. For BMI in the range of 23.0-24.9, the RR is 2.6(95% CI: 2.1-3.3), for a BMI of 25-29.9, the RR is 7.5(95% CI: 6.2-9.1), for a BMI of 30-34.9, the RR is 20.1 (95% CI: 16.6-24.4) and for a BMI $\geq$ 35, the RR is 38.8(95% CI: 31.9-44.2). Lack of physical activity was also a risk factor for T2DM, while there was an inverse relation between physical activity and risk of diabetes for women who were physically active for $\geq$7hours/week compared to women who were active for 30minutes/week with a RR of 0.4(95% CI: 0.38-0.61).

According to Al-Nozha and colleagues (2004a), central obesity is a risk factor for diabetes among Saudis. The study reported that 33.1% of the males and 27% of the females who suffer from diabetes also suffer from central obesity. El-Hamzi and Warsy (1999) studied the prevalence of obesity among diabetic and non-diabetic subjects. It has been reported that diabetic overweight and obese participants were 30% and 33%, respectively. Whereas, overweight and obesity prevalence among non-diabetic participants was 16% and 25%, respectively (El-Hamzi and Warsy, 1999). Another study by Al-Harithy and Al-Ghamdi (2005) studied the effect of adiposity on serum resistance among diabetic and non-diabetic Saudis. They found significant association between serum resistance insulin among overweight and obese, non-diabetic participants (P=0.002) and in diabetic participants (P=0.0001). Diabetic participants had significantly higher waist sizes (P<0.001), WHR (P<0.001) and hip measurement (P<0.001) than non-diabetic subjects (Al-Harithy and Al-Ghamdi, 2005). Similar results were also reported in two other studies, high prevalence of overweight and obesity was reported by Alqurashi *et al*., (2011), where there was significantly higher overweight and obesity prevalence among diabetic patients (P<0.0001). Al-Shahrani and Al-Khaldi (2013) found that 46% of the diabetic patients attending the primary health care centre in KSA were overweight or obese. Overweight and obesity are risk factors for T2DM among Saudis (Abolfotouh *et al*., 2001; Ahmed *et al*., 2014; Al-Haramlah *et al*., 2015; Al-Nozha *et al*., 2004b; Al-Nuaim., 1997; Al-Quaiz *et al*., 2014; Horaib *et al*., 2013; Osman and AL-Nozha., 2000). Montminy (2009) explained how obesity increases the risk of T2DM. The study indicated that a condition known as ER (endoplasmic reticulum) stress, which is encouraged by a high fat diet and is overly activated in obese people, triggers aberrant glucose production in the liver, an important step on the path to insulin resistance. However, in people who consume healthy diets, a "fasting switch" only flips on glucose production when blood glucose levels run low during fasting.

Alqurashi and colleagues (2011) reported that Saudi females younger than 50 years of age had significantly higher prevalence of diabetes than males (P<0.0001) and they had significantly higher BMI (≥ 25) than males (P<0.008). In addition, Al-Haramlah and colleagues (2015) found that 64.7% of the female aged ≥ 40 in KSA suffer from T2DM.

2.2 Cardiovascular disease (CVD)

Cardiovascular disease is defined as a disease caused by disorder of the heart and blood vessels. CVDs include coronary heart disease, rheumatic heart disease, heart attack, stroke, peripheral arterial disease and cerebrovascular disease (WHO, 2015c). CVD is the number one cause of death worldwide (WHO, 2014b). Around one third of the world's deaths are caused by cardiovascular disease. It is estimated that by 2030, the leading cause of death in the world will be cerebrovascular disease (stroke) and ischemic heart disease which are components of cardiovascular disease (Deaton *et al*., 2011). By 2012 the deaths from CVD globally were 17.5 million and it is estimated to increase to 22.2 million in 2030. Approximately 7.4 million of the deaths were caused by coronary heart disease and 6.7 million by stroke. 16 million deaths occurred due to non-communicable diseases for the under 70 age group, 37% of these deaths were due to CVD worldwide (WHO, 2014b). Most of the deaths from CVD (80%) occur in low or middle-income countries and the deaths from stroke were five times higher than in high income countries. In developing countries, massive changes are taking place such as urbanisation and industrialisation which often correlate to a shift in diet, environment and physical activity level (Deaton *et al*., 2011). CVD are the major cause of mortality and morbidity in developed countries (Hammond *et al*., 2007). Mortality rate of CVD is increasing in countries with emerging economics such as Africa and Middle East including KSA (Alquaiz *et al*., 2015).

2.2.1 Prevalence of CVD in KSA

The mortality rate due to CVD was approximately 46%, making it the number one cause of death in KSA (WHO, 2014c). CVD is considered as a major health problem in KSA and the country is facing a worrying increase in the prevalence and death rate caused by CVD (Gaziano *et al*., 2010). In the Eastern province of KSA, CVD accounted for 26% of deaths

(Brunner *et al*., 2007). Aljefree and Ahmad (2015) concluded that there is an increase in the prevalence and incidence of these factors in KSA with a corresponding increase risk for CVD. Al-Daghri *et al.* (2011) reported that the prevalence of CVD in Riyadh has worsened compared to a decade ago. This can be based on the high prevalence of overweight and obesity in Riyadh, which achieved 82% among the participants and is greater among females (AL-Haqwi *et al*., 2015).

2.2.2 CVD risk factors

There are modified and non-modified risk factors for CVD. The non-modified risk factors include male gender, age, mental illness and socioeconomic status. The modified risk factors include, obesity, hypercholesterolemia, smoking, physical inactivity, unhealthy diet (Australian Institute of Health and Welfare, 2013; Bahijri *et al*., 2016; Deaton *et al*., 2011; Khatib, 2004; WHO, 2013) hypertension and diabetes mellitus (Akbar *et al*., 2003; Alissa *et al*., 2005; Al-Nozha *et al*., 2004a; Bahijri *et al*., 2016; Heart UK, 2015: Rawas *et al*., 2012). The modified factors are considered responsible for 80% of CVD and cerebrovascular disease around the world (National Vascular Disease Prevention Alliance, 2012). Numbers of studies reported that changing CVD risk factors is associated with a reduction in CVD total mortality rate by 20-30% (Brunner *et al*., 2007; Davies *et al*, 2010). According to Yusuf and colleagues (2004), the modification of CVD risk factors may reduce the incidence of the first myocardial infarction by 90%.

There are number of factors related to the risk of CVD as it is presented in table (2-1). According to (Akber *et al*., 2003; Al-Haramlah *et al*., 2015; Al-Nozha et., 2004; Al-Quaiz *et al*., 2014; Ibrahim *et al*., 2014; Khattab *et al*., 1999; Kumosani *et al*., 2011; Midhet *et al*., 2012; Osman and Al-Nozha, 2000; Taha and Bella, 1998), the behavioural factors are forming the major risk among the Saudi population which is similar to the western countries.

2.2.2.1 Hypercholesterolemia and CVD

It has been found hyperlipidemia is a risk factor for CVD (Al-Nozha *et al*., 2004a; Al-Quaiz *et al*., 2014; Akbar *et al*., 2003; Elkhalifa *et al*., 2011).

Al-Daghri *et al*., (2005) found there that serum resistin was significantly higher among CHD patients (P=0.0001) than the control group. In addition, serum cholesterol and LDL cholesterol were significantly higher among the CHD patients than the control group (P=0.0003) and (P<0.01) respectively. C-reactive protein increased in CHD patients than the control group (P=0.0002) (Al-Daghri *et al*., 2005).

2.2.2.2 Diet and CVD

The main nutrients that effect CVD are fatty acids, vitamins, minerals and fibre. Fat forms an important part in human diet, it is considered the most concentrated source of energy. The type of fatty acids and quantities are very important for healthy diet (perk *et al*., 2012). The excessive consumption of fat, sugar and insufficient physical activity are the main risk factors for CVD in KSA (Al-Nuaim, 2012). Balanced diet should provide no more than 30% of fat and 300 mg of cholesterol per day which has been recommended by the American Heart Association (Krauss *et al*., 2000). The excessive fat consumption is associated with increased weight and obesity (Verschuren, 2012).

2.2.2.2.1 Fatty acids

There are three main types of lipids; triglycerides, sterols and phospholipids (Sizer and Whitney, 2014; Thompson *et al*., 2014). Triglycerides can differ in the grade of saturation, there are three grades of triglycerides: Saturated fatty acids (SFA), Monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA).

SFA and trans-fat are linked with raised risk of heart diseases as SFA and trans-fat raise the level of cholesterol in the blood. (Perk *et al*., 2012; Thompson *et al.*, 2014). MUFA are more advantageous to health since they help in lowering the level of low density lipoprotein cholesterol (LDL). They are also linked to a healthy diet and a decreased rate of coronary heart disease (Blades, 2013; Perk *et al*., 2012; Sizer and Whitney, 2014). PUFA can be divided into two groups, Omega-3 and Omega-6. Omega-3 fatty acids are very important for the body as they assist in preventing blood clotting and decrease triglyceride levels. Omega-3 fatty acids do not influence serum cholesterol levels. Although Omega-3 they have been found to reduce CHD deaths and lower extent stroke deaths (He *et al*., 2004a; He *et al*., 2004b). In addition, they play an important role in forming brain tissue thus they are significant for children and their ability to learn (Blades, 2013). They are helpful in preventing inflammation and coronary heart diseases cardiac arrest (Connor, 2000). Omega-3 can be found mainly in fish oil, fat, walnuts and chia seeds (Perk *et al*., 2012).

Fish intake has a protective impact against CVD and this resulted from the content of omega-3 in the fish. He *et al*., (2004b) found that consuming fish 2-4 times per week result in 18% reduction in the risk of stroke, RR of 0.82(95% CI 0.72-0.94) compared to consuming fish once month. The special feature of omega-3 in coronary heart disease was investigated in Greenland Eskimos who were consuming great amounts of fat in their diet from fish, seal and whale but had low attack average of coronary heart disease which could be because the type of fat they are consuming has high amount of omega-3 fatty acids (Connor, 2000). In the Arabian Gulf, the average intake of fish is 24-52g per capita per day (Musaiger *et al*., 2012). UK in 2014 had an average consumed 158g of fish per week per person which is about 22.7g per day (Watson, 2016).

The amounts of fatty acids differ from one type of food to another. For instance, plant fats provide 80-90% of their energy from monounsaturated and polyunsaturated fats. Whereas animal fats provide around 40-60% of their energy from saturated fats. Diets which are rich in plant products are commonly lower in saturated fats than diets rich in animal products (Sizer and Whitney, 2014; Thompson *et al.*, 2014).

Trans-fatty acids are produced industrially by adding hydrogen to vegetable unsaturated fats (hydrogenation) which make the fat solid. Trans-fats are used widely in the fast food sector asthey increase the shelf life and improve the texture and flavour of the food (Thompson *et al*., 2014). They can also be found in bakery products and margarine. These types of fat increase the total cholesterol whilst reducing the HDL cholesterol levels in the blood (Hu *et al*., 2001c). A meta-analysis of prospective cohort studies found that the higher consumption of trans-fat around 2% of total energy raises the risk of CHD by 23% (Mozaffarian and Clarke, 2009). A recent systematic review and meta-analysis of observational studies, Souza *et al* (2015) found that the total trans-fat consumption was associated with CHD deaths 1.28 (95% CI: 1.09-1.50 $P<0.001$). The recommendation for trans-fat is <1% of the total energy which is about (1-2g) per day (Bhupathiraju and Tucker, 2011; Mozaffarian and Clarke, 2009).

The recommended total fat intake is between 20% - 35% for adults. Asthe higher consumption of fat is linked with obesity and the problems which are related to it such as, diabetes, heart disease (Alissa *et al*., 2005; Thompson *et al*., 2014). Also, the high consumption of carbohydrate is linked with higher risk of heart disease because they lead to unhealthy change in blood lipids (Thompson *et al*., 2014). The recommendation for the saturated fat is 7%, from the total energy, for PUFA 6% and MUFA 12% of the total energy intake (Bhupathiraju and Tucker, 2011).

In 2009, Jakobsen *et al.* described how replacing SFA in the diet by PUFA lowers serum total cholesterol levels and LDL cholesterol. There was a significant decrease in the risk of CHD related deaths and events. The multivariate-adjusted hazard ratio for CHD related deaths per 5% total energy gradual substitution of PUFA for SFA was 0.87 (95% CI 0.77-0.97) for CHD events the hazard ratio was 0.74 (95% CI 0.61-0.89) (Jakobsen *et al*, 2009). Other epidemiological clinical mechanistic studies found that the risk of CHD is reduced by 2-3% when replacing the energy from SFA with PUFA by 1%. However, the results were not the same when SFA was replaced with carbohydrate or MUFA (Lloyd-William *et al*., 2008; Mozaffarian and Clarke, 2009). Thus, reducing SFA intake to a maximum of 10% of total energy by replacing it with PUFA remains substantial for the dietary prevention of CVD.

Numbers of systematic reviews reported the effect of lifestyle changes in reducing the risk of cardiovascular events (Brunner *et al*., 2007; Davies *et al*, 2010; Mead *et al*., 2006). Consumption of fast-foods (Ibrahim *et al*., 2014) and animal fat (Allam *et al*., 2012) were associated with the risk of CVD in KSA.

Table (2-1) Association of diet, lifestyle and CVD

Research/ Study	Locatio n	Study design	Factor related to CVD	Sample size	Gender / age	Method	Finding
Liu *et al*., (2001)	USA	randomis ed double-blind	vegetab le	15,220	Male, 40-48 years.	The study was a placebo-control, it examined the role of aspirin and beta-	Diets rich with carotene reduced the risk of CHD by 17%. After understanding

						carotene in the elementary avoidance of cancer and CVD. Also, to examine the relation between CVD and events such as strokes or cancer with the consumption of vegetables.	important factors such as age, BMI, smoking, alcohol consumption, activity level, randomised treatment, history of diabetes, history of hypertension, history of risen cholesterol and multivitamins intake, the researchers found that males who ate vegetables in at least 2.5 portions had the risk of CVD reduced.
Jakobsen *et al.* (2009)	America and Europe	Meta-analysis	SFA, PUFA, MUFA, Carbohydrate	344,696	Male and female, 37-76 years.	Pooled studies of 11 prospective cohort summarises the evidence from cohort studies with dietary intervention and assesses the risk of CHD. They examined replacing SFA with PUFA, MUFA or carbohydrate.	They found that when they replaced SFA with PUSA, there was a significantly reduced danger of CHD mortality and CHD events. SFA raises Low density lipoprotein (LDL) level, so superseding SFA with unsaturated fatty acid such as PUFA, raises the high-density lipoprotein (HDL), lowers the LDL cholesterol and the total cholesterol.
Larsson and Orsini (2014)	China, Europe, Greece, UK and USA	Meta-analysis	Processed meat	1,330,352	Male and female, 20-86 years	Self-reported FFQ.	High consumption of processed meat was associated with the risk of CVD.
He *et al.*, (1999)	Argentina, China, England, Italy, Japan, New	Meta-analysis	smoking	635,123	Male and female, 25-79	18 epidemiologic (10 cohort and 8 cases–control) studies examined the association between smoking and CHD	Smoking was associated with the increase risk of CHD.

	Zealand, USA						
Mcgee (2004)	Australia, Denmark, England, Israel, Finland, Italy, USA	Meta-analysis	BMI	388,622	Male and female	Mata-analysis of cohort studies	Overweight and obesity were associated with CHD related deaths.
He *et al*., (2004b)	China, Japan, Netherland and USA.	Mata-analysis	Oily fish	200,575	Male and female, 34-103 years.	The study was conducted to examine the relation of fish consumption and the risk of stroke.	Intake of fish is inversely related to the risk of stroke, particularly ischemic stroke. Fish consumption as seldom as 1 to 3 times per month may protect against the incidence of ischemic stroke
Barclay *et al*. (2008)	USA	Meta-analysis	GI, GL	154,300	Female, 30-63 years	Two studies investigated the relation between GI, GL and risk of CVD.	There was a positive association between GI, GL and risk of CHD for 4-20 years following up.
Luo *et al*. (2014)	China, Spain, Netherland, UK, USA	Mata-analysis	Nuts	48,818	Male and female, 20-87 years.	Four studies on CVD and 11 in all cause of mortality were included to investigate the relation between the consumption of nuts and CVD and mortality.	There was an inverse relation between the consumption of nuts and risk of CVD and all cause of mortality.

2.2.2.2.2 Fruit and vegetables

In KSA, low intake of vegetable <3 days/week among adolescents was significantly associated with central obesity, overweight and obesity (Al-Hazzaa *et al*., 2012). (Majeed, 2015) Saudi people prefer eating junk foods such as burgers, fried chicken and pizzas rather than consuming fruits and vegetables.

Dauchet *et al*., (2006) explains the relation between the intake of fruits and vegetables and the risk of CHD. The meta-analysis of seven large prospective studies reported valuable information regarding fruit consumption and the risk of coronary heart disease. Each increase of a portion of fruit decreases the risk of CHD by 4% (RR 0.96, 95 % CI 0.93–0.99). In addition, each extra portion of fruits and vegetables reduces the risk of stroke by 5%. This effect was attributed to different factors, such as: the micro and macro nutrients of the fruit and vegetables decreases the risk of coronary heart diseases such as diabetes, hypertension and dyslipidaemia. Fruit and vegetables consumers were found to be more educated, smoke less, exercise more, consume less saturated rich fat foods and have better diet and life style pattern (Dauchet *et al*., 2006). Hu *et al.* (2006) reported that consuming more than 5 portions of fruits and vegetables daily has a combined RR of 0.74. Consuming 3-5 portions of fruits and vegetables daily has a combined stroke risk of 0.89 compared to individuals consuming less than 3 portions a day. Another study reported that there is an inverse relation between the consumption of vegetables and the risk of CVD. The high consumption of vegetables may help in reducing the risk of coronary heart disease by 17%. The study found that males who ate vegetables at least 2.5 portions per day, have a relative risk RR of 0.77 (95% CI: 0.60–0.98) for danger of CVD compared to men who consumed less than 1 portion per day. The study found a RR of 0.83 for each extra portion of vegetables consumed per day. The inverse connection between vegetables consumption and dangers of CVD, was more obvious in men with BMI higher or equal to 25 (95% CI: 0.71–0.98) or existing smokers RR 0.40, (95% CI: 0.18–0.86) contrasting highest to the lowest groups of consumption (Liu *et al*., 2001).

Many prospective observational and case control studies have reported inverse relation between the risk of CVD and levels of vitamins A and E. The prospective impact was ascribed to vitamins antioxidant properties. Though, intervention trail designed to investigate the causality of these associations have failed to confirm the results from observational studies (Vivekananthan *et al*., 2003). In 2005, Alissa and colleagues compared the average intake of dietary energy, total fat and antioxidants vitamins (A, E, C and carotenoids) in Saudi patients with CVD and control group. They found that the serum vitamin E and A for CVD patients and control was similar. However, the intake of vitamin E and A were significantly higher among the control group than the CVD patients (i.e. $P<0.05$ and $P<0.001$, respectively) (Alissa *et al*., 2005).

The impact of fruits and vegetables in reducing the risk of CVD can be attributed to carotenoids. They are very healthy, for example, they work in the body as powerful antioxidants and vitamin A precursors. There are various types of carotene but the ones which can be found in human food are β-cryptoxanthin, β-carotene, lycopene, α-carotene and zeaxanthin. In addition, fruits and vegetables are rich in potassium, which has an effect on lowering blood pressure (He and MacGregory, 2001). Many studies have concluded the prevention impact of the high consumption of fruits and vegetables in lowering the risk of CVD (Bhupathiraju and Tucker, 2011). The daily recommendation is 5 portions of fruit and vegetables (Hung *et al*., 2004), which is equivalent to 400g (Oyebode *et al*., 2104). In the Arabian Gulf countries, 85% of the adults are consuming less than 5 portions of fruits and vegetables per day (Musaiger *et al*., 2012). Based on a health survey in the UK, which included more than 65,000 participants, 46.1% of the participants were found to consume less than 3 portions a day (Oyebode *et al*., 2104).

2.2.2.2.3 Fibre

The consumption of dietary fibre has a positive effect in reducing the risk of CVD. The high intake of soluble fibre reduces the LDL cholesterol and post-prandial glucose responses after consuming high carbohydrate meals. Main sources of dietary fibre are legumes, wholegrain products, vegetables and fruits (Weickert and Pfeiffer, 2008). Soluble fibre has a viscous or gel forming properties that slows down gastric emptying and absorption of macronutrients from the gut. Insoluble fibre is associated with decreasing the risk of T2DM (Weickert and Pfeiffer, 2008).

2.2.2.2.4 Nuts and seeds

Nuts and seeds are good sources of micronutrients and macronutrients. They are rich in fibre, unsaturated fat and minerals such as potassium and magnesium. In addition, they are rich in bioactive components such as phenolics, polyphenols, phytosterols, and tocopherols (Brufau *et al*., 2006; Sabate´ *et al*., 2006). A meta-analysis of 4 cohort studies reported that subjects who consumed nuts ≥ 4 times per week had 37% reduced risk of Coronary artery disease (CAD) compared to subjects who consumed nuts rarely or never with an average decrease of 8.3% for one serving per week of nuts (Kelly and Sabate´, 2006). A meta-analysis of 11 prospective cohort studies for coronary artery disease and hypertension, (Zhou *et al*., 2014) indicated that consumption of 1 serving of nuts per day was associated inversely with CAD risk (RR 0.81: 95% CI: 0.72-0.91 P<0.001) and hypertension (RR:0.66, 95% CI: 0.44-1.00 P=0.04).

Another meta-analysis of a group of prospective cohort studies, (Luo *et al*., 2014) reported that there was an inverse relation between the consumption of one serving of nuts per day and the risk of CVD, with a RR of 0.71(95% CI: 0.59-0.85) and for all cause of deaths 0.83 (95%, CI: 0.76-0.85). The beneficial effects of nuts and seeds maybe attributed to their content of USFA and PUFA. These fatty acids improve blood lipids profile; reduce insulin resistance, moulding inflammation and oxidative stress (Pradhan and Ridker, 2002) which impacts in reducing the risk of CVD and T2DM (Luo *et al*., 2014: Zhou *et al*., 2014). In addition, their content of potassium, calcium and magnesium are lower in carbohydrates; therefore, they contribute little to postprandial glycaemia and have a positive effect in reducing the overall CVD risk (Luo *et al.*, 2014).

The consumption of nuts and seeds is recommended to be from unsalted and roasted rather than salty and roasted nuts and seeds as the salty ones contain high amount of sodium (Luo *et al*., 2014; Sabate´ and Ang, 2009).

2.2.2.3 Hypertension and CVD

The positive relation between blood pressure and CVD is well recognised. Hypertension is the commonest factor for CHD events in Saudis (DeNicola *et al*., 2015). Hypertension affects 20 – 50% of adults in developing countries. It is the most prevalent cardiovascular disorder (Mancia *et al*, 2014). Globally, cardiovascular disease accounts for 17 million deaths annually. Approximately 9.4 million of these deaths are caused by the complication of the hypertension. 45% of the deaths from hypertension was because of heart disease, and 51% were due to stroke (WHO, 2013).

Each 20/10 mmHg increase in blood pressure over the normal level, increases the risk of CVD, and possibly doubles the risk (Beevers *et al.*, 2014; Douglas *et al*., 2003). Reducing blood pressure (BP) does not only prevent hypertension occurrence or delay it, it may also decrease the complications associated with it such as cardiovascular risk (Lin and Svetkey, 2012). Hypertension is a risk factor for cardiovascular disease, it can also cause strokes, kidney failure, disability, heart attacks and premature death (Beevers *et al.*, 2014; Mancia *et al.*, 2014; WHO, 2013).

2.2.2.4 Diabetes mellitus and CVD

Diabetes is a major risk factor for vascular events, cerebrovascular disease and myocardial infraction among young patients (Elhadd *et al*., 2007). In a meta-analysis of a group of studies, Barclay *et al*. (2008) indicated a positive association between high GI and risk of CHD as 1.25 (95% CI; 1.00-1.56) and GL and risk of CVD, GL as 1.41(95% CI: 1.18-1.69). Meanwhile, diets high in whole grain and fibre was found to be protecting against heart disease. High insulin and glucose concentrations are related to raise risk profile for CVD, increased glycosylated proteins, reduced concentration of HDL cholesterol, oxidative status, hemostatic variables and poor endothelial (Brand-Miller, 2003).

2.3 Type 2 Diabetes

The prevalence of T2DM is increasing dramatically. Globally, 6.9% of the people around the world (318 million people) are impacted by impaired glucose tolerance (IGT) and the number is expected to rise to more than 470 million by 2035 (Paneni and Cosentino, 2015). Most of the patients with T2DM, (77%) live in low and middle-income countries (IDF, 2014). In 2004, an estimated 3.4 million people passed away because of high blood sugar. Furthermore, diabetes death will increase by two thirds between 2008 and 2030, according to the project of WHO (WHO, 2012b).

Factor that are associated with type 2 diabetes (T2DM) include obesity (Elia *et al*., 2013; Montminy, 2009), physical inactivity, unhealthy diet (Midhet *et al*., 2012). Other factors are also able to increase the risk of T2DM and the most common of these include having relatives with T2DM, a sedentary lifestyle and sometimes a cluster of risk factors may lead to T2DM, such as metabolic syndromes. There are two types of diabetes, type 1 and type 2. Both types have dysfunction in regulating glucose (Elia *et al*., 2013; Sizer and Whitney, 2014). People who have diabetes have also a higher risk of stroke, heart disease and death.

Furthermore, diabetes can cause kidney failure, amputation and permanent blindness (Elia *et al*., 2013; Sizer and Whitney, 2014; Thompson *et al*., 2014). There are many complications associated with diabetes, such as impacts on the cardiovascular system, which include strokes, heart disease, heart failure and peripheral artery disease. Diabetes also has an impact on the kidney (diabetic nephropathy), the limbs (foot ulcers, amputations), the eyes (retinopathy) and the peripheral nervous system (neuropathy) (Paneni and Cosentino, 2015).

Type 1 diabetes occurs during childhood, adolescence or at any age. It accounts for 5-10% of the diabetes cases. Factors that may cause type 1 diabetes include genetics and exposure to viruses which change the immune response and subsequent beta cell disruption (Paneni and Cosentino, 2015). However, 90-95% of diabetes cases are classified as T2DM. In T2DM, body tissues lose their sensitivity to insulin. The adipose tissues and the insulin resistance muscles are unable to respond to insulin by raising up the glucose intake from the blood. As a result, the blood glucose will increase, and the pancreas will produce more insulin. Next, the pancreas cells become exhausted, may fail and produce less insulin. On the other hand, the blood glucose will be uncontrolled and will keep rising (Elia *et al*., 2013; Sizer and Whitney, 2014; Thompson *et al*., 2014).

The diagnoses of diabetes can be done by checking the blood glucose level after fasting. The test is called fasting plasma glucose (FPG). A level ≥126 mg/dL is diagnosed as diabetic. However, the recommendations showed that the glycated haemoglobin (HbA1c) is also important with the FPG and the value of ≥ 6.5 % in addition to the above value of the FPG is adequate to diagnose diabetes (Matsuzaki *et al*., 2010).

2.3.1 T2DM in KSA

In KSA, diabetes account for 6% of deaths in 2012 (WHO, 2014c). The prevalence of diabetes among Saudis in 2014 was about 20.52% (IDF, 2014). While in the UK, diabetes account for 1% of the total death (WHO, 2014d), and the prevalence of diabetes in 2014 was 5.38% (IDF, 2014). According to national studies, the prevalence of diabetes in KSA is increasing; El-Hamzi and Warsy (1998) found that 5.6% of the male and 4.5% of the female were diabetic. Warsy and El-Hamzi (1999) found that 9.7% of the males and 7% of the female were diabetic. Osman and Al-Nozha (2000) reported the prevalence of diabetes among Saudis as 13.2%. Al-Nozha *et al*. (2004b) found that 23.7% of the Saudis suffer from diabetes. El Bcheraoui *et al.* (2014b) reported 13.4% of the Saudis suffer from diabetes. Alshaikh *et al*. (2016) indicated prevalence of diabetes in KSA ranges between 9.6-27.6%.

In 2011, KSA was among the top six countries globally with high prevalence of T2DM, (16.2%) and it is estimated that by 2030, the prevalence will increase to 20.8% (Whiting *et al*., 2011). The major risk factors related to T2DM in KSA are; family history, ageing (Alqurash *et al*., 2011; El Bcheraoui *et al*., 2014b; El-Hamzi *et al*., 1998; Kalaf *et al*., 2016; Midhet *et al*., 2010a), overweight, obesity, (Al-Nuaim, 1997; Al-Quaiz *et al*., 2014; Bahijri *et al*., 2016; Elhadd *et al*., 2007; Midhet *et al*., 2010a) physical inactivity, (Whiting *et al*., 2011; Midhet *et al*., 2012) hypertension (El Bcheraoui *et al*., 2014a) and dyslipidaemia, (Al-Daghri *et al*., 2005; Al-Haramlah *et al*., 2015; El Bcheraoui *et al*., 2014a; Elhadd *et al*., 2007). Aging increases the risk of T2DM, since increase adiposity and reduced muscle mass which results from physical inactivity may lead to insulin insensitivity, (Khan *et al*., 2006; Xu *et al*., 2003) further increase the risk of prediabetes and metabolic syndrome (Zimmet *et al*., 2005).

2.3.2 Hypercholesterolemia, Hypertension and T2DM

Diabetes is associated with hypertension since high blood pressure is an important factor for metabolic syndrome and increased risk of T2DM and CVD (Alberti *et al*., 2005; Scott, 2003). Alberti *et al.* (2005) reported that there was significant association between hypertension and T2DM, with hypertension being present in 60% of the diabetic patients' participants. According to a national study, Al-Kaabba *et al.* (2012) indicated that the overall prevalence of dyslipidaemia ranged between 20-40% among Saudis. T2DM was associated with total cholesterol OR 2.2(95% CI: 1.8-2.6, P<0.001), high triglycerides OR 2.5(95% CI: 2.0-3.0, P<0.001) and total cholesterol HDL OR 1.5(95% CI: 1.2-1.8, P<0.001) (Al-Kaabba *et al*., 2012). A cross sectional national study by El Bcheraoui *et al.* (2014a) found that there was a significant association between T2DM and hypertension AOR 1.82(95% CI: 1.31-2.53). Also, there was significant association between T2DM and hypercholesterolemia AOR 2.18(95% CI: 1.5-3.15).

In addition, the commonest variable found among Saudi diabetic subjects is lipoprotein abnormalities (Al-Nuaim, 1997; Bahijri *et al*., 2016). Al-Daghri *et al* (2005) found serum resistance was significantly higher among T2DM patients than non-diabetic subjects (P=0.0007). In addition, serum cholesterol and C-reactive protein were significantly higher in T2DM patients (P<0.05) as compared to non-diabetic patients (P=0.0002). Also, T2DM resistance is associated with LDL (P=0.009).

2.3.3 Diet and T2DM

2.3.3.1 Glyceamic load

Habitual diet is the main modifiable factor for prevention of T2DM. Increases in refined sugar consumption have been accompanied by more subtle changes in starchy foods, for example, processed cereal products replaced traditionally processed grains (WHO, 2003). Since carbohydrate is the major dietary component impacting insulin secretion and postprandial glycemia, it is involved in the etiology of many NCDs (Brand-Miller, 2004). The type and quantity of carbohydrate intake have an impact on insulin secretion and postprandial glycemia (Wahlqvist *et al*., 2001). Glycaemic index, GI, is able to quantify the glycaemic response to carbohydrates in different types of foods. Glycaemic load (GL) is the mathematical product of GI of a food carbohydrate content with the amount of carbohydrate per serving. GL has been proposed as a global indicator of the glucose response and insulin demand induced by a portion of food (Salmeron *et al*., 1997a). Simple carbohydrate increases the blood glucose rapidly. However, NSP, fat and the level of cooking of some carbohydrates can result in lower glycaemic indices. Carbohydrate which are absorbed quickly, have higher GI than the ones which are absorbed slowly (Gropper *et al*., 2009; Sizer and Whitney, 2014; Thompson *et al*., 2014). The GI indicates the healthiness of the food according to the level of elevating the insulin and lipids in the blood after consuming the meal. A prospective cohort study by Salmeron *et al.* (1997a), Salmeron *et al.* (1997b) and Willett *et al*., 2002 found that there was a positive relation between dietary glycemia and risk of T2DM among women and men for 6 years follow up. Comparing the highest with the lowest quintile RR for diabetes, the results for women were 1.3 (95% CI1.09-1.7, P trend =0.005) and in men were 1.37 (95% CI: 1.02-1.83, P trend=0.03). GL was also associated with the risk of T2DM in women with RR as 1.47 (95% CI: 1.16-1.86, P trend= 0.003). Cereal fibre (CF) consumption was inversely associated with the risk of T2DM comparing the high quintiles (>8.1d/day vs <3.2g/day) in women with RR of 0.72(95% CI: 0.58-0.9, P trend= 0.001) and in men, with RR of 0.7 (95% CI: 0.5-0.96, P trend=0.007). High GL diet and low CF consumption increased the risk of diabetes for women with RR as 2.5 (95% CI: 1.14-5.5) and RR of 2.17 (95% CI: 1.04-4.5) for men compared to low glycaemic diet and high CF consumption.

A meta-analysis of 8 studies by Barclay *et al.* (2008), compared the highest and lowest quantiles of GI and GL. The study indicated positive association between overall GI, GL and the risk of T2DM. The GI RR was 1.40 (95% CI: 1.23- 1.59), GL RR was 1.27 (95% CI: 1.12-1.45) (Barclay *et al.*, 2008). There are two mechanisms of the effect of GI on T2DM. Firstly, high GI foods lead to a sudden rise in blood glucose, which results in great demand for insulin. The chronic insulin demand could finally result in failure in pancreas β cells which lead to impaired glucose tolerance (Barclay *et al.*, 2008; Elia *et al.*, 2013; Sizer and Whitney, 2014; Thompson *et al.*, 2014). Secondly, high GI diets can rise insulin resistance via their impact on glycemia, free fatty acids and counter regulatory hormone secretion (Barclay *et al.*, 2008). Low GI diets may have better protection than low GL diets since low GL diets are more heterogeneous and may include low GI, high carbohydrate foods or low carbohydrate foods such as cheese and meat (Barclay *et al.*, 2005). According Denova-Gutierrez *et al.* (2010), people who consume lower glycaemic index food, their blood glucose levels tend to be normal, also they tend to have a higher grade of HDL cholesterol and lower grade of LDL, which is linked to higher risk for heart disease (Denova-Gutierrez *et al.*, 2010). Midhet *et al.* (2010a) found a positive strong association between T2DM and routine consumption of Kabsa (traditional dish consists of rice with chicken or meat) with AOR as 5.5(95% CL: 2.3-13.5), bakery products with AOR as 2.4 (95% CL: 1.3-4.6), potato chips and French fries with AOR as 2.2 (95% CL: 1.2-3.9). While routine consumption of vegetable was inversely associated with T2DM, the AOR was 0.4 (95% CL: 0.2-0.7).

Many studies have linked the increasing intake of sugar sweetened beverages to obesity and T2DM (Al-Hazzaa *et al*., 2012; James *et al*., 2004; Schulze *et al*., 2004) sedentary behaviour (Al-Hazzaa *et al*., 2014). According to Hu and Malik, (2010) the higher intake of sugar sweetened beverages can increase the risk of developing T2DM and the metabolic syndrome. Since these beverages contain great amounts of simple sugars, these may encourage higher glycaemic and insulinemic responses. High glycaemic response is associated with the risk of developing of T2DM and cardiovascular disease (Hu and Malik, 2010).

In a prospective follow up study over 6 years, Palmer *et al.* (2008) found that the intake of ≥ 2 sugar sweetened drinks or fruit drinks per day was associated with the risk of developing T2DM. For sugar sweetened drinks, the RR is 1.24 (95% CI: 1.06-1.45, P=0.002) and for fruit drinks, the RR is 1.31 (95% CI: 1.13-1.52, P=0.001). Numerous studies have found a positive relation between GL and the risk of T2DM (Salmeron *et al*., 1997a; Salmeron *et al*., 1997b). Sugar sweetened drinks have moderate glycaemic index, but they lead to a high GL when they are consumed in increased amounts (Foster-Powell *et al*., 2002).

2.3.3.2 Cereal Fibre

Wholegrain foods have been reported to decrease the risk of diabetes (Lutsey *et al*., 2007; Mckeown *et al*., 2002, Meyer *et al*., 2000) and metabolic syndrome (Mckeown *et al*., 2002). Numbers of epidemiological studies indicated an inverse relation between wholegrain intake and C-reactive protein (CRP) in non-diabetic subjects (Lutsey *et al*., 2007; Masters *et al*., 2010) and diabetic subjects. This trend was also noticed between wholegrain and high fasting levels of glucose (Lutsey *et al*., 2007), leptin (Jensen *et al*., 2006) and insulin (Lutsey *et al*., 2007). Two intervention studies in the duration of 4-12 weeks, reported a decrease in CRP (Katcher *et al*., 2008) IL-6 in subjects with metabolic syndrome, overweight and diabetic subjects (Martinez *et al*., 2013). Another intervention study conducted on a healthy subject for 6 weeks found that intake of 168g/day of wholegrain was associated significantly with decrease in insulin (P=0.07), C-reactive protein (P=0.09), peptide (P=0.09) and IL-10 (P=0.07) (Ampatzoglou *et al*., 2016).

A prospective cohort study over 6 years follow up by Meyer *et al*. (2000) found comparing the low quintile intake with the high quintile intake of total grains, whole grains, CF and magnesium were inversely related with the risk of T2DM. For total grains, the RR was 0.68 (95% CI: 0.54-0.87, P=0.001), for whole grains, the RR was 0.79 (95% CI: 0.65-0.96, P=0.008), for CF, the RR was 0.75 (95% CI: 0.61-0.91, P=0.001) and for magnesium, the RR was 0.67 (95% CI: 0.55-0.82, P=0.000). The study indicated that, women who were consuming the highest quintile (more than 23.6g per day) of dietary fibre had a 22% lower risk of progressing diabetes than those who consumed less quintile (less than 15.3 g of fibre per day). Dietary fibres especially insoluble fibre has a positive effect in reducing risk of T2DM. A meta-analysis found that the high consumption of cereal dietary fibre was significantly related to decreased diabetes risk, with RR of 0.67 (95% CI 0.62-0.72) (Schulze *et al*., 2007). In addition, pooled data of six prospective cohort studies found that consumption of 2 portions of wholegrains per day might decrease the risk of T2DM by 21% (de Munter *et al*., 2007). The significant relation of wholegrains in reducing the danger of diabetes could be because wholegrains contain more dietary fibre and magnesium. Soluble fibre has an effect in lowering plasma glucose and slows the absorption of foods by making a gel-like component in the stomach. Insoluble fibre also may slow the absorption of foods (Meyer *et al*., 2000). Salmeron *et al*. (1997a) and Salmeron *et al*. (1997b) reported a 38% reduced risk of T2DM for individuals in the highest quintile of magnesium consumption compared to the lowest quintile of consumption.

An observational study by Howarth and colleagues (2001) examined the relation between weight and fibre intake. The study indicated that high consumption of dietary fibre was inversely associated with gaining weight. It has been found that subjects who consume low dietary fibre gain 3.6kg more than subjects who consume high dietary fibre over 10 years. This effect might be due to the fact that dietary fibres are able to reduce subsequent hunger alongside with maintaining fixed energy intake (Weickert and Pfeiffer, 2008).

2.3.3.3 Red meat and processed meat

In a systematic review and meta-analysis for cohort studies, Aune *et al.* (2009) found a significant relation between the risk of T2DM and the high intake of meat with RR of 1.17 (95% CI: 0.92-1.48), for red meat as RR of 1.21 (95% CI: 1.07-1.38) and processed meat RR as 1.41(95% CI: 1.25-1.60).

In a meta-analysis of prospective studies, Larsson and Orsini (2014) found that high intake of processed meat was significantly associated with all causes of mortality (T2DM, CVD and cancer) in men with a RR of 1.20 (95% CI: 1.11-1.30) and women with RR of 1.23 (95% CI: 1.9-1.27). High intake of total meat was also associated with all cause of mortality in men with RR of 1.32 (95% CI: 1.28-1.37) and women with RR of 1.27 (95% CI: 1.17-1.38). In addition, high intake of unprocessed red meat was significantly associated with all causes of mortality in men with RR of 1.27 (95% CI: 1.19-1.35) but not in women. In a meta-analysis of 9 prospective studies, Micha *et al.* (2012) found that each increased intake of 100g/day from unprocessed red meat was related to 19% increase risk of T2DM and each increased intake of processed meat 50g/day increased the risk of T2DM by 51%. Results of the prospective studies indicated that each increase intake of

50g/day of processed meat increases the risk of CHD by 42%. Processed meat contains high amount of salt (sodium), which is significantly related to the risk of high blood pressure and hypertension. High consumption of salt may lead to vascular stiffness (Susic and Frohlich, 2012). In addition, high consumption of red meat is often associated with unhealthy lifestyles such as overweight, obesity, smoking; physical inactivity and unhealthy dietary pattern (Aune *et al*., 2009).

Table (2-2) Association of diet, lifestyle and T2DM risk

Research/ Study	Location	Study design	Factor related to T2DM	Sample size	Gender / age	Method	Finding
Hu *et al*. (2001b)	USA	Cohort study	BMI	84,941	Female nurses, 30-55 years	The study used a semi quantitative food frequency questionnaire and followed the cohort 16 years	Overweight and obesity, inactivity, smoking and poor diet consumption were associated significantly with risk of T2DM.
Salmerón *et al*. (1997b)	USA	Cohort study	GL, CF	42,759	Male, 40-75 years	Follow up for 6 years. Diet was assessed at baseline by a validated semi-quantitative food frequency questionnaire.	There was a positive relation between dietary glycemia and risk of T2DM. GL was also associated with the risk of T2DM CF consumption was inversely associated with the risk of T2DM.
Salmerón *et al*. (1997a)	USA	Cohort study	GL, CF	65,173	Female, 40-65 years	Follow up for 6 years. Semiquantitative FFQ containing 134 food items, beverages and vitamin supplements was used in 1986.	There was a positive relation between dietary glycemia and risk of T2DM. GL was also associated with the risk of T2DM. CF consumption was inversely associated with the risk of T2DM.
Barclay *et al*. (2008)	Australia, USA	Meta-analysis	GI, GL	422,224	Male and female,	Conducted for 4-20 years following up	There was a positive association

					24-76 years	the association between overall GI, GL and risk of T2DM was investigated.	between GI, GL and risk of T2DM.
Aune *et al*. (2009)	Australia, China, and Japan	Meta-analysis	Red meat	445,323	Male and female, 27-88 years	Baseline and updated self-reported FFQ was used in collecting the data.	High consumption of red meat was associated with the risk of T2DM.
Aune *et al*. (2009)	Australia, China, Finland, Germany, UK and USA	Meta-analysis	Processed meat	433,070	Male and female, 26-88 years	Dietary history interview, baseline and updated self-reported FFQ were used in collecting the data.	High intake of Processed meat was associated with the risk of T2DM.
Jeon *et al.*, (2007)	Australia, France, Netherlad, USA	Systematic review	Moderate physical activity	301,221	Male and female 20-69	Studies included moderate intensity were included	Moderate physical activity such as brisk walking reduces the risk of T2DM.

2.4 Risk score and assessment of CVD and T2DM

Risk scores are helpful in identifying people who are at a high risk for T2DM and CVD. Risk scores were developed to identify the people at risk without laboratory tests (Lindstrom and Tuomilehto, 2003). Most of the developed risk scores were among Caucasian groups. Hence, these risk scores may not be suitable for Saudi population from other ethnicities and who have a high prevalence of T2DM and CVD.

The use of questionnaires or risk scores in assessing the risk of T2DM or CVD became popular, since it is a convenient approach (can be self-administrated), is inexpensive and non-reliant on medical history (Al-Lawati and Tuomilehto, 2007). The American Diabetes Association distributed T2DM screening questionnaires known as the “take a test to know the score” in 1993. Such questionnaires are based on a series of self-reported demographic, behaviour, risk factors e.g. age, gender, overweight, obesity, inactivity, smoking, intake of fruit and vegetables, having a baby >4kg and family history of hypertension and T2DM (American Diabetes Association, 1993).

Using risk scores developed in other population and different ethnicities may not be accurate in predicting the risk of the disease incident. Ridker *et al*. (2007) developed the Reynolds CVD risk score which included white female cohort with narrow socioeconomic rang. The study recommended that care should be taken before generalising the results of Reynolds to other population. Ridker *et al*. (2007).

According to Al-Lawati and Tuomilehto (2007), the Thai, Dutch, Danish and Finnish risk scores showed poor performance in predicting the risk of T2DM among Omani population. Whereas, the developed Omani risk score showed high sensitivity in predicting the risk of T2DM (Al-Lawati and Tuomilehto, 2007).

For the purpose of this research, an investigation into the range of studies published in English between 2000 and 2018 was undertaken, using PubMed Central and Google Scholar search. Key words used include: risk score, risk assessment of T2DM and CVD. Over 65 papers were identified primarily. The titles and abstracts of the articles were reviewed to cover: the general background of the risk scores and risk assessments of T2DM or CVD for adults. Participants were free from the disease for the baseline.

Some papers were selected, and the data extracted included a description of study samples, gender, location, study type, following time and information or clinical data gathered from the participants. Table (2-3) summarises the risk score, and risk assessment for T2DM and CVD used in previous research.

Table (2-3) risk score and risk assessment for T2DM and CVD

Research/ Study reference	Population validated	NCDs assessed	Number / gender	Age/ mean age	Study type/ following time	Variables included
Wilson et al. (1998)	USA	CVD	5,345 (M+F)	30-74Y	Cohort study/ 12Y	age, sex, diabetes, smoking, blood pressure, total cholesterol, LDL cholesterol, and HDL cholesterol.
Baan et al. (1999)	Netherland	T2DM	1,016 (M+F)	55-75Y	Cross-sectional	age, body mass index, waist-hip ratio, family history of diabetes, and smoking, physical activity, oral glucose tolerance test.
Griffin et al. (2000)	England	T2DM	1,077 (M+F)	40-46 Y	Cross-sectional 30 months	Age, gender, sex, BMI, family history of diabetes, use of steroid and hypertension medication, smoking, oral glucose tolerance test.
Stern et al. (2002)	Texas	T2DM	3,004 (M+F)	25-64 Y	Prospective cohort study/ 7.5 Y	Age, sex, ethnicity, BMI, 2-h oral glucose tolerance test, medical history, blood pressure, fasting serum total, LDL, HDL, cholesterol level, triglyceride.
McNeely et al. (2003)	USA	T2DM	465 (M+F)	34-75 Y	Cohort study/ 10 Y	Age, sex, ethnicity, BMI, 2-h glucose test, blood pressure, fasting plasma glucose, family history of diabetes, HDL, total cholesterol, glucose tolerance test.
Lindstrom and Tuomilehto (2003)	Kuopio and Finland	T2DM	4,435 (M+F)	35-64 Y	Cross-sectional / 10 Y	Age, sex, BMI, waist circumference, use of hypertension medication and high blood glucose, physical activity, consumption of fruit, vegetable, berries, fasting blood glucose, 2-h oral glucose tolerance test.
Conroy et al. (2003)	Europe	CVD	205,178 (M+F)	≥24Y	Cohort studies	age, sex, smoking status, total cholesterol and systolic blood pressure.
Schmidt et al. (2005)	USA	T2DM	7,915 (M+F)	45-64Y	Cohort study	Age, sex, BMI, waist circumference, history of diabetes, blood pressure, use of hypertension medication,

						plasma glucose, HDL, triglyceride, insulin resistance test.
Glümer et al. (2004)	Denmar k	T2DM	6,784 (M+F)	30-60 Y	Cross-sectional /5 years	Age, sex, BMI, waist circumference, history of diabetes, blood pressure, use of hypertension medication, plasma glucose, HDL, triglyceride, insulin resistance test.
Ramachandran et al. (2005)	India	T2DM	10,003 (M+F)	≥20Y	Cohort study/ 7Y	age, BMI, waist circumference, family history of diabetes, 2-h oral glucose tolerance test, and sedentary physical activity.
Mohan et al. (2005)	India	T2DM	26,001 (M+F)	≥35Y	Cohort study	Age, waist circumference, family history of diabetes, physical activity, 2h oral glucose tolerance test, plasma glucose level.
Kanaya et al. (2005)	USA	T2DM	1,549 (M+F)	67±11 Y	Cross sectional / 3 Y	Age, sex, BMI, waist circumference, fasting plasma glucose, triglyceride, blood pressure, HDL, LDL.
Silventoinena et al. (2005)	Finland	CVD	17,725 (M+F)	25-65 Y	Cross-sectional	self-administrated questionnaire, including questions about smoking, physical activity, health behaviour and use of antihypertensive drug treatment.
Norberg et al. (2006)	Sweden	T2DM	33,336 (M+F)	≥40 years	Cohort study/ 5.4Y	Age, sex, BMI, waist circumference, blood pressure, OGTT, glucose concentration, 2-h, HBA1, HDL, LDL, total cholesterol, triglyceride, smoking.
Aekplakorn et al. (2006)	Thailand	T2DM	2,677 (M+F)	35-55 Y	Cohort study/12 Y	Age, sex, BMI, waist circumference, blood pressure, family history of diabetes, impaired glucose tolerance, HDL, triglyceride, smoking, alcohol intake.

Schulze et al. (2007)	Germany	T2DM	25,167 (M+F)	35-65 Y	Prospective cohort study/ 5 Y	Age, sex, BMI, history of hypertension, physical activity, smoking, intake of red meat, wholegrain bread, coffee, alcohol. A self-reported FFQ and 24 h recall used to collect dietary information.
Al-Lawati and Tuomilehto, (2007)	Oman	T2DM	4,881 (M+F)	≥20 years	Cross-sectional / 10 Y	age, waist circumference, body mass index, family history of diabetes and hypertension. 2-h oral glucose tolerance test (OGTT).
Ridker et al. (2007)	USA	CVD	24,558 (F)	≥45 years	Cohort study/ 10.2Y	age, ethnicity, diabetes, blood pressure, blood pressure treatment, smoking status, cholesterol treatment, menopausal status, postmenopausal hormone therapy use, height, weight, alcohol use, exercise frequency, parental history of myocardial infarction before age 60 years, and current multivitamin use.
Chaturvedi et al. (2008)	India	T2DM	4,044 (M+F)	35-64 years	Cross-sectional	Demographic data, risk behaviours, past and current medical history, and family of CVD risk, blood pressure, waist circumference, plasma glucose and lipids; total cholesterol, (HDL), and triglyceride.
Rahman et al. (2008)	UK	T2DM	25,639 (M+F)	40–79 years	prospective cohort study/ 5Y	Age, sex, prescription of steroids and anti-hypertensive medication, family history of diabetes, body mass index and smoking status.
Fung et al. (2008)	USA	CVD	88,157 (F)	34-59 years	prospective cohort study/ 24 Y	age, BMI, smoking, fruit, vegetables, whole grain,s, nuts, legumes, low fat dairy, red meat, processed meat, sweetened beverages, saturated fat, multivitamins, .omega-3, and sodium intake
Bang et al. (2009)	USA	T2DM	15,732 (M+F)	≥20 years	Cross-sectional	Age, sex, family history of diabetes, history of hypertension, obesity, physical

						activity, demographic, socioeconomic characteristics, health care use, personal examinations, anthropometric and laboratory test results.
Chen et al. (2010)	Australi a	T2DM	6,060 (M+F)	≥25 years	Cross-sectional / 5 Y	Age, sex, ethnicity, parental history of diabetes, history of high blood glucose level, use of antihypertensive medications, smoking, physical inactivity and waist circumference
Gao et al. (2010)	China	T2DM	6,322 (M+F)	20-74 years	Cross-sectional / 6 Y	Age, waist circumference and family history of diabetes, 2-h 75-g oral glucose tolerance tests
Adhikari et al. (2010)	India	T2DM	551 (M+F)	≥20 years	Cross-sectional	age, family history of diabetes, physical activity and waist measurement, 2-h 75-g oral glucose tolerance tests.
Liu et al. (2011)	China	T2DM	1,851 (M+F)	30-60 years	Cross-sectional / 10Y	age, hypertension, history of high blood glucose, body mass index, fasting plasma glucose, serum triglycerides, and serum high-density lipoprotein-cholesterol
Nanri et al. (2015)	Japan	T2DM	37,416 (M+F)	≥30Y	3 Y	Age, sex, BMI, waist circumference, use of hypertension and dyslipidaemia medication, smoking, blood pressure, plasma glucose, HbA1, LDL, HDL, triglyceride.
EfirdArtigao-Ródenas et al. (2015)	Spain	CVD	342,667 (M+F)	≥18 years	Cohort study/ 14 Y	Age, sex, diabetes, left ventricular hypertrophy, occupational physical activity, age, systolic blood pressure × heart rate, number of cigarettes, and total cholesterol.
Zhang et al. (2016)	China	T2DM	20,194 (M+F)	≥18 years	Cohort study/ 6 Y	Age, sex, BMI, waist circumference, use of hypertension and dyslipidaemia medication, smoking, blood pressure,

						plasma glucose, HbA1, LDL, HDL, triglyceride. Demographic data, dietary and physical activity, family history of T2DM.
Johansson et al. (2016)	Finland	CVD	5,843 (M+F)	≥30 years	Cohort study/ 11.2Y	Sex, age, systolic blood pressure, total cholesterol, HDL, smoking status, parental death from CVD, left ventricular hypertrophy, HbA1c, and education level.
Pylypchuk et al. (2018)	New Zealand	CVD	401,752 (M+F)	30-74 years	Cohort study/ 4.5Y	Age, sex, family history of CVD, smoking status, socioeconomic status, diabetes, blood pressure, total cholesterol, (HDL), (LDL), antithrombotic medication use.

BMI; Body Mass Index, CVD, Cardiovascular disease, T2DM; Type 2 diabetes milites, Y; year, M; male, F; female, LDL; low density lipoprotein, HDL; High density lipoprotein.

Only four studies used selected food types to be included in the risk score of T2DM. Lindstrom and Tuomilehto (2003) included the intake of fruits and vegetables and berries in the score for diabetes. Schulze *et al*. (2007) included the intake of wholegrain bread, red meat, alcohol and coffee in the risk score for T2DM. Fung *et al.* (2008) assessed the intake of fruit, vegetable,whole grains, nuts, legumes, low fat dairy, red meat, processed meat sweetened beverages, saturated fat, multivitamins, omega-3, sodium intake and risk of T2DM in nurses . Zhang *et al.* (2016) assessed the intake of Chinese food. In Saudi Arabia, however, there are no developed risk score for CVD and T2DM. Almajawal *et al*. (2009) used BMI to predict the risk of T2DM and hypertension in the Eastern province. Al-Dahi *et al*. (2013) used the Framingham risk assessment to predict the risk of CVD among military men in KSA. Ibrahim *et al.* (2014) also used the Framingham assessment for the risk of CHD among university students in Jeddah.

Goff *et al.* (2013) suggested that a risk score requires a reliable quantitative estimation of absolute risk based on data from a representative population sample. Schulze *et al.* (2007)

developed the German risk score for T2DM, based on anthropometry, diet and smoking. The study developed a series of multivariate Cox regression models to produce risk functions for detecting incident diabetes in the EPIC Potsdam study cohort.

As in KSA, there is no baseline for the risk factors which are associated with T2DM and CVD. Hence, this study will form a baseline for Saudi nutritionists who are free from NCDs. By following the participants in the future and analysing the data acquired, the researcher will be able to relate the risk factors that are associated with the Saudi population and develop a correlation, which is going to help in assessing the risk of developing the disease in a certain period. This study is intended to assess the risk of T2DM and CVD based on anthropometric, dietary, and risk factors, including smoking and physical activity of the participants according to the evidence from previous studies conducted in different population. The factors' selection for T2DM and CVD was adopted from the results of the publications of the nurses' study. In this regard, the publications of the nurses' study were reviewed, and the factors related to CVD and T2DM were identified and chosen for the analysis of the data for this study. Factors for T2DM and CVD such as, food, activity level, smoking status, BMI were included in the analysis. In addition, the risk of T2DM and CVD was assessed using the same number of factors and in the same method that was used in AlMoraie (2014). AlMoraie assessed the risk of CVD using scores of 0-2 for low risk, 3-5 for medium risk and 6-8 for high risk.

Categorisation of the risk for T2DM and CVD for the participants of this study is included in table (2-4) which is carried out according to the studies presented in the reference column.

Table (2-4) factors associated with risk of T2DM and CVD according to longitudinal studies

Factors	Low	Medium	High	RR (95% CI)	Reference
GL for women (T2DM)	<143	143-165	>165/day	1.3(95% CI: 1.09-1.7)	(Salmeron *et al*., 1997a)
GL for men (T2DM)	<133	133-188	>188/day	1.37 (95% CI: 1.02-1.83)	(Salmeron *et al*., 1997b)
GL for men (CVD)	≤180	181-249	≥250/day	1.44(95% CI: 0.91-2.27)	(Levitan *et al*., 2007)
GL for women (CVD)	≤117	118-205	≥206/day	1.98(95% CI: 1.41-2.27)	(Liu *et al*., 2000)
Oily fish (CVD)	≥4 portion /week		<2 portion/week	0.82 (95% CI 0.72-0.94)	(He *et al*., 2004b)
Nuts (CVD)	≥1portion/day		Not consumed daily	0.71(95% CI: 0.59-0.85)	(Luo *et al*., 2014)
CF (men) (T2DM)	>8.1g/day	3.2-8.1g/day	<2.3g/day	0.7(95% CI: 0.5-0.96)	(Salmeron *et al*., 1997b)
CF (women) (T2DM)	>5.8g/day	2.5-5.8g/day	<2.5g/day	0.72(95% CI: 0.58-0.9)	(Salmeron *et al*., 1997a)
Vegetable (CVD)	≥2.5portion/day		<2.5portion/day	0.77 (95% CI: 0.60–0.98)	(Liu *et al*., 2001)
Saturated fat (Women) (CVD)	≤24.4g/day		>24.4g/day		(NHS, 2018)
Saturated fat (men) (CVD)	≤30.5g/day		>30.5g/day		(NHS, 2018)
Red meat (T2DM)	<100g/day		≥100g/day	1.21 (95% CI: 1.07-1.38)	(Aune *et al*., 2009), (Micha *et al*., 2012)
Processed meat (T2DM)	<50g/day		≥50g/day	1.41(95% CI: 1.25-1.60).	(Micha et al., 2012)
Processed meat (CVD)	<50g/day		≥50g/day	1.20(95% CI:1.11-1.30)	(Micha *et al*., 2012)
Smoking (CVD)	Not smoker		Smoker	1.25(95% CI: 1.17-1.32)	(He *et al*., 1999)
BMI (T2DM)	≤24.9		≥25	7.5(95% CI: 6.2-9.1)	(Hu *et al*., 2001b)
BMI (CVD)	≤24.9		≥25	2.4(95% CI: 0.71–0.98)	(Mcgee., 2004)
Physical activity (T2DM)	Moderate/ vigorous		Inactive	0.70(95% CI: 0.58-0.84).	(Jeon *et al*., 2007)

CF: cereal fibre, NCDs: non- communicable diseases, RR: relative risk, T2DM: type 2 diabetes, CVD: cardiovascular disease

The longitudinal studies included in the analysis of the result for the participants were relevant to my study (risk factors associated to CVD and T2DM). Studies were either meta-analysis or prospective cohort from the publication of the nurses' study which were following big number of participants for a long time. The studies included male and female and included either low and high or low, medium and high-risk categories for the disease and the values included in the corresponding 95% confidence interval.

Table (2-5) factors related to CVD, T2DM and questions number

Factor/	**GL**	**CF**	**Saturated fat**	**Red meat**	**P/ meat**	**Oily fish**	**vegetable**	**nut**
Question number	32,33,35,36, 37,38,41,45, 53,54,55,56, 58,59,60,64, 65,66,67,68, 69,70,71,72, 73,74,75,76, 78,81.	5053, 54, 55, 56, 57, 58, 67, 68, 69, 70, 71, 72, 74, 78, 81.	28,29,30,31 32,33,35,36 37,38,39,40, 41,42,44,46, 47,48,49,51, 52,66,67,71 74,75,78,81 84	28	84	29	34, 57	50

GL: Glycaemic Load; CF: Cereal Fibre; P/meat; processed meat

2.5 Factors Influencing Eating Habits

Conceiving and pregnancy

Pregnancy may motivate women to change in many aspects, such as; eating habits, emotionally and physically. For instance, they are advised not to eat raw meat and unpasteurised cheeses, to cut on smoking cigarettes and consuming alcohol. They tend to have an increased awareness about their health and diet, read more and obtain information to have the best choices for themselves and their babies (Lewallen, 2004; Szwajcer *et al*., 2007). In addition, adequate nutrition is important for fertilisation and might affect preconception (Szwajcer *et al*., 2007). According to Verbeke and Bourdeaudhuij, (2007), pregnant ladies are more conscious of their health and food, i.e. they change their dietary habits during pregnancy since they are aware that a healthy diet will be able to provide for both, the mother and the baby with the essential nutrients they need. Pregnancy helps in changing eating habits and choices; women tend to consume more fruits and vegetables as they aware these types of foods are healthy. On the other hand, they tend to reduce or avoid eating junk foods such as fried foods, soft drinks, sweets, foods which contain lots of salts and they also avoid positive and negative exposure to tobacco because they usually intend to give birth to a healthy baby (Lewallen, 2004; Szwajcer *et al*., 2007; Verbeke and

Bourdeaudhuij, 2007). These issues may act as confounders, so participants who were pregnant or trying to conceive were excluded.

Disabilities

Epidemiologic studies found that adults with physical disabilities have a 1.2- to 3.9-fold increase in obesity prevalence. Obesity is becoming a serious problem in disabled people. The mechanisms by which obesity occurs in people with physical disabilities is not clear, however pathophysiological changes of body composition and energy metabolism, inactivity, and muscle atrophy all can lead to the development of overweight and obesity (Liou *et al*., 2005). Adults with disabilities might have unhealthy dietary habits, inactive lifestyles (Adolfsson *et al*., 2008; Draheim *et al*., 2007) and usually have higher prevalence of overweight and obesity in comparison to physical fit population (Adolfsson *et al*., 2008; Yamaki, 2005). Adolfsson *et al*., (2008) assessed the dietary intake and physical activity of 32 participants with intellectual disability in 3 days. They found that 26% of the energy intake was from snacking. Main energy sources were milk, bread, meat, cake and buns. Their intake of fruits, vegetables and fibre were lower than the average requirement. Also, their physical activity level was low.

2.6 Nutritional assessments

2.6.1 Anthropometric

Anthropometric is used to measure the body muscle and fat, weight, height, BMI, skinfold waist circumference, waist-to-hip ratio and bioelectrical impedance which are the common anthropometric measurements used in estimating the body fat (Christie and Mitchell, 2000; Grant and DeHoog, 1999). There are other accurate ways for measuring obesity, but they are more complex such as, magnetic resonance imaging and dual energy X-ray absorptiometry that are used mostly in research studies (Hu, 2008). BMI is the easiest and most common way in measuring obesity for epidemiological studies.

2.6.1.1 Body Mass Index (BMI)

BMI is the most common way to measure the prevalence of obesity at any population; it is calculated by dividing a person's weight measurement (in kilograms) by the square of their height (in metres) (Elia *et al*., 2013; Hu, 2008). It is easy, inexpensive and can be used as a predictor for disease incidence and mortality (Hu, 2008). The numerical classification is valuable in identifying individuals, launching important evaluations of weight grades, classifying intervention priorities, and supplying a firm basis for evaluating treatments and interventions (Elia *et al*., 2013). Although using BMI to measure body fat is commonly used worldwide as a simple alternate measure of body fat and shows a close connection with obesity, it does not supply an accurate explanation of body structure. However, BMI has limitations, as a tool for measuring body fat. It does not discriminate fat mass from fat free mass (Elia *et al*, 2013; Hu, 2008). Also, it is not as accurate in measuring the body fat of elderly people as compared to young adult and middle-aged adults (Hu, 2008).

Table (2-6) Classification of BMI for adults (WHO 2000).

Classification	BMI (kg/(m2)	Risk of comorbidity
Underweight	< 18.5	Low
Normal range	18.5 – 24.9	Average
Overweight	25.0 – 29.9	Increased
Obesity	≥ 30.0	
Class I	30.0 – 34.9	Moderate
Class II	35.0 – 39.9	Sever
Class III (Morbid)	≥ 40.0	Very sever

2.6.2 Biochemical Data

This data involves having blood and urine tests which can provide a sign about the nutritional status of a subject. However, they can be affected by non-nutritional factors such as stress, hydration and use of medication (Christie and Mitchell, 2000).

2.6.3 Clinical Data

Clinical data includes data about the subject's medical history such as chronic or acute diseases, diagnoses procedures and treatments which may raise the nutrients requirement or induce malabsorption. Use of medication or drugs must be involved in this analysis (Christie and Mitchell, 2000; Williams, 1997).

2.6.4 Dietary Assessment

There are four common assessments methods used to assess dietary intake. Each dietary method is mentioned below along with its advantages and disadvantages.

2.6.4.1 Dietary Record

Foods records are written by the respondents, i.e. they record their intake of foods and drinks during a specific time, which is usually 3, 5 or 7 days (McPherson *et al*., 2000; Ortega *et al*., 2015). The quantity consumed can be measured by a kitchen scale, a tablespoon, a cup or even image to aid respondents (Coulston *et al*., 2013). The respondents must be trained in what details are required in order to sufficiently describe the foods and quantity consumed, involving the name of the food (brand name), recipe, cooking method and serving sizes (McPherson *et al*, 2000). The collected data can be followed with interviews, which can be conducted after the first day and at the end (Biró *et* *al*, 2002; Ortega *et al*., 2015). This would help in completing missing foods items and quantities, produce an accurate record and clarify the collected entries (Biró *et al*, 2002; Coulston *et al*., 2013). Missing food data intake can be expected to be minimal. Dietary record tool is considered accurate with respect to tracking food intake as food intakes are recorded and thus it is less likely to forget about the consumed food (Ortega *et al*., 2015). The weighing method is used simultaneously with dietary assessment methods. This method requires encouraging participants and cooperation from them in order to acquire accurate results (Biró *et al*., 2002; Coulston *et al*., 2013). This method might be difficult for those who are not familiar with weighing foods or do not cook their foods regularly. In addition, dietary records represent the current diet but not the usual diet. Participants may alter their diet as they can be conscious that their diet will be analysed (Ortega *et al*., 2015).

2.6.4.2 Twenty-Four Hour Dietary Recall

It is a method used to investigate the foods and beverages consumption in the previous day. The recall is conducted through an interview by a telephone or in-person using documentation or a computer assisted programme for recording details (Coulston *et al*., 2013; McPherson *et al*, 2000). In this method, the participants recall the consumed foods and drinks from their memory. The respondents are asked to describe the foods and quantity consumed, involving the name of the food (brand name), recipe, cooking method and serving sizes (McPherson *et al*, 2000). A trained interviewer asks a series of open-ended questions and allows the participants to recall and describe the food and drink items consumed in the previous 24 hours, using pictures, food models or weighing details in order to estimate the serving size of the foods consumed (McPherson *et al*, 2000). This method can be conducted on a single basis or repeated multiple times to acquire the food consumption during a specific time (Coulston *et al.*, 2013). 24–hour dietary recall programme consumes less time, is easy to manage and is helpful in assessing the average consumption of a large number of populations. However, participant’s memory and their ability to recall the foods and beverages consumed along with serving sizes has an important role in acquiring accurate results (Nelson, 2000).

2.6.4.3 Diet History

Dietary history is a dietary assessment which asks the participants to record about their past diet. This method not only asks about the frequency of food intake and drinks, it also enquires about the typical preparation of meals (McPherson *et al*, 2000). The dietary history includes three elements; a food list questioning about the frequency and amount of foods consumed, a 3-day dietary record and a detailed interview (sometimes includes 24 hours recall) (McPherson *et al*, 2000). Diet history provides a measure of the usual consumption, which enables to rank participants and predict health outcomes (Coulston *et al*., 2013). It is a qualitative examination than quantitative, allows data investigation about food consuming methods, eating habits and food intakes to be collected by a trained interviewer. The main disadvantages of this method are that it depends on the memory of the participants and it is time consuming (Livingston and Robson, 2000).

2.6.4.4 Food Frequency Questionnaire (FFQ)

FFQ investigates the usual food intake, often used for epidemiological studies as it is easy to administrate, cheaper than other methods and easy to adapt for population studies (McPherson *et al*, 2000). This method is similar to the 24-hour recall, as it depends on the memory of the respondents. It can be used to rank participants by their intake levels and it is beneficial for predicting health outcomes for groups or individual (Shu *et al*, 2004). Participants are asked to choose the frequency from the food listed and sometimes it includes the portion size (McPherson *et al*, 2000; Shu *et al*, 2004). Participants report their intake over a period of time, in the previous year, month or week (Coulston *et al*., 2013; McPherson *et al*, 2000). FFQ can be quantitative, semi-quantitative or non-quantitative. It can be conducted through telephone, mail or in person (McPherson *et al*, 2000). The questionnaire can be designed to be sensitive to the culture and ethnic background of the research population.

2.7 Mode of completion FFQ

2.7.1 Interview

The least burdensome method is face to face interview, which requires the interviewer to speak the language of the participants and to have training on speaking and listening. The interviewer must be friendly and motivating to raise the responses and response rate and clarify the unclear questions (Bingham *et al*., 1994; Bowling, 2005).

There are three types of interviews;

(a) Verbal interview, Face to face interview using traditional pencil and paper interview questionnaire (Bingham *et al*., 1994; Bowling, 2005).

(b) Verbal interview, Face to face interview assisted by personal interviewing via personal computer (Bingham *et al*., 1994; Bowling, 2005).

The interviewer can explain complex questions to the participants and provide visual aids during the interview. Also, it is less likely to put off the interview by length of the interview or give up half way like self-administrated interviews (Chang and Krosnick, 2009; Szolnoki and Hoffmann, 2013). Open questions can be asked, and interviewer can pick up clues relevant to the participants. The interviewer can control the context and environment of the interview. However, the cost related with this method can limit the size and geographical location of the survey. The reliability of the responses may be affected by interviewers in the way the questions are asked or personal characteristics of the interviewer or the socially desirable responses (Chang and Krosnick, 2009; Szolnoki and Hoffmann, 2013; Vogl, 2013).

(c) Verbal interviews by telephone using paper or electronic computer assisted questionnaires (Bingham *et al*., 1994; Bowling, 2005).

The advantage of this method is that the interviews can take place over wide geographical locations since the interviewer and the respondent does not need to travel. Interviewer's personal influence will be less as compared to the face to face interview, since the personal characteristic of the interviewers are less obvious (Chang and Krosnick, 2009; Szolnoki and Hoffmann, 2013). Most of the telephonic interviews are monitored by a supervisor to ensure they are carried out adequately. On the other hand, there are number of disadvantages of this method such as, the break off (participants refuse to continue the interview) than face to face interview so the questions must be kept simple and short. It might be difficult to ask sensitive questions and the use of visual aids may not be possible. People with no phones, disability, or those who are sick might be underrepresented (Chang and Krosnick, 2009; Szolnoki and Hoffmann, 2013; Vogl, 2013).

2.7.2 Self-administrated mode

Self-completed questionnaires can be delivered to respondents through different ways such as;

(a) Traditional pencil and paper self-administrated questionnaire delivered by post or handing in personally by the surveyor (Bingham *et al*., 1994; Bowling, 2005).

(b) Computer (electronic) self-administration methods by automated means including audio or without (Bingham *et al*., 1994; Bowling, 2005).

(c) Self-administrated via interactive voice response methods with automated computer assisted telephone programmes (Bingham *et al*., 1994; Bowling, 2005).

The completion of the FFQ, which was used in collecting the data for this study was the self-administrated one sent via internet. The advantages of this method are; a large sample population can be approached at minimal costs, thus making this approach a resource efficient (Coulston *et al*., 2013). In addition, it limits researcher biasness during completion, which make the responses more reliable and accurate. Participants can answer the questions without needing to be ashamed or embarrassed about their choices and will be confident they will not be judged by the interviewer. In addition, it reduces the biasing error caused by interviewer's characteristics and interviewer's variability skills (Shu *et al*, 2004). The disadvantages of this method are; there is no way to establish the accuracy of the answers, the researcher cannot be sure that they have got the right participants. Moreover, some people may fabricate their information, by exaggerating or trying to answer the questions to reflect preconceived ideas rather than providing an accurate reflection of their actual behaviour. Participants might make mistakes while selecting the relevant answer in case they do not understand the questions, the instructions for answering or participants may not recall the information accurately (Bingham *et al*., 1994). Hence, the questionnaires must be simple as there is no interviewer to clarify the misunderstanding. Furthermore, people with no internet or poor access to the internet are unlikely to complete the questionnaire. Also, the response rate of this method tends to be slow (Shu *et al*, 2004).

2.8 Social media against other collecting tool

Using internet as a tool for delivering questionnaires has become an increasingly popular method for collecting research data (Alshaikh *et al.*, 2014). Grieve *et al.* (2014) examined using the traditional method of collecting data using pen and paper versus the social media (Facebook) on 193 participants, who completed a questionnaire. Results reported that both offline data and social media were equivalent in terms of the patterns of association in constructs and internal reliability.

Using social media allows access to a large number of participants from different geographical locations (Wright, 2005). In addition, analysis of the data can be done during data collection. It is a quick method allowing the collection of data at different times of the day. Collecting data via social media seems to yield higher level of accuracy and honesty since participants do not feel judged by the interviewer (FoodRisc, 2016; Wright, 2005). Using online surveys can be helpful in saving money than other traditional methods such as pen and paper, mail or telephone survey (Wright, 2005). A systematic review of 13 papers by Alshaikh *et al.* (2014), examined the quality of the data, strength and limitation of using social media in collecting health data. The review reported that using social media is an effective way to collect data from hard to reach group and young age groups than older age groups, who can be computer literates and not users for Social Network Sites. Using SNS in delivering survey and online questionnaire provides an acceptable level of validity (Alshaikh *et al.*, 2014). In addition, SNS sample yielded demographic representative data and provided rich pool of quantitative and qualitative valid data (Fenner *et al*., 2012; Lord *et al*., 2011). According to Lindemann (2018), the most effective survey method in collecting data is in-person surveys, where the average response rate for telephone survey was 18%, in-person surveys was 57%, mail surveys was 50%, email surveys was 30% and online surveys was 29%. The feature that cannot be found in any other traditional method is active and two-way participation (Alshaikh *et al*., 2014). However, social media requires internet for the users to cooperate in the study, which may lead to the biasness of certain people who have access to the internet rather than the whole population. Furthermore, only users of social media would participate, which also may lead to biasing error for people who are illiterate or do not use social media (FoodRisc, 2016). The highest response rate of using SNS was reported by Lord (2011) as 27%. The questionnaire was advertised for two weeks and targeted young people with no restriction in inclusion. However, the interview response rate can achieve 95-98% response rate. It could result in sample biasness if the target population was from an older group (Alshaikh *et al*., 2014).

2.9 Types of epidemiological studies

2.9.1 Experimental design

a) Randomised controlled trial

This is considered as the foundation for medical studies, mostly used in testing new drugs or treatments. A sample of patients with a condition and ones which meet the selection criteria. They will be selected randomly to use the experimental treatment or the control treatment. Sometimes a placebo treatment will be received in the control group. Both groups, the experimental and control group will be followed for a period of time and relevant measurements will be recorded to point out the outcomes in each group. This is good for etiological and evaluative research. However, there is ethical issue in etiological applications since it usually uses selected populations and that can be issue of generalisability (Munnang and Boktor, 2018; Pearce, 2012).

b) Quasi-Experimental design

This type of study falls between true experimental and observational studies. In this type of study, there is intervention. However, it is not usually planned by the researcher. It is more practical than Randomised control trial since it uses natural experiments. There is other biasness since the control and experimental groups are not equivalent (Munnang and Boktor, 2018; Pearce, 2012).

2.9.2 Observational studies

a) Cross-sectional surveys

These are usually used in the prevalence of diseases in a population or community. The information of random sample of people is recorded in a systematic manner. Other data or factors may be collected for people with or without the disease such as obesity and diabetes. However, it is not possible to be sure, which was first the disease, or the factor related to the disease. This type of survey is quick, can cover the whole population and provide representative data on whether people are seeking health care. However, the data is based on self-reported mode which may be biased, and diagnostic data can be inaccurate (Munnang and Boktor, 2018; Pearce, 2012).

b) Cohort or “longitudinal” or prospective studies

These studies are similar to surveys but extend over time. They allow to examine the changes and establish a time-sequence in which changes or outcomes occur. Thus, this type of investigation can be used to study causes. Relative risk can be used for the data before and after the incidence. Since it is prospective, it can establish casual sequence and can estimate the incidence. However, it is time consuming, expensive and may cause attrition of the cohort (Munnang and Boktor, 2018; Pearce, 2012).

c) Case-control studies

These are retrospective studies, which work backwards to find the possible causes. These usually work with a group of people with a incidence or disease and are then compare them with another group of people or people with other diseases. Next, data is collected on their factors related to the disease. After collecting the information, the hypothesis can be tested using the statistical test. The main advantages of this type of study is that it is quicker and cheaper than cohort studies. However, it may be hard to collect the data required in the past exposure which may be inaccurate (Munnang and Boktor, 2018; Pearce, 2012).

2.10 Physical activity questionnaire (IPAQ)

IPAQ was developed between 1996 and 1998 in an attempt by one of the authors (Michael Booth) to establish an international questionnaire containing comparable measures. He wanted to develop a reliable and valid questionnaire that could measure health related physical activity, which could then be used in surveillance and research. In 1998, an international consensus Group met at the World Health Organisation in Geneva to develop the instrument. The group was coordinated by Dr Michael Pratt of the centres for disease control and prevention in Atlanta and Michael Booth, the coordinator of New South Wales (NSW) centre for the advancement of adolescent health. The consensus group members representing 20 countries met several times. They were experts in physical activity assessment and were invited to help in developing the IPAQ (Booth, 2000). The aim was to develop a standard and widely accepted tool, which could be used in cross-national studies to monitor the physical activity and inactivity for large groups or populations. Initial pilot testing occurred between 1998-1999 resulting in eight versions of the IPAQ, four short versions and four long versions. The questionnaires were to be completed either by interview, self-administrated, researcher administrated or by telephone interview. The reliability and validity were tested in 14 centres in 12 countries during the year 2000. The data reliability and validity were collected by at least two of the eight questionnaires. Test and retest were determined in the same week and the inter-method validity was determined at the same administration. Criterion IPAQ validity was determined against what is known as the ActiGraph or MTI accelerometer. IPAQ questionnaire properties are such that they produce acceptable measurement standards for measuring physical activity level for any population (spearman's p clustered around 0.8) with comparable information for long and short forms. Criterion validity median (p about 0.30) is comparable to other self-reported validation studies (Craige *et al*., 2003).

There are two versions (short and long), which can be applied to adults aged 15-69 years. The short version was included in the questionnaire used in this study. This is because the short IPAQ is designed to obtain the information for national or regional surveillance, while the long version has more details. The short version is more suitable for research work or for evaluation reasons. The first version of the IPAQ was released in August 2003, and then another version was released in April 2004. There were no alterations to the questions in the 2004 questionnaire, but a new category was included for describing the most active people in the population. Several studies have used the IPAQ as a measurement of physical activity for populations in different countries, such as, Brazil, Canada, KSA, China, Belgium, Greece, Czech Republic, Korea, France, Portugal, Norway, India, Estonia, United State, Mexico, Denmark, Switzerland, Japan, Taiwan, Sweden (Craige *et al*., 2003).

Al-Hazzaa (2007) used the short version of the IPAQ and did telephone interviews for random Saudi participants living in Riyadh, KSA. The study suggests that there is high prevalence of physical inactivity between Saudis adults. The study was applied to 1064 Saudis, aged between 15-78 years. It was found that more than 43% of Saudis were not engaged in moderate physical activity. Further, over 72% of the participants were not engaged in vigorous physical activity. 33.3% of the samples walked for 150 minutes or more in a week (Al-Hazzaa, 2007).

The study also indicated that 40.6% of the participants were inactive, 34.3% were engaged in moderate physical activity and 25.1% were active (Al-Hazzaa, 2007).

2.11 Pervious work in KSA

For the purpose of this study, an investigation of studies conducted in KSA and published between 1997 to 2017 were undertaken using Google scholar and PubMed Central search. The key words used in the search involved; KSA, dietary intake, 24-hour recall, FFQ, diet history, dietary food record assessment method, diabetes, CVD and hypertension. Over 250 papers were identified. However, upon reviewing the title and studying the abstract of the article studies included; the general background on dietary intake assessment method in KSA for healthy adults or for people who suffer from T2DM, hypertension or CVD and related risk factors was formed. Thirty-one selected papers were then undertaken, valuable information was extracted which involved the description of study sample, dietary method, city, gender and outcomes of the nutrients. Table (2-7) summarise the dietary intake assessment tools used in the study conducted in KSA.

Table (2-7) summarise the dietary intake assessment tools used in the study conducted in KSA between 2000-2018							
Study/ research & year of publication	City	Gender & number of participants	Age SD/ Range	Study type	Dietary method	Nutrients	Gaps
(Washi, 2000)	Riyadh	250 (F)	20 (1.30)	Cross-sectional	24-hour recall	Energy, carbohydrate, portion, Fat, SFA, MUFA, fibre, minerals & vitamins	The study assessed the dietary intake of female nutrition students and students from another faculty. The study did not include males and did not included graduate nutritionists. All of the participants were young. Physical activity and risk of NCDs were not evaluated.
Alissa *et al*., 2005a)	Jeddah	303 (M)	15-80 Y	Cross-sectional	FFQ	Energy, carbohydrate, portion, Fat, SFA, MUFA & cholesterol	The study investigated the dietary intake and risk factors for CVD in Saudi males with diabetes, hypertension & hypercholesterolemia and healthy subjects.
Alissa *et al*., 2005b)	Jeddah	130 (M)	55.3 (11.5)	Case-control	FFQ	Vitamins A, C & E	The study investigated the dietary intake of vitamins in Saudi male patients with established CVD and controls. The study did not examine the relation between dietary intake and risk of diabetes or hypertension.
(Al Numair *et al*., 2005)	Eastern region	120 (M)	66 (2.2)		FFQ, 24 hour & 3day FD	Omega 3, ALA, EPA & DHA	The study investigated the intake of omega-3 in Saudi elderly men
(Alissa *et al*., 2006a)	Jeddah	130 (M)	55.3 (11.5)	Case-control	FFQ	Selenium, copper & zinc	The study measured serum and urine selenium, copper, and zinc; and superoxide dismutase, glutathione peroxidase, and lipid peroxide concentrations in Saudi male subjects with CVD, and controls
(Alissa *et al*., 2006b)	Jeddah	140 (M)	21(3.1)	Cross-sectional	FFQ	Macronutrients	The study examined the relation between coronary risk score, individual coronary risk factors and the serum inflammatory markers, high sensitivity C-reactive protein, ceruloplasmin, and soluble intercellular adhesion molecule-1 in healthy Saudi males. The study did not examine the relation between dietary habit and risk of diabetes or hypertension.

(Al Numair, 2006)	Riyadh	100 (M+F)	20-54 Y		3 day FD	Copper & zinc	The study investigated the intake of Copper and zinc in healthy adult.
(Alissa *et al*., 2007)	Jeddah	270 (M)	48.4 (1.2)		FFQ	Energy, carbohydrate, portion, Fat, SFA, MUFA, cholesterol, fibre & iron	The study assessed dietary iron and measured serum iron and ferritin levels in Saudi males without CAD & those were angiogram negative. Serum lipid profile, glucose, high sensitivity-C reactive protein, serum soluble intercellular adhesion molecules-1, and caeruloplasmin were measured in all subjects.
(AL Assaf, 2007)	Riyadh	234 (M+F)			24-hour recall	Iron	The study evaluated the iron deficiency in Saudi healthy adult males and females
(Al Assaf & Al Numair, 2007)	Riyadh	117 (M)	32.1 (6.2)		3-day Food record	Energy, carbohydrate, portion, Fat, SFA, USFA, minerals & vitamins	The study investigated the intake of micronutrients in urban and rural areas. Also, it examined the relation between the intake of macronutrients and BMI in healthy Saudi males.
Al Bassam *et al*., 2007)	Riyadh	212 (F)	18-40 Y		24-hour recall.	Energy, carbohydrate, portion & Fat	The study focused on obesity on Saudi females. The study did not relate obesity with chronic diseases e.g. diabetes, CVD or hypertension.
(Al Saif *et al*., 2007)	Riyadh	100	56.6 (10.9)	Cross sectional	24-hour recall FFQ	Flavonoids, micronutrients & macronutrients	The study assessed the dietary intake of flavonoids and their effect on serum lipid levels in Saudi patients with CHD. The study did not say what gender they included.
(Al Shoshan, 2007)	Riyadh	112 (F)	26(1.8)		24-hour recall	Caffeine	The study focused on the intake of caffeine in Saudi females.
Sabra *et al*., (2007)	Dammam	159 (M)	21.2 (1.6)	Cross-sectional	FFQ	Macronutrients	The study looked at the risk factors related to CHD among university students.
(Alissa *et al*., 2009)	Jeddah	140 (M)	16-87Y		FFQ	Energy, Fat, SFA, cholesterol, MUFA, PUFA, selenium & iodine	The study investigated the relation between selenium levels, thyroid function and other coronary risk factors in heathy Saudi males.

(Al Hamdan *et al.*, 2009)	Riyadh	53 (M+F)	18-60Y		FFQ Diet history	Energy, carbohydrate, portion & Fat	The study assessed the impact of weight loss on C-reactive protein in obese subjects. The study did not include physical activity and it lasted for 3 weeks only.
(Al Numair, 2009)	Al Qassim	239 (M+F)	27.7 (7.9)		3 day FD	Protein & B6	The study evaluated the intake of B6 in young subjects, but did not see relation of their intake with NCDs, or physical activity level.
(Sadat-Ali *et al.*, 2009)	Al-Khobar	200 (M)	25-35 Y	Cross sectional	FFQ	Vitamin D	The study focused on the intake and serum of vitamin D in young men.
(Midhet *et al.*, 2010a)	Al-Qassim	498 (M+F)	30-70Y	Case-control	24 hour recall	Macronutrients	The questionnaire asked for the preference of food intake for diabetic and non-diabetic subjects but did not use FFQ. The evaluation of physical activity was not effective as it was asked if the subject was active or was involved in a job requiring activity rather than providing a validated questionnaire
(Midhet *et al.*, 2012)	Al-Qassim	2,787 (M+F)	30->60Y	Cross-sectional	24 hour recall	Macronutrients	The study evaluated the dietary intake and physical activity of subjects before and after the health education programme. The study did not relate their dietary intake with the risk of NCDs.
(Abdel-Megeid *et al.*, 2011)	Riyadh	312 (M+F)	21.1 (2.8)	Cross-sectional	3 day FD.	Macronutrients & micronutrients	The study included young age groups (university students). The exercise questions did not differ between the intensity of the exercise.
(Al Otaibi, 2011)	AlHssa	74 (F)	23-56 Y		24 hour recall	Energy & Fat	The study included only female and asked for their self-efficacy on fat intake. But, it did not ask for physical activity level or relate their intake of fat with NCDs risk.
(Al Daghri *et al.*, 2012)	Riyadh	47 (M+F)	45.7	Cross sectional	FFQ 24 hour recall	Macro-micronutrient & amino acids	The study focused on the dietary intake on adipocytokine. However, it did not see the impact of their intake on risks of developing NCDs.
(Al Othman *et al.*, 2012)	Riyadh	260 (M+F)			FFQ 24 hour recall	Selenium	The study assessed the intake and serum concentrations of selenium in Saudi subjects.
(Allam *et al.*, 2012)	Madinah	196 (M+F)	21 (1.8)	Cross-sectional	24 hour recall	Macronutrients & micronutrients	The study assessed the nutrition and health status, nutrients intake, and physical activity among Saudi medical students.

(Al-Moraie, 2014)	Jeddah, Makkah, Newcastle	308 (M+F)	18-65 Y	Cross-sectional	3 day FD	Macronutrients & micronutrients	The study investigated the dietary habit for Saudis residing in different locations & CVD risk. The study did not examine the impact of the dietary intake on the risk of developing hypertension or diabetes.
(Ibrahim *et al*., 2014)	Jeddah	214 (M+F)	20-28 Y	Cross-sectional	FFQ	Macronutrients	The study did not use a validated physical activity questionnaire and differ between the intensity. It included educated and young age group.
(AlQahtani, 2016)	Dammam	562 (M+F)	20.2 (2.06)	Cross-sectional	FFQ (self-reported)	Macronutrients	The study evaluated the dietary habits and life styles of Saudi medical students. The study did not examine the relation between dietary intake and NCDs.
(Alzahrani *et al*., 2016)	Aseer	211 (M+F)	27.9 (2.6)	Cross-sectional	FFQ (Self-reported)	Macronutrients	The study did not assess the relation between the dietary intake and the risk of NCDs. Although the study was focusing on obesity, physical activity was not assessed.
(AlKhalaf *et al*., 2017)	Riyadh	601 (M+F)	19-60 Y		FFQ (Self-reported, 24 h recall	Salt intake	The study focused on assessing the dietary intake of salt and developing FFQ that could be used to assess the dietary intake of salt.
(Aljohani N, 2017)	Jeddah	300 (M+F)	18-75 Y	Cross-sectional	FFQ	Macro & micronutrients	The study focused in developing FFQ to assess the dietary intake of college students using social media as intervention between the control group and study group.

SD: Standard deviation; Y: Years; M: Male; F: female; SAF indicates saturated fatty acids; MUFA monounsaturated fatty acids; PUFA polyunsaturated fatty acids; NCDs non-communicable diseases; FFQ food frequency questionnaire; CVD Cardiovascular disease; FD food diary; CHD coronary heart disease; ALA alpha-lenolenic acid; EPA eicosapentaenoic acid; DHA docosahexaenoic acid.

Most of the dietary assessment studies focused on the intake of specific nutrients, risk of one chronic disease or two NCDs such as hypertension and CVD. None of the studies listed in the tables evaluated the Saudi nutritionist’s food intake or their preference. Also, none of the studies listed examined the dietary risk factors associated with CVD, or T2DM for Saudi nutritionists. Most of the studies conducted in KSA were cross sectional or case controlled. The nutritional studies which used FFQ adapted from other FFQ which was developed for different culture. Only Alissa *et al*., (2005a) and (2005b) developed a FFQ to assess the dietary intake of vitamins A, C and E and risk of CVD in men. This FFQ was used in several studies after that such as Alissa *et al*. (2005a), Alissa (2006a, Alissa (2006b), Alissa *et al*. (2007) and Alissa *et al*. (2009). However, the FFQ which was developed was validated for the nutrient content of vitamins A, C and E. Al Numair *et al*. (2005) developed a FFQ listing foods that contain omega-3 fatty acid, and carried out validity checked by two nutritionists, but there was no information about piloting and validating the FFQ. AlSaif *et al.* (2007) also developed a FFQ. However, in their study, there was no information about the validation of the FFQ. It was designed to assess the dietary intake of flavonoids and their effect on the serum lipid among Saudi men with CHD. Sabra *et al.* (2007), developed a FFQ to assess the risk factors of CHD among medical students but there was no information about the validation of the FFQ. AlHamdan *et al.* (2009), did not indicate what FFQ they used in the study and there was no information about the validation of the FFQ. Sadat-Ali *et al.* (2009), developed a FFQ to assess the dietary intake of vitamin D, while there was no information about the validity of the FFQ. Al-Daghri *et al.* (2011), used a FFQ developed by Al-Disi *et al.* (2010). The FFQ developed was designed to assess the dietary intake of Saudi teenager girls. The FFQ was piloted, pretested and validated. The study did not include where it was validated, nor did it cite any information about its validity. AlOthman *et al*. (2012) used a FFQ, which was designed to assess the dietary intake of selenium. There was no information about its validity or reliability of the FFQ. Ibrahim *et al.* (2014) designed a FFQ to assess the risk factors associated with CVD. Again, there was no information about the validation of it. Al-Qahtani (2016) developed a FFQ to assess the dietary intake of medical students. Once again, there was no information about the validity of this FFQ. AlZahrani *et al.* (2016) developed a FFQ with no information about testing its validity and reliability. AlKhalaf *et* *al.* (2017) developed a FFQ to assess the dietary intake of salt. The FFQ was piloted, pretested and validated. Qusadi *et al.* (2017) developed a FFQ containing the food list that Saudi people consume. It was piloted, pretested and validated. However, the portion size included was not accurate as they included a plate as a portion size for some type of foods without indicating the size of the plate or even providing any photographic details. Most of the studies to date in KSA have focused on the intake of specific micronutrients and those that were focused on risk factor for CHD or CVD did not appear to be checked for their validity.

In addition to the earlier work, Saudi Health Interview Survey (SHIS) is a large national multistage survey that assessed NCDs, risk factors and health behaviours in adults aged 15 years or over in KSA. The survey contained household lists, a questionnaire, physical measurements and lab-based biomedical tests. KSA was divided into 13 regions, where each region was divided into blocks and sub regions (El Bcheraoui *et al*., 2014). The household selection was randomly selected from each block. A list of household members was provided for adults aged 15 years or older, the surveyed member of the household was selected randomly. The questionnaire included 42 questions on socioeconomic status and diet. The food and drinks listed in the questionnaire were; fruit, fruit juices, vegetables, eggs, nuts, yogurt, milk, cheese, soft drinks, fish, shrimp, red meat. poultry, processed meat and processed food (El Bcheraoui *et al*., 2014). For each food or drink the interviewer asked how often the person ate or drank the food, pictures were used to represent the serving size of each food or drink. In addition, types of bread consumed, fat used in cooking were also collected and the usual diary fat e.g. no fat, low fat, full fat. SHIS was based on a nationally representative household sample to produce national regional estimates (El Bcheraoui *et al*., 2014).

The information was not sufficient to calculate the total energy intake. However, the serving sizes of fruit, vegetables, processed meat, eggs and processed foods were collected. The aims of the SHIS was to help the Ministry of Health (MOH) to know the health of Saudis and inform the health policy planning and making. MOH and Institute for Health Metric and Evaluation (IHME) had data from SHIS into booklet which aim to increase Saudis awareness about high cholesterol, T2DM, smoking and hypertension (El Bcheraoui *et al*., 2014).

The main aims of SHIS was to have a nationally represented household sample to produce national estimates to help the Ministry of Health (MOH) understand the health of Saudis and accordingly inform the health policy planning to assist with the increase in awareness about cholesterol, T2DM, smoking and hypertension in Saudi. The SHIS assessed the NCDs for the study sample, risk factors, physical measurements and health behaviours. The current study aims to develop a reliable and valid FFQ which can be used in collecting data in KSA and to establish a baseline, for Saudi nutritionists, for future studies.

The method used by SHIS was a questionnaire that is not comprehensive. On the other hand, the developed Saudi FFQ in the current study can be useful as it contains the food and drink consumption information of the Saudi people with the fact that the validity and reliability of this FFQ has been tested. In addition, it included the portion sizes and the frequency, so the total energy intake can be calculated. Further details are provided in section 3 of chapter 3.

The IHME collaborated with the MOH in KSA to develop the KSA Health Interview Census. The census was carried out in 2016 and collected data from 5 million households in KSA and consisted of three parts; health facility survey, household survey and patient interview. The study aimed to provide the MOH with the set requirements for healthy lifestyle at local level which in turn helped in providing health services required for the communities (Murray, 2018).

The household survey collected information on sociodemographic, physical activity, diet, functional health, maternal and children health, NCDs, infectious diseases and mortality. IHME and MOH piloted the Saudi health interview census twice (Murray, 2018). The training of MOH staff was conducted by IHME from all regions in KSA on questionnaire, software usage, protocols, paper data collection techniques and enumeration. The aims for the census were, early detection of diseases in Saudis, raise the awareness for health risks and disease management in the Saudi, identify services and health facility level, determine patient's perception and satisfaction with health services, link the household data to the facility data (Murray, 2018).

There are no longitudinal studies in KSA assessing the food intake for Saudi nutritionists and public. Washi (2000) compared the intake of the female nutrition students with students from other faculty at King Saud University in Riyadh. The study did not include males, graduate individuals from older age group or Saudis from other cities in KSA. In addition, physical activity was not assessed. Also, none of the studies published so far have used social media to deliver the questionnaire.

This study is going to form a baseline for further studies in KSA. There is one study conducted on the dietary habit of Saudi female nutritionist student (Washi, 2000), Al-Qahtani (2016), studied the dietary habits of the medical students. Meanwhile Al-Drees (2016) studied the physical activity level of medical students, Abolfotouh *et al.* (2012) studied the metabolic abnormalities and association with obesity among Saudi college students. Sabra *et al.* (2007) studied the risk factors associated with coronary heart disease in male University students. However, there is no study investigating the self-reported eating behaviour and physical activity of Saudi nutritionists living in KSA to date. Gathering this data will enable the analysis to be undertaken more methodically and to see any changes in the pattern of eating, changes in the pattern of behaviours and changes in the incidence of the NCDs.

The study included the FFQ for assessing the dietary habit as it is a good tool in recording the usual intake over a length period of 1 year. Hence it will be able to assess the usual dietary habits rather than just the current diet. Also, it is cost effective and time saving. In addition, FFQ can collect complex information and highly accurate data for a large number of participants or epidemiological studies. In addition, the mentioned portion sizes provide relatively accurate quantitative information on consumption (Illner *et al.,* 2012; Shim *et al.,* 2014).

This study developed a FFQ since there were no FFQ previously available to be used in KSA and diets may be influenced by ethnicity, culture, individual's preference and economic status. Also, focus on dietary exposure related to CVD and T2DM risk was highlighted. In addition, using a FFQ with detailed serving size and its description can help the participants to choose the relative answer and will be less time consuming and will ease the analysis. Also, it includes the frequency categories which is based on the number of times certain items were consumed per day, per week or per month.

Using other method such as dietary history requires a complete 24-hour, 3-day food dairy recall and checklist of usual food consumed. Highly skilled professional is required to collect the data from the participants and conduct a detailed interview. Hence, it is not suitable for epidemiological studies (Illner *et al.,* 2012; Shim *et al.,* 2014).

Dietary record is an open-ended survey, it requires well trained interviewer to reduce recall bias. The participants require training before participating. They take longer time than FFQ since it requires a trained interviewer and training for participants which may consume time more than FFQ and it may not be accurate as it represents the current diet. It is more suitable for small number of respondents (Margetts and Nelson, 1997).

24 hours recall requires training for the respondents to be able to complete them. It also requires description of food, quantity, cooking method and serving size. In addition, it requires weighing. Thus, using this method for this study may be difficult for people does not have food scale or are not familiar with weighing. This method is time consuming since it requires training before collecting the data and after while analysing different type of food with different cooking method and quantity. In addition, it may not be accurate as it represents the current diet not the usual diet (Illner *et al.*, 2012; Shim *et al.*, 2014).

Thus, 24-hour recall, dietary history and dietary record are not suitable for this study since it is time limited and these methods are time consuming and not suitable for large cohort.

2.12 Conclusion

NCDs are widespread diseases and are increasing rapidly worldwide. They accounted for significant premature deaths, morbidity and have considerable effects on health care costs. NCDs lead to the death of about 36 million people annually (WHO, 2014). In KSA, NCDs accounted for 78% of the deaths for people aged 30-70 years in 2012. 46% of the deaths were caused by cardiovascular disease, which makes CVD the number one cause of death in KSA (WHO, 2014). Saudi lifestyle and dietary habits have changed in the last 30 years due to a number or reasons. Hence, sedentary behaviours, improper diets and smoking may result in increasing the risk of CVD. High intake of saturated fats, sugars, fast-foods, sugar sweetened beverages and processed meat are the main risk factors for CVD.

Globally, 6.9% of the people are impacted by impaired glucose tolerance and the number is currently increasing. In KSA, diabetes accounted for 6% of the deaths in 2012. The prevalence of diabetes in KSA in 2014 was 20.5%. Diabetes increases the risk of strokes, heart disease and death. There are many factors increasing the risk of T2DM including, overweight and obesity, reduced physical activity, consumption of high GL food, red meat, processed meat, fast-food, sugar sweetened beverages and trans-fat. Obesity is the most common problem which may cause T2DM. 80-90% of the people with T2DM are overweight or obese. Numerous diets were found to be associated with T2DM. Meanwhile high intake of whole grain, dietary fibre, magnesium, CF and polyunsaturated fat assisted with reduction risks associated with T2DM.

Moreover, there are many factors which affect food consumption such as, marital status and having children. According to studies, being married or having children has a positive impact on food type’s intake and health.

Obesity is a worldwide problem especially among children as it makes the children more likely to suffer from NCDs in the future. 170 million children around the world are overweight or obese. In 2013, there were 42 million children under the age of 5 years who were overweight or obese. In KSA, the prevalence of overweight is 11.85% and 8.9% for obesity. The most common way of measuring obesity is BMI and some studies found there is a strong relation between heavy weight and diabetes.

Physical activity plays an important role in maintaining health and preventing diseases. Worldwide, inactivity is associated with 2 million early deaths annually. 60% of Saudi children and 71% of youth are not engaged in sufficient frequent physical activity.

Overweight, obesity and smoking are increasingly common in KSA, while physical activity is limited. Such behaviours contribute significantly to the development of NCD’s which are increasing in the Kingdom. This will create a huge demand on the health sector and may cause tremendous cost in the future. Research into the extent of the problem needs to continue in order to establish plausible health interventions for the Kingdom.

2.13 Aims, Objectives and Hypothesise of the Study

There are currently no baselines for food frequency or physical activity established for Saudi nutritionists. There have not been any longitudinal dietary studies carried out for Saudi nutritionists. Thus, the purpose of this research is to develop tools which could be used to track BMI, physical activity, dietary behaviour and incidence of T2DM and CVD in the target group over time.

2.13.1 Aims

1. To develop a food frequency questionnaire that could record self-reported dietary behaviours in nutritionists in KSA;

2. To use an established Physical Activity questionnaire (IPAQ) to record self-reported levels of physical activity in nutritionists in KSA;

3. To use the self-reported behaviours to categorise the respondents according to the accepted associations of those behaviours with NCD’s;

4. To obtain a baseline of self-reported behaviours for Saudi nutritionists that could be used for comparison in future research.

2.13.2 Objectives

1. To design a food frequency questionnaire in two languages (Arabic and English) that could be used in KSA in this study and in the future;

2. To identify the main sample groups (Saudi Nutritionists) and then use the FFQ along with the pre-existing physical activity tools to establish baseline measurements for self-reported behaviours that are associated with the development of NCD's;

3. To send out the FFQ to participants in KSA and UK, who were identified through social media sites and evaluate the responses;

2.13.3 Hypotheses

The hypotheses to be tested in the present study are as follows:

- There are differences between Saudi nutritionists and public in the food choices.
- There are no differences between Saudi and British participants in the risk factors related to T2DM.
- There are no differences between Saudi and British participants in the risk factors related to CVD.
- There are no differences in the consumption of foods related to T2DM and CVD with regards to age, gender, BMI and socioeconomic background.

CHAPTER 3 – RESEARCH METHODOLOGY

As this study did not consider an ethical approval before collecting the data, the Ethical Approval Committee at the University of Birmingham conducted a management review on the study. They concluded based on their review that the study did not raise any ethical concerns and thus gave the permission to submit the thesis and publish the results.

3.1 Introduction

The main purpose of this research was to develop a valid FFQ, which could be used for epidemiological studies in KSA. The intention was to focus on self-reported behaviours and diet choices, which are considered to relate to the development of NCD's, either as risk factors or protective factors.

A food frequency questionnaire (FFQ) was chosen as the instrument for data collection in this study. A FFQ is a common tool used to investigate the dietary habits of a sample group, as discussed in detail in chapter 2. The results can be used to assess the possibility of developing non-communicable diseases according to an individual's dietary habits. As outlined in chapter 2, NCDs are widespread around the global, with cardiovascular diseases, T2DM, high cholesterol, and hypertension being the most common causes of deaths in the Kingdom of Saudi Arabia (WHO, 2014c). The questionnaire presented in this study contains questions about lifestyle and food consumption, which could be helpful in determining the dietary habits of an individual while also allowing to identify risk factors of NCDs. The questions were based on longitudinal peer reviewed studies on human nutrition.

It was decided to use a participant completed questionnaire, which would be delivered electronically. The advantages of this method are:

1. A large sample population can be approached at a minimal cost, thus making it resource efficient. Other methods, such as face to face interview, are very resource intensive and consequently limit the size and makeup of the sample group (Shu *et al*, 2004).

2. The questionnaire can be designed to be sensitive to the culture and the ethnic background of the research population (Shu *et al*, 2004).

3. It limits researcher's biasness during completion. Participants can answer the questions without being embarrassed or feeling uncomfortable as they would know they are not being judged by anyone such as the interviewer. In addition, it helps the respondents to describe their own events rather than inferring the answers, wished by the interviewer (Shu *et al*, 2004).

3.2 Study sample selection

As the main purpose of this work was to develop a valid FFQ, which could be used in epidemiological studies in KSA and collect baseline data for KSA, participants living in the country were regarded as the main target group. The country of Saudi Arabia was chosen for conducting this research because:

1. There is limited existing data on nutritional behaviours in the KSA, as detailed in chapter 2, tables (2-4).

2. The availability of processed food and the number of fast-food restaurants have increased considerably in the last decade with a consequent increase in consumption of these foods by the Saudi population, especially in teenagers and young adults.

3. Due to improper diets, lack of physical activity, and considerable smoking habits along with a number of issues, the health of Saudi residents is at significant risk. Hence, it

was very important to conduct an investigative study in KSA, which could then further aid in improving the health of the residents of the country.

It was decided not to consider a fully representative sample for the entire population of KSA because of resource limitations. Also, there is no dietary information available for different groups of people in KSA. Hence, a selective sample was identified. Given the relevance of the Nurses' studies in USA (Kyungwon *et al.*, 2005), it was decided in this research to also focus on a group of participants with health-related education. Nutritionists were selected because:

1. It was assumed that they would have a good knowledge about dietary habits and health care since they are trained professionally. This should enhance their ability to provide complete and accurate information about diets and lifestyles due to their education. It could also be predicted that this group would give the best-case scenario for self-reported dietary habits in KSA, based on Washi's (2000) results.

2. Both KSA and UK have well-established professional training for nutritionists, thus equivalent sample groups could be identified and selected in both countries, should comparisons be needed.

3. There are professional membership organisations in both countries which could be approached to assist in identifying appropriate participants and to allow follow up studies to take place in the future in the same target group.

It was decided not to attempt a fully representative sample for the entire population in KSA because of a number of limitations. These included:

- The time was limited

- The researcher did not have the authority to access the population data and make sure to include a representative sample of nutritionists in the study
- There is no data available regarding the eating habits of the Saudi population, which could be used for comparison purposes.

Instead, a sample which would be more likely to have better eating habits, i.e. “nutritionists”, was used as the respondents for the main target group for the FFQ.

A sample of non-nutritionists was also recruited. These are referred to as the ‘general public groups’, which means that they are not nutritionists. These participants were included to determine what type of responses would be received from the social media recruitment and to see if there were any problems using the FFQ in a non-nutritionist group. The purpose of this testing analysis is to determine whether Saudi nutritionists demonstrate healthy behaviours or not. The hypothesis is that the nutritionist will show healthy behaviours in their lifestyle habits. The sample strategy identifies a group of Saudi nutritionists who volunteered to participate in this study using the developed FFQ, so the approach and the methodology adopted in this work directly leads to the hypothesis.

The sample type used for this research is a non-probability, snowball (chain referral sampling) method. This method is often used when the sample group is rare or difficult to find (Baltar and Brunet, 2012; Dusek *et al*., 2015). Nutritionists are not exactly rare, but using this method maximizes the number of participating nutritionists by allowing to reach many participants in a limited time period (Ghazi *et al*., 2017). It also reflects the way social media works, by cascading on information, and it was of interest to see how well this approach worked with something like a FFQ. Snowball sampling is based on referrals from initial individuals to push other individuals as well to participate. There are three types of snowball methods: linear snowball sampling, exponential discriminative snowball sampling and exponential non-discriminative snowball sampling (Dudovskiy, 2018). Liner snowball sampling starts with the establishment of one participant and s/he will refer to one new participant. The new participant will also provide a new individual until the sample group is established (Dudovskiy, 2018). Exponential discriminative snowball sampling involves individuals providing multiple referrals, but only one new individual is recruited through them. The choice of the new individual is indicated by the aims and objectives of the research (Dudovskiy, 2018). Exponential non-discriminative snowball is the type which was used in this research. The initial individual was sent the invitation and asked to resend it to multiple referrals, their friends and family members. Each new referral is explored until the primary data is collected (Dudovskiy, 2018).

3.2.1 Identification of Participants

The nutritionists were identified through the biographical information available on their profile at the social networking sites. Social media is a term derived from the social software movement, which is a collection of internet websites, collaborations, community buildings, services, practices that support sharing and participation. Social media is an internet-based technology that features the opportunity for its registered users to have a type of "social" communication (Otieno and Matoke, 2014). It improved through new interaction tools and sites, which are known as social networking sites (SNS's). SNS's have audio and visual ability in addition to saving, connecting, capturing and storing feature. SNS's include Facebook, Twitter, Linked In, Flicker and Google +. The SNS's became in the recent years as the most popular destination (Otieno and Matoke, 2014). The social networking sites used in the search were Facebook, Linked In and Twitter. Emails were also used to send the questionnaire to participants.

All the contacted nutritionists had mentioned on their online biographies (seen in their social networking sites profiles) that they were nutritionists. Once a list of nutritionists in both countries had been compiled, they were sent an email invitation to participate in the project. The invitation to the nutritionists explained clearly that nutritionists were needed to participate in the study by completing the questionnaire provided in the link and, they were asked to further promote the email to their nutritionist's colleagues. A copy of the invitation is available in appendix A.

The classification was double checked in the FFQ as question 6 asked about the respondent's occupation. The only options available to answer this particular question were: nutritionists or dietitian. Respondents who did not choose one of these were not included in the 'nutritionists' group.

Participants who were not nutritionists were also invited to complete the survey. These participants are referred to as 'General Public'. Recruitment to the general public groups in UK and KSA was achieved electronically via emails, Facebook and Twitter. The participants were asked to fill the questionnaire provided in the invitation and were also requested to forward it to other potential individuals. Some of the participants in both groups volunteered to help by sending the link of the questionnaire to their friends or to their family members.

The Arabic version of the questionnaire was distributed using Facebook, Twitter and email. The sample group was identified in the following ways:

1. There are pages on Facebook where registered nutritionists communicate and share information such as the Association for Nutritionists in KSA. The page is designed specially and specifically for the nutritionist community

2. On Twitter, similar approach was used, where there are some useful pages for nutritionists. These include, ‘Your questions about food’, ‘Gathering of nutritionists’, ‘Saudi Food and Drug Authority’, ‘My health in my food’, ‘consultation world centre for nutrition’, ‘your food is your treatment’, ‘health information and community of nutritionists’. Members who wrote in their online profile that they are nutritionist from KSA were contacted and messaged with the survey link.

Webpages, which include registered nutritionists in KSA were contacted and asked to send the FFQ to their members as the information of the members was not available to the public. Emails were also sent to members of universities who are positioned within the nutrition department. In both ways, social networking site users and email users were requested humbly to participate in the study by filling the FFQ and to forward it to their colleagues, friends and family members. It is worth mentioning that all these pages are Arabic pages and their names are written in Arabic. Hence, the researcher has also made an attempt to translate the required data from Arabic to English, based on the researcher’s good command in both languages. Furthermore, the researcher went to the webpages where nutritionists were registered and sent them individual messages as well containing the following information:

1) The researcher is a doctoral researcher at the University of Birmingham.

2) The researcher is looking for nutritionists to fill the questionnaire attached.

3) The researcher also requests the respondents to retweet and spread the message to their members and nutritionists colleagues.

Several people responded and retweeted the message which further helped in collecting data quicker as compared to using Facebook. However, one limitation of this approach is that the response rate will not be accurate as the questionnaire is forwarded on. It is worth mentioning that searching for public members and asking them to participate was not as complicated as looking for potential nutritionists. The link of the questionnaire was distributed to users of the social networking sites; Facebook, Twitter, Linked In and emails.

The distribution method used for the English version of the questionnaire was the same as the Arabic questionnaire (Facebook, Twitter, Linked In and emails). Also, webpages for relevant professional associations such as British Association for Applied Nutrition and Association for Nutrition were identified. A message was sent to all members identified from the page, who had mentioned in their biography that they were a nutritionist and were from the United Kingdom. The invitation was provided with the link of the questionnaire and recipients were asked to send it to their nutritionist's colleagues as well. Additionally, web pages such as Nutritionist Resource, were also emailed with a short description of the study and a request for help was made by sending the survey to the nutritionists members. However, the response received by the webpage stated that were unable to promote third party products on their website. Nevertheless, refining the search by inserting different region, country town or name, the website allowed the researcher to find the closest nutritionists to the information added. Keeping the search boxes blank and by clicking search, e information of all nutritionists registered with British Association for Applied Nutrition and Nutritionist Resource was received. Details of nutritionists, their names, qualifications, phone numbers and webpages, which contained further information about email addresses, Facebook pages, Twitter and Linked In were received. Then, the invitations were emailed individually via emails, Facebook, Twitter or Linked In and the participants were politely requested to forward the link of the questionnaire to their nutritionists colleagues.

Table (3-1) URL of nutritionists' pages on social media which were used in this study.

British webpages	Arabic webpages
http://www.nutritionist-resource.org.uk/	https://twitter.com/EatNutritious
https://twitter.com/BrDieteticAssoc?lang=en-gb	https://twitter.com/Saudi_FDA?lang=en-gb
https://twitter.com/NutritionBasic?lang=en-gb	https://twitter.com/DietArab?lang=en-gb
https://twitter.com/Nutrition_UK?lang=en-gb	https://twitter.com/h4food/followers?lang=en-gb
https://twitter.com/AfN_UK_?lang=en-gb	https://www.facebook.com/se7ati8ethaee/likes
https://www.linkedin.com/groups/3701260/profile	https://twitter.com/dietitiankau?lang=en-gb
https://twitter.com/NutritionSoc	https://twitter.com/CN_counseling
	https://twitter.com/SmartDiet8
	https://twitter.com/AbanCommunity
	http://www.sda.org.sa/index_ar.php

Universities in KSA, which offer courses on nutrition studies were contacted with a request to distribute the questionnaire to their graduates and staff members. To do so, firstly, search was carried out on the internet about the courses offered by the Saudi universities. A document providing the details about the universities in KSA and the courses offered was used. The criterion for shortlisting universities was based on the fact if they offered nutrition or dietitian-based courses for bachelor's degree, MSc or PhD. Any universities which did not have human nutrition courses were excluded. A list of universities providing nutrition courses were contacted with the aim of the study and asking them to send the questionnaire to graduate students and working staff. Fourteen universities were contacted in KSA; Um AlQura University, King Saud University, King Abdul-Aziz University, King Faisal University, King Khalid University, Princess Nourah bint Abdulrahman University, Taibah University, Hail University, Al Jouf University, Tabuk University, Al-Baha University, University of Dammam, Al-Kharj University and Al Hudud ash Shamaliyah University.

Universities in the UK which offer courses in human nutrition were also contacted with a request to distribute the questionnaire to their graduates and staff members. First the researcher used the webpage, "find a master degree" in the UK, and used the search box to find 'human nutrition', upon which a list of universities was obtained. The email addresses of the staff in the nutrition division of each university were identified and an invitation was sent containing the link of the questionnaire. Thirty six universities in the UK were contacted; University of Leeds, University of Sheffield, , St Mary's University, Manchester University, University of Plymouth, University of Nottingham, University of Reading, University of Bangor, Manchester metropolitan, University of Surrey, Liverpool John Moor University, Bournemouth University, Hertfordshire University, Newcastle University, Queen Margaret University, Heriot Watt University, University of Westminster, Kingston University London, Ulster University, Glasgow University, Aberdeen University, Imperial college London, University of Chester, London Metropolitan University, North Umbria University, University of Roehampton, University of Chester, University of Central London, Coventry University, University of Worcester, Glasgow Caledonian University, University of Bristol, Northumbria University, University of Central Lancashire and Edge Hill University. Only 2.7% of the universities in the UK (University of Sheffield) replied that they will participate. However, there were no responses received from the Saudi universities (0%). Nevertheless, it is worth mentioning that individuals might have participated and sent back the questionnaire but there were no formal responses received from any of the institutions. Developing sample groups and contacting them through personal and electronic contacts resulted in an opportunistic sample group. The samples that were available at the time of the research and fit the criterion were contacted.

3.3 Instrument Development

The questionnaire used to collect dietary habit data was designed and validated as no validated FFQ was available to capture the dietary habits or suitable to be used in nutritional epidemiological studies in KSA in 2014. The design of the food frequency questionnaire was adopted from the food frequency questionnaires developed by Nurses' Health Study. This design was selected as its validity and reliability was previously tested (Willett *et al*., 1985). FFQ used during the nurse's study was chosen since it is linked to CVD risk factors.

Since the questionnaire was based on nurses' health study, the questions included were translated to Arabic and culturally adapted to the Saudi food and their portion sizes. So, the risk can be detected according to the pervious results of the nurse's study in the USA. Most of the portion size provided in the nurse's study were included in the FFQ developed. Description of the portion size was estimated using household measures such as; teaspoons, tablespoons, cups, check book and computer mouse. This helped people estimate their consumption of food accurately especially the public who are unable to know how many grams of each type of food they are consuming. The constructed questionnaire was developed in English language and then translated following Beaton *et al*., (2000) method. The questionnaire administered in two languages, English and Arabic. It was designed and delivered using Survey Monkey. The questionnaire comprised five parts. This sectioning in the questionnaire was not revealed to participants but organized in different pages. Part one covered demographic information. The second part of the questionnaire determined whether the participant was eligible for inclusion in the study. Part 3 focused about smoking. Part 4 questioned about physical activity level and was the only section not designed for the project. Part four incorporated an existing, validated questionnaire on physical activity known as the International Physical Activity Questionnaire (IPAQ) (IPAQ, 2004). Part five, was the longest section, contained the questions regarding food frequency.

3.3.1 Inclusion and Exclusion Criteria

In the third part participants were asked if they were pregnant or trying to have a baby (Questions 15-16). If the responses were yes, they were excluded from the study. People, who were trying to have a baby or were pregnant, tend to eat healthier food choices than those who are not trying or not pregnant. It was felt this might be a confounder in getting accurate baseline data. During preconception, some women think about the impact of their diet on the health of the child they will have in the future. So, through ovulation women concentrate more on their nutrition because they may become pregnant (Szwajcer *et al*., 2007). This applied also to men who answered ‘yes’ to trying to conceive as changes in eating behaviours by their wife are also likely to affect the man.

Question 17 in the second part, was about disabilities. Having a disability can influence lifestyle and dietary consumption (see appendix C1). Since this study is aiming to give a baseline measure of food consumption and lifestyle, people with disabilities; physical or severe brain disability were excluded to avoid biasing the results.

The third exclusion question (question number 18) in part three was to identify any pre-existing chronic diseases such as T2DM, hypertension, kidney failure, heart diseases, stroke, high blood cholesterol, high triglyceride and non-alcoholic fatty liver. As people with chronic diseases change their dietary behaviour after diagnosis (Yu *et al*., 2016). Also, one of the aims of this research was to obtain a baseline of self-reported behaviours for Saudi nutritionists that could be used for comparisons in future research. The development of any NCD’s identified in future work could be related to their lifestyle and consumption of food in the interim, so people with existing chronic conditions were be excluded from this study. 45 Saudi and 8 British participants were excluded because they were suffering from chronic diseases. Using the responses to these questions ensured that the final sample group comprised only KSA or UK participants who had no pre-exiting NCD's and were not pregnant or trying to conceive.

This study is a foundation of an intended prospective study to follow up in the future, the researcher will use the same procedure in searching for participants to collect the data for nutritionists and public for both populations British and Saudi. The same web pages, groups in the social media, universities, friends and email addresses some participants provided in the questionnaires will be used. Even if the same people are not contacted in the future, the same type of groups and same questionnaires for participants will be used as the study undertaken in 2014.

3.3.2 Survey Monkey

Survey Monkey is a website which allows the researcher to sign up and design or use the available readymade templates. Amongst the different plans and prices available, the one chosen in this study, allowed the researcher to filter, compare between the results of the respondents and export the answers of the respondents to SPSS sheet / Excel. The survey monkey templates can support many languages including English and Arabic. Also, it is easy to use and to edit the information in it. The researcher before initiating an account with Survey Monkey had attempted the use of accounts which were free of cost at different hosting sites. However, the use of these accounts was not successful. On the contrary, Survey Monkey has clear instructions and was easy to use and modify. In addition, Survey Monkey has a feature which allows the researcher to send the questionnaire by choosing the option of posting the survey on to social media pages (Facebook, Twitter, linked In) or choose the web link option, which makes a copy of the web link and this link can then be sent via email or to participants using social media pages multiple times. When participants receive the invitation, they can then access the questionnaire. Once the participant completes the questionnaire the numbers of the responses in Survey Monkey, which appears to the researcher will increase even if the questionnaire received was not completed fully. If the participants stopped half-way or did not complete all the questions, in the top right of the received questionnaire it will be highlighted in orange as incomplete while if it is completed it will be highlighted in green as complete. When the total number of questionnaires received are high, there is an option to filter the questionnaires by completeness, so incomplete ones will not be included in the analysis page. The filter option can also filter by particular questions and answers, completeness, time or period and the respondents' answers. There is also an option to compare between two questions. Each participant was identified by a number; the first completed questionnaire was labelled as number one. The data were stored in an account in Survey Monkey under FFQ for the English version and FFQ in Arabic language for the Arabic version. Both versions were accessed by the researcher and the supervisor of this doctoral research. Once the study collection time was over, the data were downloaded in Excel and SPSS sheets and was stored in a hard drive which was kept at the university in the supervisor's office. All the information of the participants was kept confidential.

3.3.3 Part One: Demographics and Body Mass Index

Demographics

The first part of the questionnaire (questions 1-8) covered demographic questions including age, gender, education level, marital status, number of children; employment status and house hold income. A full copy of the questionnaire (Arabic and English) can be found in Appendix D and B. Demographic questions are important to establish how well the sample groups represent the overall target population. They also allow differentiation between sub-groups and allow comparisons to be made within the sample population.

Dietary behaviours might vary according to the age and education level of the participants, so questions were included on these aspects (Gilovich *et al*., 2006). Also, a question on gender was important as there are behavioural and legal differences between men and women in KSA which may affect activity levels as well as dietary behaviours (Alqout and Reynolds, 2014).

Participants were asked about the number of children they have, as it might influence the dietary habits of the family. Parents usually think that food is important for their child's growth and health. The healthy food concept is different from one family to another. So, parents might control their children's diet or pressure their children to eat what they offer them and what they think it is good for them (Wardle *et al.*, 2005). A question about education level was included as it is also having an impact on the occurrence of diseases along with obesity, hypertension and CVD in KSA (Alquaiz *et al*., 2014; Al-Turki *et al*., 2008; Horaib *et al*., 2013; Kalantan *et al*., 2001; Khalid., 2007; Koura *et al*., 2012; Memish *et al*., 2014).

The study aimed to set a baseline for Saudi participants and to test the impact of social media in KSA and UK, while understanding the outcomes of using social media and cascading the FFQ. For this reason, there was a question about nationality, and only Saudis and British citizens were included in this study. People from other nationalities were excluded. This was established by question 3 (appendix C1).

Body Mass Index

Since BMI is the method to determine self-reported obesity, participants were asked to provide their height and weight (questions 9-10). From this data, their BMI can be calculated by dividing the weight in kilograms by the square of their height in meters. BMI is a tool for measuring the prevalence of obesity (Elia *et al*., 2013; Hu, 2008) and is used in categorising participants according to their BMI into underweight, normal, overweight or obese.

3.3.4 Part Two: Smoking

The second part of the questionnaire contained four questions about smoking (questions 11-14). These established the type of smoking as well the amount and time for some types such as cigarette, cigar, pipe, shisha and muasel. Although smoking is not a dietary behaviour, it has a negative effect on developing hypertension and CVD (Rhee *et al*., 2007). It also increases the risk of complications for T2DM (Niskanen *et al*., 2004). For these reasons, questions on smoking were included as calculating the risk of NCDs from dietary behaviours needs to be corrected for smoking where appropriate.

3.3.5 Part three: Physical Activity

The third part of the questionnaire focuses on physical activity and sedentary behaviour. Rather than developing bespoke questions, it was decided to incorporate questions from the international physical activity questionnaire (IPAQ) which was available in different languages including English and Arabic. IPAQ had been tested and validated in previous studies and it is widely accepted and freely available. IPAQ was developed between 1996-1998. The IPAQ contains questions asking in detail about the type and the time spent in a variety of activities in the last seven days including occupation and transport related to physical activity. Participants were ticking the right answers, and the data obtained was numerical. Physical activity levels are divided into three levels light, moderate and vigorous. Each one contains a list of examples. However, the intensity was not specified, since it was considered that this might introduce a bit of biasness in the respondent’s choice (Marsden and Wright, 2010).

3.3.6 Part Four: Food Frequency questions

The fourth part of the questionnaire is about the participants' consumption of foods and eating habits. This comprises of questions numbers 26-88 for the English version and 26-89 for the Arabic version.

3.4 Content of Questions and NCDs

The study's primary aim was to develop a valid semi quantitative FFQ that could be used in the future in epidemiological studies in KSA. It contains Saudi dishes and traditional foods alongside with other western foods that participants consume according to their answers. The other aim of the study was to evaluate the dietary patterns as risk factors for certain chronic diseases e.g. CVD and T2DM. Each disease has a group of related questions about diet and lifestyle that might affect the chance of developing it in the future according to longitudinal studies provided in the literature review. To ensure content validity of the questionnaire, the questions were based on peer reviewed research papers which provided evidence of the connection between the NCD in question and the food or behaviour.

For carbohydrate foods, GL of the foodstuff were used for the foods included in the FFQ. The GL for Saudi traditional foods were calculated using the glycaemic index of the foods provided in Al-Mssallem's (2014) paper. Mean of the foods for each question was taken from Foster-Powell *et al*. (2002). The study included the GL for more than 750 types of foods tested with the use of the standard method. Foods which were not included in the study, had the GL calculated by multiplying the carbohydrate content of the food by its glycaemic index, then further multiplying this value by the frequency of consumption. For instance, the GL for chocolate (question 66); the mean GL of a portion of chocolate is 20.

Eight responses were possible ranging from ‘’never’’ to ‘’3 or more times per day’’ The GL was calculated as follows:

Never=0, 1-3 a month= 0.9, once a week= 2.8, 2-3/week= 7, 4-5/week= 12.6, once a day= 20, 2-3/day= 50 and >3/day= 90. GL was computed by multiplying the frequency of consumption of each food from the FFQ by the GL of the portion according to GL from (Foster-Powell *et al*., 2002). The sum of the values from all foods and beverages for each participant was then categorised according to Salmeron *et al.* (1997a); almeron *et al*. (1997b); (Willett *et al*. (2002), included in the table (3-4) below.

The content of saturated fat in foods was calculated based on the inclusion of further details in questions regarding the food item such as: egg, cheese, milk, ice cream, yogurt, crisps, cream, mayonnaise, biscuits, chocolate, desserts, ghee, pies, lard, butter, red meat, processed meat and fast-food, using the composition of foods (McCance and Widdowson, 2002). For the traditional Saudi foods, different recipes were collected, and the mean of saturated fat was used. For red meat, the saturated fat was calculated for the mean of saturated fat of different cuts and the mean for the relevant answer was used. Then, the saturated fat was calculated per portion and was summed for each participant. The result of saturated fat was compared to the guidance for British residents which is 30.5g/day for male and 24.4g/day for female, which is 11% of the recommended calories (i.e. 220kcal for female and 275 kcal for male). The daily calories for men and women were adopted from the recommendation by the NHS which is 2000 kcal for women and 2500 kcal for men (NHS, 2018). The saturated fat recommendation was assessed using the Dietary Reference Values (DRVs) which was 11% of the total calories (British Nutrition Foundation, 2016).

The questions in section 5 were not in any order, but reflected behaviour related to T2DM and CVD. Questions were not grouped for each disease because the researcher organised them by food type and to include four questions (salt, fast-food, vegetable and dessert) twice to examine the internal consistency. The four questions were repeated twice at the beginning of the questionnaire and in the middle of the questionnaire, as the internal reliability needed to be tested for these questions.

Some questions were specific to only one NCD, while others related to both CVD and T2DM. A subset of questions relating to each NCD was compiled.

Before developing the FFQ, the researcher asked 30 participants from the five-main region in KSA to provide the researcher with a food list of the main dishes in these regions that people eat frequently. This step was very important to insure the FFQ was comprehensive as it would be sent via social media which include Saudis from different regions in KSA.

3.4.1 Food Frequency

The food frequency questions asked participants to select the category of answer that best described how often they ingested the food in question. The frequency at which a food is eaten is not the only important factor. The amount eaten each time is also important. To try and ensure consistency, each food item had a portion size associated with it that was determined by using the portion size included in the nurse’s study FFQ. Food items that were not included in the FFQ such as traditional Saudi dishes consisted of rice and meat, chicken or fish, the portion size was 1 cup for the rice which is the same as the nurse’s FFQ. Other traditional dishs such as Mahshi, which is stuffed vegetables with rice (peppers, zucchini, tomato, potato), was included in the traditional rice dishes with the portion size estimated as 1 pepper, 4 zucchinis, 4 tomatoes, 2 potatoes, according to their content of the rice. Other traditional dishes such as vegetable curries, the portion was half a cup of cooked vegetables. Examples of Saudi traditional curries were included in the

Arabic FFQ such as Okra, Zucceni, Molokhaya, Selg, Reglah, which was the same as the nurse's study's vegetable portion size. However, in the FFQ of the nurse's study, food item such as cheese had the portion sizes in ounce. Thus, in order to make sure that people know what an ounce equals to, a well-known description was given. Participants were asked to estimate how many portions of a food they ate in each time. In that way participants who ate large portions could indicate this by increasing the frequency. The way a portion size was described depended on the food items in question. Portion sizes could be in gram or millimetres, but people might find this difficult to estimate. To help people who are not aware of how much constituted a gram, some foods such as meat, fish and chicken had a descriptive example relating a portion to a well-known item. For example, a portion size of red meat was described as approximately equal to the size of a computer mouse and portion size of fish equal to the size of cheque book. Other types of food such as mayonnaise, oil, nuts, sugar, honey etc. were described by the number of spoons. Either table spoon or tea spoon was specified depending on the portion size of the foodstuff. All the description of the portion size depends on published guidelines for average adults (Bupa, 2016). It is also estimated in the same range in the nurse's study portion size, for example the portion size of the cheese is 1oz, which is equal to 28.8-30g of matches' box, the portion size of the fish in the nurse's study was written as 3-5oz, and cheque book is 150g which is equal to 5oz. This was applied on questions 28-30 & 47-49, (as detailed in appendix C1).

It was beyond the scope of this study to assess the dietary intake or nutrients intake of the participants. One reason for this is because there is currently no Saudi nutritional database available for researchers to facilitate nutritional epidemiological investigations capable of linking food eating frequency with energy and nutrient intake (Gosadi *et al*., 2017). Furthermore, the researcher is developing categories and is evaluating the diet of the participants according to the published literature in human nutrition longitudinal studies provided in chapter 2.

3.5 Categorising the participants according to their NCD category

Each disease has a cluster of questions which relate to that disease. The respondents' scores were calculated for each disease according to their answers and then they were put within categories.

3.5.1 T2DM

There were six factors included in the analysis of T2DM risk. According to the answers given to these questions, each participant was given an overall score for GL, CF and categorised their BMI, physical activity, red meat intake, processed meat intake. They were then grouped according to their nationality and compared.

3.5.2 Qdiabetes

In addition to evaluating the self-reported behaviours of the participants as described above, it was decided to also use an independent diabetes risk calculator, as detailed in chapter2, section 2.4, table (2-3).

Qdiabetes was used as a calculator to determine the risk of diabetes for the participants as well. It can be used to predict the risk of diabetes in 10 years or less, i.e. as low as 1 year (Hippisley-Cox *et al*., 2009).

The reasons for selecting the Qdiabetes calculator were:

1. It has been formally validated on two separate populations of patients; one of the validations was conducted by a fully independent team from Oxford University. It was developed by academics and doctors working in the national health services (NHS) (Hippisley-Cox *et al.*, 2009).

2. Although Qdiabetes has been developed to be used in the UK, it can be used globally. For example, if the postcode is left blank, the score will be calculated using the average value for the respondents according to the other data available. This meant it could be used for the Saudi respondents as well as the UK respondents. Post codes were not available for any respondents, so the biasness was the same for both (Qdiabetes, 2015).

3. The Qdiabetes calculator can be used without certain data. Family history was unknown although the disease status of the participants, their smoking habits, BMI, gender, age category and ethnicity were known. Where information was unavailable for a category of information, the Qdiabetes programme uses the average data for respondents with the same age, smoking status, ethnicity, sex, BMI and chronic diseases to fill. It can be used for any person between 25 – 84 years without existing diabetes. Qdiabetes was recommended by NICE as a calculator for predicting the risk of diabetes (Hippisley-Cox *et al.*, 2009).

According to Gray and colleagues, result of Qdiabetes ≥20% is considered as a high risk, 10-19.9 % as intermediate risk and <10% as a low risk (Gray *et al.*, 2014). Further information on other T2DM risk calculators is detailed in appendix E.

3.5.3 Cardiovascular Disease

There are 9 factors that are included in the analysis of the CVD risk. According to the answers given to these questions each participant was given an overall score for GL, CF, saturated fat and had their BMI, physical activity, smoking, nuts intake, processed meat intake and oily fish categorised. Then they were grouped according to their nationality and compared.

3.5.4 Qrisk2

In addition to evaluating the self-reported behaviours of the participants as described above, it was decided to also use an independent cardiovascular risk calculator. There are various types of cardiovascular risk calculator used by professionals to assess the risk of developing CVD in the future. They help the people to identify the necessity for lifestyle alters or medication. Six calculators were identified as being freely available to researchers. These are described in the literature review section 2.4, table (2-3).

For this study, it was decided to use the Qrisk2 calculator to determine risk of the participants. The Q risk algorithm uses data on age, sex, blood pressure, cholesterol (HDL ratio), diabetes, ethnicity, smoking status, family history of premature coronary heart disease in the first-degree relatives under age 60 years, deprivation, blood pressure treatment, BMI, chronic kidney disease, rheumatoid arthritis and atrial fibrillation (Hippisley-Cox *et al*., 2007). The reasons for selecting the Qrisk2 calculator were:

1. It is an externally validated system which was developed by academics and doctors working in the national health services (NHS). Now, it is included in the Department of Health's Standard Operating procedure for vascular screening and the national GP contract.

2. Although Qrisk2 has been developed to be used in the UK, it can be used globally. For example, if the postcode is left blank, the score will be calculated using the average value for the respondents according to the other data. This meant it could be used for the Saudi respondents as well as the UK respondents. Post codes were not available for any respondents, so the biasness was the same for both.

3. The Qrisk2 calculator can be used without certain data. It was beyond the scope of this study to collect information on blood cholesterol or systolic pressure, so it was necessary to find a calculator which could be used without this information. Family history was also unknown although the disease status of the participants, their smoking habits, BMI, gender, age category and ethnicity were known. Where information is unavailable for a category of information, the Qrisk2 programme uses the average data for respondents with the same age, smoking status, ethnicity, sex, BMI and chronic diseases to fill in. In this case, the average systolic blood pressure and HDL cholesterol ratio would have been used for the category of respondent according to these criteria. It can be used for any person between 25 – 84 years without existing CVD. Qrisk2 was developed by doctors working in the NHS and academics. NICE recommended using the calculator for predicting the risk of CVD.

The Qrisk2 calculator was completed for every participant and their risk was calculated. For British public and nutritionists, the ethnic group which was chosen to calculate their risk was White or not stated and for Saudi public and nutritionists the category ‘other ethnic group’ was used as in this research as there was no question about race. The exact age of the participants was not available, only the category (as shown in question 1). In using the Qrisk2 calculator, the age was input as the median number for the category, so for example respondents ticking they were in the category 20-25 years were entered as being 22.5 years old. All other information for the participants was chosen according to their responses on the questionnaire.

The Qrisk2 calculator provides a score for each respondent as a % risk of developing CVD in the next 10 years. A score 10% or over means there should be an intervention to reduce the risk of CVD (Qrisk2, 2016). More details on other CVD risk calculators is shown in appendix E.

3.6 Development of the Questionnaire

The questionnaire was designed as a series of closed questions with multiple choice answers. This style allowed responses to be analysed using a numerical scoring system based on a Likert-type scale. For parts three, four and five, the allocation of a number to each answer allowed a score to be calculated for each participant. This was based on the longitudinal studies provided in chapter 2. The score was calculated separately for each NCD, considering the questions which related to it. Almost all the questions require an answer, the exception being the smoking questions because a number of people do not smoke.

This style (closed questions with multiple choice answers) also gave the researcher control over the categories of answer, simplifying the analysis and encouraging consistency across the sample group. Another advantage of using closed questions with multiple choice answers provides ease of completion for the participants. Given the length of the questionnaire, it was important to ensure it was as user friendly as possible to maximise participation and encourage completion.

The disadvantages of closed questions may be considered as follows:

1. Offering closed categories of answers can limit the respondent's answers. A respondent may wish to give an answer which is not available. Options for closed questions must be comprehensive to cover all expected answers that respondents may choose. This can be achieved through correct development of the questionnaire. Using a test group, all the questions can be offered in open format, to see all the answers that people may provide. These can then be put in categories to form the answer options and close the question. The pre-test process described below in section 3.6 explains how a similar process was used to ensure comprehensive answers for the food frequency questions. Given the types of questions used, this disadvantage was limited in this research as many of the questions offered continuous interval answers, for example:

   Never, once, twice, three times, four times, five times, and more than five times.

2. Closed questions allow participants to guess the answers. To some extent this can be avoided by including a 'don't know' or 'not applicable' option as appropriate. However, open questions, in addition to being more difficult to score accurately and consistently, are more likely to have ''do not know'' answers (Marsden and Wright, 2010). These are from people who would answer them correctly but did not, possibly because: a. They are not sure enough of the answer or

   b. They did not recall the information instantly and did not want to spend time thinking about the right answer.

Closed questions with a 'don't know' option minimise these difficulties.

3. Putting closed categories to respondents such as 1-3 hours, 3-6 hours may produce errors, (such as the overlaps of answers in the example above– both contain the possibility of 3 hours) but these can be reduced through effective piloting.

An additional barrier to the use of open questions is the complexity of analysis. If open questions are used, to analyse them they must be grouped into small categories, and then coded. This demands the development of a coding scheme which needs confirmation by many people. Agreement between the coders can be difficult to achieve, time consuming and resource intensive (Marsden and Wright, 2010). By contrast, using closed questions streamlines the coding and analysis.

Given the complexity and potential inconsistency of scoring open questions, the type of information being solicited and the additional burden on the participants, it was decided to use closed questions for the questionnaire.

3.6.1 Questionnaire Translation

The questionnaire was delivered in two languages, English and Arabic, so all participants could complete the questionnaire in their mother tongue. Because comparisons were intended between the two groups it was important that the questions were valid in both languages. Preparing a questionnaire, which was consistent and valid in both languages required many steps:

1. Translation

2. Back translation

3. Expert Committee Assessment, including cultural adaptation

3.6.2 English to Arabic

The translation procedure of the questionnaire followed the guidelines described by Beaton *et al.* (2000). The questionnaire was written in English, and then two independent bilingual translators who spoke and understood Arabic fluently and as their first language translated it. In addition, the first translator has a nutritional background whilst, the second translator has no nutritional background. Both were members of the University of Birmingham. Each translated the questionnaire to Arabic (T1 and T2) as the first stage described in Beaton *et al*. (2000). Then, the developer synthesized the result of the translations working from the original questionnaire, T1 and T2 versions producing the T-12 version.

3.6.3 Arabic to English

Then two other translators, worked with the T-12 version, with no idea about the original version. They translated the questionnaire back to English. Neither of the translators had any nutritional background. The first translator was a computer science student and the second translator was a biochemistry student from the University of Birmingham. The purpose of having translators without any information about the concept of the questionnaire and background was both, to avert information biasness and identify the unforeseen meanings of the points in the translated survey (T-12). There was also a translator with a nutritional background from University of Birmingham who translated the questionnaire to confirm the translation was technically correct.

The results from the translation and back translation were then fed into the next step, the expert committee stage. A copy of the translated FFQs in appendices C1, C2 and C3.

3.6.4 Expert Committee

The purpose of an Expert Committee stage is for checking the validity of the questionnaire, and for detecting inconsistency and conceptual errors in the translation (Beaton *et al*., 2000). The Committee for this questionnaire was formed from all translators who participated in the translation of the survey, the two translators who translated the questionnaire back to English, the developer of the questionnaire; two independent academics, the research supervisor and a lecturer at the University of Birmingham with expertise in the use of questionnaires for research, and a chairperson. The material they used comprised the original questionnaire, the translations (T1, T2, T-12, BT1, BT2) and the reports relating to suggested changes or issues identified during the translation process. The committee structure is very important in order to achieve cross cultural adaptation. This ensures the results are consistent, appropriate and can be compared between the groups with confidence. During the meeting of the committee members, they worked to consolidate all the versions of the survey; and reached the pre-final version after consensus on all discrepancies identified.

There are four areas that need to be addressed to achieve adaptation between cultures:

1. Semantic equivalence: to make sure the words hold the same meaning in both versions and to identify any grammatical difficulties in the translation (Beaton *et al*., 2000).

2. Idiomatic equivalence: if there are any idioms or colloquialisms which are difficult to translate, they need to be translated by the committee to formulate an equivalent expression which has the same meaning (Beaton *et al*., 2000) or eliminated if unnecessary.

3. Experiential equivalence: This relates to items aimed to identify experiences of daily life, but which in other countries could not be relatable even if they are translatable.

For instance, asking if the person is having difficulties eating with a fork, whilst the people of that particular region do not use a fork for eating (Beaton *et al*., 2000) probably because they habitually use chopsticks.

4. Conceptual equivalence: often words have other conceptual meaning between countries. For example, family may be defined as extended family in some cultures (Beaton *et al*., 2000) but only as parents and children in others.

A summary of the changes and adaptations that resulted from the Expert Committee follows under the next heading 'Cultural Adaptation'.

3.6.5 Cultural Adaptation

The Expert Committee identified the following issues which required cultural adaptation:

Part 1 Demographics

In question 7 about salary, experiential equivalence was applied. In the Arabic version, the question requests the monthly income but the English version requests annual income. This variation was implemented because in KSA people are used to being asked about the monthly income and it is a common question in Arabic questionnaires (Bayt, 2017).

Alterations were also required for questions 9 and 10 which are about the body weight and the height. In the Arabic version, the weight is in kilograms and the height in centimetres. However, in the English version the weight is in stones and the height in feet, to reflect the units in common use in each country.

Part of experiential equivalence is omitting questions that are irrelevant or those which participants would not answer for culture and religious reasons. This applies to question number 12 which is about the type of smoking. In KSA, these are; cigarette, cigar, shisha and one type called muasel which is lighter than shisha, with fruit flavour. However, muasel is called shisha in the UK so it might be confusing for the people to answer a question if they do not understand what it means (Beaton *et al*., 2000). In the UK version only shisha was mentioned, muasel was omitted. This does not affect the quality or accuracy of the data as the analysis combined all categories.

Question number 46 also required experiential equivalence. There is a choice in the English version (lard) that is not in the Arabic version questionnaire. Since there are no pigs in KSA and people do not consume their meat for religious reasons, there is no question about lard included in the Arabic questionnaire. Some products were omitted because they are uncommon rather than prohibited in their religion. An example is goose fat. It is quite rare to find goose in KSA in supermarkets since, goose do not live in environments like KSA where there is such hot weather. The same applied for the English version. There are some foods that were not included in the English version like camel meat which is included in the Arabic version under the question number 28 as red meat (Beaton *et al*., 2000).

Additionally, some questions (such as number 29) asked about fish intake. The names of white fish are not the same in the Arabic and English versions because the types of fish which exist locally are not the same in KSA and UK. For instance, the types of white fish included in the English version are cod, sea bass and haddock, but in the Arabic version are, parrot fish, king fish and spotted grouper. However, the names of the oily fish and shellfish were kept the same for both versions since oily fish are imported in KSA. These amendments do not affect the consistency of the data as the questions still gather relevant information relating to the NCD, but in a form, that reflects the products of the country.

Questions 32 and 73, contain more examples in the Arabic version than the English version; this is another case for experiential equivalence. For instance, there are lots of Arabic desserts such as, kenafa, saraya, muhalabia, tatly, maasoub which cannot be found in the UK thus, besides the cake, doughnut and other kinds of dessert in the Arabic version there are other Arabic sweets names as well which are available in KSA. The English products such as cake and doughnuts are also available in KSA, so they were included in the Arabic version along with the Arabic deserts.

There are some types of foods which cannot be found in the UK such as Saudi traditional food that form an important part in Saudi diet. However, many Kurdish and Turkish restaurants serve a similar type of food in the UK, which are rich in fat and carbohydrate and the meat is similar to the Saudi traditional meals. So, this is an example of conceptual equivalence applied in Arabic and English versions, question number 81 in the English questionnaire and 82 in the Arabic questionnaire.

Making these cultural adaptations does not affect the equivalency of the questionnaires but makes them more accurate for the target group.

The IPAQ questions used in part 4 on physical exercise had already been subjected to the requirements of translation and cultural adaptation and were not included in this process.

3.7 Pre-Test and Piloting the questionnaire

Once both versions (Arabic and English) of the questionnaire had been developed it was necessary to carry out a test of the pre-final version as detailed in Beaton *et al*. (2000). This was mainly to ensure that the adapted version was holding its equivalence. Piloting assesses the practical elements of delivery. In this stage, the researcher first pre-tested the questionnaire for the adaptation processes. Fifteen people, nine nutritionists and six from the public were recruited from KSA. They completed the questionnaire online and were then subjected to an interview to investigate what participants thought were meant by each question and response. Each participant completed the questionnaire alone without seeing each other's answers. The researcher observed them while they were doing the questionnaire, taking notes of any unclear things, they identified during completion. One of the public was a young girl aged 12 years, who read through the Arabic questionnaire to ensure that all the questions are clear and easily understandable as recommended in Beaton *et al*. (2000). Although no one under 18 was going to be included in the final sample group, it was important to make sure that the final questionnaire is easy and clear to understand. Most adults should be able to do so as well. During the pretesting questionnaire stage, the following issues were identified and altered:

1. Part 5, regarding cheese in the Arabic version, the name of cheeses in questions 47, 48 and 49 were modified for cultural reasons. For example, during the pre-test, two Saudi participants stated that they cannot remember the names of the cheeses they are consuming. This is because in KSA, most of the public use descriptive words such as, white cheese for Feta cheese, yellow cheese for cheddar cheese and glass cheese for cream cheese (since most cream cheese in KSA is sold in glasses). To have reliable data, the researcher asked the participant about the name which are well known and added them.

In addition, the questions which were asked about cheese fat amount were modified but for the reason of avoiding the judgment of the participant’s intake (Marsden and Wright, 2010). They were categorised to high fat cheeses, medium fat cheeses and low-fat cheeses. So, the judgment words were taken off (high, medium) but the low fat is kept as a descriptive word. One of the questions was how many servings of full fat cheese such as stilton, cheddar - Halloumi - Brie, Gouda do you consume. Then it was modified to how many serving of cheese such as stilton, cheddar - Halloumi - Brie, Gouda do you consume. Since, the respondents need to distinguish between the types they are consuming. However, low fat cheeses were kept as some of the types of cheeses have more than one category, full fat and low fat such as Philadelphia, cheddar mozzarella and others.

2. Part 5, milk: Questions number 36, 37 and 38 are about the number of cups of milk (full fat- low fat- skimmed) consumed daily. Two participants stated that they consume much more than 4 cups daily which was the maximum choice in the three questions. So, more choices were added, and the maximum choice was increased to 8 cups per day.

3. Part 5, dessert: Also, regarding the dessert questions, three people reported that the type of dessert they consumed was not present in the questionnaire, especially in the Arabic version, so these types of dessert were added.

4. Part 5, pasta and rice: In Questions 68 and 69, which are about the intake of pasta and rice, there were choices about how many times daily the products were consumed and text boxes underneath the questions asking about the amount consumed using cup as a measurement. However, three participants kept the box blank; two said they did not notice it and one said they did not understand it. So, these questions have been modified to how many servings of pasta / rice do you consume? And the serving size of both pasta and rice were included. This seemed to be more understandable.

5. Part 5 soft drinks: For the questions about the soft drinks and diet soft drinks, 76 and 77; the questions were: ‘how many cans of soft drinks /diet soft drinks do you consume?’ The can size was included underneath. However, two participants said they do not consume a whole can and most of the times they buy a big bottle and use cups for drinking them. So, the questions have been modified to how many millilitres of soft drinks / diet soft drinks do you consume? Underneath were the sizes of each can and

cups in millilitres and the choices are various millilitres in a month, various millilitres in a week and various millilitres in a day. In Part 5, regarding the consumption of water: Question number 79, which is about the number of cups of water consumed daily, the choices had the minimum option as 1-2 cups. However, one participant said that they drink less than one cup of water daily. So, less than one cup was added as a choice.

Part 5 stock, soup etc: Also, there was slight modification done in question 86, regarding the amount of vegetable, chicken, beef, fish stock, powdered broths, soups, and gravies consumed weekly. A male participant reported that he does not know. This is likely to be because they do not cook the food and usually they eat out or a member of their family cook for them such as their mothers, sisters or wives. Consequently, the choice (do not know) was added for people who do not cook and have no idea about their consumption of these products.

Some questions were added as the products were found to be consumed regularly by a considerable number of participants during the pre-test. These included consumptions of green and herbal tea, fruit juices (from concentrate) and processed nuts which contain sugar and/or salt.

Table (3-2) questions before and after modification; for details see appendix C1

Question before change	After modifying
Milk questions maximum choice was 4 cups a day (36-37-38)	The maximum choice is 8 cups a day.
Cheese names (Feta, Cheddar, cream cheese) (47-48-49)	White cheese, yellow cheese and glass cheese.
Rice and pasta; there was a text box to put the amount they consume in a day, week, month (69-70)	Multiple choice containing different amounts in a day, week and in a month

Soft drinks; how many cans do you consume (77-78)	How many millilitres do you consume provided with different amounts in a day, week and in a month.
Water; the minimum choice was 1-2 cups a day (80)	The minimum choice made as less than 1 cup a day.
Question about cooking stocks, broth, soups and gravies (87)	‘Do not know’ option was added as a choice for people who do not cook and do not know

3.7.1 Piloting

Before sending the questionnaire, fifteen nutritionists from Saudi Food and Drug Authority and twelve participants from the public were sent the FFQ to their email addresses they provided the researcher with. They were invited to complete the questionnaire during the pilot stage in a computer room at the University of Birmingham. The researcher went through the steps of the questionnaire from the beginning to the end with the participants. Piloting is mainly to identify practical problems with implementation rather than the design of the questionnaire.

The main comment that most of the participants said during the piloting was that the questionnaire is long and they feel bored doing it. Since they started the questionnaire, the researcher counted the time it took for the first and the last participant to complete the questionnaire. Length of the FFQ was not shortened as the FFQ needed to be comprehensive to collect the dietary habits of the participants. Incomplete questionnaires were sent back to Survey Monkey with a label on the top mentioning incomplete in an orange colour, the completed questionnaire was labelled complete with a green colour. The researcher can have a look at the data received in form of answers and can delete the incomplete questionnaires.

At the beginning, there were several uncompleted questionnaires (21%). Email responses from respondents reported that they could not submit their answers and others said they received an error message on submission, but they cannot detect the problem. The researcher contacted survey monkey with these difficulties. Their advice was to split the questionnaire into 5 or more pages making it easier to submit the answers of each page. This allowed easier detection of the errors rather than having one very long page. This would solve the error messages and improved submission. However, they established that the uncompleted submissions were not a problem with the survey, but some people changed their mind during filling the survey and did not wish to complete it.

The last stage of development, according to Beaton *et al*. (2000), is the submission of documents to the designer for appraisal of adaptation procedure. So, all the suggestions and the not understandable questions or answers were modified and during the pre-test, the participants were asked about the clearer suggestion to them and their answers were taken in to account, as stated in table (3-2). The FFQ was split in to 5 pages to ensure completeness of each section. Then, the translation process was accomplished, and all the translated copies were given to the researcher. The English and Arabic questionnaires are available in appendix B and D, respectively.

3.8 Questionnaire Reliability

All questionnaires need to be assessed for reliability to see if the questionnaire produces stable and consistent results. Test-retest reliability is a measure of questions reliability done by applying the same test twice over a period to a group of people.

During the test of the pre-final Arabic version questionnaire, the researcher examined the test- retest reliability of the questionnaire. Using SPSS version 23, Person Correlation was calculated for four questions, which are repeated twice (consumption of salt, fast food, vegetable and dessert). The good range of number is between 0 and1 (Field, 2005), making the responses about fast food highly reliable.

The vegetable and dessert questions were not identical in the pre- test and that may distract the respondents. So, to get internal consistency, the questions were modified to be identical in the last version of the questionnaire.

Four questions were repeated to examine the test-retest reliability of the respondents. These questions were:

1. Questions number 27 and 86 in the Arabic version and 27 and 85 in the English version, which are about the amount of added salt consumed daily.

2. Questions 32 and 74 in the Arabic version and 32 and 73 in the English version, which are about dessert.

3. Questions 33 and 45 in the Arabic and English version, about fast-food.

4. Questions 34 and 58 in the Arabic version and 34 and 57 in the English version, which are about number of portion of vegetables consumed daily.

3.9 Data gathering

Data gathering lasted for four months, between 01/09/2014 to 30/12/2014 for both English and Arabic questionnaires. The questionnaire was open for participation during the full time of the four months. The researcher made sure that during the data gathering season, there is no major changes in diet of the majority of participants. For instance, collecting data during Ramadan was avoided since Muslims fast for a month and there is a significant change in their dietary habits and they usually eat less food. Nine Arabic questionnaires were completed after the closure and four English questionnaires were completed after the closure. All the questionnaires which came after the closure were deleted.

The data of the participants were collected through Survey Monkey. The researcher has an account in Survey Monkey which no one can access unless they have the user name and the password. The data was then exported to SPSS and kept in the researcher's computer at the University of Birmingham. The computer of the researcher has a user name and password also and no one had the password except the researcher. All the data was backed up in an external hard drive and kept in a safe place in the university office which is locked, and no one has access to it except the researcher and the supervisor.

There are at the end of the questionnaire two questions asking if the participants are willing to participate in the future in a study to provide their name and email address. For those who provided their information, all their personal information was kept confidential. Also, their answers were anonymised.

The questionnaire was developed to be administered electronically, through Linked in, Facebook, Twitter and electronic mails. The link of the questionnaire was provided with an invitation to participate in the study. One of the objectives of this study was to assess the use of social media as a data gathering tool.

3.10 Statistical Tests

The questionnaire was designed to be analysed using Microsoft Excel and SPSS (IBM Corp, NY, USA) version 23. Survey Monkey has an option to export the data of the questionnaires into an Excel or SPSS format. A scoring system was developed to measure food intake frequency. A sum of consumption frequency for factors related to CVD and T2DM score was calculated for each factor and then tested for association using

Correlation Coefficients, which was used to test how strong is the relationship between two variables; factors related to CVD and T2DM with BMI, education level, age, income and smoking status. Frequency were calculated to describe binary and categorical variables. Means and standard deviations were calculated to illustrate continuous variables. Cronbach's alpha test was used to test the internal consistency for English and Arabic questions of CVD and T2DM. Mann Whitney was used to test the difference between results from obesogenic questions for the Saudi public and nutritionists. Chi Square test was used to test the significant difference between the factors for the groups included in the study. A P-value of 0.05 or less was designed as statistically significant for applied statistical test. Relative risk was used to test the ratio of the probability of CVD and T2DM to occur in Saudi and British groups.

3.11Analysis of the data

3.11.1 BMI

Table (3-3) Classification of BMI for adults (WHO 2000).

Classification	BMI (kg/m²)
Underweight	< 18.5
Normal range	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity	≥ 30.0

3.11.2 Physical Activity

Physical activity questions were taken from the short version of the International Physical Activity Questionnaire (IPAQ, 2004). The analysis for IPAQ questions was designed to classify people into three categories;

inactive, minimally active and (Health Enhancing Physical Activity) HEPA active.

Table (3-4) IPAQ categories of physical activity level

Inactive (category 1)	Minimally active (category 2)	HEPA active (people who exceed the minimum public health physical activity recommendations) (category 3)
Insufficient active individuals can be categorised if he or she does not meet the criteria for category 2 or 3 (IPAQ, 2004).	a) Walking at least 30 minutes per day or 5 or more days of moderate intensity activity OR b) 5 or more days of any combination of moderate activity or vigorous activity, walking at least 600 MET-minutes in a week. OR c) 3 or more days of vigorous activity of at least 20 minutes in a day (IPAQ, 2004).	a) 7 or more days of any combination of walking, moderate activity or vigorous activity achieving at least 3000 MET-minutes in a week. OR b) Vigorous activity on at least 3 days, meeting a minimum of at least 1500 MET-minutes in a week (IPAQ, 2004).

IPAQ indicates International Physical Activity Questionnaire; HEPA, Health Enhancing Physical Activity; MET, Metabolic Equivalent of Task

One metabolic equivalent (MET) is defined as the amount of oxygen consumed while sitting at rest and is equal to 3.5 ml O_2 per kg body weight x min.

Once a physical activity score had been calculated for all participants, these were allocated into categories and scored as follows: 1= HEPA Active, 2 = minimally active and 3 = inactive. A MET-minute is computed by multiplying the MET score by the minutes performed. MET-minute scores are equivalent to kilocalories for a 60-kilogram person.

3.11.3 Food Frequency Questionnaire

In section five, participants gave information about their dietary habits. The questions had multiple choice answers and participants had to select one answer for each question. The answers for each factor related to a disease was scored and then calculated. For more clarification, chapter 4 can be reviewed.

Question number 89 in the English version and 90 in the Arabic version, were about other type of food participants consumed regularly other than the ones in the questionnaire. The answers of these questions were added to the score of participants' relevant food type they were eating. Food consumed in small quantity such as spices (cumin, ginger powder), bee pollen or vitamins were not added to any food scores. Also, alcohol was not considered. There were some food items included in the questionnaire participants stated they are eating in the open question; their answers were not added. Most of the participants did not state how many servings they consumed per day, week or month, so their answers were not considered. However, other types of food which had a frequency and are not included at any type of food in the questionnaire were added to the relevant foods. For example, vegetables soup was added to vegetable score, quinoa was added to wholegrain pasta and rice score and peanut butter was added to nut and seeds.

Although in the Arabic version, the same questions have been reversed, the numbers do not correspond to the English version because there was one question added in the Arabic version, which was not included in the English one. This was question number 51 in section 5 in the Arabic version which was about number of servings consumed from salted or sugar-coated nuts and seeds.

For each NCD, the possible answers were categorised into two or three categories; Low and high or low, medium and high. This was done by categorising each answer according to the literature of longitudinal studies, and then allocating the category. According to the answer a participant gave, s/he would be allocated the score corresponding to the answer.

3.12 Conclusion

The development and translation of the FFQ were according to a systemic approach. It included risk factors related to CVD and T2DM in the nurses' studies. The analysis of the result of the participants was according to the risk factors associated with CVD and T2DM included in the literature. The FFQ is a good tool for establishing a baseline for Saudi nutritionists and to follow them in the future to check their health and incidence of NCDs. Also, it is a good tool to show what factors are related to Saudis and what are the high and low cut off points for each risk factor for CVD and T2DM.

CHAPTER 4- Comparison between British and Saudi participants

This chapter aims to provide a description on the tool used in collecting data for the Saudi and British participants while also showing comparisons between Saudi and British populations in terms of gender using the CVD and T2DM related factors.

4.1 Validity and Reliability of the FFQ

4.1.1 Consistency and internal reliability

There are four questions repeated in the questionnaire to assess the internal consistency. These questions are on; fast-food, dessert, salt and vegetables. Table (4-1) below shows the mean score for each question for each group.

Table (4-1) The mean scores for repeated questions (27, 86 - 32, 74 – 33, 45 – 34, 58) Arabic version and (27, 85 – 32, 73 – 33, 45 – 34, 57) English version

Time point		Mean score for vegetables	R2	*P*	Mean score for dessert	R2	*P*	Mean score for fast-food	R2	*P*	Mean score for salt	R2	*P*
British public	T1 T2	1 1.2	.52	.000	1.4 1.1	.44	.000	0.9 1	.52	.000	1.9 1.7	.42	.000
British nutritionists	T1 T2	0.6 0.9	.57	.000	1.1 0.8	.50	.000	0.6 0.7	.25	.000	1.4 1.1	.54	.000
Saudi public	T1 T2	3.6 3.6	.19	.000	3.8 3	.31	.000	3.2 3.2	.63	.000	4.3 3.4	.18	.000
Saudi nutritionists	T1 T2	3.5 3.7	.30	.000	4.2 3.2	.29	.000	3.3 3.4	.63	.000	4.3 3.7	.24	.000

T1: time point 1. T2: time point 2. R2: regression square. P <0.05; Significant

As it appears in Table (4-1), there is a positive relation between each repeated question and the P value was significant for all the repeated questions. The results from the current study suggest a high correlation between the answers of the repeated questions, showing the food frequency responses have a good internal consistency.

Table (4-2) Result of Cronbach alpha for T2DM and CVD questions for Saudi and British people.

	Arabic questionnaire	English questionnaire
Diabetes	0.729	0.737
CVD	0.687	0.720

The questions on diabetes and CVD show a high Cronbach's alpha. Cronbach alpha is a test which provides a measure of the internal consistency within any set of items in a group. It is commonly used when there are multiple Likert-type questions in a questionnaire that form a scale and helps to determine if the scale is reliable. A reliability coefficient of 0.70 or higher is considered acceptable (Field, 2005).

4.2 Response Rate

A total of 1400 questionnaires were sent in this investigative study. Table (4-3) below shows the number of invitations sent via emails, LinkedIn and Twitter for each group in KSA and UK.

Table (4-3) Numbers of questionnaires and invitations sent via Twitter, LinkedIn and Emails.

	Saudi Nutritionists	**Saudi Public**	**British Nutritionists**	**British Public**	**Total**
Twitter	421	621	95	81	1218
LinkedIn	34	4	14	12	64
Email invitation	15	23	65	15	118
Total	470	648	174	108	1400/1400

The response rate was estimated based on the total number of questionnaires sent out to participants. The sampling technique was snowball; therefore, the response rate is likely to be in reality a lot less than this. This is because the researcher could not distinguish between the numbers of questionnaires as the questionnaires were cascaded through participants.

Table (4-4) Number of responses in the UK and KSA and their corresponding total.

	Saudi nutritionists (SN)	**Saudi public (SP)**	**British nutritionists (UKN)**	**British public (UKP)**	**Totals**
Total invitation	470	648	174	108	1400
Total responses	240	483	94	121	938
Overall responses	51%	75%	54%	112%	67%
Incomplete	57	99	17	24	197
Excluded	12	49	3	8	72
Valid responses	171	335	74	89	669
Valid responses rate	36.3%	51.6%	42.5%	82.%	47.7%

The total number of returns for the questionnaires was 938 and the total valid responses were 669. 61 Saudi respondents were excluded; since 45 were suffering from chronic diseases, 12 females were pregnant and four were trying to get pregnant. On the contrary, eight British respondents were excluded because they were either suffering from chronic diseases or were pregnant.

This survey reached a response rate of 47%, which was similar to the response rates gained through mailed surveys (around 25% -30%) without follow up (Petrovcic *et al.,* 2016). the response rate for Saudi nutritionists are much higher than other groups also British public is very high. Initial responses before exclusion >100% due to cascade effect; the high responses are significant for the study. That could be because most of the participants from KSA were interested in the topic, or because snowball method helped in spreading the questionnaire to a high number of SNS users without following-up. Reaching higher response rate than Petrovicic *et al*., (2016), could be because participants were interested in the topic of the survey, as found by Zhang *et al*., (2017). Lewis *et al*, (2013) found that motivation significantly affects the response rate. It might be that sending the questionnaire in groups and webpages where nutritionists gathered motivated nutritionists to participate in this study. Also, the topic of the questionnaire might motivate the public to participate since they are suffering from problems related to BMI or food choices. Hence, an interest in the research topic is obvious.

Social media users increased from 0.97 billion users in 2010 to 2.46 billion in 2017. In 2018, Twitter had 321 million active users, it was one of the most popular social networks for teenager in USA. However, Instagram and Snapchat became more popular between teenager recently (Statista, 2019).

Facebook is the biggest social networks worldwide. In 2017, Facebook had 2.3 billion global monthly active users and WhatsApp had 1.2 billion. In the same year, the active users of Facebook in KSA were 14.3 million users. In 2017, Linked In had over 467 million members globally. It is the most popular social network in term of active users. The users of emails in 2017 were over 3.7 billion users worldwide. Snapchat reported 186 million daily users worldwide. While Instagram has 1 billion active monthly users globally and 500 million active users daily (Statista, 2019). In 2014, it was found that biggest Instagram users 37% were between 16-24 years, while for Facebook the biggest users group 29%, Twitter 31%, Pinterest 34%, and Linked In 32% were between 25-34 years (Statista, 2019).

4.3 Results and Comparisons between British and Saudi people

In a total of 282 questionnaires distributed to British people via social media and emails, 163 returned completed questionnaires. Amongst these 163 respondents, there were 139 women (85.2%) and 24 men (14.7%). Mean and SD of the anthropometric variables are presented in table (4-6). The mean (SD) ages of British public women and men participants were 33(10.2) years and 33.6(11.9) years, respectively. British nutritionist women and men were 34.6(11.1) years and 32.2(6.0) years, respectively.

In a total of 1,118 questionnaires distributed to Saudi people via social media and emails, 506 returned completed questionnaires. Amongst these 506 respondents, there were 400 women (79%) and 106 men (20.9%). The mean (SD) ages of Saudi nutritionist women and men participants were 26.2(4.7) years and 26.7(4.2) years, respectively. Saudi public women and men were 26.5(5.3) years and 29.4(7.0) years, respectively.

Table (4-5) Age distribution of British and Saudi study participants; public and nutritionists combined.

Age	20-25	26-30	31-35	36-40	41-45	46-50	Over 50
KSA participants n=506	274 (54.1%)	127 (25.1%)	73 (14.4%)	19 (3.7%)	4 (0.7%)	6 (1.1%)	3 (0.5%)
UK participants n=163	46 (28.3%)	30 (18.4%)	25 (15.3%)	19 (11.6%)	5 (9.2%)	10 (6.1%)	18 (11%)

KSA: Kingdom of KSA. UK: United Kingdom

Table (4-6) Age and anthropometric characteristics of study subjects (mean and (SD))

Variables	**Male**		**Female**	
	British	Saudi	British	Saudi
Age mean (SD)	32.9(8.9)	28(5.6)	33.9(10.6)	26.3(4.2)
Height (cm)	178.2(6.9)	171(17.7)	162.9(17.7)	159(9.3)
Weight (kg)	78.1(9.5)	79.9(17.1)	59.1(11.5)	60(13.5)
BMI (kg/m2)	24.1(3.2)	26.5(5.1)	22.1(2.8)	23.4(5.1)

SD: Standard Deviation. BMI: Body Mass Index.

Table (4-7) GL and portion numbers of some food types related to T2DM and CVD (mean and (SD))

Variables	Male			Female		
	British	**Saudi**	***P***	**British**	**Saudi**	***P***
GL mean/day	183.6(73.1)	205.2(82.8)	N.S	162.1(55.7)	147.5(74.5)	0.000
CF(g)	12.3(9.9)	6.5(5.8)	0.01	10.0(7.0)	6.1(4.5)	0.000
Red meat	0.19(0.32)	0.4(0.8)	N.S	0.10(0.11)	0.3(0.9)	0.02
Processed meat	0.03(0.08)	0.08(0.1)	N.S	.09(0.01)	0.1(0.1)	N.S
Vegetable serving	2.15(1.8)	0.7(0.8)	0.000	3.2(1.4)	0.6(0.5)	0.000
Oily fish	0.1(0.07)	0.09(0.2)	0.000	0.1(0.08)	0.18(0.2)	0.000
Saturated fat (g)	25.9(9.2)	30.6(16.4)	N.S	16.8(8.2)	24.9(13.3)	0.000
Nuts	0.06(0.1)	0.1(0.3)	0.000	0.11(0.17)	0.06(0.09)	0.000

SD: Standard Deviation. GL: GL. (<0.1 1-3 month or less, 0.1: once week, 0.2-0.3: 2-3 week, 0.4- 0.5: 4-5 week)

Table (4-7) summaries the portion numbers and GL mean for British and Saudi participants; males and females. As it appears from the table, British females had significantly higher GL intake than Saudi females (P=0.000). Saudi males and females had significantly the lowest intake from CF with values of 6.5 and 6.1g/day, respectively, as compared to British males and females (P=0.01, P=0.000, respectively). Comparing the intake of vegetables, British males and females had the highest intake, with 2.1 and 3.2 portions /day, respectively. On the contrary, Saudi females had the lowest intake with 0.1portion/day of vegetables. Saudi males had the highest intake from saturated fat with 30.6g/d. The lowest intake was among British females with 16.8g/day. There was a significant difference between the Saudi and British genders in terms of the intake of vegetables (P=0.000 for both), oily fish (P=0.000 for both), saturated fat (P=0.000) for females and nuts (P=0.000 for both) with Saudis consuming less vegetables, oily fish, saturated fat and nuts compared to British.

Table (4-8) summarises the age range of the participants from both UK and KSA. About 28.3% of the British participants were in the age range of 20-25 years, 18.4% of the participants were between 26-30 years, 15.3% were between 31-35 years, 11.6% were between 36-40 years, 9.2% were between 41-45 years, 6.1% were between 46-50 and 11% were over 50 years. Whereas for Saudi participants, 54.1% were in the age range of 20-25 years, 25.1% were between 26-30 years, 14.4% were between 31-35 years, 3.7% were between 36-40 years, 0.7% were between 41-45 years, 1.1% were between 46-50 years and 0.5% were over 50 years.

Table (4-8) Age distribution of British and Saudi study participants; public and nutritionists combined.

Age	**20-25**	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	**Over 50**
KSA participants n=506	274 (54.1%)	127 (25.1%)	73 (14.4%)	19 (3.7%)	4 (0.7%)	6 (1.1%)	3 (0.5%)
UK participants n=163	46 (28.3%)	30 (18.4%)	25 (15.3%)	19 (11.6%)	5 (9.2%)	10 (6.1%)	18 (11%)

KSA: Kingdom of KSA. UK: United Kingdom

4.4 Comparison of Factors Related to CVD and T2DM

4.4.1 Saudi & British BMI

All the groups from KSA were combined and all the groups from UK as well. Next, both the groups were compared using the Chi square test. Overweight and obese Saudis accounted for 46.7% compared to the 19.7% of the British overweight and obese participants. There was a significant difference between Saudi and British BMIs with Saudis being more overweight and obese than the British (P=0.000).

4.4.2 Saudi & British Smoking status

It was observed that10.1% of the Saudis and 3.6% of the British participants were smokers. Hence, there was a significant difference between Saudi and British participants in terms of their smoking statuses (P=0.01).

4.4.3 Saudi & British Physical Activity

The results of the chi square test for physical activity and number of British and Saudi participants was significant (P=.000), as detailed in Table (4-9). Nearly a quarter (24%) of the Saudis and 13% of the British participants were found to be inactive. Also, 44.5% off the Saudis and 40% of the British participants were engaged in vigorous physical activity.

Diagram (4-1) Saudi participants at high-risk category based on the risk factors related to CVD and T2DM.

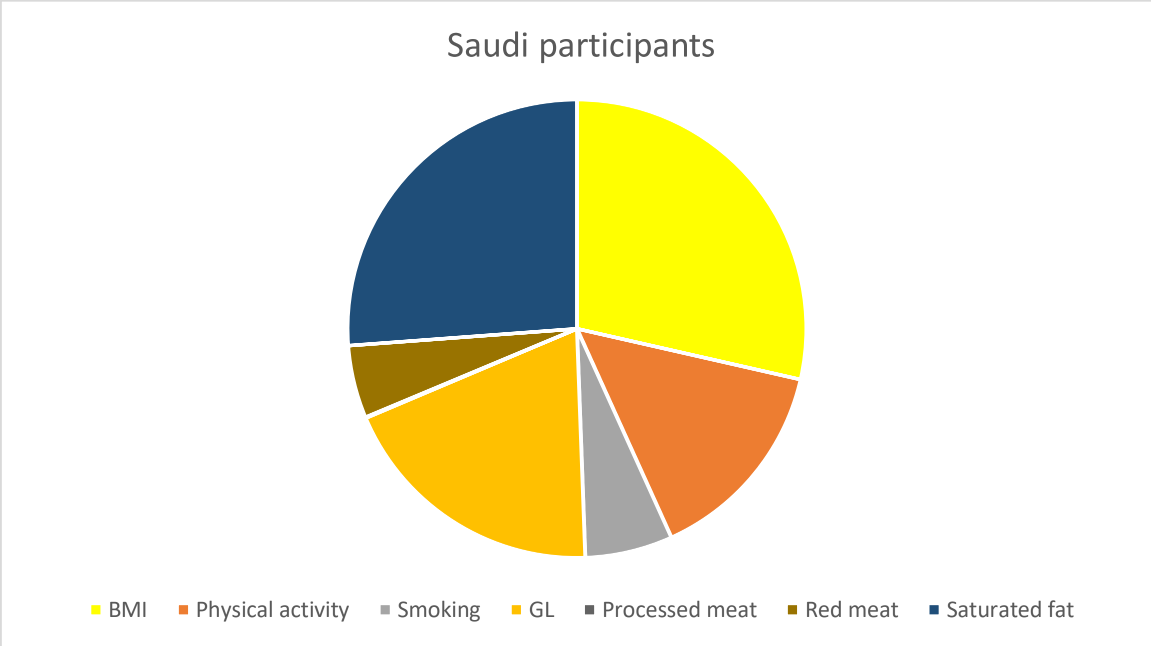

Diagram (4-2) British participants at high risk category based on the risk factors related to CVD and T2DM

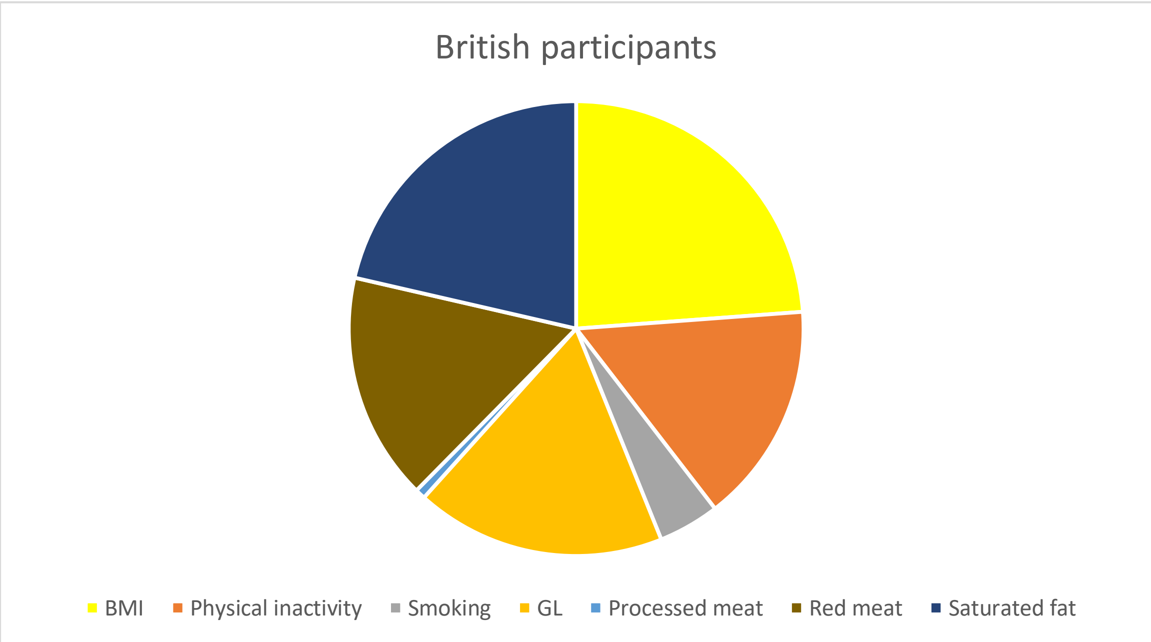

Diagram (4-1) and (4-2), show the percentage of Saudi and British participants at high risk for CVD and T2DM based on factors related to CVD and T2DM; BMI, inactivity, smoking, GL, processed meat, red meat and saturated fat.

Table (4-9) Comparison of factors related to CVD and T2DM in British and Saudi participants.

	Saudi		British		*P*
	n=506	%	n=163	%	
BMI classification					
Underweight	53	10.4	13	8	<0.05
Normal	216	42.6	118	72.3	
Overweight	174	34.3	22	13.4	
Obese	63	12.4	10	6.3	
Smoking status					
Non-smoker	455	89.9	157	96.3	<0.05
Smoker	51	10.1	6	3.6	
Physical activity level					
Low	121	24	21	13	<0.05
Medium	159	31.1	77	47.2	
High	226	44.5	65	40	
Gl (CVD)					
Low	262	51.7	44	26.9	0.000
Medium	85	16.7	95	58.2	
High	159	31.4	24	14.7	
GL (T2DM)					
Low	158	31.2	69	42.3	0.000
Medium	191	37.7	23	14.1	
High	157	31	71	43.5	
CF					
Low	147	29	108	66.2	0.000
Medium	231	45.6	40	24.5	
High	128	25.2	15	9.2	
Vegetable					
Low	103	20.3	129	79.1	0.000
High	403	79.6	34	20.8	
Oily fish					
Low	71	14	18	11	N.S
High	435	85.9	145	88.9	
Nuts					
Low	8	1.5	38	23.2	0.000
High	498	98.4	125	76.6	
Processed meat					
Low	505	99.8	162	99.3	N.S
High	1	0.1	1	0.6	
Red meat					
Low	463	91.5	141	86.5	N.S
High	43	8.4	22	13.4	
Saturated fat					
Low	289	57.1	134	82.2	0.000
High	217	42.8	29	17.7	

N.S: not Significant. P<0.05 N.S: not significant, BMI: body mass index, GL: glycaemic load, CF: cereal fibre, T2DM; type 2 diabetes, variables were compared to t test

4.4.4 Saudi & British dietary factors related to CVD and T2DM

There was a significant difference between British and Saudi participants' GL, CF, vegetable, nuts and saturated fat intakes (P<0.000). In terms of all these mentioned food types, Saudi participants were at a higher risk category. There were no differences in the intake of oily fish, processed meat and red meat (P>0.05) between the Saudi and British.

Relative risk test was used to see whether overweight and obesity is a risk factor for Saudi or British males and females. The relative risk was calculated for Saudi and British males and females public and nutritionists.

Table (4-10) Relative risk for BMI for Saudi and British, public and nutritionists.

Groups compared	Relative risk	Result
Saudi public males & females	2.1(95% CI: 1.63-2.76, P<0.0001)	Males were significantly more likely to be overweight and obese than females.
Saudi nutritionist males and females	1.1(95% CI: 0.87-1.41, P=0.36)	There was no significant difference between males and females, with females being slightly less overweight and obese than males.
British and Saudi females	2.1(95% CI: 1.51-3.09, P<0.0001)	Saudi females were significantly more likely to be overweight and obese than British females.
British and Saudi males	3.1 (95% CI: 1.41-6.90, P=0.004)	Saudi males were significantly more likely to be overweight and obese than British males.
Saudi nutritionist males & females	1.1(95% CI: 0.87-1.41, P=0.3)	Male nutritionists were at a slightly higher risk for CVD and T2DM according to their BMI than Saudi nutritionist females, but this difference was not a major one (p=0.3).
Saudi public and nutritionist females	2.3(95% CI: 1.84-2.88, P<0.0001)	Saudi public females were significantly more likely to be overweight and obese than Saudi nutritionists, which makes them at a higher risk for CVD and T2DM.
Saudi public and nutritionists (both genders)	1.8(95% CI: 1.57-2.23, P<0.0001)	Saudi nutritionists were significantly more likely to be overweight and obese than the public, indicating that their professional knowledge does not seem to exert a protective effect on their personal choices.
Saudi and British (whole groups and gender combined)	2.3(95% CI: 1.72-3.29, P<0.0001)	Saudi participants were significantly more likely to be overweight and obese than British participants.

Relative risk test was used for the risk factors related to T2DM for Saudi and British participants (genders combined).

Table (4-11) Relative risk for T2DM risk factors for Saudi and British, public and nutritionists.

Group compared	Relative risk	Result
Saudi and British participants	1.85(95% CI: 1.20-2.84, P=0.004)	Saudi participants were significantly less active than British participants
Saudi and British participants	1.19 (95% CI: 1.03-1.37, P=0.016)	Saudi participants were significantly at higher risk for T2DM than British participants according to GL
Saudi and British participants	2.0(95% CI: 1.66-2.60, P<0.0001)	Saudi participants were significantly at higher risk for T2DM than British participants according to CF

4.5 CVD risk factors

The current study found alarming prevalence of CVD risk factors in Saudi participants. It was revealed that 96% of the Saudi male respondents to this survey had ≥3 CVD risk factors. Saudi females appear to be at a lower risk with between 23.5-40.3% of female Saudi respondents demonstrating ≥3 CVD risk factors. The common risk factors for Saudi males were based on a lack of the protective factors such as low intake of nuts (i.e. 94.6% did not consume nuts in the required portions), oily fish (94.6%) and vegetables (71.9%). For Saudi public females, the common factors included low intake of nuts (100%), oily fish (82.2%) and vegetables (80%). In Saudi nutritionist males, the commonest factor was the low intake of vegetables (100%) followed by nuts (96.7%) and among Saudi nutritionist females, low intake of nuts (97.7%) and oily fish (87.1%) were the commonest factors. Other CVD risk factors which are common in Saudis include; for Saudi public males, there is a high saturated fat intake (40%) and overweight (36%). Whereas, for Saudi public females, the CVD risk factors are also based on high saturated fat intake (45%) and GL (34.2%). For Saudi nutritionists, the males were overweight (71%) and had high saturated fat intake (35.4 %) while Saudi nutritionist females were overweight (57.1%) and high saturated fat intake as well (42.1%).

By comparison, British participants demonstrating ≥3 CVD risk factors ranged from a low of 6.9% (public female), to a high of 35.2% (public male). For British public males, the common risk factors were low intake of nuts (64.6%) and vegetables (41.1%). For public females, the common factors were low intake of oily fish (95.8%) and nuts (74.9%).

This study computed the proportion of the participants having scores from 0-8 of risk factors (BMI, physical activity, smoking, GL, processed meat, oily fish vegetable, nuts, saturated fat). Scores of 0-2 for low risk, 3-5 for medium risk and 6-8 for high risk were allocated. Table (4-12) shows the proportion by gender with CVD risk factors for all participants. Low intake of nuts, oily fish and vegetables were the main common protective risk factors, which were not consumed sufficiently in Saudi participants.

Table (4-12) Prevalence of CVD risk factors categories in Saudi and British participants.

	CVD risk factors		
	Low RF (0-2)	Medium RF (3-5)	High RF (6-8)
	N (%)	N (%)	N (%)
Saudi public male (75)	3(4)	62(82.6)	10(13.3)
Saudi public female (260)	155(59.1)	104(40)	1(0.3)
Saudi nutritionist male (31)	1(3.2)	28(90.3)	2(6.4)
Saudi nutritionist female (140)	107(67.4)	31(22.1)	2(1.4)
British public male (17)	11(64.7)	6(35.2)	0(0)
British public female (72)	67(93)	5(6.9)	0(0)

British nutritionist male (7)	5(71.4)	2(28.5)	0(0)
British nutritionist female (67)	58(86.5)	9(13.4)	0(0)

4.6 Qrisk2 calculator

Qrisk2 required information such as; age, smoking status, ethnicity, sex, height, weight and existence of any chronic diseases. There were few other questions required by Qrisk2 but were not included in the study questionnaire, so they were kept blank. Qrisk2 uses the average for the missing questions for the same age, sex and ethnicity. When information is added, the calculator gives an estimate of the risk of CVD for the person, in ten years, according to the information added. This is detailed in chapter 3. The Qrisk2 calculator placed all respondents in the same low category, which means that all respondents had a low risk of developing CVD in the next ten years. According to the Qrisk2 calculator, none of the participants are at a high risk of developing CVD. By comparing the categories of the Qrisk2 with the assessment of the FFQ, it appears there is a significant difference between the Qrisk2 and the FFQ assessment among all groups, as presented in table (4-13). The discrepancy in the categories of the Qrisk2 and the FFQ of this study might be because the FFQ focused on dietary habits, BMI and physical activity along with smoking status as a risk for CVD. Whereas for the Qrisk2 calculator, the main factors are; age, gender, ethnicity, smoking, BMI and illnesses related to CVD and are known as risk factors. The data collected in this study did not include some variables such as the illnesses related to CVD. Also, data on family history of CVD for the participants was missing. This explains the dissimilarity in the outcomes. Perhaps, if there was no data missing, the results might have been similar. In addition, Gary *et al*., (2014) examined Qrisk2 on local health employees who are free from diabetes and CVD. 371 females were included in the study, all of them older than 40 years if Caucasian or 25 years if South Asian. After analysis they found that <1% of the participants were at high risk of developing CVD and the majority were at the low risk category of CVD (96%) (Gray *et al*., 2014). All the participants of this study are at low risk category according to the Qrisk2. Having similar result to Gray *et al*., (2014) suggest that Qrisk2 does not discriminate the risk of CVD as the FFQ.

Table (4-13) Risk of CVD according to the Qrisk2 and FFQ for British and Saudi public and nutritionists.

Risk level of CVD	Low Qrisk2	Low FFQ	Medium Qrisk2	Medium FFQ	High Qrisk2	High FFQ	*P*
British public n=89	89(100%)	78(87.6%)	0(0%)	11(12.3%)	0(0%)	0(0%)	0.001
British nutritionists n=74	74(100%)	63(85.1%)	0(0%)	11(14.8%)	0(0%)	0(0%)	0.001
Saudi nutritionists n=171	171(100%)	108(63.1%)	0(0%)	59(34.5%)	0(0%)	4(2.3%)	0.000
Saudi public n=335	335(100%)	158(47.1%)	0(0%)	166(49.5%)	0(0%)	11(3.2%)	0.000

Table (4-14) Relative risk for CVD risk factors for Saudi and British, public and nutritionists.

Group compared	Relative risk	Result
Saudi and British participants	1.85(95% CI: 1.20-2.84, P=0.004)	Saudi participants were significantly less active than British participants
Saudi and British participants	3.8 (95% CI: 2.82-5.16, P<0.0001)	Saudi participants were significantly at a higher risk for CVD according to vegetable intake
Saudi and British participants	1.2 (95% CI: 1.17-1.39, P<0.0001).	Saudi participants were significantly at higher risk for CVD according to nuts intake
Saudi and British participants	2.4(95% CI: 1.70-3.40, P<0.0001).	Saudi participants were significantly at higher risk for CVD according to saturated fat intake
Saudi and British participants	2.73(95% CI: 1.19-6.26, P=0.01).	Saudi participants were significantly at higher risk for

CVD according to their smoking status

4.7 T2DM risk factors

The current study found that T2DM risk factors are prevalent, with 45.3% of Saudi public males, 22.1% of Saudi public females, 25.8% of Saudi nutritionist males and 26.4% of Saudi nutritionist females having ≥3 risk factors. Whereas, among British participants, only 5.8% of public males, 14.2% of nutritionist males and 7.4% of nutritionist females had ≥3 risk factors. This study computed the proportion of the participants as having scores from 0-8 of risk factors (BMI, physical activity, red meat processed meat, GL, and fibre). Scores of 0-2 for low risk, 3-5 for medium risk and 6-8 for high risk were allocated. Table (4-15) shows the proportion by gender with T2DM risk factors scores for all participants. The common risk factors in Saudi public males was due to high GL (53.3%) and overweight (36%). In Saudi public females, the common ones were inactivity (21.5%) and high GL (21.1%). In Saudi nutritionist males, the common factors were overweight (71%) and high GL (35.4%) and in Saudi nutritionist females, overweight (57.1%) and high GL 36.4% were the main factors.

Table (4-15) Prevalence of T2DM risk factor categories in Saudi and British participants.

	T2DM risk factors		
	Low RF (0-2)	Medium RF (3-5)	High RF (6)
	N (%)	N (%)	N (%)
Saudi public male (75)	41(54.6)	34(45.3)	0(0)
Saudi Public female (260)	202(77.6)	58(22.1)	0(0)
Saudi nutritionist male (31)	23(74.1)	8(25.8)	0(0)

Saudi nutritionist female (140)	103(73.5)	37(26.4)	0(0)
British public male (17)	16(94.1)	1(5.8)	0(0)
British public female (72)	72(100)	0(0)	0(0)
British nutritionist male (7)	6(85.7)	1(14.2)	0(0)
British nutritionist female (67)	62(92.5)	5(7.4)	0(0)

4.8 Qdiabetes categories

The Qdiabetes programme used information on the following; age, smoking status, ethnicity, sex, height, weight and existence of any chronic diseases. There were few other questions required by Qdiabetes but were not included in the study questionnaire, so they were kept blank. Qdiabetes uses the average for missing questions for the same age, sex and ethnicity. When information is added, the calculator gives an estimate risk of diabetes for the person in ten years according to the information added. This is further detailed in chapter 3.

Results of Qdiabetes risk calculators compared with the FFQ assessment for T2DM for participants were as following.

Table (4-16) Risk of T2DM according to Qdiabetes risk calculator and FFQ.

Risk category	Low (<10%) Qdiabetes	Low FFQ	Medium (10-19.9%)	Medium FFQ	High (≥20%)	High FFQ	*P*
British public n=89	88(99%)	88(99%)	0(0%)	1(1%)	1(1%)	0(0%)	N.S
British nutritionists n=74	74(100%)	68(91.8%)	0(0%)	6(8.1%)	0(0%)	0(0%)	0.003
Saudi nutritionists n=171	171(100%)	126(73.6%)	0(0%)	45(26.3%)	0(0%)	0(0%)	0.000
Saudi public n=335	332(99.1%)	243(72.5%)	3(0.8%)	92(27.4%)	0(0%)	0(0%)	0.000

Almost all British public (99%) and Saudi public (99.1%) members were in the low risk category. Only 1% of British public were in the high category and 0.8% of the Saudi public were in the medium category. All British and Saudi nutritionists were in the low risk category.

Qdiabetes result is similar to the result found by Gray and colleagues (2015), who compared the result of Qdiabetes with Leicester Risk Assessment (LRA), FINDRISC, and Cambridge Risk Score (CRS) algorithms. All of the participants were over 40 years if Caucasian or over 25 is South Asian and free from diabetes and CVD. They found that Qdiabetes calculator put most of the participants in the low risk category compared to other risk calculators (Gray *et al.*, 2015). According to our result almost all the participants were in the low category. Having similar results as Gray *et al.*, (2015), suggest that Qdiabetes does not discriminate the risk of diabetes as the FFQ.

By comparing the categories of the Qdiabetes with the assessment of the FFQ, it appears that there is significant difference between the Qrisk2 and the FFQ assessment among all the groups, as presented in table (4-16). The discrepancy between Qdiabetes and the FFQ might be because the FFQ focused on the dietary habits, BMI and physical activity. While, Qdiabetes focuses on age, gender, ethnicity, smoking BMI and illness related to T2DM. In addition, in this study there were some variables missing, such as the illnesses related to T2DM and the family history of T2DM. This explains the dissimilarity in the outcomes. Perhaps, if there was no data missing, the results might have been similar.

4.9 Discussion of CVD and T2DM for Saudi and British subjects

It is already determined that there is a significant difference in gender in KSA and the males are significantly more likely to be overweight or obese than the females among public, however, this is not the same amongst nutritionists. Overweight and obesity are also higher among Saudis than British people with being especially significant amongst Saudi males as compared to Saudi females. High BMI is also associated with high risk of CVD (Alqarni., 2016; ALquaiz *et al*., 2014; Ibrahim *et al*., 2014; Khattab *et al*., 1999**)** and T2DM (Elhadd *et al*., 2007) in KSA (Alqarni, 2016; Bahijri *et al*., 2016; DeNicola *et al*., 2015).

According to the results from the current study, as shown in table (4-9), nearly a third (29.4%) of British male (public) respondents engaged in vigorous physical activity while 40% of the Saudi male participants from the public claimed to do so. However, Saudi males significantly were more obese and overweight than British male participants. If the self-reported levels of physical activity are accurate, the difference in BMI between the two nationalities cannot be explained by differing levels of vigorous physical activity. If the self-reported activity levels are accurate, one would expect the Saudi males to be less likely to be obese or overweight than the British respondents, but the opposite appears to be the case. If the Saudi males are indeed as physically active as they claim, they must be over-eating in a much more severe manner to explain the levels of overweight and obesity. Other reasons could be that Saudi males are muscular and not obese, but the BMI measurements are unable to distinguish between the fat and muscles.

Saudi males smoke more than British people. This can be because in the UK there has been a history of many anti-smoking campaigns. Furthermore, there is a strict legislation laid on smoking with several restrictions on not selling any cigarettes to young children. In July 2007, smoking became prohibited in all enclosed work and public places, in the UK (Health Act, 2006). Furthermore, in 2015, a new legislation was issued for smokers carrying children in vehicles, which prohibited smokers to smoke in vehicles if there were any people aged under 18 years old. Also, it became illegal to sell electronic cigarettes to people aged less than 18 years (Department of Health, 2015). No such initiatives have been implemented in KSA and inhabitants may smoke in public or in their vehicles depending on their personal preferences.

4.10 Conclusion

The response rate of the questionnaires was high, which suggests that using electronic surveys for collecting data is a good way. Results of the repeated questions showed high correlations between the answers thus indicating a good internal consistency of the FFQ. Cronbach's alpha results of T2DM and CVD questions were high, which means there was a good internal reliability for the FFQ. Saudi participants were younger than British participants, which means that most of the users of SNS in KSA are young. Most of the participants from the UK and KSA have undergraduate or even postgraduate degrees, which means the participants are highly educated.

Saudis were found to be significantly more into smoking than British participants. There is a significant difference between the numbers of Saudi and British participants in terms of the BMI categories, with Saudis tending to be more overweight and obese than British participants. Saudi participants were significantly at a higher risk for CVD than British participants according to their BMI, smoking status, physical activity, GL, oily fish intake, vegetables intake, nuts intake and saturated fat intake. Saudi participants were also significantly at a higher risk for T2DM than British participants based on their BMI, physical activity level, GL and CF intake.

CHAPTER 5 – Dietary Patterns and Risk of Cardiovascular diseases and T2DM for Saudi male and female Participants

This chapter aims to provide a measure in terms of describing the dietary factors related to CVD and T2DM for Saudi public and nutritionist's male and female members with the use of a food frequency questionnaire sent through social networks. Also, this chapter analyses the differences in factors related to CVD and T2DM by gender.

5.1 Demographic and Anthropometric data

Table (5-1) summaries the anthropometric characteristic of all study participants using mean and standard deviation.

Table (5-1) Age and anthropometric characteristic of Saudi subjects (mean and (SD))

Variables	Saudi nutritionists female	Saudi public female	*P*	Saudi public male	Saudi nutritionists male	*P*
Number in groups	(n=140)	(n=260)		(n=75)	(n=31)	
Age range (years)	20-50	20-55		20-55	20-40	
Age mean (SD)	26.2(4.7)	26.5(5.3)	N.S	29.4(7.0)	26.7(4.2)	N.S
Height mean, cm,(SD)	159(10.4)	159(8.7)	<0.05	168(28.5)	172.4(6.4)	N.S
Weight, mean, kg,(SD)	59.1(10.7)	60(14.8)	N.S	81.6(17.9)	75.8(14)	<0.05
BMI mean kg/m^2 (SD)	23.1(3.8)	23.6(5.7)	<0.05	27(5.5)	25(3.8)	<0.05

SD: Standard Deviation. BMI: Body Mass Index.

Table (5-2) Age distribution of Saudi participants with the population of KSA

Age	20-25	26-30	31-35	36-40	41-45	46-50	>50
Saudi population N=20774906	2069706 (10%)	2058514 (10%)	1899773 (9.1%)	1663506 (8%)	1412750 (6.8%)	1119815 (5.3%)	2831518 (13.6%)
Saudi participants N=506	274 (54.1%)	127 (25.1%)	73 (14.4%)	19 (3.7%)	4 (0.7%)	6 (1.1%)	3 (0.5%)

(General authority for statistics, 2016)

5.2 Demographic and characteristics of Saudis

Table (5-2) shows the distribution of the sample of the study with the population of KSA. As it appears in the table, study sample between the age 20-25, 26-30 and 31-35 years are over represented in the Saudi sample compared to the national population. However, for the age range, 36-40, 41-45 and >50 years, the study samples were slightly under represented than the population. Table (5-3) summarises the demographic characteristic of Saudi public and nutritionists for both genders. There was a significant difference between Saudi male and female educational levels (P=0.000). Also, P value was significant if it was equal to or less than 0.008 for the six variables included in table (5-3). These variables were: education level, marital status, number of children, occupation, monthly income and socioeconomic status. This level of significance was determined by using a Bonferroni correction, known as post hoc test. Post hoc indicates the application of a correlation or a second test after the initial analysis to correct any errors. It is based on a familywise correction (Field, 2005). Bonferroni correction was used to reduce the chances of obtaining false positive results when multiple tests were performed on a single set of data.

For Saudi nutritionists, 100% of the male and female were (university qualified or even higher) educated. With regard to Saudi public marital status, there was a significant difference between genders and marital status.

Table (5-3) Demographic characteristics of Saudi participants by gender

Characteristic	**Saudi Public**				***P***	**Saudi nutritionists**				***P***
Gender	Male (n=75) %		Female (n=260) %			Male (n=31) %		Female (n=140) %		
Education level										
	No.	%	No.	%		No.	%	No.	%	
Illiterate	0	0	0	0		0	0	0	0	
Primary school	0	0	1	0.3	<0.008	0	0	0	0	N.S
Intermediate	0	0	2	0.7		0	0	0	0	
High school	8	10.6	49	18.8		0	0	0	0	
Technical	4	5.3	0	0		0	0	0	0	
Undergraduate	35	46.6	167	64.2		24	77.4	115	82.1	
postgraduate	28	37.3	41	15.7		7	22.5	25	17.8	
Marital status										
Single	37	49.3	170	65.3		20	64.5	98	70	
Married	38	50.6	77	29.6	<0.008	10	32.2	40	28.5	N.S
Divorced	0	0	9	3.4		1	3.2	2	1.4	
Widowed	0	0	0	0		0	0	0	0	
Separated	0	0	4	1.5		0	0	0	0	
Number of children										
0	42	56	190	73		24	77.4	107	76.4	
1	12	16	22	8.4		3	9.6	11	7.8	
2	7	9.3	19	7.3		2	6.4	11	7.8	
3	8	10.6	16	6.1	N.S	1	3.2	7	5	N.S
4	3	4	6	2.3		1	3.2	1	0.7	
More than 4	3	4	7	2.6		0	0	3	2.1	
Occupation										
Employ for wages	39	52	57	21.9		0	0	0	0	
Out of work and looking for a job	5	6.6	42	16.1		0	0	0	0	
Out of work and not looking for a job	3	4	17	6.5	<0.008	0	0	0	0	N.S
Self-employee	2	2.6	2	0.7		0	0	0	0	
Home maker	0	0	24	9.2		0	0	0	0	
Student	24	32	118	45.3		0	0	0	0	
Nutritionists, dietitian	0	0	0	0		31	100	140	100	
Soldier	1	1.3	0	0		0	0	0	0	
Retired	1	1.3	0	0		0	0	0	0	
Unable to work	0	0	0	0		0	0	0	0	
Monthly income in RS*										
Less than 3000	9	12	56	21.5		5	16.1	17	12.1	
3001-8000	10	13.3	81	31.1		8	25.8	47	33.5	
8001-13000	22	29.3	63	24.2		12	38.7	32	22.8	
13001-18000	22	29.3	24	9.2	<0.008	4	12.9	18	12.8	N.S
18001-23000	6	8	15	5.7		2	6.4	9	6.4	
More than 23000	6	8	21	8.0		0	0	17	12.1	
Socioeconomic status										
Low	9	12	56	21.5		5	16.1	17	12.1	
Medium	10	13.3	81	31.1	<0.008	8	25.8	47	33.5	N.S

High	56	74.6	123	47.3	18	58	76	54.2

N.S: not Significant
P<0.008; Significant
*Riyal Saudi (Currency 5.5 Riyal Saudi = £1)

With regard to the employment status of the public there was a significant difference between the males and females in Saudi Arabia (P=0.000).

5.2.1 Saudi Participants Socioeconomic factors

Education level and monthly income was used in classifying Saudi Participants' socioeconomic status, which is the same classification used by Almorai, 2014 for Saudi public members and there was a substantial difference observed among Saudi public males and females (P=0.000).

It is worth mentioning that for Saudi nutritionists, there was no significant difference between the socioeconomic status of Saudi nutritionists who were males as compared to those who were females (P=0.65).

5.3 Risk Factors related to CVD for Saudi

5.3.1 Comparison between genders

The commonness of cardiovascular disease risk factors among Saudi males and females is presented in table (5-4). The BMI was classified according to the WHO, (2000) classification, which was mentioned in detail in chapter 3, section 3.11.1. BMI values ranged from 16.5 to a maximum 35.5 kg/m² for both genders. One third of the Saudi male public (36%) was found to be overweight and about quarters (25.3%) was obese. In addition, there was a significant difference between the BMI values and genders among Saudi public (P=0.000) with more males being overweight and obese as compared to females.

Nearly three quarter (71%) of Saudi nutritionists who were males were overweight and 3.2% were obese. More than half of the female nutritionists were overweight (57%) and 20% were obese. There were no differences between BMI and genders among nutritionists (P=.33).

One third of the Saudi public males were smokers (33.3%), but only 4.6% of the females were smoker. There was a significant difference between smoking status and genders among Saudi public (P=0.000). Among Saudi nutritionists, the proportions were similar with 32.2% of the males and 3% of the females being smokers. Hence, there was a significant difference between smoking status and gender among Saudi nutritionists as well (P=0.000).

Physical activity levels were assessed using the short form of International Physical Activity Questionnaire (IPAQ), which is described in detailed in chapter 3, section 3.11.2, table (3-4). Nearly one third (30.6%) of the Saudi public males and one fifth (21.5%) of the females were inactive according to their responses in the IPAQ. There were no significant differences between gender and physical activity levels among Saudi public members (P=0.20). For Saudi nutritionists, 26% of the males and 24.2% of the females were inactive. Again, there were no major differences between gender and physical activity levels (P=0.89).

GL was used to assess the risk of CVD according to Liu *et al*., (2000) for females and Levitan *et al*., (2007) for males, as described in chapter 2, section 2.4 tables (2-4). Based on the obtained glycaemic loads, 34.6% of the Saudi public males and 51.5% of the Saudi public females were at a low risk of CVDs. Significantly higher percentage of Saudi female public were at low risk for CVD according to their GL intake (P=0.000) compared with the male respondents. For Saudi nutritionists, there were no major differences between GL and gender (P=0.44). 19.3% of the males and 30% of the females were found to be in the high-risk category.

Table (5-4) Cardiovascular disease risk factors for Saudi participants by gender

Characteristic	**Saudi Public**					**Saudi nutritionists**				
Gender	**Male (n=75)**		**Female (n=260)**		***P***	**Male (n=31)**		**Female (n=140)**		***P***
BMI Classification	No.	%	No.	%		No.	%	No.	%	
Underweight	4	5.3	28	10.7	<0.005	2	6.4	19	13.5	N.S
Normal	25	33.3	157	60.3		6	19.3	28	20	
Overweight	27	36	45	17.3		22	71	80	57.1	
Obese	19	25.3	30	11.5		1	3.2	13	9.2	
Smoking Status										
Non-smoker	50	66.6	248	95.3	<0.005	21	67.7	136	97	<0.005
Smoker	25	33.3	12	4.6		10	32.2	4	3	
Physical activity level										
Low	23	30.6	56	21.5	N.S	8	26	34	24.2	N.S
Moderate	22	29.3	75	29		12	38.7	50	35.7	
Vigorous	30	40	129	49.6		11	35.4	56	40	
GL as risk for CVD										
Low	26	34.6	134	51.5	<0.005	20	64.5	82	58.5	N.S
Medium	27	36	37	17.2		5	16.1	16	6.6	
High	22	29.3	89	34.2		6	19.3	42	30	
Processed meat										
Low	74	98.6	260	100	N.S	31	100	140	100	N.S
High	1	1.3	0	0		0	0	0	0	
Oily fish										
Low	4	5.3	46	17.6	N.S	3	9.6	18	12.8	N.S
High	71	94.6	214	82.2		28	90.2	122	87.1	
Nuts										
Low	4	5.3	0	0	<0.005	1	3.2	3	2.1	N.S
High	71	94.6	260	100		30	96.7	137	97.7	
Vegetable										
Low	21	28	52	20	N.S	0	0	30	21.4	<0.005
High	54	71.9	208	80		31	100	110	78.5	
Saturated fat										
Low	45	60	143	55	N.S	20	64.5	81	57.8	N.S
High	30	40	117	45		11	35.4	59	42.1	

N.S: not Significant, P<0.005 variables were compared to *t* test

Processed meat was used to classify the participants according to Micha *et al*., (2012) as described in chapter 2, section 2.4, tables (2-4). Only 1.3% of the Saudi public males were at a high-risk category using this indicator. Among Saudi public members, there were no differences between gender and intake of processed meat. Also, there were no differences between gender and intake of processed meat among Saudi nutritionists.

Oily fish intake classification for CVD was used based on He *et al*., (2004b), as described in chapter 2, section 2.4, tables (2-4). 94.6% of the males and 82.2% of the females were found to be in the high-risk category. Amongst Saudi public members, there were no differences between oily fish intake and gender (P=0.008). Among Saudi nutritionists, 90.2% of the males and 87.1% of the females were at high risk category. Again, there were no differences between oily fish intake and gender for this category (P=0.85).

Nuts association with CVD intake and categories was assessed according to Luo *et al*., (2014), as mentioned in chapter 2, section 2.4 table (2-4). None of the Saudi public females consumed nuts daily while 5.3% of the males did. Thus, females were significantly at a high risk of developing CVDs according to their nut's intake (P=0.002). Among Saudi nutritionists, there were no differences between the intake of nuts and gender (P=1.0).

The intake of vegetables was assessed according to Liu *et al*., (2001), as briefed in chapter 2, section 2.4, tables (2-4). Among Saudi public members, there were no differences between genders and intake of vegetables (P=0.13). Saudi nutritionists who were males were significantly at a higher risk of developing CVDs than females, based on their intake of vegetables (P=0.005), with 100% of the males consuming less than 2.5 portion/day.

Saturated fat is classified as a high-risk factor for developing CVDs if it is consumed more than 11% in terms of the overall calories. In the UK, the daily recommendation for males and females according to the Dietary reference values is not more than 11% of the total calories consumed. For Saudi public members, 40% of the males and 45% of the females were at found to be in the high-risk category based on the saturated fat intake. Also, there were no differences between genders and the intake of saturated fat (P=.44). For Saudi nutritionists, 35.4% of the males and 42.1% of the females were at high risk category in terms of the saturated fat intake. Hence, there were no major differences between the genders and intake of saturated fat among Saudi nutritionists (P=0.49).

5.3.2 Comparison between public and nutritionists

Table (5-5) summaries the difference between Saudi public members and nutritionists in terms of CVD risk factors. Among Saudi males, there was a significant difference in the BMI between public members and the nutritionists (P=0.002). Nearly three quarter of nutritionists (71%) were overweight as compared to 36% of the public members. However, in terms of obesity, a different trend was observed where more than quarter of the public members were obese (25.3%) while only 3.2% of nutritionists were obese

There was no difference in smoking status among Saudi public and nutritionists' males (P=0.91), where 66.6% and 67.7% were smokers, respectively.

There were no major differences between public and nutritionists' physical activity levels (P=0.64). A third of the public (30.6%) and 26% of nutritionists were found to be inactive. On the contrary, about 40% of public members and 35.4% of nutritionists were engaged in vigorous activities.

For GL, there were no differences between the public members and nutritionists (P=0.01), with more than a third of the public (34.6%) and 64.5% of nutritionist consuming low GL foods. Also, nearly a third of public members and 19.3% of nutritionists were consuming high GL foods.

For processed meat, oily fish and nuts, there were no differences on the intake of public and nutritionists' males, i.e. P=0.40, P=0.42 and P=1.0, respectively.

However, in the intake of vegetables, there was a significant difference between public and nutritionists (P=0.001). Nearly a third of public members were in the low risk while none of nutritionist males were. In addition, 71.9% of public and 100% of nutritionists were found to be in the high-risk category.

In terms of the saturated fat intake, there were no differences between public and nutritionists (P=0.66). For Saudi males 40% of the public members and 35.4% of nutritionists were in the high-risk category.

Among females, there was a significant difference between public and nutritionists with more nutritionists than public members being overweight (57.1% and 17.3%, respectively) (P=0.000).

According to the smoking status of females, there were no differences between public and nutritionists (P=0.39). Only 4.6% of the public and 3% of nutritionists were smoking.

Physical activity levels for Saudi females showed no differences among the public and nutritionists (P=0.17). 21.5% of the public and 24.2% of nutritionists were inactive. Also, nearly half of public (49.6%) and 40% of nutritionists were sufficiently active.

There were no differences of GL food intake of public and nutritionists females (P=0.39). Half of the public (51.5%) and 58.5% of nutritionists were in low risk category. More than a third of public (34.2%) and 30% of nutritionists were consuming high GL foods.

The intake of processed meat, oily fish and nuts showed no differences between Saudi female public members and nutritionists, i.e. P=1.0, P=0.20 and P=0.07, respectively.

There were no differences in the intake of vegetables between Saudi females' public members and nutritionists (P=0.73), (20%) of public and (21.4%) of nutritionists were at low risk category. Also, there were no differences in the intake of saturated fat among public and nutritionists Saudi females (P=0.01).

Table (5-5) Cardiovascular disease risk factors for Saudi participants by occupation

Characteristic	**Saudi males**					**Saudi females**				
Gender	**Public (n=75)**		**Nutritionist (n=31)**		***P***	**Public (n=260)**		**Nutritionist (n=140)**		***P***
BMI Classification	No.	%	No.	%		No.	%	No.	%	
Underweight	4	5.3	2	6.4	<0.005	28	10.7	19	13.5	<0.005
Normal	25	33.3	6	19.3		157	60.3	28	20	
Overweight	27	36	22	71		45	17.3	80	57.1	
Obese	19	25.3	1	3.2		30	11.5	13	9.2	
Smoking Status										
Non-smoker	50	66.6	21	67.7	N.S	248	95.3	136	97	N.S
Smoker	25	33.3	10	32.2		12	4.6	4	3	
Physical activity level										
Low	23	30.6	8	26	N.S	56	21.5	34	24.2	N.S
Moderate	22	29.3	12	38.7		75	29	50	35.7	
Vigorous	30	40	11	35.4		129	49.6	56	40	
GL as risk for CVD										
Low	26	34.6	20	64.5	N.S	134	51.5	82	58.5	N.S
Medium	27	36	5	16.1		37	17.2	16	6.6	
High	22	29.3	6	19.3		89	34.2	42	30	
Processed meat										
Low	74	98.6	31	100	N.S	260	100	140	100	N.S
High	1	1.3	0	0		0	0	0	0	
Oily fish										
Low	4	5.3	3	9.6	N.S	46	17.6	18	12.8	N.S
High	71	94.6	28	90.2		214	82.2	122	87.1	
Nuts										
Low	4	5.3	1	3.2	N.S	0	0	3	2.1	N.S
High	71	94.6	30	96.7		260	100	137	97.7	
Vegetable										
Low	21	28	0	0	<0.005	52	20	30	21.4	N.S
High	54	71.9	31	100		208	80	110	78.5	
Saturated fat										
Low	45	60	20	64.5	N.S	143	55	81	57.8	N.S
High	30	40	11	35.4		117	45	59	42.1	

N.S: not Significant, P<0.005 variables were compared to t test

5.4 Factors related to T2DM for Saudi

5.4.1 Comparison between genders

GL was classified according to Salmeron *et al*., 1997a; Salmeron *et al*., 1997b; Willett *et al*., 2002, as mentioned in chapter 2, section 2.4, table (2-4). For Saudi public members, 53.3% of the males and 21.1% of the females were found to be in the high-risk category. Males were significantly at a higher risk for T2DM (P=0.000), according to GL. Among Saudi nutritionists, 35.4% of the males and 36.4% of the females were in the high-risk category. There were no differences between GL and genders (P=0.52).

Table (5-6) T2DM risk factors for Saudi participants by genders

Characteristic	Saudi Public					Saudi nutritionists				
Gender	**Male (n=75)**		**Female (n=260)**		***P***	**Male (n=31)**		**Female (n=140)**		***P***
	No.	**%**	**No.**	**%**		**No.**	**%**	**No.**	**%**	
BMI Classification										
Underweight	4	5.3	28	10.7	<0.008	2	6.4	19	13.5	N.S
Normal	25	33.3	157	60.3		6	19.3	28	20	
Overweight	27	36	45	17.3		22	71	80	57.1	
Obese	19	25.3	30	11.5		1	3.2	13	9.2	
Physical activity level										
Low	23	30.6	56	21.5	N.S	8	26	34	24.2	N.S
Moderate	22	29.3	75	29		12	38.7	50	35.7	
Vigorous	30	40	129	49.6		11	35.4	56	40	
GL										
Low	15	20	87	33.4	<0.008	8	25.8	48	34.2	N.S
Medium	20	26.6	118	45.3		12	38.7	41	29.2	
High	40	53.3	55	21.1		11	35.4	51	36.4	
CF										
Low	15	20	100	38.4	N.S	11	35.4	21	15	N.S
Medium	37	49.3	112	43		13	41.9	69	49.2	
High	23	30.6	48	18.4		7	22.5	50	35.7	
Red meat										
Low	65	86.6	245	94.1	N.S	27	87	126	90	N.S
High	10	13.8	15	5.7		4	12.9	14	10	
Processed meat										
Low	74	98.6	260	100	N.S	31	100	140	100	N.S
High	1	1.3	0	0		0	0	0	0	

N.S: not significant, BMI: body mass index, GL: glycaemic load, CF: cereal fibre, T2DM; type 2 diabetes, P<0.008 variables were compared to t test

CF was used to assess the risk of T2DM according to Salmeron *et al*., 1997a; Salmeron *et al*., 1997b; Willett *et al*., 2002, as detailed in chapter 2, section 2.4, table (2-4). A third of the public males (30.6%) and 18.4% of the females were in the high-risk category. For nutritionists, 22.5% of the males and 35.7% of the females were in the high-risk category. Among Saudi public members and Saudi nutritionists, there were no differences between gender and intake of CF.

Red meat was classified according to Aune *et al*., 2009, as mentioned in chapter 2, section 2.4, table (2-4). Also, 13.8% of the public males and 5.7% of the females were in the high-risk category for T2DM. There was a significant difference between gender and intake of red meat (P=0.02). Among Saudi nutritionists, there were no differences between red meat intake and gender (P=0.63), with 12.9% of the males and 10% of the females being in the high-risk category for T2DM.

Processed meat was classified according to Micha *et al*., 2012, as briefed in chapter 2, section 2.4, tables (2-4). Amongst Saudi public members, there were no differences between gender and processed meat intake. Also, amongst Saudi nutritionists there were no differences.

5.4.2 Comparison between public and nutritionists

GL foods intake showed no differences between Saudi male public members and nutritionists (P=0.24). About 20% of public and 25.8% of nutritionists were in the low risk category. Among females, there was a significant difference in the intake of GL foods (P=0.000) with more public members being at high risk than nutritionists, i.e. 55% and 36.4%, respectively.

CF intake showed no differences among public and nutritionists males (P=0.23), where 20% of the public members and 35.4% of nutritionists were in the low risk category.

30.6% of public and 22.5% of nutritionists were in the low risk category. However, among female public members and nutritionists, there was a significant difference (P=0.000) with more public members than nutritionists being at low risk, i.e. 38.4% compared to 15%, respectively. More nutritionists were in the high-risk category than public members, i.e. 35.7% and 18.4%, respectively.

Table (5-7) T2DM risk factors for Saudi participants by occupation

Characteristic	**Saudi males**					**Saudi females**				
Gender	**Public (n=75)**		**Nutritionist (n=31)**		***P***	**Public (n=260)**		**Nutritionist (n=140)**		***P***
	No.	**%**	**No.**	**%**		**No.**	**%**	**No.**	**%**	
BMI Classification										
Underweight	4	5.3	2	6.4	<0.008	28	10.7	19	13.5	<0.008
Normal	25	33.3	6	19.3		157	60.3	28	20	
Overweight	27	36	22	71		45	17.3	80	57.1	
Obese	19	25.3	1	3.2		30	11.5	13	9.2	
Physical activity level										
Low	23	30.6	8	26	N.S	56	21.5	34	24.2	N.S
Moderate	22	29.3	12	38.7		75	29	50	35.7	
Vigorous	30	40	11	35.4		129	49.6	56	40	
GL										
Low	15	20	8	25.8	N.S	87	33.4	48	34.2	<0.008
Medium	20	26.6	12	38.7		118	45.3	41	29.2	
High	40	53.3	11	35.4		55	21.1	51	36.4	
CF										
Low	15	20	11	35.4	N.S	100	38.4	21	15	<0.008
Medium	37	49.3	13	41.9		112	43	69	49.2	
High	23	30.6	7	22.5		48	18.4	50	35.7	
Red meat										
Low	65	86.6	27	96	N.S	245	94.1	126	90	N.S
High	10	13.8	4	12.9		15	5.7	14	10	
Processed meat										
Low	74	98.6	31	100	N.S	260	100	140	100	N.S
High	1	1.3	0	0		0	0	0	0	

N.S: not significant, BMI: body mass index, GL: glycaemic load, CF: cereal fibre, T2DM; type 2 diabetes, P<0.008 variables were compared to t test

According to the intake of red meat, there were no differences between Saudi public members and nutritionist males (P=1.00), with 13.8% of public members and 12.9% of nutritionists being at a high risk. Among females, there were no differences between public members and nutritionists (P=0.12) with 5.7% of public members and 10% of nutritionists being in the high-risk category.

Processed meat among males in the public and nutritionists suggests no differences (P=0.66). This was also the trend found amongst female public members and nutritionists (P=0.01).

Table (5-8) GL and portion numbers of some food types related to T2DM and CVD (mean and (SD))

Variables	Saudi nutritionist's		Saudi public	
	female	male	female	male
GL mean/day	140.2(72.8)	179.7(68.9)	155.1(71.4)	210(78.6)
CF(g)	5.9(4.3)	7.9(7.1)	6.2(4.6)	5.9(5.1)
Red meat	0.2(0.6)	0.4(0.9)	0.3(1.0)	0.4(0.8)
Processed meat	0.1(0.1)	0.07(0.1)	0.1(0.1)	0.1(0.2)
Vegetable serving	0.1(0.1)	0.7(0.6)	1.2(1.0)	0.7(1.0)
Oily fish	0.18(0.2)	0.12(0.2)	0.18(0.3)	0.09(0.2)
Saturated fat (g)	24.8(13.7)	32.2(18.5)	25(13)	29(14.3)
Nuts	.07(0.1)	0.1(0.2)	0.06(.09)	0.1(0.4)

SD: Standard Deviation. GL: GL. (<0.1 1-3 month or less, 0.1: once week, 0.2-0.3: 2-3 week, 0.4- 0.5: 4-5 week)

Table (5-8) summaries the portion numbers and GL mean for Saudi Participants. As it appears from the table, Saudi public males consumed the highest GL diet (mean 210) followed by Saudi nutritionist males (mean 180). Saudi public males and Saudi nutritionists female had the lowest intake based on CF (mean 5.9g/day). The highest intake of fibre was among Saudi nutritionist males with 7.9g/day. Comparing the intake of vegetables, Saudi public females had the highest mean intake with 1.2 portion/day, which is considered low intake according to the daily recommended requirements. Saudi nutritionist females also had the lowest intake with 0.1portion/day of vegetables. Saudi nutritionist males had the highest intake from saturated fat (mean 32.2g/d). The lowest intake was among Saudi nutritionist females with 24.8g/day.

5.5 Obesogenic Questions

Nine questions which related to foods often associated with overconsumption and resulting overweight were selected as a group and medians were calculated for the percentage of Saudi public and nutritionists in each consumption category. The questions which used were based on desserts, fast food, white bread, sweets, chocolate, traditional Saudi food, ice cream, biscuits, and crisps intake. The questions can be found in appendix C5. The median of the answers of the participants was calculated for each question (as presented in the Tables in Appendix C5). Next, Mann Whitney test was used to check if there was a significant difference between the two groups. It was found that there is no significant difference between the consumption of the Saudi public members and nutritionists in terms of these types of foods (P= 0.87).

5.6 Relationship of foods related to CVD and T2DM with age, BMI, smoking and socioeconomic status

In terms of food intake related to CVD and T2DM, tables 4.9, 4.10, 4.11 and 4.12 show the correlation coefficients of food intake with age, BMI, smoking and socioeconomic status.

Among Saudi public males, as shown in table 5.9, there was a statistically significant negative association for educational levels with GL, in terms of traditional Saudi food and fast-food intakes (i.e. P=0.001, P=0.01, P=0.04, respectively). Age was negatively associated with fast-food intake (P=0.001). BMI was significantly related to GL and traditional Saudi food intake (P=0.009, P= 0.000, respectively).

Among Saudi public females (table 5.10), age was negatively associated with GL, saturated fat, CF, traditional Saudi food and fast-food intake (i.e. P=0.02, P=0.03, P=0.01, P=0.01, P=0.03, respectively).

Among Saudi nutritionist males (table 5.11), age was negatively associated with fast-food intake (P=0.03) and smoking was associated with fast-food intake (P=0.04).

Among Saudi nutritionists females (table 5.12), education was negatively associated with processed meat intake (P=0.005). Income was negatively related with vegetable intake (P=0.03). However, it was positively associated with intake of processed meat (P=0.002), as expected

Table 5.9: Correlation coefficients between intakes of food related to CVD and T2DM with socioeconomic factors and CVD risk factors in Saudi public males

Factors	GL		Processed meat (portion)		Oily fish (portion)		Nuts (portion)		Vegetable (portion)		Saturated fat (g)		Red meat (portion)		CF (g)		Traditional Saudi meal (portion)		fast-food (portion)	
	r	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***
Age	-.702	.075	-.111	.344	.103	.378	.027	.821	.064	.585	-.173	.138	-.110	.347	-.040	.733	-.003	.983	**-.380**	**.001**
Education	**-.367**	**.001**	-.148	.206	-.028	.815	-.162	.165	-.143	.222	-.131	.263	-.022	.848	-.091	.436	**-.292**	**.011**	**-.234**	**.044**
Income	-.104	.375	-.203	.080	-.041	.727	-.125	.287	.023	.847	-.164	.158	-103	.380	-.009	.938	.133	.256	-.100	.392
BMI	**.300**	**.009**	.050	.672	**-.222**	**.055**	-.214	.065	-.046	.692	-.063	.592	-.018	.876	.068	.561	**.469**	**.000**	.134	.251
Smoking	.215	.064	-.046	.694	.018	.876	-.019	.874	.042	.721	.052	.659	-.177	.130	.105	.372	.161	.167	.103	.378

Table 5.10: Correlation coefficients between intakes of food related to CVD and T2DM with socioeconomic factors and CVD risk factors in Saudi public females

Factors	GL		Processed meat (portion)		Oily fish (portion)		Nuts (portion)		Vegetable (portion)		Saturated fat (g)		Red meat (portion)		CF (g)		Traditional Saudi meal (portion)		fast-food (portion)	
	r	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***
Age	**-.137**	**.027**	-.040	.519	.052	.405	-.095	.127	-.072	.256	**-.130**	**.037**	-.008	.904	**-157**	**.011**	**-.161**	**.010**	**-.135**	**.030**
Education	-.076	.221	.043	.488	-.036	.567	-.083	.545	-.046	.456	-.096	.122	.073	.242	.001	.988	-.083	.181	-.011	.856
Income	.001	.985	-.034	.583	-.033	.593	.104	.093	-.084	.177	-.016	.800	.107	.087	.032	.608	.024	.703	-.034	.589
BMI	.039	.533	.095	.128	-.032	.611	-.020	.749	-.098	.113	.074	.233	.085	.128	-.085	.174	.003	.957	.020	.745
Smoking	-.027	.668	.061	.331	.025	.690	-.001	.988	.037	.555	.044	.480	.074	.237	-.033	.595	-.015	.814	.053	.398

Table 5.11: Correlation coefficients between intakes of food related to CVD and T2DM with socioeconomic factors and CVD risk factors in Saudi nutritionist males

Factors	GL		Processed meat (portion)		Oily fish (portion)		Nuts (portion)		Vegetable (portion)		Saturated fat (g)		Red meat (portion)		CF (g)		Traditional Saudi meal (portion)		fast-food (portion)	
	r	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***
Age	-.073	.696	-.026	.889	.070	.709	-.153	.412	.122	.513	-.111	.552	.170	.362	-.149	.424	.194	.295	**-.388**	**.031**
Education	-.165	.374	.137	.464	.087	.641	-.158	.395	-.202	.275	-.224	.227	.117	.531	.045	.808	.024	.898	-.264	.152
Income	.022	.908	-.057	.763	-.018	.925	-.095	.610	.057	.759	.159	.393	.058	.758	.083	.656	.159	.392	-.138	.459
BMI	.189	.309	.247	.181	-.216	.243	.015	.937	.084	.654	.117	.532	.255	.167	.119	.524	-.041	.827	.218	.238
Smoking	.170	.362	.190	.306	.063	.738	.040	.832	.267	.133	-.105	.574	.183	.325	-.307	.093	.026	.091	**.369**	**.041**

Table 5.12: Correlation coefficients between intakes of food related to CVD and T2DM with socioeconomic factors and CVD risk factors in Saudi nutritionist's female

Factors	GL		Processed meat (portion)		Oily fish (portion)		Nuts (portion)		Vegetable (portion)		Saturated fat (g)		Red meat (portion)		CF (g)		Traditional Saudi meal (portion)		fast-food (portion)	
	r	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***
Age	-.111	.193	.052	.544	-.065	.448	.051	.547	.029	.729	-.070	.409	.014	.870	-.150	.077	-.052	.539	-.097	.256
Education	-.134	.114	**-237**	**.005**	.070	.412	-.075	.377	-.073	.393	-.100	.240	.034	.687	-.029	.730	-.085	.316	-.104	.222
Income	.052	.542	**.257**	**.002**	-.163	.054	-.001	.988	**-.179**	**.035**	.037	.665	.089	.294	.010	.904	.079	.352	.131	.123
BMI	.092	.279	.046	.593	.039	.651	.075	.381	-.081	.340	.055	.518	.124	.144	.087	.304	-.092	.282	.074	.386
Smoking	.041	.630	.162	.055	.015	.856	-.020	.812	.058	.496	.002	.979	.061	.471	-.109	.200	.094	.268	.059	.490

5.7 Discussion of CVD and T2DM for the Saudi sample

This study sample was received from Saudi participants using social media. In total, 506 participants in the age range of 20-55 years of both genders (106 male and 400 female) were included in the study. More females than males contributed in this study. According to Saleh and Bista (2017), female contribute in electronic surveys more than males. Males would contribute if the surveys are kept short and if are repeatedly reminded.

These results of BMI in this study were close to the data obtained from a national study by Memish *et al*. (2014) in number of categories. The national study included 10,735 Saudi participants aged 15 and over from different areas in KSA. The study found 35.4% of males and 32.3% of females being normal weight. This is similar to the finding of this current study where 29.2% of females and 32.7% of males were in normal weight. The occurrence of overweight in the present study was 31.2% and 47.7% among females and males, respectively. Memish and colleagues (2014) found 28% of males and 33.4% of females being overweight, where results were close to the finding of this current study in terms of females, but for males, the findings of this current study are slightly higher. However, obesity prevalence was higher than this study with 24.1% for males and 33.4% of females being obese in Memish's study as compared to this study, where 10.7% of females and 18.8% of males were found to be obese. However, this does not support the result of the literature (Al-Almaie, 2005; Al-Daghri *et al*., 2014; Al-Haqwi *et al*., 2015; Al-Malki *et al*., 2003; Al-Shammari *et al*., 2001; Mahfouz *et al*., 2011), which indicated that females are more obese than males in KSA. It is worth mentioning that overweight and obesity increases the risk of T2DM (Alqurashi *et al*., 2011; Abolfotouh *et al*., 2001; Ahmed *et al*., 2014; Al-Haramlah *et al*., 2015; Al-Nozha *et al*., 2004b; Al-Nuaim., 1997; Al-Quaiz *et al*., 2014; Horaib *et al*., 2013; Osman and AL-Nozha., 2000; Colditz *et al*., 1990; El-Hamzi and Warsy, 1999) and CVD (Li *et al*., 2006) among Saudis (Alqarni., 2016; ALquaiz *et al*., 2014; Ibrahim *et al.*, 2014; Khattab *et al*., 1999).

Smoking among Saudi males was significantly higher than Saudi females, with 33% of the males and 4% of the females being smokers. This is also supported by the literature which states that smoking among men in KSA is 13-38% and among women is 1-16% (median 9%) (Bassiony, 2009). A number of studies (Al-Nozha *et al*., 2009; AlSwuailem *et al*., 2014; Bassiony 2009) found that males are significantly more involved with smoking than females in KSA. Smoking increases the risk of CVD (AlSwuailem *et al*., 2014; Alissa *et al*., 2005a; Al-Quaiz *et al*., 2014; BHF, 2016; Stampfer *et al*., 2000). Also, it seems that those Saudi males who smoke are heavy smokers as compared to Saudi females, according to the current study. This could be due to the fact that smoking among females in KSA is still socially unacceptable (Koura *et al*., 2011). However, certain groups such as university students mentioned above (Hashim, 2009; Merdad *et al*., 2006) are ignoring these taboos. This could be based on the fact that they have more intellectual freedom and less strict rules in universities than schools.

A third of the Saudi males and nearly quarter of the Saudi females are inactive, which is supported by the literature (Al-Nuaim *et al*., 2012) for males but not for females. The results of this study show that females are slightly more active than males. Physical inactivity is associated with the risk of developing CVDs, (Alqarni., 2016; Alquaiz *et al*., 2014; Ibrahim *et al*., 2014; Khattab *et al*., 1999) and T2DM (Midhet *et al*., 2010a).

More Saudi males were inactive than females, with females found to be more engaged in vigorous physical activity than males, which is also supported by the literature (Al-Hazzaa *et al*., 2012), suggesting that there is an inverse relation between vigorous physical activity and overweight and obesity. The results obtain in this current study for the Saudi public members' physical activity using the IPAQ can be compared with the result of Al-Hazzaa, (2007). According to Al-Hazzaa, 43.7% of the male were engaged in low intensity physical activity whereas the current study shows that 30.6% of the Saudi public participants were engaged in low intensity physical activities. 36.5% of the males in Al Hazzaa's study were doing moderate physical activity compared to the 29.3% of the Saudi male participants in this study. 19.8% of the male in Al- Hazzaa's study were engaged in vigorous physical activity as compared to the 40% of the male participants in this study. It would appear from these results that a larger proportion of Saudi males are now engaged in vigorous physical activity than they were at the time of Al-Hazzaa's study in 2007, while a smaller proportion are engaged in low or moderate activity. However, this does not seem to explain the BMI results as it appears that although their self-reported physical activity seems to be improving, Saudi males are still 36% overweight and 25.3% obese. It might be that the participants were exaggerating or over reporting their physical exercise levels. Also, it might be that they were correctly reporting their physical exercise levels, but BMI levels cannot provide the difference between fat and muscle, so the participants might be muscular.

The results Al-Hazzaa's (2007) study for the females showed that 34.3% of the females were inactive compared to the 21.5% of the female participants in this study. About a third of the females (30.1%) in Al-Hazzaa's study were engaged in moderate physical activity, which is not far from the current results of 29%. Also, 35.6% of the females were reported to be engaged in vigorous physical activity in Al-Hazzaa's study as compared to the 49.6% females in this current study. It seems from the results of the Saudi females that the trend is similar to the males, as a higher proportion of Saudi female participants were reporting to be engaged in vigorous physical activity compared with Al-Hazzaa's results from 2007. Similar to the male participants, they were less engaged in moderate physical activity or were inactive. However, according to the present results for females, a large proportion of respondents were both, overweight or obese with 29% of the Saudi public members and 66% of the Saudi nutritionists.

The discrepancy in the results for the females with those found by Memish *et al* (2014) might be due to most Saudi female participants being young. Since the study was performed using social media, most of the users of the social media tend to be young according to Lau *et al.*, 2016. One of the outcomes of having skewed sample groups towards the young may mean we are also under representing obesity among females, by this means under estimating the potential for diabetes. However, the current study does not under represent the obese men, which is significant; although the sample is skewed to the young there are a substantial and representative number of obese men in the sample that might have implications for the future in terms of diabetes development in KSA.

A third of Saudi public males and females along with Saudi nutritionist females were in the high-risk category of GL intake, which is related to the risk of CVDs, as literature suggests (Levitan *et al*., 2007; Liu *et al*., 2000).

For the GL category related to T2DM, more than half of the Saudi public males were in the high category compared to 35.4% of the Saudi nutritionist males and 36.4% of the females, which means that the Saudi public males demonstrated the highest risk in the current sample groups for T2DM using this indicator (Salmeron *et al*., 1997a; Salmeron *et al*., 1997b; Willett *et al*., 2002). According to Salmeron *et al.* (1997a), the study included 65,173 nurses and found women in high quintile with a 40% higher risk of T2DM than women in low quintile. Alqurashi and colleagues (2011) reported males are at higher risk for T2DM than females in KSA. The study included 6024 patients attending primary care clinic with a mean age of 55.3(13.2) years. Prevalence of T2DM among the patients was

34.1% in males and 27.6% in females. This could be since males were slightly older than females, i.e. 57.5(13.1) and 53.4 (13.1) years, respectively.

The intake of CF shows that a third of the Saudi males in public and Saudi female nutritionists are at the high risk of T2DM (Meyer *et al*., 2000; Salmeron *et al*., 1997a; Salmeron *et al*., 1997b; Willett *et al*., 2002). Salmeron *et al.* (1997a) found that women with high intake of cereal fibre had a 27% lower risk of T2DM.

As the intake of CF is low among Saudi public males and Saudi nutritionist females, it is obvious that more than two third of them were overweight or obese. The highest intake of fibre was among Saudi public females (more than the third) and two third of them were in the normal BMI, which is also supported by the literature (Howarth *et al*., 2001) that suggests the high consumption of fibre is inversely associated with weight gain but not for Saudi male nutritionists.

Saudi nutritionists female were consuming low amount of vegetables followed by Saudi public males and nutritionists where the highest intake of vegetable in Saudis was among the Saudi public females. Saudi public females had the lowest overweight and obesity ratios compared to all Saudi groups. This is also supported by the literature (Abdul-Mageid *et al*., 2011; Amin *et al*., 2008; Horaib *et al*., 2013), which suggested that there is a positive relation between vegetable intake and being in the normal BMI range.

The result of this study adds to the current evidence suggesting that food intake might have an effect on CVD factors and is impacted by socioeconomic factors such as education and age. Higher education was negatively associated with GL (P=0.001), traditional Saudi food (P=0.01) and fast-food intake (P=0.04) in Saudi public males. Also, among Saudi public females, education was negatively associated with processed meat intake (P=0.005). This suggests that lower education leads to the consumption of high energy and dense foods.

There was a negative relation between age and fast-food intake (P=0.001) in Saudi public males. Also, in Saudi public females, there was a negative relation between age and fast-food intake along with traditional Saudi food (P=0.03, P=0.01, respectively). Moreover, there was a negative relation between age and fast-food intake among Saudi nutritionist males (P=0.03). These results support the literature, which reported that prevalence of fast food consumption is higher among young people (Abdullah *et al*., 2015; Moore *et al*., 2009; Pereira *et al*., 2005; Shori *et al*., 2017). Anderson *et al.* (2011) found that young males in the age range of 18-24 years are consuming more fast food than the older males or females.

5.8 Conclusion

Saudi public males were significantly more overweight and obese than the females. This might be because they are consuming more calories than their daily requirements, as there was no difference in the activity levels between them. Saudi male nutritionists were found to be more overweight than public and public members being more obese than nutritionists. Saudi female nutritionists were significantly more overweight than public, which might be because they were consuming more calories than they needed to as there was no difference in the activity level between them. Saudi public males were at high risk of CVD than females according to GL. The recommendation for vegetable is 3-5 portions a day in KSA; however, none of the participants consumed the recommended dose of vegetables. There was a significant difference between Saudi public and nutritionist males in the intake of vegetables with all nutritionists being at a high risk than public members for CVD.

There was a significant difference between public and nutritionist females' CF, GL intake and being overweight with regards to T2DM with nutritionists being at a high risk than the public.

Higher education was found to be negatively associated with GL, traditional Saudi food and fast-food intake among Saudi public members. Also, age was negatively associated with fast-food intake. However, BMI was significantly related to GL and traditional Saudi food intake. Age was negatively associated with GL, saturated fat, CF, traditional Saudi food and fast-food intake among Saudi public females. Saudi public males are at a higher risk for CVD and T2DM than all other groups of the Saudi participants. Nearly a third of them were at a high risk for CVD and over half of them were at a high risk for T2DM using GL. There were no differences between Saudi public and nutritionists in terms of their intakes of the obesogenic food items, which means that nutritionists do not implement their knowledge into their dietary habits.

CHAPTER 6- Dietary Patterns and Risk of Cardiovascular Disease and T2DM amongst British Male and Female Participants

This chapter aims to provide a measure and a description of the dietary factors related to CVD and T2DM for British public and nutritionists with the use of a food frequency questionnaire sent through social networks. In addition, the chapter also aims to provide the main differences in factors related to CVD and T2DM by gender. Table (6-1) summaries the anthropometric characteristics of all study participants using mean and standard deviation.

Table (6-1) Age and anthropometric characteristic of British subjects (mean and (SD)).

Variables	British nutritionists female	British public female	*P*	British nutritionists males	British public males	*P*
	(n=67)	(n=72)		(n=7)	(n=17)	
Age range (years)	20-55	20-55		20-55	20-40	
Age mean (SD)	33.3(10.2)	34.6(11.1)	N.S	33.6(11.9)	32.2(6.07)	<0.05
Height mean, cm (SD)	164.6(7.2)	161.3(28.2)	N.S	175.5(8.1)	181(5.8)	N.S
Weight mean, kg (SD)	58.3(12)	60(11)	N.S	77(10.6)	81(5.8)	N.S
BMI mean, kg/m^2 (SD)	21.9(3.3)	22.1(3.8)	N.S	25.5(4.5)	25.1(2.1)	N.S

SD: Standard Deviation. BMI: Body Mass Index.

Table (6-2) age distribution of British participants with the population of UK.

Age	20-25	26-30	31-35	36-40	41-45	46-50	>50
British population N=57408454	3823995 (6.5%)	3910483 (7%)	3889281 (6.7%)	3563751 (6.2%)	3903960 (6.6%)	4136176 (7%)	20566140 (36%)
British participants N=163	46 (28.3%)	30 (18.4%)	25 (15.3%)	19 (11.6%)	5 (9.2%)	10 (6.1%)	18 (11%)

6.1 Demographic and characteristic of the British public and nutritionists

According to table (6-2), all the age groups, i.e. 20-25, 26-30, 31-35, 36-40 and 41-45 years are over represented than the population. However, the age group of 46-50 and >50 years was under represented by the sample. Table (6-3) summarises the demographic characteristics of British public and nutritionists for both genders. With respect to the education level, there were no differences between male and female genders for both, the public and nutritionist.

In terms of the marital status and number of children of British public and nutritionists, there was no difference between the male and females.

Table (6-3) Demographic characteristic of British participants by gender.

Characteristic	**British Public**					**British Nutritionists**				
Gender	Male (n=17) %		Female (n=72) %			Male (n=7)%		Female (n=67)%		
Education level										
	No.	%	No.	%		No.	%	No.	%	
Illiterate	0	0	0	0		0	0	0	0	
Primary school	0	0	0	0	N.S	0	0	0	0	N.S
High school	1	5.8	1	1.3		0	0	0	0	
Technical	1	5.8	0	0		0	0	0	0	
undergraduate	5	29.4	38	52.7		3	42.8	23	34.3	
postgraduate	10	58.8	33	45.8		4	57.1	44	65.6	
Marital status										
Single	10	58.8	38	52.7		4	57.1	36	53.7	
Married	7	41.1	27	37.5		3	42.8	26	38.8	
Divorced	0	0	6	8.3	N.S	0	0	5	7.4	N.S
Widowed	0	0	1	1.3		0	0	0	0	
Separated	0	0	0	0		0	0	0	0	
Number of children										
0	13	76.4	44	61.1		5	71.4	41	61	
1	1	5.8	9	12.5		0	0	8	11.9	
2	1	5.8	15	20.8	N.S	1	14.2	12	17.9	N.S
3	1	5.8	3	4.1		1	14.2	6	8.9	
4	1	5.8	0	0		0	0	0	0	
More than 4	0	0	1	1.3		0	0	0	0	
Occupation										
Employ for wages	6	35.2	36	50		0	0	0	0	

Out of work and looking for a job	1	5.8	5	6.9		0	0	0	0	
Out of work and not looking for a job	0	0	1	1.3		0	0	0	0	
Self-employee	4	23.5	20	27.7	N.S	0	0	0	0	N.S
Home maker	1	5.8	0	0		0	0	0	0	
Student	4	23.5	8	11.1		0	0	0	0	
Nutritionists, dietitian	0	0	0	0		7	100	67	100	
Soldier	0	0	0	0		0	0	0	0	
Retired	1	5.8	2	2.7		0	0	0	0	
Unable to work	0	0	0	0		0	0	0	0	
Annually income in GBP*										
<20,000	6	35.2	14	19.4	N.S	0	0	16	23.8	N.S
20,001-25,000	2	11.7	11	15.2		0	0	6	8.9	
25,000-30,000	1	5.8	7	9.2		3	42.8	4	5.9	
30,001-35,000	1	5.8	4	5.5		2	28.5	9	13.4	
35,001-40,000	1	5.8	5	6.9		0	0	4	5.9	
More than 40,000	6	35.2	31	43		2	28.5	28	41.7	
Socioeconomic status										
Low	8	47	25	34.7	N.S	0	0	22	32.8	<0.008
Medium	2	11.7	9	12.5		5	71.4	13	19.4	
High	7	41.1	36	50		2	28.4	32	47.7	

*Great British Pounds, N.S: not significant

Also, regarding the occupation of British public, there were no differences between gender and occupation.

6.1.1 British Participants' Socioeconomic factors

The monthly income and education level were used in classifying British Participants' socioeconomic status. A chi-square test was used to compare the socioeconomic status between male and female among British public and there were no differences between them (P=0.76). For British nutritionists, none of the males and 32.8% of the females had a low socioeconomic status. There was a significant difference between socioeconomic status of British nutritionist males and females (P=0.007).

6.2 Factors related to CVD for British

6.2.1 Comparison between genders

Table (6-4) summaries variables related to CVD for British participants. Most of the males (76.4%) were in the normal weight, 11.7% were overweight and 11.7% were obese. Nearly three quarter of the females (72.2%) were in the normal body weight range, 12.5% were overweight, 7% were underweight and 8.3% were obese. The total overweight and obese British public males were 23.4% while 21% of the females were overweight or obese. There was no significant difference between gender and number of people in BMI categories for the British public (P=0.50), the likelihood ratio was used as there are 4 cells which have expected value less than 5.

Nearly three quarter of the British nutritionists' males, (71.4%), were in the normal body weight, while none of the males participated were obese but 14.2% were overweight. Nearly three quarter of the female participants were in the normal weight range (i.e. 71.6%). It was found that15% were overweight and 3% were obese. Overweight and obese British nutritionist males were accounted for 14.2% of the sample, while 18% of the female were overweight or obese.

Chi square test was applied to test if there is any difference between genders and BMI. There was no significant difference between gender and number of people in BMI categories among British nutritionists (P=0.92), the likelihood ratio was used as there are 4 cells which have expected value less than 5.

None of the British male participants among the public smoked. Only 2, i.e. 2.7% females smoked cigarettes as mentioned in a self-reported frequency of 1-5 per day. To test whether there is any difference between the number of male and female smoking status, Chi square was applied, where a result of P<.05 is significant. There was no significant difference between British public males and females (P=.35). The likelihood ratio was used as there are 2 cells (i.e. 50%) have an expected count less than 5. This is further detailed in appendix D.

It was also revealed that 14.2% of the British nutritionist males and 4.4% of the females were smokers. The majority (i.e. 85.7%) of the males and 95.5% of the females were not smoking. Chi square test was done to check if there is any difference between gender and number of smokers and non-smokers. There was no significant difference between gender and smoking status among British nutritionists (P=.34) where the likelihood ratio was used as there were 2 cells (50%) which had an expected count less than 5. This is further detailed in appendix D.

British public males who were inactive accounted for 11.7% and 12.5% of the females were inactive. A third, i.e. 29.4% of the males and 41.6% of the females were engaged in vigorous physical activity. Chi square test was applied to test if there was any difference between the number of British public in different physical activity levels and gender. There was no significant difference between gender and physical activity level among them (P=0.63).

For British nutritionists, 28.8% of the males and 12% of the females were inactive. Also, 43% of the males and 40.2% of the females were engaged in vigorous physical activity. There was no significant difference between gender and physical activity levels among British nutritionists (P=0.44). The likelihood ratio was used as there are 3 cells (50%) having an expected count less than 5.

Table (6-4) Cardiovascular disease risk factors for British participants by gender.

Characteristic	**British Public**					**British nutritionists**				
Gender	**Male (n=17) %**		**Female (n=72) %**		***P***	**Male (n=7)%**		**Female (n=67)%**		***P***
BMI Classification	No.	%	No.	%		No.	%	No.	%	
Underweight	0	0	5	7		1	14.2	7	10.4	
Normal	13	76.4	52	72.2		5	71.4	48	71.6	
Overweight	2	11.7	9	12.5	N.S	1	14.2	10	15	N.S
Obese	2	11.7	6	8.3		0	0	2	3	
Smoking Status										
Non-smoker	17	100	70	97.2	N.S	6	85.7	64	95.5	N.S
Smoker	0	0	2	2.7		1	14.2	3	4.4	
Physical activity level										
Low	2	11.7	9	12.5	N.S	2	28.5	8	12	N.S
Moderate	10	59	33	46		2	28.5	32	47.7	
Vigorous	5	29.4	30	41.6		3	43	27	40.2	
GL as risk for CVD										
Low	8	47	18	25	N.S	2	28.5	16	23.8	N.S
Medium	5	29.4	46	63.8		5	71.4	39	58.2	
High	4	23.5	8	11.1		0	0	12	17.9	
Processed meat										
Low	16	94.2	72	100	N.S	7	100	67	100	N.S
High	1	5.8	0	0		0	0	0	0	
Oily Fish										
Low	12	70.5	3	4.1	<0.005	1	14.2	2	2.9	N.S
High	5	29.4	69	95.8		6	85.6	65	96.9	
Nuts										
Low	6	35.2	18	25	N.S	2	28.5	12	17.9	N.S
High	11	64.6	54	74.9		5	71.3	55	82	
Vegetable										
Low	10	58.8	57	79.1	N.S	6	85.7	56	83.5	N.S
High	7	41.1	15	20.8		1	14.2	11	16.3	
Saturated fat										
Low	14	82.3	62	86.1	N.S	3	42.8	55	82	<0.005
High	3	17.6	10	13.8		4	57.1	12	17.9	

N.S: not Significant, P<0.005 variables were compared to *t* test

GL was calculated for each participant and then each group was classified according to Liu *et al*. (2000) for women and according to Levitan *et al*. (2007) for men. For British public there were no significant difference between gender and GL (P=0.01). However, among British nutritionists there were no differences between gender and GL (P=.24).

Processed meat was classified according to Micha *et al*. (2012) and Larsson and Orsini. (2014) where the low risk was <50g/day and high risk was ≥50g/day. For British public, there were no significant difference between gender and intake of processed meat (P=0.42). About Six percent (5.8%) of the males and none of the females were at high risk for CVD. Among British nutritionists, there were also no differences between gender and processed meat, where none of the males and females were at high risk for CVD.

Oily fish classification was assessed according to He *et al*. (2004b) where high risk was <2portion/week and low risk was ≥4 portion/week. For British public, there was a significant difference between gender and intake of oily fish (P=0.000) with females in a higher risk category (i.e. 95.8% compared to 29.4% of males). For British nutritionists, there were no differences between gender and intake of oily fish (P=0.66), where 85.6% of the males and 96.9% of the females were in a high-risk category for CVD.

Intake of nuts and their relation to CVD was classified according to Luo *et al*. (2014), where low risk was ≥1 portion/day and high risk was <1portion/day. For British public males, 35.2% were at low risk and 64.6% were at high risk. In terms of the females, 25% were at low risk and 74.9% were at high risk. There were no differences between gender and nuts intake (P=0.57). Amongst British nutritionists, there were also no significant difference (P=0.85), with 71.3% of the males and 82% of the females being at a high risk.

Vegetable classification was assessed according to Liu *et al*. (2001). For British public, there were no differences between gender and intake of vegetables (P=0.15), with 41.1% of the males and 20.8% of the females being at high risk for CVD. Also, among British nutritionists, there were no differences between gender and intake of vegetables (P=1.0), with 14.2% of the males and 16.3% of the females being at high risk for CVD.

Saturated fat was classified according to 11% of the recommended calories for males and females by 30g/day and 24.4g/day respectively. For British public, there were no differences between gender and saturated fat intake (P=0.99), with 17.6% of the males and 13.8% of the females being at a high risk for CVD. Among British nutritionists, there were significant difference between gender and saturated fat intake (P=0.014). More than half of the males (57.1%) and 17.9% of the females were at high risk.

6.2.2 Comparison between public and nutritionists

Table (6-5) summaries comparison between British public and nutritionists. Among British males, there were no differences between public and nutritionists (P=0.27). More than three quarter, i.e. 76.4% of public and 71.4% of nutritionist were in the normal BMI range. Also, 11.7% of the public and 14.2% of the nutritionists were found to be overweight. In addition, 11.7% of public were obese but none of nutritionists were obese.

Among British females, there were also no differences between public and nutritionists (P=0.27). Results showed that 12.5% of the public and 15% of nutritionists were overweight. Additionally, 8.3% of public and 3% of nutritionists were obese.

With regard to smoking, there were no differences between British public and nutritionist males (P=0.10). None of the public participants were found to be smokers while 14.7% of nutritionists were smokers. Among females, there were no differences between public and nutritionists (P=0.59). Only 2.7% of public females and 4.4% of the nutritionists were smokers.

According to physical activity, there were no differences between the intake of British public males and nutritionists (P=0.36). Nearly a third of the public (i.e. 29.4%) and about 43% of nutritionists were engaged in vigorous activity. Among females, there were no differences in the physical activity level (P=0.97). Also, 41% of the public and 40.2% of the nutritionist were engaged in vigorous physical activity.

According to GL intake as a risk of CVD, there were no differences between public and nutritionist males (P=0.07). None of the nutritionists were in the high-risk category while 23.5% of the public were at high risk. Nearly three quarter (i.e. 71.4%) of the nutritionists and 29.4% of public were at medium risk. Among females, there were no differences between public and nutritionists (P=0.51). It was revealed that 11.1% of the public and 17.9% of nutritionist were at high risk. Around a quarter (25%) of the public and 23.8% of the nutritionists were at low risk category.

In terms of the intake of processed meat, there were no differences between public and nutritionist males (P=0.40). Among females, there were also no differences between public and nutritionists (P=1.0) as well.

According to the intake of oily fish, there were no differences between public and nutritionist males (P=0.009). Nearly three quarter (70.5%) of the public and 14.2% of nutritionist were at low risk. A third of the public and more than three quarters of nutritionists were in the high-risk category. Among females, there were no differences also (P=0.70) with only 4.1% of the public and 2.9% of the nutritionists being in the low risk category.

Nuts intake among British public and nutritionists' males was not significant (P=0.74). More than a third of the public (35.2%) and 28.5% of the nutritionists were at low risk. Also, among females, there were no differences between public and nutritionists (P=0.31). A quarter of the public (i.e. 25%) and 17.9% of nutritionists were at low risk.

There was no difference between the intake of vegetables in nutritionists and public males (P=0.03). More than half of the public (i.e. 58.8%) and 85.6% of nutritionists were in the low risk category for CVD. Among females, there were also no differences between public and nutritionists (P=0.50). More than a three quarter of the public (79.1%) and 83.5% of the nutritionists were at low risk.

According to the intake of saturated fat, there were no differences between public and nutritionist males (P=0.05). More than three quarter of the public males (82.3%) and

42.8% of the nutritionist males were found to be at low risk. Among females, there were also no differences (P=0.51). Only 13.8% of the public and 17.9% of the nutritionists were in the high-risk category.

Table (6-5) Cardiovascular disease risk factors for British participants by occupation.

Characteristic	**British males**					**British females**				
Gender	**Public (n=17) %**		**Nutritionist (n=7) %**		***P***	**Public (n=72)%**		**Nutritionist (n=67)%**		***P***
BMI Classification	No.	%	No.	%		No.	%	No.	%	
Underweight	0	0	1	14.2	N.S	5	7	7	10.4	N.S
Normal	13	76.4	5	71.4		52	72.2	48	71.6	
Overweight	2	11.7	1	14.2		9	12.5	10	15	
Obese	2	11.7	0	0		6	8.3	2	3	
Smoking Status										
Non-smoker	17	100	6	85.7	N.S	70	97.2	64	95.5	N.S
Smoker	0	0	1	14.7		2	2.7	3	4.4	
Physical activity level										
Low	2	11.7	2	28.5	N.S	9	12..5	8	12	N.S
Moderate	10	59	2	28.5		33	46	32	47.7	
Vigorous	5	29.4	3	43		30	41.6	27	40.2	
GL as risk for CVD										
Low	8	47	2	28.5	N.S	18	25	16	23.8	N.S
Medium	5	29.4	5	71.4		46	63.8	39	58.2	
High	4	23.5	0	0		8	11.1	12	17.9	
Processed meat										
Low	16	94.2	7	100	N.S	72	100	67	100	N.S
High	1	5.8	0	0		0	0	0	0	
Oily Fish										
Low	12	70.5	1	14.2	N.S	3	4.1	2	2.9	N.S
High	5	29.4	6	85.6		69	95.8	65	96.9	
Nuts										
Low	6	35.2	2	28.5	N.S	18	25	12	17.9	N.S
High	11	64.6	5	71.3		54	74.9	55	82	
Vegetable										
Low	10	58.8	6	85.7	N.S	57	79.1	56	83.5	N.S
High	7	41.1	1	14.2		15	20.8	11	16.3	
Saturated fat										
Low	14	82.3	3	42.8	N.S	62	86.1	55	82	N.S
High	3	17.6	4	57.1		10	13.8	12	17.9	

N.S: not Significant, P<0.005 variables were compared to *t* test

6.3 Factors related to T2DM for British public and nutritionists

6.3.1 Comparison between genders

Table (6-6) summaries T2DM risk factors for British participants. GL was used to assess the risk of T2DM according to Salmeron *et al*. (1997a); Salmeron *et al*. (1997b) and Willett *et al*. (2002). For British public, there were no differences between gender and GL (P=0.53). More than a half of the males (52.9%) and 45.9% of the females were at high risk. In British nutritionists, there were also no differences between gender and GL (P=0.65). Nearly half (42.8%) of the males and 44.7% of the females were at low risk.

Table (6-6) T2DM risk factors for British participants.

Characteristic	**British Public**					**British nutritionists**				
Gender	**Male (n=17) %**		**Female (n=72) %**		***P***	**Male (n=7)%**		**Female (n=67)%**		***P***
	No.	%	No.	%		No.	%	No.	%	
BMI Classification										
Underweight	0	0	5	7	N.S	1	14.2	7	10.4	N.S
Normal	13	76.4	52	72.2		5	71.4	48	71.6	
Overweight	2	11.7	9	12.5		1	14.2	10	15	
Obese	2	11.7	6	8.3		0	0	2	3	
Physical activity level										
Low	2	11.7	9	12.5	N.S	2	28.5	8	12	N.S
Moderate	10	59	33	46		2	28.5	32	47.7	
Vigorous	5	29.4	30	41.6		3	43	27	40.2	
GL as risk for T2DM										
Low	5	29.4	31	43	N.S	3	42.8	30	44.7	N.S
Medium	3	17.6	8	11.1		2	28.5	10	14.9	
High	9	52.9	33	45.8		2	28.5	27	40.2	
CF										
Low	6	35.2	39	54.1		7	100	56	83.5	
Medium	7	41.1	26	36.1	N.S	0	0	7	10.4	N.S
High	4	23.5	7	9.7		0	0	4	5.9	
Red meat										
Low	16	94.1	71	98.6	N.S	5	71.4	49	73.1	N.S
High	1	5.8	1	1.5		2	28.5	18	26.7	
Processed meat										
Low	16	94.2	72	100	N.S	7	100	67	100	N.S
High	1	5.8	0	0		0	0	0	0	

N.S: not significant, BMI: body mass index, GL: glycaemic load, CF: cereal fibre, T2DM; type 2 diabetes, P<0.008 variables were compared to t test

The intake of CF was classified according to Salmeron *et al*. (1997a); Salmeron *et al*. (1997b) and Willett *et al*. (2002). Among British public, there were no differences between gender and intake of CF (P=0.20). More than a third (35.2%) of the males and half of the females (54.1%) were at low risk. Also, there were no differences between gender and intake of CF among British nutritionists (P=0.30). All the British males (100%) and 83.5% of the females were at low risk.

Red meat classification was assessed according to Aune *et al*. (2009) and Micha *et al*. (2012). For British public, there were no differences between gender and intake of red meat (P=0.83). Also, 5.8% of the males and 1.5% of the females were at high risk for T2DM. Among British nutritionists, there were no differences between gender and intake of red meat (P=1.0). Nearly a third (28.5%) of the males and 26.7% of the females were at high risk for T2DM.

Processed meat was classified according to Micha *et al*., 2012 and Larsson and Orsini. (2014). For British public, there were no significant differences between gender and intake of processed meat (P=0.42). It was found that5.8% of the males and none of the females were at high risk for T2DM. Among British nutritionists, there were also no differences between gender and processed meat. None of the males and females were found to be at high risk for T2DM.

6.3.2 Comparison between public and nutritionists

GL foods intake showed no differences between British male public and nutritionists (P=0.54). Nearly a third (29.4%) of public and 42.8% of nutritionists were in the low risk category. Among females, there was no significant difference in the intake of GL foods (P=0.71), with 43% of the public and 44.7% of the nutritionists being at a low risk.

CF intake among males was significantly different (P=0.004) with all the nutritionists being at low risk compared to 35.2% of the public. Among public and nutritionist females, there was a significant different in the intake of CF (P=0.001) with more than three quarter of the nutritionists (83.5%) being at a low risk as compared to the 54.1% of the public.

Table (6-7) T2DM disease risk factors for British participants by occupation.

Characteristic	**British males**					**British females**				
Gender	**Public (n=17) %**		**Nutritionist (n=7) %**		***P***	**Public (n=72)%**		**Nutritionist (n=67)%**		***P***
	No.	%	No.	%		No.	%	No.	%	
BMI Classification										
Underweight	0	0	1	14.2	N.S	5	7	7	10.4	N.S
Normal	13	76.4	5	71.4		52	72.2	48	71.6	
Overweight	2	11.7	1	14.2		9	12.5	10	15	
Obese	2	11.7	0	0		6	8.3	2	3	
Physical activity level										
Low	2	11.7	2	28.5	N.S	9	12.5	8	12	N.S
Moderate	10	59	2	28.5		33	46	32	47.7	
Vigorous	5	29.4	3	43		30	41.6	27	40.2	
GL as risk for T2DM										
Low	5	29.4	3	42.8	N.S	31	43	30	44.7	N.S
Medium	3	17.6	2	28.5		8	11.1	10	14.9	
High	9	52.9	2	28.5		33	45.8	27	40.2	
CF										
Low	6	35.2	7	100		39	54.1	56	83.5	
Medium	7	41.1	0	0	<0.008	26	36.1	7	10.4	<0.008
High	4	23.5	0	0		7	9.7	4	5.9	
Red meat										
Low	16	94.1	5	71.4	N.S	71	98.6	49	73.1	<0.008
High	1	5.8	2	28.5		1	1.5	18	26.7	
Processed meat										
Low	16	94.2	7	100	N.S	72	100	67	100	N.S
High	1	5.8	0	0		0	0	0	0	

N.S: not significant, BMI: body mass index, GL: glycaemic load, CF: cereal fibre, T2DM; type 2 diabetes, P<0.008 variables were compared to t test

According to the intake of red meat, there were a slight difference between British public and nutritionist males (P=0.14), with 5.8% of public and 28.5% of nutritionists being at high risk. Among females, there was a significant different between public and nutritionists in the red meat intake (P=0.000) with more nutritionists at high risk than the public (i.e. 1.5% of public as compared to 26.1% nutritionists). In terms of the intake of processed meat among females, there were no differences between public and nutritionists (P=1.0).

Table (6-8) GL and portion numbers of some food types related to T2DM and CVD (mean and (SD)).

Variables	British public		British nutritionist's	
	female	male	female	male
GL mean/day	161(59.5)	198(76.1)	163.3(51.9)	168(54.3)
CF(g)	8.7(7.3)	9.4(9.7)	11.3(6.3)	19.3(6.3)
Red meat	0.09(0.08)	0.10(0.10)	0.1(0.07)	0.11(0.14)
Processed meat	.01(0.02)	.03(.07)	.008(.01)	0.04(0.1)
Vegetable serving	3.1(1.4)	2(1.7)	3.3(1.3)	3.3(1.6)
Oily fish	0.10(0.09)	0.07(0.08)	0.10(0.08)	0.13(0.07)
Saturated fat (g)	16.3(9.2)	21.9(7.4)	17.4(7.2)	29.9(11.1)
Nuts	0.09(0.1)	0.06(0.1)	0.1(0.1)	0.06(0.1)

SD: Standard Deviation. GL: GL. (<0.1 1-3 month or less, 0.1: once week, 0.2-0.3: 2-3 week, 0.4- 0.5: 4-5 week)

6.4 Relationship between foods related to CVD and T2DM with age, BMI, smoking and socioeconomic status.

Among British public females, age was significantly associated with nuts and red meat intake (P=0.017, (P=0.02, respectively). However, age was negatively related to fast-food intake (P=0.002), as detailed in table 6.9.

Among British public males, as shown in table 6.10, education was negatively associated with GL (P=0.001).

In British nutritionist females, as shown in table 6.11, there was a significant association between age and nuts and vegetable intake (P=0.01, P=0.006 respectively). However, there was a negative relation between age and fast-food intake (P=0.014). BMI was associated with GL (P=0.000), red meat intake (P=0.019) and fast-food intake (P=0.004). Smoking was associated with the intake of CF (P=0.039).

Among British nutritionists males, as shown in table 6.12, there was a significant association between GL with income and BMI (P=0.027, P=0.004, respectively). BMI was negatively related to vegetable intake (P=0.04). Smoking was significantly associated with processed meat and oily fish intake (P=0.029, P=0.016, respectively).

Table 6.9: Correlation coefficients between intakes of food related to CVD and T2DM with socioeconomic factors and CVD risk factors in British public females.

Factors	GL		Processed meat (portion)		Oily fish (portion)		Nuts (portion)		Vegetable (portion)		Saturated fat (g)		Red meat (portion)		CF (g)		Middle Eastern food (portion)		fast-food (portion)	
	r	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***R***	***P***
Age	-.192	.106	-.029	.807	.149	.210	**.281**	**.017**	.021	.862	.225	.057	**.261**	**.027**	.144	.229	-.029	.809	**-.358**	**.002**
Education	-.022	.852	-.032	.786	-.107	.369	.015	..899	-.062	.607	-.002	.985	-.076	.525	.186	.117	.133	.265	-.019	.873
Income	-.103	.389	.063	.601	.135	.258	.101	.398	-.082	.496	-.031	.798	.086	.487	.070	.558	-.023	.848	-.222	.061
BMI	.177	.138	-.007	.945	-.042	.724	-.026	.826	.085	.476	.059	.622	.036	.764	-.149	.211	.188	.115	-.133	.266
Smoking	-.153	.201	.008	.945	-.015	.902	-.050	.675	-.198	.096	-.116	.330	.002	.990	-.055	.649	.216	.069	.222	.060

Table 6.10: Correlation coefficients between intakes of food related to CVD and T2DM with socioeconomic factors and CVD risk factors in British public males.

Factors	GL		Processed meat (portion)		Oily fish (portion)		Nuts (portion)		Vegetable (portion)		Saturated fat (g)		Red meat (portion)		CF (g)		Middle Eastern food (portion)		fast-food (portion)	
	r	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***
Age	-.239	.356	-.379	.134	.065	.803	.196	.450	.337	.186	-.212	.414	-.254	.326	-.124	.635	.157	.546	-.376	.136
Education	**-.739**	**.001**	-.266	.302	-.043	.869	.139	.594	.087	.738	-.453	.068	-.046	.860	.246	.341	-.178	.494	-.323	.207
Income	-.374	.173	.191	.462	-.223	.390	-.133	.610	.224	.388	-.197	.449	-.290	.260	.327	.200	-.068	.794	-.201	.380
BMI	-.037	.887	.100	.702	.099	.706	.410	.102	-.265	.304	.211	.415	-.123	.638	-.119	.649	-.067	.798	-.085	.747

Table 6.11: Correlation coefficients between intakes of food related to CVD and T2DM with socioeconomic factors and CVD risk factors in British nutritionist females.

Factors	GL		Processed meat (portion)		Oily fish (portion)		Nuts (portion)		Vegetable (portion)		Saturated fat (g)		Red meat (portion)		CF (g)		Middle Eastern food (portion)		fast-food (portion)	
	r	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***
Age	.101	.416	-.029	.814	.008	.948	**.291**	**.017**	**.334**	**.006**	-.188	.129	.145	.241	-.157	.204	-.057	.645	**-.298**	**.014**
Education	-.029	.819	-.167	.177	.168	.175	.002	.986	.003	.983	-.227	.064	.147	.236	-.050	.686	-.129	.298	-.066	.597
Income	.006	.960	.206	..095	.131	.292	-.112	.367	.043	.729	-.176	.155	.082	.507	-.018	.518	.030	.808	.230	.062
BMI	**.615**	**.000**	.093	.455	-.052	.678	.018	.895	.142	.253	.034	.782	**.286**	**.019**	.121	.330	.174	.159	**.346**	**.004**
Smoking	-.003	.979	.225	.067	.034	.784	-.095	.443	.087	.485	.080	.521	.086	.488	**.253**	**.039**	.212	.084	.127	.307

Table 6.12: Correlation coefficients between intakes of food related to CVD and T2DM with socioeconomic factors and CVD risk factors in British nutritionist males.

Factors	GL		Processed meat (portion)		Oily fish (portion)		Nuts (portion)		Vegetable (portion)		Saturated fat (g)		Red meat (portion)		CF (g)		Middle Eastern food (portion)		fast-food (portion)	
	r	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***	***r***	***P***
Age	-.087	.854	.625	.133	.403	.370	.385	.394	.361	.426	.325	.476	.168	.719	.087	.852	.315	.455	-.367	.419
Education	.329	.472	.533	.218	.433	.332	.070	.881	-.512	.240	.077	.870	.382	.398	.455	.305	.354	.437	-.750	.052
Income	**.811**	**.027**	.028	.952	.061	.897	.661	.106	.697	.094	.055	.908	.455	.305	-.316	.490	.609	.147	.099	.832
BMI	**.913**	**.004**	-.008	.987	-.179	.700	-.049	918	**-.766**	**.045**	.042	.928	.138	.768	-.663	.104	.739	.058	.090	.848
Smoking	-.545	.206	**.804**	**.029**	**.648**	**.016**	-.149	.751	-.258	576	-.205	.663	.540	.211	.612	.144	-.167	.721	-.471	.286

6.5 Discussion of CVD Risk and T2DM for British sample

The study sample was from United Kingdom, in total 163 participants took part and the age range was 20-55 years for both genders. To elaborate, 24 males and 139 females were included in this study. In terms of the British participants, the prevalence of overweight was 12.5% for males and 13.6% for females while the occurrence of obesity in the participants was found to be 8.3% for males and 5.7% for females. These results were not close to the results of the UK statistics, which shows that 26% of the males are obese and 40% are overweight. Also, for the females, 30% were overweight and 27% were obese (Baker, 2018).

British participants in this survey are much less than the total number of participants in the statistics of the British public, which means the participants in the current study do not reflect the national data. That might be also because the current study over represents the young people and under represents the old people. Furthermore, the current study included more females' participants than males, so the results might be slightly skewed. This also suggests that the results obtained from the current study might under estimate the risk of diabetes in the population using BMI as an indicator.

According to the statistics of smoking in the UK, 19% of adults are smokers, where 20% of the males are smoker but none of the males in this study was reported to smoke. Also, 17% of the UK females are smoker (Ash, 2016); however, the findings of the current study showed that only 2.7% of the British public females were smokers.

According to the British Heart Foundation (2015), 67% of men in the British population, in general, are meeting the recommendation of the physical activity (high intensity physical activity). In the current study's survey, the British participant men, who were involved in high intensity activities were found to be 29.4%. Also, 10% of the British population was involved in some sort of physical activity (moderate intensity). Around a third (30%) of the British population was found to be involved in low intensity physical activity as compared to the 11.7% of British public men who participated in the study and were engaged in low intensity physical activities (British Heart Foundation, 2015). As the statistics show, British male participants from this survey were less engaged in vigorous physical activity than the general population, but more engaged in moderate activity.

Among the British Heart Foundation (2015) results, British females who engaged in vigorous physical activity account for 55% of the general British population, while British females who participated in the current study's survey accounted for 41.6% of the respondents. Also, 13% of the British female population did some sort of physical activity (moderate activity) as compared to 46% of British female participants in this survey. Only 6% of the British female population was found to be engaged in low intensity physical activity compared to the 12.5% of the female respondents in this survey (British Heart Foundation, 2015). As the statistics show, British participants in this survey were engaged more in moderate physical activity than the female population. However, they are more inactive and less engaged in vigorous activity than their population.

6.6 Conclusion

British public males were consuming the highest GL foods compared to the other groups, which puts them at a higher risk for CVD and T2DM. British public males were significantly consuming less CF than British nutritionist males. The lowest intake of vegetable was among British public males with 2 portions a day, which then puts them at a higher risk for CVD than other groups. Higher education was negatively associated with GL in British public males.

British public females were significantly at a higher risk for CVD than males, due to their oily fish intake as compared to males. British public females were significantly consuming less CF than British nutritionist females. Aging was significantly associated to increasing nuts and red meat intake among British public females. However, age was negatively related to fast-food intake.

British nutritionist females were significantly consuming more red meat than British public females. There was a significant positive association between age and nuts and vegetable intake in British nutritionist females. BMI was associated with GL, red meat intake and fast-food intake. Smoking was associated with the intake of CF.

There was a significant difference between saturated fat intake and gender in British nutritionists with more than half of the British nutritionist males being at a high risk for CVD. Among British nutritionist males, there was a significant positive association between GL with income and BMI. BMI was negatively related to vegetables intake. Smoking was significantly associated with processed meat and oily fish intake.

CHAPTER 7- DISCUSSION

General Discussion, Limitations, Recommendations, and Future Work

This study is a cross-sectional, it provides data on the spread of modified risk factors related to CVD and T2DM in KSA. Interventions using social media would be a good way to educate participants and following up will help in discovering eating habit or lifestyle changes and to measure if social media is a good intervention tool. The researcher is hoping that early interventions will help in reducing the modified risk factors related to CVD and T2DM among Saudis in the future.

7.1 Key Findings

KSA witnessed enormous lifestyle changes in the last four decades (De Nicola *et al*., 2015). These changes negatively affected the nutritional habits, health status and disease patterns (Kumosani *et al*., 2011). CVD is the number one cause of death in KSA, 46% of the total death is caused by CVD (WHO, 2014c). Lifestyle factors such as smoking, inactivity, unhealthy diet, overweight and obesity play important roles in the cause of CVD (Smith *et al*., 2004; Yusuf *et al*., 2004).

7.1.1 CVD

Aging is the largest risk factor for cardiovascular disease. Males have higher death rate caused by CVD than women (Steenman and Lande, 2017). From table 5-1 it can be seen that the Saudi respondents in this study are young (mean age of respondents is under 30 years). Even at this young age, over 90% of the male respondents demonstrate more than three risk factors for CVD and the main risk factor (advancing age) is not one of them. There are several other risk factors associated with the risk of developing CVD in male and female such as obesity, hypercholesterolemia, smoking, physical inactivity, unhealthy diet (Australian Institute of Health and Welfare, 2013; Bahijri *et al*., 2016; Deaton *et al*., 2011; WHO, 2013). However, these factors vary in the effect on males and females (Deaton *et al*., 2011). In this study, aging was associated positively with higher BMI among Saudi public female only (P=0.000). This supports the literature which found that obesity increases by age in KSA (Ahmed *et al*., 2014; Al Haqwi *et al*; 2015; Al-Haramlah *et al*., 2015; Al-Nozha *et al*., 2005; AlSaif *et al*., 2002, Al-Saleem *et al*., 2013; Al-Shammari *et al*., 2001; Memish *et al*., 2014; Ng *et al*., 2011). However, the lack of association between increasing age and obesity in this study must be considered in the context of the population. The older generations in KSA would not have been exposed to the fast food and obesogenic options for their entire lives and this may be the reason for the lack of association. If the study is carried out in the future where older people have been exposed for their whole lives, an association between increasing age and increasing levels of obesity may be demonstrated.

BMI

High BMI is associated with high risk of CVD (Alqarni., 2016; ALquaiz *et al*., 2014; Ibrahim *et al*., 2014; Khattab *et al*., 1999**)**. Nearly half of the Saudi participants (46.8%) were overweight or obese (table 5-4). This could be because of unhealthy eating habits or sedentary lifestyle or both. Although only 24% of Saudi participants were inactive, they rest of the Saudi might be active or might be exaggerating their activity level. A study which compared weight between Arab Gulf countries (Al Mahroos and Al Roomi, 1999; Al Nuaim, 1997) suggests that KSA have the highest obesity prevalence in the gulf. A number of studies in KSA in the general public found that the prevalence of obesity is high among both genders (Kumosani *et al*., 2011). A national study by Memish *et al*. (2014), of 10,293 male and female over 15 years found that 28% of the female were overweight and 33.5% were obese. In addition, 33.4% of the male were overweight and 24.1% were obese (Memish *et al*., 2014). All these studies confirm the findings from the FFQ, namely that the respondents BMI and weight categories reflect the situation in KSA. Unlike age, BMI is a risk factor which can be altered and reducing the levels of obesity and overweight in KSA would reduce the risk of CVD in the population.

Smoking

Smoking is also associated with CVD risk (BHF, 2016). It is one of the factors for CVD found higher in Saudi male in this study. This study found there was significant difference between smoking status and gender in Saudi participants public and nutritionists, with male tending to be more smoker than women ($P<0.05$). This finding agrees with studies by (Al-Nozha *et al*., 2009; AlSwuailem *et al*., 2014; Bassiony, 2009) which found that there are significantly more male smokers than females in KSA. The high prevalence of CVD and mortality among males worldwide is partially due to high prevalence of smoking in males (Pilote *et al*., 2007).

Thirty three percent (33%) out of 106 of the male respondents in this study smoked (cigarettes and/or shisha). Most of the smokers were between 20-50 years. However, only 4% of the females out of 400 were smokers. Shisha smoking was more prevalent among female. All, 100% of Saudi nutritionist smokers and 75% of Saudi public female were smoking shisha compared to 30% of Saudi nutritionist male and 32% of Saudi public male. This result support the finding by (Merdad *et al.*, 2007) which found that women smokers prefer shisha as they find it more prestigious and fashionable than cigarettes and it is considered as social entertainment behaviour. It could be since shisha has a more attractive smell and taste than cigarettes (AlSwuailem *et al.*, 2014). In addition, smoking is still a taboo for females and that might be a reason female are less smokers than males. Al Nozha *et al.*, (2009) highlighted the relation between coronary artery disease and smoking prevalence among Saudi in the east, west and north of KSA.

From table 5-3, a higher proportion of male Saudi respondents are overweight or obese and a higher proportion smoke compared to females. This information suggests that interventions could be targeted at young males, with the aim to help achieve/maintain a normal BMI and stop smoking. If successful these interventions could have a positive impact on the risk of CVD in the Kingdom.

Physical activity

Physical activity is also an important risk factor for CVD. This study found there was no significant difference between the physical activity level and gender among Saudis. Inactivity prevalence among Saudi males was 29.2% and 22.5% among females. This underestimates the level of inactivity compared with other studies conducted in KSA which found that females were less active than males by (Al-Hazzaa, 2004; Alshaikh *et al.*, 2016; Al-Nuaim *et al*, 2012; Kalaf *et al.*, 2016). Al-Hazzaa (2004), in a national study included 4,299 male and female between 7-60 years found that inactivity was between 43.3-99.5%. The disagreement between results could be because most of the Saudi participants in this study were young and possibly more active or because the participants were fabricating their physical activity. Since the overweight and obesity reported among the participants is high it is quite possible they were overestimating their physical activity. A 20-30% inactivity rate is still important, and interventions aimed at increasing activity rate in Saudi citizens should help reduce the risk of CVD. However, as this study found no significant difference between the genders, such an intervention could be equally beneficial to males and females, unlike an intervention to reduce smoking where maximum potential exists through targeting males.

Oily fish

Only 14% of Saudis consumed 42.8g of oily fish/day. (Almoraie, 2014) found that people live near coastal area have higher intake of oily fish 32.6g/day and there was a significant difference between the intake of people live in coastal area and internal cities 3.2g/day. This may suggest that Saudi participants with high consumption of oily fish could be living in coastal areas. Non-coastal areas in KSA, get the fish transported which can be affected by the temperature and need to be controlled. Even if it was correctly stored, it should be stopped and inspected by the borders which may affect the quality of the fish in such hot country which maybe a reason for low intake of oily fish.

Vegetables

Only 20.3% of the Saudi participants consumed 2.5 portions/day. Twenty-eight 28% of public male, 20% public female, 21.4% nutritionist female and 0% nutritionist male were consuming 2.5 portions of vegetable a day. This finding is similar to the finding by (El Bcheraoui *et al.*, 2014), the study conceded a Saudi national health survey included 10,753 Saudi aged 15 and over found that only 2.6% consumed five serving of fruit and vegetables a day. The low consumption of vegetables could result of the hot climate in KSA which there is no major production of fruit or vegetables except for dates. Most of the fruit and vegetables in KSA are imported so the country is self-sufficient, but they are more expensive (El Bcheraoui *et al.*, 2014). (El Bcheraoui *et al.*, 2014) found that educational level significantly increases the intake of fruit and vegetables. Although the consumption of Saudi participants in this study was low, it is higher than (El Bcheraoui *et al.*, 2014) findings. That can be as our sample group is highly educated and most of them are in high or medium socioeconomic level see table (5-3).

Saturated fat

Comparing the mean intake of saturated fat of Saudi participants with Almoraie, (2014), female mean intake was 24.9g/day compared to 29.5 and 34.1g/day for females living in Jeddah and Makkah respectively. For male mean intake of saturated fat was 30.6g/day compared to 26.1 and 38.1g/day for males live in Jeddah and Makkah respectively. The intake of the Saudi female participants is lower than the finding by Almoraie (2014) but for males it is slightly higher than males in Jeddah. However, both studies identify that for females the mean intake is higher than the recommended daily intake of 20 g and for males in parts of KSA also above the recommended daily intake of 30 g. This can be seen in Saudi public male, more than half of them were overweight or obese. And there was a relation between the intake of the traditional Saudi meals and BMI in Saudi public, as it is presented in table (5-9).

7.1.2 T2DM

T2DM accounted for 6% of deaths in 2012 in KSA (WHO, 2014c). The prevalence of diabetes among Saudis in 2014 is about 20.52% (IDF, 2014). Risk factors associated with T2DM include obesity (Elia *et al*., 2013; Montminy, 2009), physical inactivity and unhealthy diet (Midhet *et al*., 2012).

Aging increase is a risk factor for T2DM, since increase adiposity and reduced muscle mass which resulted from physical inactivity may lead to insulin insensitivity, (Khan *et al*., 2006; Xu *et al*., 2003). From table 5-1 and 5-2, the respondents in this study are young (mean age of respondents is under 30 years). Even at this young age, over 45% of the male respondents demonstrate more than three risk factors for T2DM and the main risk factor (advancing age) is not one of them.

Aging was associated positively with higher BMI among Saudi public female only (P=0.000). This supports the literature which found that obesity increases by age in KSA (Ahmed *et al*., 2014; Al Haqwi *et al*; 2015; Al-Haramlah *et al*., 2015; Al-Nozha *et al*., 2005; AlSaif *et al*., 2002, Al-Saleem *et al*., 2013; Al-Shammari *et al*., 2001; Memish *et al*., 2014; Ng *et al*., 2011).

There was a negative association between fast food consumption and age in Saudi public male and Saudi nutritionist male. This support the literature which found that young male in KSA consumes more fast food than older males and females (Al-Hazzaa *et al*., 2011; Anderson *et al*., 2011). Among Saudi public males there was a positive association between the consumption of traditional Saudi foods and overweight and obesity, this support the finding which found that high fat intake (Abdul-Megeid *et al*., 2011) were associated with overweight and obesity in KSA.

BMI

High BMI is associated with high risk of T2DM (Elhadd *et al*., 2007) in KSA (Alqarni, 2016; Bahijri *et al*., 2016; DeNicola *et al*., 2015). Lifestyle interventions play an important role as modified risk factors such as physical activity and dietary habits can help in reducing the weight and BMI (WHO, 2003). Nearly half of the Saudi participants 46.8% were overweight or obese (table 4-9).

Physical activity

Inactivity prevalence among Saudi males was 29.2% and 22.5% among females. This underestimates the level of inactivity compared with other studies conducted in KSA which found that females were less active than males (Al-Hazzaa, 2004; Alshaikh *et al*., 2016; Al-Nuaim *et al*, 2012; Kalaf *et al*., 2016). AlQuaiz and Tayel, (2009) found that the main reasons of inactivity are lack of resources. Lack of willpower was the second barrier to inactivity among Saudi.

Cereal fibre

Comparing the finding of this study with Almoraie (2014), Saudi female mean intake of fibre was 6.0g/day compared to 11.3 and 8.9g/day for female residing in Jeddah and Makkah. Saudi male participants mean intake of fibre was 6.9g/day compared to 8.8 and 8.9g/day. The results of this study are not far from Almoraie's findings but slightly lower. In all studies the average intake is well below the daily intake of 30g/day recommended by the British Nutrition Foundation. This might be because Saudi have lack of willpower for making changes and eating healthier options as found by (AlQuaiz and Tayel, 2009).

7.1.3 Interventions

None of the British participants had more than 5 risk factors. Very few were even in the medium risk category with 3-5 risk factors. There has been long history of interventions and educational programmes in the UK to reduce the risk factors associated with CVD and T2DM. For example, in the UK there are many anti-smoking campaigns and strict legislations on smoking advertising and selling cigarettes and electronic cigarettes to children under 18 years (Department of Health, 2015). Also, smoking is prohibited in public places (Health Act, 2006) and in vehicles carrying children under 18 years. Such restrictions, legislations and campaigns resulted in decreasing the number of smokers in the UK, new data published in University Collage of London report shows that there is a high rate of quitting smoking for the first 6 months of 2017, up to 19.8% which is significantly higher than the average for the last 10 years 15.7% (Brown and West, 2017). However, no such initiatives have been implemented in KSA and inhabitants many people smoke in public or in their cars with their children in the cars. There is a need for governmental policies which cam effectively helps Saudis quit smoking and educate them about the risk factors related to it.

There also many campaigns in the UK advertising eat 5- a-day, which is basically encouraging people to consume five portions of fruit and vegetables a day which were advertised using T.V and radio fillers (Capacci and Mazzocchi, 2011). The campaign increased the intake of fruit and vegetable between 2002-2006 by 0.3 portions/day. In addition, there were increase among income groups by 0.2-0.7 portions/day. Although the increase was not high, the main aim of the campaign was to increase the awareness and knowledge about the health benefits of fruit and vegetables among young and low-income groups. All effects are greater than those observed by simply comparing pre-policy and post-policy consumptions (Capacci and Mazzocchi, 2011). In addition, there is a Change 4 life which has a website in the internet with information about food, healthy choices, recipes, facts, activities and weight. It encourages people to eat well and move more to live longer. It helps to reduce obesity and choose better foods for their health such as lower fat option, high fibre and 5 portions of fruit and vegetables. Schools, GPs and society centres are engaged in distributing flyers of Change 4 life programme. In KSA, the Ministry of Health the governmental responsible body to spread awareness and campaigns among the public and assess the impact. There are number of active awareness campaigns such as; combating tobacco advertising and promotion, national campaign against overweight and obesity and national diabetes awareness program (Ministry of Health, 2019). However, still most of the cafes and restaurant did not comply with the legislation of not smoking in closed places. Recently, there have been many changes in KSA, such as allowing women to drive and running marathons. It seems that these changes may increase the activity level for both genders. Low intake of vegetables was among the common CVD Risk factors in Saudi public and nutritionist males. High proportion of Saudi males consumed less than 2.5 portions/day. Thus, Saudi males are in need for educational programmes such as Change 4 Life about the importance of vegetables to encourage them to consume more portions. Furthermore, there is a need for educational programmes for all groups in Saudi communities to encourage adopting healthy options (Al Rukban, 2003; Midhet and Sharaf, 2011), such as the use of social media in delivering information and spreading awareness, web pages (Jradi, 2016) and school curriculums for children about choices and the influence of unhealthy options on their overall health (Al-Saleh *et al*., 2015). Other CVD risk factors which were common in all Saudi participants were high intake of saturated fat and being overweight.

There were few British in the medium risk for T2DM as seen in table (4-15). This could be as described above, there are many campaigns in the UK encouraging healthy food choices and getting active such as change 4 life. There have been also campaigns for fighting and preventing T2DM which make society for people suffering from T2DM and people who wants to prevent getting the disease by being active and choose healthy options. There is a web page available for the public contain recipes, risk calculator and information about risk factors related to T2DM which may help the public and raise awareness about T2DM. People can subscribe and get involved in the activities they provide such as 1 million steps, running marathon or cycling. In KSA during World Diabetes Day run by nutritionists where they distribute flyers containing information about T2DM, risk factors and preventing T2DM. There is a national diabetes prevention and control program for the public (Ministry of Health, 2019). Even though, the problem of overweight and obesity and T2DM are increasing. Diabetes UK and other governmental research and activities in the UK resulted in better changes such as; the research which aim to detect diabetes retinopathy and led to a nationwide screening programme reducing sight loss (Lane, 2018). Also, using Stains for diabetic patients with high cholesterol resulting in reducing the risk of cardiovascular complications. Furthermore, there were research on treatment and managing T2DM which help patients in understanding and managing T2DM and decreasing the complications related to T2DM such as kidney, eye complications, heart attack and death (Lane, 2018). The common T2DM and CVD risk factors in Saudi participants are overweight, high GL and saturated fat. There is a need for urgent interventions in KSA before the overweight Saudis reach obesity level especially if they have not developed other health chronic complications. Saudi should be targeted for overweight and obesity prevention programs. Since this sample group of Saudis most of them are young there is a high possibility they will develop health complication in the future if they did not change their eating habits and lifestyle.

The results from this study suggest increased health implications and burden of the NCDs in KSA in the future and will result in a huge health problem among young and old people. Also, nutritionists were having eating habit similar to the public who have no training or nutritional education which means nutritionists should be targeted as well. From the self-reported behaviours in this study, nutritionists are not implementing their knowledge in their own lives.

Looking at the data of Saudi and British, it is obvious that there were more Saudi male smokers than Saudi female, British male. This mean there should be intervention targeted for Saudi male by anti-smoking campaigns for educating them about the risk of smoking. In addition, Strict regulations are needed such the ones in the UK for protecting children from smoking parents in closed places such as cars and homes. Educational information about the risk of smoking is needed for males in schools and universities by the government and organisations.

More than half of the participants from Saudi public males, Saudi nutritionist’s male and Saudi nutritionist’s female were overweight or obese. There is a national campaign in KSA, Saudi nutritionists as well as public should be targeted. The campaign’s aim is to educate people about the risk factors associated with overweight and obesity and the risk factors associated with high BMI, tips and recipes to help people lose weight (Ministry of Health, 2019). This research will help in highlighting the risk factors related to CVD and T2DM which is spreading among Saudi population. Interventions are urgently needed as if the situation does not change, it is a matter of time before the Kingdom experiences an unprecedented level of NCD’s.

7.2 Evaluation of research tool

Dietary data was collected from 506 Saudi and 163 British participants. One of the purposes of this study was to develop a FFQ, establish a baseline for Saudi nutritionists in KSA and evaluate their dietary habits. Information was collected using FFQ which included serving size using household measures and grams or ml to help participants choose the correct and accurate answer. The questionnaire shows high reliability and validity which makes it a good tool to collect the data of participants. It was translated and culturally adapted to reflect the Saudi population eating habits. Electronic FFQ is like any other dietary assessment method, it has limitations. The response rate is often low; it depends on the length of the questionnaire, subject matter, presentation, ease of completion, the motive offered and participants interest in cooperating (Key, 1997). The response rate cannot be probed. This method required initiative respondents which will lead to selective samples increasing concerns about nonresponse bias. The collection time might be long as the questionnaire need to be distributed to the participants and returned to the researcher (Office of National Statistics, 2016). There is no way to establish the accuracy of the answers. Some people may fabricate their information, by exaggerating or try to answer the questions to reflect preconceived ideas rather than accurate reflection of their actual behaviour. Participants might make mistakes selecting the relevant answer if they do not understand the question or the instructions for answering or participants may not recall the information accurately (Shu *et al*, 2004). On the other hand, this method may be representative for population of subgroups only (Szolnoki and Hoffmann, 2013). High number of questionnaires can be sent with low cost and the questionnaire can be spread widely and in a high speed. It is less disturbing to daily activities than other method such as weighed food dairy (Key, 1997; Szolnoki and Hoffmann, 2013).

Using social media allows access to large number of participants from different geographical locations (Wright, 2005). In addition, it is a quick method and analysis of the data can be done during data collection. Collecting data via social media seem to yield higher level of accuracy and honesty since participants does not feel judged by the interviewer (FoodRisc, 2016; Wright, 2005). Using online survey can be saving money compared to other traditional methods such as pen and paper (Wright, 2005). Using social media is a more effective way to collect data from a young age group than older age group. Older people may not be computer literates and or users for social network sites SNS. Using SNS in delivering survey and online questionnaire provides an acceptable level of validity (Alshaikh *et al*., 2014). In addition, SNS sample yielded demographic representative data and provide rich pool of quantitative and qualitative valid data (Fenner *et al*., 2012; Lord *et al*., 2011). However, social media require internet for the users to cooperate in the study, which may lead to a bias including only people who have access to the internet rather than the whole population. Users of social media only would participate which also may lead to bias for people who are illiterate or do not use social media (FoodRisc, 2016). The response rate of using SNS is low 27%. It could result in sample bias if the target population was an older group (Alshaikh *et al*., 2014).

The validation of the dietary assessment methods has extensively mentioned, the miss reporting happens during recording the data (Torun *et al*., 1996) and mostly under reporting the intake (Nelson, 2000). Validation of the FFQ has been achieved by using the nurse’s study FFQ which has already validated and contains CVD risk factors. The FFQ was culturally adopted and translated to make sure the FFQ developed is measuring the population required. The FFQ was piloted and tested for internal reliability using 4 repeated questions (vegetables, fast food, dessert and salt). The result of the repeated questions found that there was positively significant relation between the answers (P=0.000). In addition, Cronbach Alpha test was done on questions related to T2DM and CVD for both versions English and Arabic. It has been found that both versions have good internal reliability.

The physical activity assessment method used in this study was the International Physical Activity Questionnaire (IPAQ) the short version, which was tested and validated previously (Al-Hazzaa, 2007). IPAQ was designed to obtain the information for national or regional surveillance, while the long version has more details. This makes it more suited to research work or for evaluation reasons (Craige *et al*., 2003). Studies on Nutritionists' dietary habits in KSA are limited. Washi, (2000) is the only study which included female nutrition students and found there was significant difference between their dietary habits and other student from other faculty with nutritionist's student were consuming more healthy options than other students from another faculty. However, this study found that being nutritionists in KSA does not indicate any difference between eating habits and being nutritionist or from the public.

This thesis considered factors related to food habit and T2DM and CVD risk factors in Saudi and British adults. The factors included age, gender, and socioeconomic status and dietary issues such as GL, intake of red meat, processed meat, vegetable, nuts, oily fish, and saturated fat. There was a comparison of the results with British public and nutritionists. A previous detailed discussion of the results is included in chapter 4 to 6. The strengths of this study included developing a culturally adapted, validated food frequency questionnaire, which can be used for collecting data associated with the risk of T2DM and CVD among Saudi population. No studies have so far examined the dietary risk factors associated with CVD or T2DM for Saudi nutritionists in KSA. Most of the studies conducted in KSA were cross sectional or case control. The nutritional studies which used FFQ were mainly adapted from other culture's FFQ. Only Alissa *et al*., (2005a) and (2005b) developed a culturally adapted FFQ and this was to assess the dietary intake of vitamin A, C and E and risk of CVD in men. This FFQ was validated for the nutrient content of vitamin A, C and E. Al Numair *et al*., (2005) developed a FFQ listing foods that contained omega-3 fatty acid. The content validity was checked by two nutritionists, but there is no information about piloting and validating the FFQ. AlSaif *et al* (2007), developed a FFQ, but in the paper, there was no information about the validation of the FFQ. It was designed to assess the dietary intake of flavonoids and their effect on the serum lipid among Saudi men with CHD. Sabra *et al* (2007), developed a FFQ to assess the risk factors of CHD among medical students, but there was no information about the validation of the FFQ. AlHamdan *et al* (2009), did not indicate what FFQ they used in the study and there was no information about the validation of the FFQ. Sadat-Ali *et al* (2009), developed a FFQ to assess the dietary intake of vitamin D, there was no information about the validity of the FFQ. Al-Daghri *et al* (2012), used a FFQ developed by Al-Disi *et al* (2010). The FFQ developed was designed to assess the dietary intake of Saudi teenage girls. The FFQ was piloted, pretested and validated. The study did not include where was validated or cited any information about its validity. AlOthman *et al*., (2012), the FFQ used in the study was designed to assess the dietary intake of selenium. There was no information about its validity or reliability of the FFQ. Ibrahim *et al* (2014) designed a FFQ to assess the risk factors associated with CVD. There was no information about the validation of it. Al-Qahtani (2016) developed a FFQ to assess the dietary intake of medical students. There was no information about the validity of it. AlZahrani *et al* (2016) developed a FFQ with no information about testing its validity and reliability. AlKhalaf *et al* (2017) developed a FFQ to assess the dietary intake of salt. The FFQ was piloted, pretested and validated. Qusadi *et al* (2017) developed a FFQ contains the food list that Saudi people consume. It was piloted, pretested and validated. However, the portion size included was not accurate as they include a plate as a portion size for some type of food without indicating the size of the plate or a photo of it compared with another object. Most of the studies focused on the intake of specific micronutrients and the other FFQ that were focused on risk factor for CHD or CVD were not checked for its validity.

Also, the delivery and collecting method of this study used social media, which has not been used widely in collecting dietary information among Saudi. This was one of the main aims of the study. Furthermore, this study has set a baseline for future studies in KSA. There was one published study which assessed the dietary habits of the nutritionists in KSA (Washi, 2000). However, the study did not include males, graduated nutritionists, older age group or Saudis from other cities in KSA. In addition, physical activity was not assessed. Using social media was a good way to collect data of nutritionists who are young. One of the goals of this study was to provide a data set which could be used to compare the results of follow up studies of the participants in the future. The data of the Saudi show high proportion of Saudis overweight and consuming foods high in saturated fat and GL. On the other hand, they consumed less than 2.5 portions a day from vegetable which is less than the recommendations.

7.2 Limitations of the study

There are some limitations in this study:

(i) Reduction in the sample size of the data occurs with the exclusion of those with existing NCDs, pregnant, under 20 years or trying to conceive. The study included adult Saudis and was design for follow up and forming a baseline, hence the exclusion.

(ii) Many of the behavioural data such as diet, weight, height and physical activity, are self-reported, and subject to recall and social desirability biases.

(iii) Chronic diseases were also self-reported which means some participants could have these diseases but have not been formally diagnosed. In the future, there could be collaboration with nurses and doctors to measure blood pressures, perform fasting glucose tests and provide total cholesterol levels to achieve accurate results.

(iv) Using emails to send questionnaires and collect data may increase the use of spam filtering techniques, where the invitations sent via emails could be blocked by spam filters and most of the people do not check their junk mails (Manca and Ranieri, 2016). This can be addressed using other methods for distribution, which were more effective than emails, such as SNS.

(v) Using social media in collecting data needs an internet access. Although most of the devices nowadays have internet access, not all the people connect with the internet. So, people with no internet connection cannot have access to the online surveys. If the researcher in the future requires a representative sample, then additional methods could be used with the online surveys, such as pen and paper surveys.

(vi) Lack of familiarity with the topic or negative ideas of social media or the time which is required to complete the questionnaire may result in inaccurate answers (Manca and Ranieri, 2016). This can be addressed by putting an introduction section at the top of the FFQ, which can help people to know what is expected from them and give them a brief idea about the survey.

(vii) BMI does not discriminate fat mass from fat free mass. However, using BMI to measure body fat is commonly used worldwide as a simple alternate measure of body fat and closely connects with obesity (Elia *et al*, 2013; Hu, 2008).

(viii) The smoking question did not include ex-smokers, which reduces the risk for CVD; in future questionnaire, the option ex-smoker will be included.

(ix) Intake of alcohol, supplement and vitamins are not included in the questionnaire, in the future they will be included.

(x) The disability question; in the future the question will be for the status of the participants, not for excluding them.

(xi) The response rate cannot be considered to be completely accurate, since the sampling method was snowballing. This sample technique is used in research, and the response rate can be estimated.

7.3 Summary & Conclusion

- Of the total 669 participants, 506 were Saudi, 106 male and 400 females, 163 British, 24 males and 139 females. The average ages for Saudi nutritionist women and men participants were 26.2 and 26.7 years respectively. Saudi public women and men were 26.5 and 29.4 years, respectively. While a majority of Saudi and British reported high socioeconomic status, most of British nutritionist males reported medium socioeconomic status.
- Smoking is one of the major CVD risk factors, which is prevalent in 33% of the Saudi males and 4% among the females. Smoking was prevalent in only 4.1% of the British males and 3.5% in British females. Smoking was more prevalent among Saudis than British (P=0.01).
- Overweight and obesity was more prevalent in Saudi participants (46.7%) than British (19.7%), (P=0.000). Obesity is the main public health problem among Saudi participants, with the Saudi public males being at the highest rate of the all groups.
- Physical inactivity was more prevalent in Saudi participants (24%) than the British (13%) (P=0.000). There were no differences between gender and activity level among Saudi or British (P>0.05).
- The results of the study showed there are more respondents exhibiting unhealthy lifestyle and dietary habits related to CVD and T2DM such as smoking in Saudis than British.
- Saudi participants had unhealthy dietary eating habits compared with British with significantly higher intake of high GL food, saturated fat (P=0.000) for both and significantly lower intake of CF, vegetables and nuts (P=0.000) for all.

- The FFQ show high internal reliability and validity which makes it a good tool to collect the dietary habits of the Saudi participants in epidemiological studies.
- The study established a baseline for Saudi nutritionists which can be used for future studies.
- Social media is a good way to collect dietary habits of specific groups of people in KSA such as nutritionists and to form a baseline for future studies following up the participants.

7.4 Hypotheses testing

The following null hypotheses were tested in the present study:

- There were no differences between Saudi nutritionists and the public in the consumption of the obesogenic food. In addition, Saudi nutritionists were more overweight and obese than the public. So, being nutritionists does not change their eating habits or activity levels.
- There are differences between Saudi and British participants in the risk factors related to T2DM.

  The present results indicate that the prevalence of T2DM risk factors such as; overweight, obesity, inactivity, high GL and low intake of CF among Saudi participants were statistically higher than British participants.
- There are differences between Saudi participants and British participants in the risk factors related to CVD.

  The prevalence of CVD risk factors such as; overweight, obesity, inactivity, smoking, saturated fat, low intake of vegetables and nuts among Saudi participants were statistically higher than British participants.

- There are differences in the consumption of foods related to T2DM and CVD with regards to age, gender and socioeconomic background in British and Saudi participants.

7.5 Recommendations

This study focused on the relation of dietary intake with NCDs and obesity. Overweight and obesity must be targeted in KSA for prevention of NCDs. There should be an intervention with overweight Saudis before they reach obesity levels, especially if they have not developed other health chronic complications.

The findings point to the need for health education to reduce obesity and overweight issues in KSA. For instance, identified high risk groups, e.g. Saudi nutritionists, both males and females and Saudi public males should be targeted for obesity prevention programs. There is a need for change in the Saudi dietary habits, nutritional education and intervention to increase the consumption of fruit and vegetables.

The adult's awareness of the risk factors associated with CVD and T2DM needs to be increased using educational information to be distributed by easy and accessible messages supported by governmental and private organisations.

It is useful to adopt educational programmes on dietary consumption and physical activity promotion using any method to deliver it such as social media. For instance, initiate a Facebook page or Twitter account to send advice on healthy diet and physical activity promotion to users, or try to discourage them from eating unhealthy foods by revealing the calories in healthy and unhealthy foods.

Public policies are needed to encourage active lifestyle and discourage inactivity.

7.6 Future Work

As some information was not available (such as the family history of diabetes and CVD), in the future, questions about the family history and other related factors will be required to give more accurate results. Also, there will be a question about the factors related to T2DM and CVD such as high blood pressure, high cholesterol, heart disease and T2DM.

It seems that FFQ might help to set a baseline level for future reference. It cannot be used as a predictor for NCDs at this stage. The current data needs to be compared to the actual development of NCD's in the future. However, interpreting the baseline results in the context of published work from other countries suggest there is a significant risk of developing NCD's in the population of KSA, and that being a nutritionist does not offer a protective effect. This group reported similar or higher levels of acknowledged risk factors compared to the non- nutritionist (public) group of participants. Thus, health education is needed for Nutritionists especially and for the public also.

There are many participants who put in their email address as willing to participate in this study in the future. This study will be following up in four years to compare the results and the incidence of diabetes and CVD among the participants.

Publishing the results of this study may interest the Department of Health or nutritionist's association or university nutrition department to sponsor this project and follow up this study.

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APPENDICES

Appendix A: Study invitation

The invitation sent to participants through social media and email

I am a PhD student looking for British nutritionists and public to complete the food frequency questionnaire. Can you please forward the link to your friend. Thank you for your help. The invitation was attached with the link of the questionnaire.

Appendix B: English questionnaire

Thank you for participating and taking time to complete this survey. Your information is important to us. We need to know the average food consumption over the past 12 months. The survey will take around 15-20 minutes of your time. We respect your privacy and we will save your information and won't be used in any other purposes. The aim of this study is to know the average consumption of food and to link between diet and chronic diseases.
If you have any enquiries you can contact the researcher on this email: KMF976@bham.ac.uk

1. Age:

Under 20 years old ◯ 20-25 years old ◯ 26-30 years old ◯ 31-35 years old ◯ 36-40 years old ◯ 41-45 years old
46-50 years old ◯ Older than 50

2. Sex:

Male ◯ Female

3. Nationality:

British ◯ Saudi

Other (please specify)

4. Marital status:

Single never married ◯ Married ◯ Divorced ◯ Widow ◯ Separated

5. Number of children if any:

0 ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ more than 4

6. Occupation:

Employed for wages Out of work and looking for a work Out of work and currently not looking for a work

Self employed A homemaker A student A nutritionist, dietitian solider Retired Unable to work

7. Annual household income:

Less than £20.000 £20.001 - £25.000 £25.001 - £30.000 £30.001 - £35.000 £35.001 - £40.000

More than £40.001

8. What is the highest level of education you completed?

never attended schools ◯ Primary school ◯ High school ◯ Technical ◯ Undergraduate ◯ Postgraduate

9. Weight in stones:

10. Height in feet:

11. Do you smoke?
If No please go to question 15

Yes ◯ No

12. What kind of smoking do you use?
(you may choose more than one answer)

Cigarette ☐ Cigar ☐ Shisha

Pipe

13. How many cigarettes or cigars do you smoke in a day?

1 - 5 ◯ 6 - 10 ◯ 11 -15 ◯ 16 - 20 ◯ 21 - 25 ◯ 26 - 30 ◯ More than 30

14. If you smoke shisha, how long does each session last?

less than 30 minutes ◯ 30 minutes ◯ One hour ◯ Two hours ◯ More than 3 hours

please specify per day, week or month

2. This questions for females only

15. Are you pregnant ?

Yes ◯ No

16. Are you trying to have a baby?

Yes ◯ No

3.

17. Do you have any physical disability?

Yes ◯ No

if yes please specify

4.

18. Do you suffer from of the following diseases?
If you changed your eating habits can you please fill the questionnaire as you were eating before you diagnosed with any of these diseases.

Type two diabetes ◯ Hypertension ◯ Kidney Failure ◯ Heart Disease ◯ Stroke ◯ High blood cholesterol (LDL)

High triglyceride ◯ Non alcoholic fatty liver ◯ Non

Other (please specify)

5.

19. This question is about vigorous activities that you did in the last 7 days. vigorous physical activities refer to activities that take hard physical effort and make you breath much harder than normal. think only about those physical activities that you did for at least 10 minutes at time.
During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

No vigorous physical activities. skip to question 21

days per week

20. How much time did you usually spend doing vigorous physical activities on one of those days?

hours per day

minutes per day

Do not know/ Not sure

21. Think about the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breath somewhat harder than normal. think only about those physical activities that you did for at least 10 minutes at a time.
During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis?
Do not include walking.

No moderate physical activities. skip to question 23

days per week

22. How much time did you usually spend doing moderate physical activities on one of those days?

hours per day

minutes per day

Do not know/ Not sure

23. Think about the time you spend walking in the last 7 days. This includes at work and at home, waking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.
During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

No walking. Skip to question 25

days per week

24. How much time did you usually spend walking on one of those days?

hours per day

minutes per day

Do not know/ Not sure

25. Think about the time you spend sitting on weekdays during the last 7 days. Include time spend at work, at home, while doing course work and during leisure time. This may include time spend sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.
During the last 7 days, how much time did you spend sitting on a week day?

hours per day

minutes per day

Do not know/ Not sure

26. Do you add salt to your food?

Yes ◯ No

27. What is your daily average consumption of salt?

Less than 0.25 tsp ◯ 0.25 tsp ◯ 0.5 tsp ◯ 1 tsp ◯ 2 tsp ◯ More than 2 tsp ◯ Don't know

28. How many times do you consume red meat e.g. lamb or
beef? A serving = 113g- 168g (about the size of a deck of cards)

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Everyday once ◯ 2-3 a day

more than 3 times a day

29. How many servings of (fresh, canned, frozen) fish or seafood do you consume? A serving of oily fish and white fish = 85g-140g (the size of cheque book). A serving of shellfish = 40- 60 g

	Never	1-3 servings a month	Once a week	2-3 a week	4-5 a week	Everyday once	2-3 a day	more than 3 servings a day
White fish (Cod, Seabass, Haddock)								
Oily fish (Salmon, Mackerel, Trout, fresh Tuna)								
Shellfish (prawns, mussels oysters, squid, langoustine)								

30. How many servings of poultry e.g. chicken or turkey do you consume? A serving = 100g (about the size of a computer mouse)

Never ○ 1-3 servings a month ○ Once a week ○ 2-3 a week ○ 4-5 a week ○ Once a day ○ 2-3 a day

more than 3 servings a day

31. How many serving of eggs do you consume? A serving = A medium egg

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

32. How many servings of cake, muffin or Arabic dessert do you consume?
A serving = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

33. How many times do you consume food which prepared in takeaway or fast food restaurants such as fried chicken, fried fish, falafel, pizza, burger, fried shrimp, french fries, hotdog, kebab, donor

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 times a day

34. How many servings of fresh, frozen or canned vegetables do you eat (not including potatoes)?
A serving = A medium vegetable (courgettes, carrot, artichoke, parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =half cup of broccoli florets, onion, spinach or 3-4 tablespoons of vegetable curry.

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

35. How many servings of cream e.g. single, double, thick cream, sour cream do you consume? A serving= A tablespoon

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

36. How many cups of full fat milk do you consume (including the milk in tea and coffee)? A serving= A small glass = 250ml

Never ◯ 1-3 cups a month ◯ One cup a week ◯ 2-3 cups a week ◯ 4-5 cups a week ◯ One cup a day

2-3 cups a day ◯ 4-5 cups a day ◯ 6-7 cups a day ◯ more than 8 cups a day

37. How many cups of semi skimmed milk do you consume (including the milk in tea and coffee)? A serving= A small glass = 250ml

Never ◯ 1-3 cups a month ◯ One cup a week ◯ 2-3 cups a week ◯ 4-5 cups a week ◯ One cup a day

2-3 cups a day ◯ 4-5 cups a day ◯ 6-7 cups a day ◯ more than 8 cups a day

38. How many cups of skimmed milk do you consume (including the milk in tea and coffee)? A serving= A small glass = 250ml

Never ◯ 1-3 cups a month ◯ One cup a week ◯ 2-3 cups a week ◯ 4-5 cups a week ◯ One cup a day

2-3 cups a day ◯ 4-5 cups a day ◯ 6-7 cups a day ◯ more than 8 cups a day

39. How many servings of full fat yoghurt do you consume? A serving = 112ml-168ml

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

40. How many servings of low fat yoghurt do you consume? A serving = 112ml-168ml

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

41. How many servings of fruit yoghurt, fruit mousse do you consume? A serving = 112 - 168 g

Never ◯ 1-3 servings a month ◯ One serving a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

42. When you eat poultry (e.g. chicken, turkey) what do you with the skin?

I don't eat poultry ◯ eat the skin ◯ eat some of the skin ◯ I don't eat the skin

43. When you cook red meat (e.g. lamb, beef) what do you do with the visible fat?

I don't eat meat ◯ keep it ◯ keep little fat ◯ take off the visible fat

44. When you eat red meat (e.g. lamb, beef) what do you do with the visible fat?

I don't eat meat ◯ eat it ◯ eat some of it ◯ don't eat it

45. How many times do you eat fast food in restaurants or at home (fast food include burger, pizza, fried chicken, fried fish, fried shrimp, french fries, falafel, hotdog, kebab, donor)?

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 times a day

46. How many serving of fat do you consume (a serving is a tablespoon)?

you may choose more than one answer

	Never	1-3 servings a month	Once a week	2-3 a week	4-5 a week	Once a day	2-3 a day	more than 3 servings a day
Goose fat								
Butter								
Olive oil								
Sunflower oil								
Vegetable oil								
Ghee								
Lard								
Coconut oil								
Peanut oil								
Grape seed oil								
Rape seed oil								
Polyunsaturated Margarine (flora, sunflower, soya or olive oil based spread)								

Other (please specify)

47. How many servings of cheese such as stilton, cheddar - Halloumi - brie, gouda do you consume? A serving = 30g the size of a small matchbox

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

48. How many servings of cheese such as edam, goats, camembert, feta, emmantal do you consume? A serving = 30g the size of a small matchbox

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

49. How many servings of low fat cheese such as fresh mozzarella, cream cheese, katiki, cottage, quark, low fat Philadelphia do you consume?
A serving of hard cheese = 30g the size of a small
matchbox A serving of cottage cheese = 2 tablespoons

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day
more than 3 servings a day

50. How many servings of Nuts and seeds e.g. almonds, peanuts, pumpkin seeds do you consume? A serving = 2 tablespoons = 30g

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day
more than 3 servings a day

51. How many serving of full fat mayonnaise or salad cream do you use? A serving= a tablespoon

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day
more than 3 servings a day

52. How many serving of low fat mayonnaise or salad cream do you use? A serving = a tablespoons

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day
more than 3 servings a day

53. How many servings of porridge do you consume? A serving = a cup

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day
more than 3 servings a day

54. How many servings of wholemeal or bran bread do you consume A serving = 1 slice of medium bread, 1 pitta

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day
more than 3 servings a day

55. How many servings of bran cereals (such as All bran) do you consume? A serving = 30-45g= 0.5 cup

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day

more than 3 servings a day

56. How many servings of beans or pulses e.g. lentil, chickpeas, fava beans, kidney beans do you consume?
A serving = 4 heaped tablespoons of pulses, five tablespoons of beans = 0.5 cup

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day more than 3 servings a day

57. How many servings of raw, cooked, frozen, tinned vegetable (not including potato) do you consume in an average week?
A serving = A medium vegetable (courgettes, carrot, artichoke, parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =half cup of broccoli florets, onion, spinach or 3-4 tablespoons of vegetable curry.

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day More than 3 servings a day

58. How many servings of fresh, frozen, canned fruit do you consume in an average week?
A serving = 150 ml (half glass) of fresh fruit juice not from concentrated (count as a maximum of one portion a day) = A fruit (apple, orange, banana) =1 heaped tablespoon of dried fruit

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day More than 3 servings a day

59. How many servings of fruit juice (from concentrate) do consume? A serving = average glass 250ml

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week once a day 2-3 a day More than 3 servings a day

60. How many servings (A serving = a tablespoon) of honey, marmalade, jam or chocolate spread do you consume?

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day more than 3 servings a day

8.

61. How many cups of herbal tea or fruit tea do you consume? A cup= 250 ml

Never 1-3 cups a month Cup a week 2-3 cups a week 4-5 cups a week Cup a day

2-3 cups a day 4-6 cups a day more than 6 cups a day

62. How many cups of green tea do you consume? A cup = 250 ml

Never 1-3 cups a month Cup a week 2-3 cups a week 4-5 cups a week Cup a day

2-3 cups a day 4-6 cups a day more than 6 cups a day

63. How many cups of black tea or coffee do you consume? A cup = 250 ml

Never 1-3 cups a month Cup a week 2-3 cups a week 4-5 cups a week Cup a day

2-3 cups a day 4-6 cups a day more than 6 cups a day

64. How many teaspoons of sugar do you add to your coffee, tea, cereal in an average day?

0 1 2 3 4 more than 4

65. How many serving do you consume form sweets e.g. marshmallow, toffees, jelly sweets? A serving = a sweet size of a tablespoon

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day

more than 3 servings a day

66. How many servings of chocolate do you consume?
A serving = a standard bag of Minstrels (42g) , Malteasers (37g), a Creme egg (34g) or a standard Mars bar (58g), Bounty bars (57g)

Never 1-3 servings a month Once a week 2-3 a week 4-5 a week Once a day 2-3 a day

more than 3 servings a day

67. How many servings of breakfast cereals do you
consume? A serving = 30-45g = 0.5 cup

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

68. How many servings of cooked rice and pasta do you
consume? A serving of cooked rice = 1 cup
A serving of cooked pasta = 1 cup

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

4-5 a day ◯ more than 5 servings a day

69. How many servings of cooked wholemeal pasta or brown rice do you
consume? A serving of cooked rice = 1 cup
A serving of cooked pasta = 1 cup

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

4-5 a day ◯ more than 5 servings a day

70. How many servings of white bread do you consume?
A serving = a slice of medium bread = a bagel or roll = a croissant = a slice of french stick = slice of fruit bread or malt loaf or tortillas or burger bun = a slice of garlic bread

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

71. How many servings of crisps do you
consume? A serving = 25-30 g = a small bag

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

72. How many serving of potatoes (excluding French fries and chips) do you
consume? A serving = a medium potato, half baked potato, 1 cup mashed potato

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

73. How many servings of cake, muffin or Arabic dessert do you consume?
A serving = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

74. How many times do you consume savoury pies, meat pies, pasties, sausage rolls?

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 times a day

75. How many servings of ice cream do you consume?
A serving = A Mars bar ice cream, a fruit lolly, a scoop of ice cream

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

76. How many millilitres of soft drinks and energy drinks do you consume? A serving= average glass = 250 ml
A can = 330 ml

Never ◯ 330 ml - 660 ml a month ◯ 330 ml a week ◯ 660 ml -990 ml a week ◯ 1320 ml - 1650 ml a week

330 ml a day ◯ 660 ml -990 ml a day ◯ More than 990 ml a day

77. How many millilitres of diet soft drinks do you consume? A serving= average glass = 250 ml
A can = 330 ml

Never ◯ 330 ml - 660 ml a month ◯ 330 ml a week ◯ 660 ml - 990 ml a week ◯ 1320 ml - 1650 ml a week

330 ml a day ◯ 660 ml -990 ml a day ◯ more than 990 ml a day

78. How many servings of sweet biscuits e.g. chocolate digestive or cookie do you consume? A serving = a biscuit or a cookie

Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 servings a day

79. How many glasses of water do you drink in an average day? A glass = 250 ml

Less than 1 glass ◯ 1-2 ◯ 3-4 ◯ 5-6 ◯ 7-8 ◯ more than 8 glasses

80. How often do you eat your breakfast?

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Everyday

81. How many times do you consume Middle Eastern meals e.g. Kurdish, Turkish or Iranian?
A serving of rice=1 cup

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 times a week ◯ 4-5 times a week ◯ Once a day

2-3 times a day ◯ More than 3 times a day

82. How many times do you consume canned food (food in tin) e.g. tuna, tomato, chickpeas, baked beans?

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 times a day

83. How many times do you consume ready to eat meals or processed food such as frozen pizza - nuggets- fish - burger?

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 times a day

84. How many times do you eat sausage, cured meat or salami?
A serving= 1 sausage or hotdog, salami 2 small links

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 times a day

85. How many teaspoons of added salt do you consume in an average day?

less than 0.25 teaspoon ◯ 0.25 teaspoon ◯ 0.5 teaspoon ◯ 1 teaspoon ◯ 2 teaspoons

more than 2 teaspoons ◯ Don't know

86. How many vegetable, chicken, beef or fish cube stocks, powdered broths, soups, and gravies do you use in an average week?
A cube = a tablespoon
If you are cooking several portions, how many cube in average approximately per person?

Don't know ◯ 0 ◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ more than 5

87. How many times do you consume sauces e.g. soy sauce, fish sauce, yeast spread?

Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

more than 3 times a day

88. How many times do you eat sun dried tomatoes or pickled food e.g. olives, cucumber?

Never ○ 1-3 times a month ○ Once a week ○ 2-3 a week ○ 4-5 a week ○ Once a day ○ 2-3 a day

more than 3 times a day

89. Do you regularly eat other types of food than listed in this survey, if so please specify the foodstuff and the frequency.

1

2

3

4

90. Thank you for your time in completing this survey.
The answers you provide will be used for this study only and will be kept confidential / if you want feedback based on this survey or would like to be part of this study in the future, please write your name and email address.

Name:

Email address:

Appendix C1: Translated questionnaire (1)

Thank you for your cooperation and taking the time to complete this questionnaire. You answer are important, and completing this questionnaire will take about 15-20 minutes. We respect your privacy and your answers will be retained and will not be used for any other purpose. This study aims to determine food intake rate and it also investigates the relationship between diet and chronic diseases. If you have any question please do not hesitate to contact the researcher on KMF976@bham.ac.uk

1- **Age group:**

Less than 20 years 20-25 years 26-30 years 31-35 years

36-40 years 41-45 years 46-50 years more than 50 year

Gender :

Male Female

2- **Nationality:**

Saudi British other, please specify:……………..

3- **Material Status :**

Single Married Divorced Widowed

4- **Are you pregnant or trying to get pregnant?**

Yes No

5- **Number of children if there is**

0 1 2 3 4 more than 4

6- **Occupational status**

Employed –full time Unemployed and seeking for job Unemployed and not interested in work Employed – my own business Housewife Dietician Soldier

Retired Unable to work

7- **Total monthly income (for house)**

Less than 3000 SR 3000-8000 SR 80001-130000 SR

13001-18000 SR 18001-23000 more than 23000

8- Weight in Kg:

9- Height in cm:

10- Highest level of education :

No education background Intermediate Secondary Technician (diploma) University graduate Postgraduate level

11- Do you have any disability?

Yes No

Please specify if there is :……………….

12- Do you suffer from any of the following diseases?

Type 2 diabetes Hypertension Renal failure Heart diseases

Thrombosis High cholesterol High triglycerides Cirrhosis liver (Nonalcoholic)

I don't have any diseases

Other, please specify:…………………

13- Are you a smoker? if not, please move to question 18 .

Yes No

14- What do you smoke?

Cigarette Cigar
Shisha Pipe

15- How many cigarettes, or cigar, do you smoke a day?

1-5 6-10 11-15 16-20

21-25 26-30 more than 30

16- If you smoke shisha how long it takes to finish it?

Less than 30 m 30 minutes one hour two hours

more than three hours (what if I do smoke three hour?)

Please specify if that in a day or a week or a month:

18-How much time do you spend weakly doing the following physical activities? you can select more than one choice:

	0	15 m	30 m	One hour	Two hours	More than two hour and half
Stair climbing						
Jogging						
Running						
Bike riding						
Self-defence sport						
Weight Lifting						
Football						
Basketball						
Handball						
Squash tennis						
Walking						
Brisk walking						
Volleyball						
Badminton						
Table tennis						
Household chores						
Swimming						

Other, please specify: ……………………….

17- How much the time do you spend in activities that require you sitting, such as using the computer, internet, reading, knitting and watching the TV on a day?

Less than an hour 1-2 hours 3-4 hours more than 5 hours

18- How much your daily consumption of salt?

Less than ¼ tea spoon	¼ tea spoon	½ tea spoon	one tea spoon	2 tea spoons	more than 2 tea spoons

19- How many servings of red meat, such as lamb and beef, do you consume?

One serving size = 113g- 168g (about the size of a deck of cards)

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one servings a day	2-3 servings a day	more than 3 servings a day

20- How many servings of fish and seafood (fresh, canned or frozen) do you consume?

A serving of oily fish and white fish = 85g-140g (the size of cheque book). A serving of shellfish = 40- 60 g

	I don't consume it at all	1-3 servings monthly	one serving a week	2-3 serving a week	4-5 serving a weak	one serving a day	2-3 serving a day	more than 3 serving a day
White fish								
Fatty fish								
Crustaceans								

21- How many servings of poultry (chicken and turkey) do you consume?

One serving = 100 gm (equals to the computer's mouse)

I don't consume	1-3 servings	one serving	2-3 servings	4-5 servings	one serving	2-3 servings	more than 3

it at all	monthly	a week	a week	a weak	a day	a day	servings a day

22- How many servings of eggs do you consume?

One serving of eggs = 1 medium size egg

I don’t consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

23- How many servings of dessert (such as: cake, tart, pancake, éclair and pudding) do you eat?

A serving = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun

I don’t consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

24- How <u>many times</u> do you eat foods that prepared in takeaway/ fast food restaurants (such as, fried chicken, fired fish, falafel, pizza, burger and kebab?

<u>I don’t consume it at all</u>	<u>1-3 servings monthly</u>	one serving a week	2-3 servings a week	4-5 servings a weak	one servings a day	2-3 serving a day	more than 3 servings a day

25- How many servings of vegetables (fresh, frozen and canned but it doesn’t include potato) do you consume?

A serving = A medium vegetable (courgettes, carrot, artichoke, parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =half cup of broccoli florets, onion, spinach or 3-4 tablespoons of vegetable curry.

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

26- How many servings of cream do you consume?

One serving = 1 tablespoon

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

27- How many cups of full fat milk (including that added in tea or coffee) do you consume?

One cup = 250 ml

I don't consume it at all	1-3 cups a month	1 cup a week	2-3 cups a week	4-5 cups a weak	one cup a day	2-3 cups a day	4-5 cups a day	6-7 cups a day	more than 8 cups

28- How many cups of low fat milk (including that added in tea or coffee) do you consume?

One cup = 250 ml

I don't consume it at all	1-3 cups a month	1 cup a week	2-3 cups a week	4-5 cups a weak	one cup a day	2-3 cups a day	4-5 cups a day	6-7 cups a day	more than 8 cups

29- How many cups of skimmed milk (including that added in tea or coffee) do you consume?

One cup = 250 ml

I don’t consume it at all	1-3 cups a month	1 cup a week	2-3 cups a week	4-5 cups a weak	one cup a day	2-3 cups a day	4-5 cups a day	6-7 cups a day	more than 8 cups

30- How many servings of full fat yogurt drink do you consume?

A serving = 112ml-168ml

I don’t consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

31- How many servings of low fat yogurt drink do you consume?

A serving = 112ml-168ml

I don’t consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

32- How many times do you consume fruit yogurt/ mousse?

A serving = 112ml-168ml

I don’t consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day	more than 3 times a day

33- When you eat poultry (chicken or turkey) what do you do with the skin?

I don’t eat chicken at all I do eat the skin I do eat some of the skin I don’t eat the skin

34- When you cook red meat, what do you do with the clear fat?

I don't consume red meat at all	I keep all fat on the meat	I keep some fat on the meat	I remove all clear fat

35- When you eat red meat, such as lamb and beef, what do you do with the clear fat?

I don't consume red meat at all	I the clear fat on the meat	I eat some fat on the meat	I remove it all

36- How many times you do eat fast food at/out the home (including : pizza, burger, fried chicken, fried fish, fried shrimp, chips, hotdog, kebab and shawerma) – same to Q 26

I don't consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day

37- How many servings of the following fat do you consume?

One serving = 1 tablespoon,

You can select more than one answer.

	I don't consume it at all	1-3 servings monthly	one serving a week	2-3 serving a week	4-5 serving a weak	one serving a day	2-3 serving a day	more than 3 serving a day
Butter								
Olives oil								
Sunflower Oil								
Vegetable oil								

Ghee

Coconut Oil

Peanut oil

Grape seed oil

Rapeseed oil

Margarine (flora, sunflower butter, soya oil, olives oil

Other, please specify:……………………………..

38- How many servings of full fat cheese , such as stilton cheese, cheddar, brie or gouda, do you consume ?

A serving = 30g the size of a small matchbox

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

39- How many servings of medium fat cheese, such as edam, goat cheese, camembert cheese, feta and emmental do you consume ?

A serving = 30g the size of a small matchbox

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

40- How many servings of low fat cheese, such as mozzarella, creamy cheese, katiki, cottage and quark cheese, do you consume?

A serving = 30g the size of a small matchbox

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

41- How many servings of nuts and seed such as almond, peanut and pumpkin seeds, do you consume?

A serving = 2 tablespoons = 30g

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

42- How many servings of mayonnaise or salad cream do you consume ?

One serving = 1 full tablespoon

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one servings a day	2-3 servings a day	more than 3 servings a day

43- How many servings of low fat mayonnaise or salad cream do you consume

One serving = 1 full tablespoon

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

44- How many servings of oats porridge do you consume ?

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

One serving = 1 cup

45- How many servings of whole grain bread/ brown bread do you consume ?

A serving = 1 slice of medium bread, 1 pitta

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

46- How many servings of bran flakes do you consume?

A serving = 30-45g= 0.5 cup

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

47- How many servings of legume, such as lentil, homos and bean, do you consume ?

A serving = 4 heaped tablespoons of pulses, five tablespoons of beans = 0.5 cup

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

48- How many servings of fresh, frozen or canned vegetables do you consume weekly? (it doesn't include potato)

A serving = A medium vegetable (courgettes, carrot, artichoke, parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =half cup of broccoli florets, onion, spinach or 3-4 tablespoons of vegetable curry.

0	less than 7	7-14	15-21	22-28	29-35	more than 45

49- How many servings of fresh, frozen or canned fruit do you consume? Or dried ?

A serving = 150 ml (half glass) of fresh fruit juice not from concentrated (count as a maximum of one portion a day) = A fruit (apple, orange, banana) =1 heaped tablespoon of dried fruit

0	less than 7	7-14	15-21	22-28	29-35	more than 45

50- How many servings of honey or jam do you consume?

One serving = 1 tablespoon

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

51- How many cups of green tea, herb tea and fruit tea do you consume?

1 cup = 250 ml

I don't consume it at all	1-3 cups a month	1 cup a week	2-3 cups a week	4-5 cups a weak	one cup a day	2-3 cups a day	4-5 cups a day	6-7 cups a day	more than 8 cups

52- How many cups of tea and coffee do you consume?

1 cup = 250 ml

I don't consume it at all	1-3 cups a month	1 cup a week	2-3 cups a week	4-5 cups a weak	one cup a day	2-3 cups a day	4-5 cups a day	6-7 cups a day	more than 8 cups

53- How many spoons of sugar do you put in your tea, coffee or breakfast cereal during the normal day ?

0	1	2	3	4	more than 4 spoons

54- How many servings of dessert, such as marshmallow, toffee and jelly candy do you consume?

One serving = 1 tablespoon size of dessert

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

55- How many servings of chocolate do you consume?

A serving = a standard bag of Minstrels (42g) , Malteasers (37g), a Creme egg (34g) or a standard Mars bar (58g), Bounty bars (57g).

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

56- How many servings of breakfast cereal do you consume?

One serving = 30-45g = 0.5 cup

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

57- How many times do you consume cooked rice or macaroni?

58- ? A serving of cooked rice = 1 cup
A serving of cooked pasta = 1 cup

I don't consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day	more than 3 times a day

How many times do you consume brown cooked rice or macaroni? ? A serving of cooked rice = 1 cup
A serving of cooked pasta = 1 cup
59-

I don't consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day	more than 3 times a day

60- How many servings of white bred do you consume?

A serving = a slice of medium bread = a bagel or roll = a croissant = a slice of french stick = slice of fruit bread or malt loaf or tortillas or burger bun = a slice of garlic bread

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

61- How many servings of chips do you consume?

One serving = 25-30 g = small size bag

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

62- How many servings of potato do you consume?

A serving = a medium potato, half baked potato, 1 cup mashed potato

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

63- How many servings of muffin or Arabic dessert do you consume?

A serving = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

64- How many times do you consume salty pastry, pasties or sausage?

I don't consume it	1-3 times	one time a	2-3 times a	4-5 times a	one time a	2-3 times a	more than 3 times a

at all	monthly	week	week	weak	day	day	day

65- How many servings of ice-cream do you consume?

One serving = 1 mars ice-cream = fruit sundae or 1 scoop

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

66- How many servings of soft drinks or energy drinks do you consume?

One serving = normal cup = 250 ml

One can = 330 ml

I don't consume it at all	330-660 ml onthly	330 ml a week	660-990 ml a week	1320-1650 ml a weak	330 ml a day	660-990 ml a day	more than 990 ml a day

67- How many servings of diet soft drinks or diet energy drink do you consume?

One serving = normal cup = 250 ml

One can = 330 ml

I don't consume it at all	330-660 ml monthly	330 ml a week	660-990 ml a week	1320-1650 ml a weak	330 ml a day	660-990 ml a day	more than 990 ml a day

68- How many sweetened biscuits such as chocolate digestive chocolate or cookies do you consume?

One serving = 1 biscuit or cookies

I don't consume it at all	1-3 servings monthly	one serving a week	2-3 servings a week	4-5 servings a weak	one serving a day	2-3 servings a day	more than 3 servings a day

69- How many glasses of water do you consume in a typical day?

One glass = 250 ml

1-2	3-4	5-6	7-8	more than 8 glasses

70- How many times do you consume breakfast?

I don't consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	everyday

How many times do you consume traditional dishes that contain rice and chicken or meat? A serving of rice=1 cup

I don't consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day	more than 3 times a day

71- How many times do you consume canned food such as tuna, tomato, homos and bean?

I don't	1-3 times	one	2-3	4-5	one	2-3	more

consume it at all	monthly	time a week	times a week	times a weak	time a day	times a day	than 3 times a day

72- How many times do you consume ready meals (which prepare in microwave)?

I don't consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day	more than 3 times a day

73- How many times do you consume cold meat, sausage and salami?

A serving= 1 sausage or hotdog, salami 2 small links

I don't consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day	more than 3 times a day

74- How many tea spoons of salt do you consume in a typical day?

0	¼ tea spoon	½ tea spoon	1 tea spoon	2 tea spoons	more than 2 tea spoons

75- How many vegetable stock cubes, chicken, meat, fish, stock powder, soup powder or , ready gravy sauce do you consume a typical week?

One cube = 1 tablespoon

0	1	2	3	4	5

76- How many time do you consume ready sauces such as, soya sauce , fish sauce and Yeast ?

I don’t consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day	more than 3 times a day

77- How many times do you consume dried tomato and pickles?

I don’t consume it at all	1-3 times monthly	one time a week	2-3 times a week	4-5 times a weak	one time a day	2-3 times a day	more than 3 times a day

78- Do you consume any other types of food that is not included in this questionnaire? If so please define it and how many times you do?

1

2

3

4

79- Thank you so much for taking the time to complete this questionnaire, the information that you’ve provided will be used only for this study purposes and will be kept confidential. If you would like to evaluate you answers, or if you wish to participate in this study in the future, kindly write your name and your email address below.

Name

Email address

Appendix C2: Translation (2)

1.Age

- Less than 20 years old.
- Between 20-25.
- 26-30.
- 31-35.
- 36-40.
- 41-45.
- 46-50.
- 50 years or more.

1. Gender:

- Male.
- Female.

2. Nationality:

- Saudi.
- British.
- Other. Specify please ……………………

3. Marital Status:

- Single never been married.
- Married.
- Divorced.
- Widowed.
- Separated.

4. Are you pregnant, or trying to have a baby.

- Yes.
- No.

5. Number of children if any.

- 1
- 2
- 3
- 4
- More than 4.

6. Occupation.

- Employee with a salary.
- Unemployed and looking for a job.
- Unemployed and not looking for a job.
- Self-Employed.
- Housewife.
- Student.
- …
- Officer.
- Retired.
- Can’t work.

7. Monthly income.

- Less than 3000 SR.
- 3,000-8,000 SR.
- 8,001-13,000 SR.

- 13,001-18,000 SR.
- 18,001-23,000 SR.
- More than 23,000 SR.

8. Weight in Kg.

- ……………………

9. Height in cm.

- ……………………

10. What is your highest level of education?

- Never attend school
- Elementary
- High school graduate
- Technical training
- Bachelors
- Master’s degree or more

11. Do you have disability?

- Yes
- No

If yes specify please …………………

12. Are you suffering from one of these diseases?

- Type 2 diabetes
- High blood pressure
- Kidney failure

- Heart disease
- Stroke
- High level of cholesterol
- High level of triacylglycerol (TG).
- Other (specify)
- None.

13. Do you smoke?

- Yes
- No

If no go to question 18.

14. What do you smoke?

- Cigarette
- Cigar
- Shisha or hubbly bubbly
- Pipe

15. How many cigarettes or cigar you smoke daily?

- 1-5.
- 6-10.
- 11-15.
- 16-20.
- 21-25.
- 26-30.
- 30 or more.

16. If you smoke shisha or hubbly bubbly how long does it take

- Less than 30 min.
- 30 min
- An hour
- 2 hours
- More than 3 hours.

Please determine the day or week or month………

17. How much time do you spend doing physical activity weekly?

You can chose more than one

	0	15min	30min	60min	120min	150min or more
Stairs						
Jogging						
Running						
Cycling						
Self defense sports						
Weight lifting						
Football						
Basketball						
Handball						
Tennis						
Walking						
Fast walking						
Volleyball						
Badminton						
Table tennis						

House chores

Swimming

Other.

Specify please

18. How much time do you spend on activities requires setting like using computer, reading, browsing, Knitting or watching TV in regular day?

- Less than an hour
- 1-2 hours
- 3-4 hours
- More than 5 hours

19. Your daily intake of salt

- Less than 0.25 teaspoon
- 0.25 teaspoon
- 0.5 teaspoon
- 1 teaspoon
- 2 teaspoons
- More than 2 teaspoons

20. How many portions of red meat do you consume such as beef and lamb?

The portion = 113g- 168g (about the size of a deck of cards)

- None
- 1-3 in a month
- A portion a week
- 2-3 portions a week
- 4-5 portions a week

- ○ A portion a day
- ○ 2-3 portions a day
- ○ More than 3 portions a day

21. How many portions of fish or seafood do you consume (Fresh, Canned or Frozen)?

A serving of oily fish and white fish = 85g-140g (the size of cheque book). A serving of shellfish = 40- 60 g.

	None	1-3 a month	1 a week	2-3 a week	4-5 a week	1 daily	2-3 a day	More than 3 a day
-White fish (Cod, Sea bass, Haddock).								
-Oily fish (Salmon, Mackerel, Trout)								
-Crustaceans (Shrimp, Mussel, Oysters, Squid, Langoustine)								

22. How many portions of poultry do you consume (chicken, turkey)?

The portion= 100gm (size of computer mouse).

- ○ None
- ○ 1-3 a month
- ○ A portion a week.
- ○ 2-3 a week
- ○ 4-5 portions a week.

- A portion a day.
- More than 3 portion a day.

23. How many portions of egg do you consume?

The portion= 1 medium size egg.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

- How many portions of sweet such as A serving = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun
- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

24. How often do you eat in restaurants or from fast food restaurants?

Such as: (Fried chicken, Fried fish, Falafel, Pizza, Burger or Kebabs).

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

- How many portions of vegetables (Fresh, Frozen or canned do not include potatoes) do you eat? A serving = A medium vegetable (courgettes, carrot, artichoke, parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =half cup of broccoli florets, onion, spinach or 3-4 tablespoons of vegetable curry None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

25. How many portions of cream –all different kinds- do you consume?

The portion= 1 spoon.

- None
- 1-3 a month
- A portion a week
- 2-3 a week

- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

26. How many cups of whole milk do you consume (which includes milk in tea and coffee)? The cup= 250ml.

- None
- 1-3 cups a month
- 1 cup a week
- 2-3 cups a week
- 4-5 cups a week
- A cup daily
- 2-3 cups a day
- 4-5 cups a day
- 6-7 cups a day
- More than 8 cups a day

27. How many cups of low-fat milk do you consume (which includes milk in tea and coffee)? The cup= 250ml.

- None
- 1-3 cups a month
- 1 cup a week
- 2-3 cups a week
- 4-5 cups a week
- A cup daily
- 2-3 cups a day
- 4-5 cups a day

- 6-7 cups a day
- More than 8 cups a day

28. How many cups of skimmed milk do you consume (which includes milk in tea and coffee)? The cup= 250ml.

- None
- 1-3 cups a month
- 1 cup a week
- 2-3 cups a week
- 4-5 cups a week
- A cup daily
- 2-3 cups a day
- 4-5 cups a day
- 6-7 cups a day
- More than 8 cups a day

- How many portions of whole yogurt do you consume? The portion= = 112ml-168ml
- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

How many portions of low-fat yogurt do you consume? The portion= 112ml-168ml

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

How many portions of skimmed yogurt do you consume? The portion= 112ml-168ml

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

29. When you eat poultry (chicken, turkey) what do you do to the skin?

- Don’t eat poultry
- Eat the skin
- Eat some of it
- Don’t eat the skin

30. When you cook red meat what do you do with the appeared fat?

- Don’t eat meat
- Leave the fat on the meat
- Leave some of the fat
- Remove all the appeared fat

31. When you eat red meat like lamb or beef, what to do with the appeared fat?

- Don’t eat red meat
- Eat the fat
- Eat some of the fat
- Remove it and don’t eat it

32. How many times do you eat fast food in or outside home? Fast foods includes; Burger, Pizza, Fried Chicken, Fried Fish, Fried shrimp, French fries, Sausage Kebab or Shawarma.

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 a day

33. How many consumed portions of the following fat? The portion= full spoon. You can choose more than one answer.

	None	1-3 a month	1 a week	2-3 a week	4-5 a week	1 daily	2-3 a day	More than 3 a day

Butter

Olive oil

Sunflower Oil

Vegetable oil

Ghee

Coconut Oil

Peanut oil

Grape seed oil

Rapeseed oil

Margarine
(Flora,
sunflower
butter, soy
butter, olive oil
butter.

Other

Please specify………

34. How many consumed portions of high-fat cheeses such as: chider……. do you consume?

The portion= 30g the size of a small matchbox

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day

- More than 3 portions a day

35. How many portions of medium-fat cheeses such as goat cheese, feta… do you consume?

The portion= 30g the size of a small matchbox

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

36. How many portions of low-fat cheeses such as fresh mozzarella… and creamy chees do you consume

The portion= 30g the size of a small matchbox

The portion of the creamy chees= 1 spoon

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

37. How many portions of nuts and seeds such as almonds, peanuts, pumpkin seeds do you consume?

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

38. How many portions of mayonnaise or salad dressing do you consume?

The portion= 1 full spoon.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

39. How many portions of low-fat mayonnaise or low-fat salad dressing do you consume?

The portion= 1 full spoon.

- None
- 1-3 a month
- A portion a week

- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

40. How many portions of porridge oats do you consume?

The portion= a cup.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

41. How many portions of whole wheat bread (brown bread) or bran bread do you consume?

The portion= 1 medium slice of the bread.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day

- More than 3 portions a day

42. How many portions of bran flakes do you consume?

The portion= 30-45g= 0.5 cup

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

43. How many portions of pulses such as lentils, chickpeas and beans do you consume?

The portion= 4 heaped tablespoons of pulses, five tablespoons of beans = 0.5 cup None

- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

44. How many portions in a regular week do you consume fresh vegetables, frozen or canned (potatoes not included or not counted)?

The portion= medium size vegetable, A medium vegetable (courgettes, carrot, artichoke, parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =half cup of broccoli florets, onion, spinach or 3-4 tablespoons of vegetable curry0

- Less than 7.
- 7-14
- 15-21
- 22-28
- 29-35
- More than 35

45. How many portions in a regular day do you consume fresh fruit, frozen or canned?

The portion= 150 ml (half glass) of fresh fruit juice not from concentrated (count as a maximum of one portion a day) = A fruit (apple, orange, banana) =1 heaped tablespoon of dried fruit.

- 0
- Less than 7.
- 7-14
- 15-21
- 22-28
- 29-35
- More than 35

46. How many consumed portions of jam or honey?

The portion= 1 spoon.

- None
- 1-3 a month
- A portion a week
- 2-3 a week

- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

47. How many cups of green tea or herbal tea or fruit tea do you consume?

The cup= 250ml.

- None.
- 1-3 cups a month.
- A cup a week.
- 2-3 cups a week.
- 4-5 cups a week.
- A cup a day.
- 2-3 cups a day.
- 4-6 cups a day.
- More than 6 cups a day.

48. How many cups of tea and coffee do you consume?

The cup= 250ml.

- None.
- 1-3 cups a month.
- A cup a week.
- 2-3 cups a week.
- 4-5 cups a week.
- A cup a day.
- 2-3 cups a day.
- 4-6 cups a day.

- More than 6 cups a day.

49. How many teaspoons of sugar in a regular day do you add to tea, coffee or breakfast cereal?

- 0
- 1
- 2
- 3
- 4
- More than 4

50. How many portions of sweets like marshmallow, toffee, jelly do you consume?

The portion= a spoon size.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

51. How many portion of chocolate do you consume?

The portion= small bag of Galaxy Manstrles, small bag Maltsters, medium size Mars, or regular size Bounty.

- None
- 1-3 a month
- A portion a week

- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

52. How much breakfast cereal do you consume?

The portion30-45g = 0.5 cup.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

53. How many times do you consume cooked rice or pasta? 1 cup

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 times a day
- More than 3 times a day

54. How many times do you consume cooked brown rice or pasta? 1 cup

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 times a day
- More than 3 times a day

55. How many portions of white bread do you consume?

The portion= medium-sized slice of bread= bagel bread= medium croissant= a slice of French toast= half slice of fruit bread or rye bread or tortillas bread or burger bread= a slice of garlic bread.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

56. How many portions of potato chips do you consume?

The portion= 25-30 g = a small bag

None

- 1-3 a month
- A portion a week

- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

57. How many portions of potato do you consume?

The portion= medium size potato. half baked potato, 1 cup mashed potato

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

58. How many portions of cake muffin or Arabic sweets do you consume?

The portion= a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day

- More than 3 portions a day

59. How many times do you consume salty pies, pasties, pastry or sausage patties

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 times a day
- More than 3 times a day

60. How many portions of ice cream do you consume?

The portion= 1 mars ice cream, fruit ice cream or an ice cream scoop.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day
- More than 3 portions a day

61. How many portions of soft drinks or energy drinks do you consume?

The portion= regular glass= 250ml, can= 330ml.

- None
- 330ml- 660ml a month
- 330ml a week

- 660-ml-990ml a week
- 1320ml- 1650ml a week
- 330ml a day
- 660ml- 990ml a day
- More than 990ml a day

62. How many portions of low- calories soft drinks or diet energy drinks do you consume?

The portion= regular glass= 250ml, can= 330ml.

- None
- 330ml- 660ml a month
- 330ml a week
- 660-ml-990ml a week
- 1320ml- 1650ml a week
- 330ml a day
- 660ml- 990ml a day
- More than 990ml a day

63. How many portions of sweet biscuits like chocolate digestive biscuit or cookies?

The portion= 1 biscuits or cookies.

- None
- 1-3 a month
- A portion a week
- 2-3 a week
- 4-5 a week
- A portion a day
- 2-3 a day

- More than 3 portions a day

64. How many glass of water do you consume in a regular day?

The glass= 250ml.

- 1-2
- 3-4
- 5-6
- 7-8
- More than 8 glass

65. How many times do you consume breakfast?

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Everyday

66. How many times do you eat traditional food that contains rice and chicken or meat? The portion= 1 cup of rice

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day

- 2-3 times a day
- More than 3 times a day

67. How many times do you consume canned food like tuna, tomato, chickpeas, and beans?

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 times a day
- More than 3 times a day

68. How many times do you consume prepared foods (prepared in the microwaves)?

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 times a day
- More than 3 times a day

69. How many times do you consume sausage, cold meats and salami?

A serving= 1 sausage or hotdog, salami 2 small links

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 times a day
- More than 3 times a day

70. How many teaspoon of salt do you consume in a regular day?

- 0
- ¼ teaspoon
- ½ teaspoon
- 1 teaspoon
- 2 teaspoons
- More than 2 teaspoons

71. How many cubs of vegetable, chicken, meat or fish stock or packet soup or prepared meat sauce do you consume in a regular week?

The cube= 1 spoon.

- 0
- 1
- 2
- 3
- 4
- 5
- More than 5.

72. How many times do you consume ready-made sauces such as soy sauce, fish sauce and yeast?

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 times a day
- More than 3 times a day

73. How many times do you consume dried tomatoes or pickles such as olives or pickled cucumber?

- None
- 1-3 times a month
- Once a week
- 2-3 times a week
- 4-5 times a week
- Once a day
- 2-3 times a day
- More than 3 times a day

74. Do you regularly eat different types of food that is not listed in this questionnaire? If so please determine them and number of times.

- .
- .
- .

- ○ .

75. Thank you for your time, the provided information will be used for educational purposes and kept confidential. If you want your answers to be evaluated, or you wish to be involved in this study in the future, please write your name and your email address.

Name……

Email……

Appendix C3: Translation (3)

1. Age:

Less than 20 years

From 20-25 years

From 26-30 years

From 31-35 years

2. Gender

Female Male

3. Nationality

British Saudi

4. Marital Status

Single -Married -divorce -Widowed-separated

5- Are you pregnant or try to trying to have a child?

6-Number of Children

7- Occupation

Working with Salary XXX

Don’t work and trying to find out a job

Don’t work and don’t trying to find out a job

Have my own business

Housewife

Student

Nutritionist

Soldier

Retired

Can’t work

8-monthly salary of House

9-Weight in kg

10-Length in cm

11-What is the highest level of completed education?

Not enrolled in school

Intermediate

Secondary

Technical technician

Undergraduate

Postgraduate

12-Do you suffer from any disability?

Please specify the type of disability that found

13- Do you suffer from one of the following diseases?

type 2 diabetes

high blood pressure

Renal failure

heart attack

clots

High Cholesterol

High in the rate of fat Tripartite

Fleshy Liver (non-Alcoholic)

Do not suffer from these diseases

Other please specify

14 Are you a smoker?

If the answer is no, go on to question 18

15-What do you smoke?

Cigarettes

Cigar

Shisha

Pipe

16-How many cigarettes or cigars, do you smoke daily?

17-If you smoke shisha, How long does a session take?

Please select a day or week or month

18- How long do you spend weekly on the sporting activities, from the following?

You can choose more than one answer:

0 15 mins 30 mins 30 mins 1 hour 2 hours 2 hours and half or more

Up the stairs, Scrambling, Run, sport self-defence, Weightlifting , Football, Basketball, Handball, Tennis singles, Walking, Brisk walking, Volleyball, Badminton, Tennis, household chores, Swimming.

Other, please specify:

19- How long do you spend in activities that require you to sit, such as, use the computer, Internet, reading, knitting, watching. TV in a typical day?

Less than an hour, 1-2 hours, 3-4 hours, more than 5 hours.

20- What is the rate of your daily intake of salt?

Less than 0.25 teaspoons, 0.25 tsp, 0.5 tsp, 1 tsp, 2 tsp, more than 2 tsp

21- How many portions do you consume from red meat such as beef or lamb?

portion = 113g- 168g (about the size of a deck of cards

Do not never consumed

From 1-3 portions monthly

One portion weekly

From 2-3 portions weekly

From 4-5 portions weekly

One portion daily

From 2-3 portions daily

More than 3 portions daily

22- How many portions do you consume from fish or seafood (fresh, canned, Frozen)?

? A serving of oily fish and white fish = 85g-140g (the size of cheque book). A serving of shellfish = 40- 60 g White fish (Cod, Seabass, Haddock)

Oily fish (Salmon, Mackerel, Trout)

Shellfish (Prawns, mussels, oysters, squid, langoustine)

Do not never consumed

From 1-3 portions monthly

One portion weekly

From 2-3 portions weekly

From 4-5 portions weekly

One portion daily

From 2-3 portions daily

More than 3 portions daily

23- How many portions do you consume from Chicken (chicken, turkey)?

Portion = 100 g (the size of a computer mouse)

Do not never consumed

From 1-3 portions monthly

One portion weekly

From 2-3 portions weekly

From 4-5 portions weekly

One portion daily

From 2-3 portions daily

More than 3 portions daily

24- How many portions do you consume from eggs ?

Portion = 1 medium-sized egg

25- How many portions do you consume from dessert such as (Cake, gato, tart, Pancakes, *Ecla*ir or Pudding)?

A serving = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun.

26- How often do you eat the processed foods in restaurants or take-out food restaurants such as (Fried chicken, Fried fish, falafel, Pizza ,Burgers Kebabs)?

27- How many portions do you eat from vegetables (fresh, frozen or canned do not include potatoes)?

Portion= A medium vegetable (courgettes, carrot, artichoke, parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =half cup of broccoli florets, onion, spinach or 3-4 tablespoons of vegetable curry..

28- How many portions do you consume from cream, all kinds of cream?

portion = 1 tablespoon

29- How many cups do you consume from full-fat milk (milk which includes in tea and coffee)?

cup = 250 ml

Do not never consumed

From 1-3 cups monthly

One cup weekly

From 2-3 cups weekly

From 4-5 cups weekly

One cup daily

From 2-3 cups daily

From 4-5 cups daily

From 6-7 cups daily

More than 8 cups daily

30 - How many cups do you consume from low-fat milk (milk which includes in tea and coffee)?

cup = 250 ml

31- How many cups do you consume from Skim milk (milk which includes in tea and coffee)?

cup = 250 ml

32- How many portions do you consume from full-fat milk ?

Portion= 112ml-168ml

Do not never consumed

From 1-3 portions monthly

One portion weekly

From 2-3 portions weekly

From 4-5 portions weekly

One portion daily

From 2-3 portions daily

More than 3 portions daily

33- How many portions do you consume from low-fat milk ?

Portion= 112ml-168ml

34- How many times do you consume fruit milk or fruit mousse?

Portion= 112ml-168ml

35- When you eat poultry (chicken, turkey) what do you do with the skin?

Don’t eat poultry

Eat the skin

Eat some of it

Don’t eat the skin

36- when you cook the red meat, what do you do with the apparent fat?

Don’t eat red meat

Leave the fat on the meat

Leave some of it on the meat

Remove all the fat

37- When you eat the red meat such as lamb or beef, what to do with the apparent fat?

Don’t eat red meat

Eat apparent fat

Eat some of apparent fat

Remove it and don’t eat it

38- How many times do you eat the fast food in the home or outside the home(fast food including: Burger, Pizza, fried Chicken, fish, Fried shrimp, French Fried, sausage, kebab, Shawarma)?

Do not never consumed

From 1-3 portions monthly

One portion weekly

From 2-3 portions weekly

From 4-5 portions weekly

One portion daily

From 2-3 portions daily

More than 3 portions daily

39- What are the numbers of portions that are consumed from fat following:

Portion= tablespoon

You can choose more than one answer.

Butter, Olive oil, Sunflower Oil, Vegetable oil, Margarine, Coconut Oil, Peanut oil, Grape seed oil, Rapeseed oil, Margarine (Flora, sunflower butter), Soy butter, olive oil butter. Other (please specify)

40- How many portions do you consume from full-fat cheese, such as, stilton cheese, Cheddar, brie, gouda?

Portion = 30g the size of a small matchbox

41- How many portions do you consume from the medium-fat cheeses such as edam, Goat cheese, camembert, feta, emmantal ?

Portion = 30g the size of a small matchbox

42- How many portions do you consume from the low-fat cheeses such as Fresh Almozyrella, Cream cheese, katiki, Cottage, Quark?

Portion = 30g the size of a small matchbox

portion of Creamy cheese = 2 tablespoon

43- How many portions do you consume from Nuts and seeds such as, Almond, Peanuts and Pumpkin seeds?

Portion= 2 tablespoons = 30g.

44- How many portions do you consume from Mayonnaise or salad cream?

Portion = 1 full tablespoon

45- How many portions do you consume from low-fat Mayonnaise or low-fat salad cream?

Portion = 1 full tablespoon

46- How many portions do you consume from Porridge oats?

Portion= 1 cup

47- How many portions do you consume from Whole grain bread (brown bread) or bran bread?

Portion= 1 Medium slice of bread

48- How many portions do you consume from Bran flakes?

Portion = 30-45g= 0.5 cup

49- How many portions do you consume from Pulses such as, Lentils, chickpeas and beans?

Portion= 24 heaped tablespoons of pulses, five tablespoons of beans = 0.5 cup 50- How many portions do you consume from the fresh vegetables per week, frozen or canned (not including potatoes)?

Portion= A medium vegetable (courgettes, carrot, artichoke, parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =half cup of broccoli florets, onion, spinach or 3-4 tablespoons of vegetable curry.

51- How many portions do you consume from the fresh fruit per day, frozen or canned?

Portion= Half a cup of fruit juice (125 ml) counted as a maximum of Portion per day= medium-sized fruit (Apple orange Banana)=full Spoon of dried fruit.

52- How many consumed portions of Honey or jam (share = 1 teaspoon)?

53- How many cups of tea do you consume from the green, herbal or fruit tea?

Cup = 250 ml

54- How many cups do you consume of tea and coffee?

55- How many teaspoons of sugar do you add in tea, coffee or on breakfast cereal in a typical day?

56- How many portions do you consume from sweets such as marshmallow, toffee or jelly Sweet? Portion= one sweet is sized of tablespoon.

57- How many portions do you consume from Chocolate?

Portion= Small bag of Galaxy Minstrels- Small bag Maltesers- cream egg= medium-sized mars ,normal size of Bounty.

58- How many portions do you consume from Breakfast cereal?

Portion = 30-45g = 0.5 cup

59- How many times do you consume from cooked rice or Cooked pasta?

cooked rice= 1 cup

cooked pasta = 1 cup

60- How many times do you consume from cooked rice and cooked Brown pasta?

cooked brown rice= 1 cup

cooked wholemeal pasta= 1 cup

61- How many portions do you consume from White bread?

Portion= Medium-sized slice of bread= bagel = Medium-sized of Croissant= A slice of French toast= Half a slice of fruit bread or barley bread or tortillas or burger bread = slice of garlic bread.

62- How many portions do you consume from Potato chips?

Portion= 25-30 g = a small bag

63- How many portions do you consume from potato?

Portion= Medium-sized potato, half baked potato, 1 cup mashed potato

64- How many portions do you consume from Cake, muffins or Arabic sweets?

Portion = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun.

65- How many times do you consume from Salty pies, meat pies, pastries and sausage patties?

66- How many portions do you consume from Ice-cream?

Portion= 1 Mars Ice Cream, ice fruit or a scoop of ice cream.

67- How many portions do you consume from Soft drinks and energy drinks?

Portion= Normal cup = 250 ml

Can = 330 ml

68- How many portions do you consume from Low-calorie soft drinks?

69- How many portions do you consume from sweet biscuits such as digestive with chocolate or cookies?

Portion = 1 biscuit or cookie.

70- How many glass of water do you consume in a typical day?

Portion= cup = 250 ml

71- How many times do you consume Breakfast?

72- How many times do you eat the traditional food that containing rice, chicken or meat? Portion= 1 cup of rice

73- How many times do you consume the canned foods (food in cans Tin) such as tuna, tomatoes, chickpeas, kidney beans?

74- How many times do you consume foods (prepared with microwaves)?

75- How many times do you consume from sausage, cold meats, salami?

Portion= 1 sausage or hotdog, salami 2 small links

76- How many teaspoon of salt do you consume in a day?

77-How many vegetable, chicken, beef or fish cube stocks, powdered broths, soups, and gravies do you consume in a normal week? A cube = a tablespoon

78- How many times do you consume the ready-made sauces such as soy sauce, fish sauce, yeast spread?

79- How many times do you consume dried tomatoes or pickles such as olives or pickled cucumber?

80- Do you regularly eat other types of foods not included in this questionnaire, if yes, please specify the food name and how many times.

81- Thank you to take time to complete this questionnaire, your information provided to us will be used for the purpose of this study only and will remain confidential.

If you wish to evaluate your answer and wish to participate in this study in the future, please write your name and your email address.

1.

Thank you for participating and taking time to complete this survey. Your information is important to us. We need to know the average food consumption over the past 12 months.The survey will take around 15-20 minutes of your time. We respect your privacy and we will save your information and won't be used in any other purposes. The aim of this study is to know the average consumption of food and to link between diet and chronic diseases.
If you have any enquiries you can contact the researcher on this email: KMF976@bham.ac.uk

1. Age:

○ Under 20 years old ○ 20-25 years old ○ 26-30 years old ○ 31-35 years old ○ 36-40 years old ○ 41-45 years old
○ 46-50 years old ○ Older than 50

2. Sex:

○ Male ○ Female

3. Nationality:

○ British ○ Saudi

Other (please specify)

4. Marital status:

○ Single never married ○ Married ○ Divorced ○ Widow ○ Separated

5. Number of children if any:

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ more than 4

6. Occupation:

○ Employed for wages ○ Out of work and looking for a work ○ Out of work and currently not looking for a work
○ Self employed ○ A homemaker ○ A student ○ A nutritionist, dietitian ○ solider ○ Retired ○ Unable to work

7. Annual household income:

○ Less than £20.000 ○ £20.001 - £25.000 ○ £25.001 - £30.000 ○ £30.001 - £35.000 ○ £35.001 - £40.000
○ More than £40.001

8. What is the highest level of education you completed?

- ◯ never attended schools
- ◯ Primary school
- ◯ High school
- ◯ Technical
- ◯ Undergraduate
- ◯ Postgraduate

9. Weight in stones:

[ ]

10. Height in feet:

[ ]

11. Do you smoke?
If No please go to question 15

- ◯ Yes
- ◯ No

12. What kind of smoking do you use?
(you may choose more than one answer)

- ☐ Cigarette
- ☐ Cigar
- ☐ Shisha
- ☐ Pipe

13. How many cigarettes or cigars do you smoke in a day?

- ◯ 1 - 5
- ◯ 6 - 10
- ◯ 11 -15
- ◯ 16 - 20
- ◯ 21 - 25
- ◯ 26 - 30
- ◯ More than 30

14. If you smoke shisha, how long does each session last?

- ◯ less than 30 minutes
- ◯ 30 minutes
- ◯ One hour
- ◯ Two hours
- ◯ More than 3 hours

please specify per day, week or month

[ ]

2. This questions for females only

15. Are you pregnant ?

◯ Yes ◯ No

16. Are you trying to have a baby?

◯ Yes ◯ No

3.

17. Do you have any physical disability?

◯ Yes ◯ No

if yes please specify

4.

18. Do you suffer from of the following diseases?
If you changed your eating habits can you please fill the questionnaire as you were eating before you diagnosed with any of these diseases.

- ◯ Type two diabetes
- ◯ Hypertension
- ◯ Kidney Failure
- ◯ Heart Disease
- ◯ Stroke
- ◯ High blood cholesterol (LDL)
- ◯ High triglyceride
- ◯ Non alcoholic fatty liver
- ◯ Non

Other (please specify)

5.

19. This question is about vigorous activities that you did in the last 7 days. vigorous physical activities refer to activities that take hard physical effort and make you breath much harder than normal. think only about those physical activities that you did for at least 10 minutes at time.
During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

○ No vigorous physical activities. skip to question 21

days per week

20. How much time did you usually spend doing vigorous physical activities on one of those days?

hours per day

minutes per day

Do not know/ Not sure

21. Think about the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breath somewhat harder than normal. think only about those physical activities that you did for at least 10 minutes at a time.
During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis?
Do not include walking.

○ No moderate physical activities. skip to question 23

days per week

22. How much time did you usually spend doing moderate physical activities on one of those days?

hours per day

minutes per day

Do not know/ Not sure

23. Think about the time you spend walking in the last 7 days. This includes at work and at home, waking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.
During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

- ◯ No walking. Skip to question 25

days per week

24. How much time did you usually spend walking on one of those days?

hours per day

minutes per day

Do not know/ Not sure

25. Think about the time you spend sitting on weekdays during the last 7 days. Include time spend at work, at home, while doing course work and during leisure time. This may include time spend sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.
During the last 7 days, how much time did you spend sitting on a week day?

hours per day

minutes per day

Do not know/ Not sure

26. Do you add salt to your food?

◯ Yes ◯ No

27. What is your daily average consumption of salt?

◯ Less than 0.25 tsp ◯ 0.25 tsp ◯ 0.5 tsp ◯ 1 tsp ◯ 2 tsp ◯ More than 2 tsp ◯ Don't know

28. How many times do you consume red meat e.g. lamb or beef?
A serving = 70g (about the size of a deck of cards)

◯ Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Everyday once ◯ 2-3 a day ◯ more than 3 times a day

29. How many servings of (fresh, canned, frozen) fish or seafood do you consume?
A serving of fish = 150g (the size of cheque book)
A serving of oily fish = 75g
A serving of shellfish = 40- 60 g

	Never	1-3 servings a month	Once a week	2-3 a week	4-5 a week	Everyday once	2-3 a day	more than 3 servings a day
White fish (Cod, Seabass, Haddock)	○	○	○	○	○	○	○	○
Oily fish (Salmon, Mackerel, Trout, fresh Tuna)	○	○	○	○	○	○	○	○
Shellfish (prawns, mussels oysters, squid, langoustine)	○	○	○	○	○	○	○	○

30. How many servings of poultry e.g. chicken or turkey do you consume?
A serving = 100g (about the size of a computer mouse)

○ Never ○ 1-3 servings a month ○ Once a week ○ 2-3 a week ○ 4-5 a week ○ Once a day ○ 2-3 a day

○ more than 3 servings a day

6.

31. How many serving of eggs do you consume?
A serving = A medium egg

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

32. How many servings of cake, muffin or Arabic dessert do you consume?
A serving = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

33. How many times do you consume food which prepared in takeaway or fast food restaurants such as fried chicken, fried fish, falafel, pizza, burger, fried shrimp, french fries, hotdog, kebab, donor

- Never
- 1-3 times a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 times a day

34. How many servings of fresh, frozen or canned vegetables do you eat (not including potatoes)?
A serving = A medium vegetable (courgettes, carrot, artichoke,parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =4 broccoli florets = 5 spears of asparagus = 3-4 tablespoons of vegetable curry.

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

35. How many servings of cream e.g. single, double, thick cream, sour cream do you consume?
A serving= A tablespoon

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

36. How many cups of full fat milk do you consume (including the milk in tea and coffee)?
A serving= A small glass = 200ml

- Never
- 1-3 cups a month
- One cup a week
- 2-3 cups a week
- 4-5 cups a week
- One cup a day
- 2-3 cups a day
- 4-5 cups a day
- 6-7 cups a day
- more than 8 cups a day

37. How many cups of semi skimmed milk do you consume (including the milk in tea and coffee)?
A serving= A small glass = 200ml

- ◯ Never ◯ 1-3 cups a month ◯ One cup a week ◯ 2-3 cups a week ◯ 4-5 cups a week ◯ One cup a day
- ◯ 2-3 cups a day ◯ 4-5 cups a day ◯ 6-7 cups a day ◯ more than 8 cups a day

38. How many cups of skimmed milk do you consume (including the milk in tea and coffee)?
A serving= A small glass = 200ml

- ◯ Never ◯ 1-3 cups a month ◯ One cup a week ◯ 2-3 cups a week ◯ 4-5 cups a week ◯ One cup a day
- ◯ 2-3 cups a day ◯ 4-5 cups a day ◯ 6-7 cups a day ◯ more than 8 cups a day

39. How many servings of full fat yoghurt do you consume?
A serving = 150ml a small pot

- ◯ Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day
- ◯ more than 3 servings a day

40. How many servings of low fat yoghurt do you consume?
A serving = 150ml a small pot

- ◯ Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day
- ◯ more than 3 servings a day

7.

41. How many servings of fruit yoghurt, fruit mousse do you consume?
A serving = 120 - 170 g

- Never
- 1-3 servings a month
- One serving a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

42. When you eat poultry (e.g. chicken, turkey) what do you with the skin?

- I don't eat poultry
- eat the skin
- eat some of the skin
- I don't eat the skin

43. When you cook red meat (e.g. lamb, beef) what do you do with the visible fat?

- I don't eat meat
- keep it
- keep little fat
- take off the visible fat

44. When you eat red meat (e.g. lamb, beef) what do you do with the visible fat?

- I don't eat meat
- eat it
- eat some of it
- don't eat it

45. How many times do you eat fast food in restaurants or at home (fast food include burger, pizza, fried chicken, fried fish, fried shrimp, french fries, falafel, hotdog, kebab, donor)?

- Never
- 1-3 times a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 times a day

46. How many serving of fat do you consume (a serving is a tablespoon)?

you may choose more than one answer

	Never	1-3 servings a month	Once a week	2-3 a week	4-5 a week	Once a day	2-3 a day	more than 3 servings a day
Goose fat	◯	◯	◯	◯	◯	◯	◯	◯
Butter	◯	◯	◯	◯	◯	◯	◯	◯
Olive oil	◯	◯	◯	◯	◯	◯	◯	◯
Sunflower oil	◯	◯	◯	◯	◯	◯	◯	◯
Vegetable oil	◯	◯	◯	◯	◯	◯	◯	◯
Ghee	◯	◯	◯	◯	◯	◯	◯	◯
Lard	◯	◯	◯	◯	◯	◯	◯	◯
Coconut oil	◯	◯	◯	◯	◯	◯	◯	◯
Peanut oil	◯	◯	◯	◯	◯	◯	◯	◯
Grape seed oil	◯	◯	◯	◯	◯	◯	◯	◯
Rape seed oil	◯	◯	◯	◯	◯	◯	◯	◯
Polyunsaturated Margarine (flora, sunflower, soya or olive oil based spread)	◯	◯	◯	◯	◯	◯	◯	◯

Other (please specify)

47. How many servings of cheese such as stilton, cheddar - Halloumi - brie, gouda do you consume?
A serving = 30g the size of a small matchbox

◯ Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

◯ more than 3 servings a day

48. How many servings of cheese such as edam, goats, camembert, feta, emmantal do you consume?
A serving = 30g the size of a small matchbox

◯ Never ◯ 1-3 servings a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

◯ more than 3 servings a day

49. How many servings of low fat cheese such as fresh mozzarella, cream cheese, katiki, cottage, quark, low fat Philadelphia do you consume?
A serving of hard cheese = 30g the size of a small matchbox
A serving of cottage cheese = 2 tablespoons

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

50. How many servings of Nuts and seeds e.g. almonds, peanuts, pumpkin seeds do you consume?
A serving = 2 tablespoons

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

51. How many serving of full fat mayonnaise or salad cream do you use?
A serving= a heaped tablespoon

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

52. How many serving of low fat mayonnaise or salad cream do you use?
A serving = a heaped tablespoons

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

53. How many servings of porridge do you consume?
A serving = 0.5 cup= 160g

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

54. How many servings of wholemeal or bran bread do you consume
A serving = 1 slice of medium bread

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

55. How many servings of bran cereals (such as All bran) do you consume?
A serving = 3 tablespoons

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

56. How many servings of beans or pulses e.g. lentil, chickpeas, fava beans, kidney beans do you consume?
A serving = 4 heaped tablespoons of pulses, five tablespoons of beans

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

57. How many servings of raw, cooked, frozen, tinned vegetable (not including potato) do you consume in an average week?
A serving = A medium vegetable (courgettes, carrot, artichoke,parsnip, tomato, pepper) = 125 ml (half glass) of vegetable juice =4 broccoli florets = 5 spears of asparagus = 3-4 tablespoons of vegetable curry.

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- More than 3 servings a day

58. How many servings of fresh, frozen, canned fruit do you consume in an average week?
A serving = 150 ml (half glass) of fresh fruit juice not from concentrated (count as a maximum of one portion a day) = A fruit (apple, orange, banana) =1 heaped tablespoon of dried fruit

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- More than 3 servings a day

59. How many servings of fruit juice (from concentrate) do consume?
A serving = average glass 250ml

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- once a day
- 2-3 a day
- More than 3 servings a day

60. How many servings (A serving = a teaspoon) of honey, marmalade, jam or chocolate spread do you consume?

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

8.

61. How many cups of herbal tea or fruit tea do you consume?
A cup= 250 ml

- Never
- 1-3 cups a month
- Cup a week
- 2-3 cups a week
- 4-5 cups a week
- Cup a day
- 2-3 cups a day
- 4-6 cups a day
- more than 6 cups a day

62. How many cups of green tea do you consume?
A cup = 250 ml

- Never
- 1-3 cups a month
- Cup a week
- 2-3 cups a week
- 4-5 cups a week
- Cup a day
- 2-3 cups a day
- 4-6 cups a day
- more than 6 cups a day

63. How many cups of black tea or coffee do you consume?
A cup = 250 ml

- Never
- 1-3 cups a month
- Cup a week
- 2-3 cups a week
- 4-5 cups a week
- Cup a day
- 2-3 cups a day
- 4-6 cups a day
- more than 6 cups a day

64. How many teaspoons of sugar do you add to your coffee, tea, cereal in an average day?

- 0
- 1
- 2
- 3
- 4
- more than 4

65. How many serving do you consume form sweets e.g. marshmallow, toffees, jelly sweets?
A serving = a sweet size of a tablespoon

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

66. How many servings of chocolate do you consume?
A serving = a standard bag of Minstrels (42g) , Malteasers (37g), a Creme egg (34g) or a standard Mars bar (58g), Bounty bars (57g)

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

67. How many servings of breakfast cereals do you consume?
A serving = 30g = 3 tablespoons

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

68. How many servings of cooked rice and pasta do you consume?
A serving of cooked rice = 2 tablesspoons
A serving of cooked pasta = 3 tablespoons

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- 4-5 a day
- more than 5 servings a day

69. How many servings of cooked wholemeal pasta or brown rice do you consume?
A serving of cooked rice = 2 tablesspoons
A serving of cooked pasta = 3 tablespoons

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- 4-5 a day
- more than 5 servings a day

70. How many servings of white bread do you consume?
A serving = a slice of medium bread = a bagel or roll = a croissant = a slice of french stick = slice of fruit bread or malt loaf or tortillas or burger bun = a slice of garlic bread

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

71. How many servings of crisps do you consume?
A serving = 40 g = a medium bag

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

72. How many serving of potatoes (excluding French fries and chips) do you consume?
A serving = a medium potato, half baked potato

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

73. How many servings of cake, muffin or Arabic dessert do you consume?
A serving = a slice of cake or cheesecake or a muffin or gateau = A cupcake = an eclair = a pudding = baklava = a doughnut = current bun

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

74. How many times do you consume savoury pies, meat pies, pasties, sausage rolls?

- Never
- 1-3 times a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 times a day

75. How many servings of ice cream do you consume?
A serving = A Mars bar ice cream, a fruit lolly, a scoop of ice cream

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

76. How many millilitres of soft drinks and energy drinks do you consume?
A serving= average glass = 250 ml
A can = 330 ml

- Never
- 330 ml - 660 ml a month
- 330 ml a week
- 660 ml -990 ml a week
- 1320 ml - 1650 ml a week
- 330 ml a day
- 660 ml -990 ml a day
- More than 990 ml a day

77. How many millilitres of diet soft drinks do you consume?
A serving= average glass = 250 ml
A can = 330 ml

- Never
- 330 ml - 660 ml a month
- 330 ml a week
- 660 ml - 990 ml a week
- 1320 ml - 1650 ml a week
- 330 ml a day
- 660 ml -990 ml a day
- more than 990 ml a day

78. How many servings of sweet biscuits e.g. chocolate digestive or cookie do you consume?
A serving = a biscuit or a cookie

- Never
- 1-3 servings a month
- Once a week
- 2-3 a week
- 4-5 a week
- Once a day
- 2-3 a day
- more than 3 servings a day

79. How many glasses of water do you drink in an average day?
A glass = 250 ml

- Less than 1 glass
- 1-2
- 3-4
- 5-6
- 7-8
- more than 8 glasses

80. How often do you eat your breakfast?

- ◯ Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Everyday

81. How many times do you consume Middle Eastern meals e.g. Kurdish, Turkish or Iranian ?

- ◯ Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 times a week ◯ 4-5 times a week ◯ Once a day ◯ 2-3 times a day ◯ More than 3 times a day

82. How many times do you consume canned food (food in tin) e.g. tuna, tomato, chickpeas, baked beans?

- ◯ Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day ◯ more than 3 times a day

83. How many times do you consume ready to eat meals or processed food such as frozen pizza - nuggets- fish - burger?

- ◯ Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day ◯ more than 3 times a day

84. How many times do you eat sausage, cured meat or salami?

- ◯ Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day ◯ more than 3 times a day

85. How many teaspoons of added salt do you consume in an average day?

- ◯ less than 0.25 teaspoon ◯ 0.25 teaspoon ◯ 0.5 teaspoon ◯ 1 teaspoon ◯ 2 teaspoons ◯ more than 2 teaspoons ◯ Don't know

86. How many vegetable, chicken, beef or fish cube stocks, powdered broths, soups, and gravies do you use in an average week?
A cube = a tablespoon
If you are cooking several portions, how many cube in average approximately per person?

- ◯ Don't know ◯ 0 ◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ more than 5

87. How many times do you consume sauces e.g. soy sauce, fish sauce, yeast spread?

- ◯ Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day ◯ more than 3 times a day

88. How many times do you eat sun dried tomatoes or pickled food e.g. olives, cucumber?

◯ Never ◯ 1-3 times a month ◯ Once a week ◯ 2-3 a week ◯ 4-5 a week ◯ Once a day ◯ 2-3 a day

◯ more than 3 times a day

89. Do you regularly eat other types of food than listed in this survey, if so please specify the foodstuff and the frequency.

1 __________

2 __________

3 __________

4 __________

90. Thank you for your time in completing this survey.
The answers you provide will be used for this study only and will be kept confidential / if you want feedback based on this survey or would like to be part of this study in the future, please write your name and email address.

Name: __________

Email address: __________

شكرا لتعاونك واقتطاعك وقتا لملئ هذا الاستبيان. هذه الدراسة تهدف لمعرفة معدل الاستهلاك الغذائي على مدى الاثنى عشرة شهرا الفائتة. وذلك لاكتشاف العلاقة بين النظام الغذائي والأمراض المزمنة. معلوماتك تهمنا، الوقت المتوقع لإكمال الاستبيان 15-20 دقيقة. نحن نحترم خصوصيتك ، سيتم الاحتفاظ بمعلوماتك لغرض هذه الدراسة فحسب ولن يتم استخدامها في أي غرض اخر. اذا كان لديك اي استفسار يمكنك التواصل مع الباحث على الايميل التالي:

KMF976@bham.ac.uk

1. العمر:

من 46 - 50 سنة | من 41 - 45 سنة | من 36 - 40 سنة | من 31 - 35 سنة | من 26 - 30 سنة | من 20 - 25 سنة | أقل من 20 سنة

50 سنة أو أكثر

2. الجنس

أنثى | ذكر

3. الجنسية

بريطاني | سعودي

أخرى (يرجى التحديد)

4. الحالة الاجتماعية

منفصل | أرمل | مطلق | متزوج | أعزب لم أتزوج أبدا

5. عدد الاطفال ان وجد

أكثر من 4 | 4 | 3 | 2 | 1 | 0

6. الوظيفة

طالب | ربة منزل | أعمل لحسابي الخاص | لا أعمل وحاليا لا أبحث عن وظيفة | لا أعمل وأبحث عن وظيفة | موظف براتب

غير قادر على العمل | متقاعد | عسكري | لديك شهادة في التغذية, طالب ماجستير او دكتوراة في التغذية , أخصائي تغذية

7. الراتب الشهري للمنزل

من 18001 - 23000 ريال | من 13001 - 18000 ريال | من 8001 - 13000 ريال | من 3000 - 8000 ريال | أقل من 3000 ريال

أكثر من 23000 ريال

8. ماهو أعلى مستوى تعليمي أكملته؟

دراسات عليا ◯ جامعي ◯ فني تقني ◯ ثانوي ◯ متوسط ◯ ابتدائي ◯ لم التحق بالمدارس ◯

9. الوزن بالكيلو جرام

10. الطول بالسنتميتر

11. هل أنت مدخن؟
اذا كانت الاجابة بلا أرجو الانتقال الى السؤال رقم 15

لا ◯ نعم ◯

12. ماذا تدخن؟

☐ معسل ☐ سيجار ☐ سجائر
☐ شيشة

13. كم عدد السجائر أو السيجار الذي تدخنه يوميا؟

أكثر من 30 ◯ 26-30 ◯ 21-25 ◯ 16-20 ◯ 11-15 ◯ 6-10 ◯ 1-5 ◯

14. اذا كنت تدخن المعسل أو الشيشة كم تستغرق الجلسة الواحدة؟

أكثر من ثلاث ساعات ◯ ساعتان ◯ ساعة ◯ دقيقة 30 ◯ أقل من 30 دقيقة ◯

الرجاء التحديد في اليوم أو الاسبوع أو الشهر

هذه الاسئلة للنساء فقط

15. هل أنت حامل؟

لا ◯ نعم ◯

16. هل تحاولي أن تنجبي طفل؟

لا ◯ نعم ◯

17. هل تعاني من اي اعاقة حركية؟

لا ◯ نعم ◯

يرجى تحديد نوع الاعاقة ان وجد

18. هل تعاني من أحد الامراض التالية؟

ارتفاع معدل الدهون الثلاثية ◯ ارتفاع الكيلسترول ◯ الجلطات ◯ مرض القلب ◯ الفشل الكلوي ◯ أرتفاع ضغط الدم ◯ مرض السكر من النوع الثاني ◯

لا أعاني من هذه الأمراض ◯ الكبد الدهني (غير الكحولي) ◯

أخرى يرجى التحديد

19. فكر في جميع الأنشطة البدنية قوية الشدة التي قمت بها خلال السبعة الأيام الماضية، الأنشطة قوية الشدة هي الأنشطة التي تتطلب جهد بدني قوي وتجعل تنفسك أصعب من المعتاد. فكر فقط في تلك الأنشطة البدنية التي قمت بها لمدة 10 دقائق على الأقل في كل مرة.
خلال السبعة اليام الماضية ، كم عدد الأيام التي قمت بممارسة الأنشطة البدنية قوية الشدة مثل رفع الأشياء الثقيلة، حرث الأرض، الأيروبيك، ركوب الدراجة بسرعة عالية؟

عدد الأيام في الأسبوع	
لم أمارس أي نشاط بدني قوي الشدة. اذهب الى السؤال رقم 21	

20. في المعتاد، كم من الوقت تقضيه في ممارسة الأنشطة البدنية قوية الشدة في أحد تلك الأيام؟

عدد الساعات في اليوم	
عدد الدقائق في اليوم	
لا أعلم \ غير متأكد	

21. فكر في جميع الأنشطة البدنية التي تتطلب جهدا بدنيا متوسط الشدة والتي قمت بممارستها خلال السبعة الايام الماضية، الأنشطة البدنية متوسطة الشدة ه االتي تتطلب جهدا وتجعل تنفسك بطريقة ما اعلى من الطبيعي. فكر فقط في الأنشطة البدنية التي مارستها لمدة 10 دقائق في كل مرة.
خلال السبعة الأيام الماضية ، كم عدد الأيام التي قمت فيها بممارسة الأنشطة البدنية متوسطة الشدة مثل حمل الأشياء الخفيفة ، وركوب الدراجة بسرعة عادية ، لعب التنس؟

عدد الأيام في الأسبوع	
لم أمارس أي نشاط بدني متوسط الشدة اذهب الى السؤال رقم 23	

22. في المعتاد كم من الوقت تقضيه في ممارسة الأنشطة البدنية متوسطة الشدة في أحد تلك الأيام؟
ملاحظة لا تحسب المشي ضمن هذه الأنشطة.

عدد الساعات في اليوم	
عدد الدقائق في اليوم	
لا أعلم \ غير متأكد	

23. فكر في الوقت الذي قضيته في المشي خلال السبعة الأيام الماضية ، يتضمن ذلك المشي للعمل أو المشي للمنزل، المشي للانتقال من مكان الى اخرأو المشي للاستجمام فقط ، رياضة ، تمرين ، أو في وقت الفراغ.
خلال السبعة الايام الماضية ، كم عدد الأيام التي مشيت فيها لمدة 10 دقائق على الأقل في كل مرة؟

عدد الأيام في الأسبوع	
لم أمشي . اذهب الى السؤال رقم 25	

24. في المعتاد كم من الوقت قضيته في كل مرة مارست فيها المشي؟

عدد الساعات في اليوم

عدد الدقائق في اليوم

لا أعلم \ غير متأكد

25. فكر في الوقت الذي قضيته جالسا خلال أيام الأسبوع خلال السبعة الأيام الماضية. أحسب الوقت الذي قضيته جالسا في العمل، المنزل، خلال الدراسة أو وقت الفراغ. من الممكن أن يتضمن ذلك وقت الجلوس غلى المكتب، زيارة الأصدقاء، القراءة أو الجلوس أو الاستلقاءلمشاهدة التلفاز.
خلال السبعة الأيام الماضية ، كم من الوقت قضيته جالسا خلال أيام الأسبوع (بدون اجازات نهاية الأسبوع)؟

عدد الساعات في اليوم

عدد الدقائق في اليوم

لا أعلم غير متأكد

26. هل تضيف الملح الى طعامك؟

لا ◯ نعم ◯

27. ماهو معدل استهلاكك اليومي من الملح المضاف؟

لا أعرف ◯ أكثر من ملعقين شاي ◯ ملعقتا شاي ◯ ملعقة شاي ◯ نصف ملعقة شاي ◯ ربع ملعقة شاي ◯ أقل من ربع ملعقة شاي ◯

28. كم عدد الحصص التي تستهلكها من اللحوم الحمراء مثل لحم البقر , لحم الجمل أو الضأن؟
الحصة = 70 جم (بحجم فأرة الكمبيوتر)

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

29. كم عدد الحصص التي تستهلكها من السمك أو المأكولات البحرية (طازجة - معلبة - مجمدة)؟
حصة السمك = 150 جم (بحجم دفتر الشيكات)
حصة الاسماك الدهنية= 75 جم (بحجم دفتر الشيكات)
حصة االماكولات البحرية= 40 -60 جم

	أكثر من 3 حصص في اليوم	من 2-3 حصص في اليوم	حصة كل يوم	من 4-5 حصص في الاسبوع	من 2-3 حصص في الاسبوع	حصة في الاسبوع	من 1-3 حصص في الشهر	لا أستهلكها أبدا
السمك الأبيض (الهامور- الناجل - الشعور- الكنعد)	☐	☐	☐	☐	☐	☐	☐	☐
الأسماك الزيتية (السلمون - السردين	☐	☐	☐	☐	☐	☐	☐	☐
القشريات (الجمبري - بلح البحر - المحار- الحبار- استكوزا - ربيان - سرطان البحر)	☐	☐	☐	☐	☐	☐	☐	☐

30. كم عدد الحصص التي تستهلكها من الدواجن (دجاج ، ديك الرومي)؟
الحصة = 100 جم (بحجم فأرة الكمبيوتر)

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

31. كم حصة تستهلك من البيض؟
الحصة = 1 بيضة متوسطة الحجم

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

32. كم عدد الحصص التي تأكلها من الحلى مثل (الكيك - الجاتو - التارت الحلو - الفطائر المحلاة- الاكلير- أو البودينج)؟
الحصة = شريحة من كيك الشوكولاتة او الجاتو= كيك الكوب= قطعة اكلير= قطعة بسبوسة = كنافة = خلية نحل = بقلاوة= جلي = مهلبية.

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

33. كم عدد المرات التي تأكل فيها الأطعمة المجهزة في المطاعم السريعة مثل (الدجاج المقلي- السمك المقلي - الفلافل - البيتزا - البرجر- الكباب؟

- مرة كل يوم
- من 4-5 مرات في الاسبو
- من 2-3 مرات في الاسبوع
- مرة في الاسبوع
- من 1-3 مرات في الشهر
- لا أستهلكها أبدا
- أكثر من 3 مرات في اليوم
- من 2-3 مرات في اليوم

34. كم عدد الحصص التي تتناولها من الخضروات (الطازجة - المجمدة أو المعلبة لا تشمل البطاطس)؟
الحصة = خضرة متوسطة الحجم (بصل- طماطم- فلفل رومي- كوسا جزر) =نصف كوب 125 مل عصير خضروات = 4 زهيرات بروكلي= ٥ هليون = 3-4 ملاعق ايدام خضار

- من 2-3 حصص في اليوم
- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم

35. كم عدد الحصص التي تستهلكها من الكريمة ، بأنواعها أو القشطة؟
الحصة = 1 ملعقة طعام

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

36. كم كوب تستهلك من الحليب الكامل الدسم (يتضمن الحليب الذي في الشاي والقهوة)؟
الكوب = 200 مل

- كوب يوميا
- من 4-5 أكواب في الاسبوع
- من 2-3 أكواب في الاسبوع
- كوب في الاسبوع
- من 1-3 أكواب في الشهر
- لا أستهلكه أبدا
- أكثر من 8 أكواب في اليوم
- من 6-7 أكواب في اليوم
- من4-5 أكواب في اليوم
- من 2-3 أكواب في اليوم

37. كم كوب تستهلك من الحليب القليل الدسم (يتضمن الحليب الذي في الشاي والقهوة)؟
الكوب= 200 مل

- كوب يوميا
- من 4-5 أكواب في الاسبوع
- من 2-3 أكواب في الاسبوع
- كوب في الاسبوع
- من 1-3 أكواب في الشهر
- لا أستهلكه أبدا
- أكثر من 8 أكواب في اليوم
- من 6-7 أكواب في اليوم
- من4-5 أكواب في اليوم
- من 2-3 أكواب في اليوم

38. كم كوب تستهلك من الحليب خالي الدسم (يتضمن الحليب الذي في الشاي والقهوة)؟
الكوب = 200 مل

- كوب يوميا
- من 4-5 أكواب في الاسبوع
- من 2-3 أكواب في الاسبوع
- كوب في الاسبوع
- من 1-3 أكواب في الشهر
- لا أستهلكه أبدا
- أكثر من 8 أكواب في اليوم
- من 6-7 أكواب في اليوم
- من4-5 أكواب في اليوم
- من 2-3 أكواب في اليوم

39. كم عدد الحصص الي تستهلكها من اللبن كامل الدسم؟
الحصة = ١٥٠ مل

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

40. كم عدد الحصص التي تستهلكها من اللبن قليل الدسم؟
الحصة= ١٥٠ مل

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

41. كم مرة تستهلك لبن الفواكة او موس الفواكه؟
الحصة= 120 - 170 جم

- مرة كل يوم
- من 4-5 مرات في الاسبوع
- من 2-3 مرات في الاسبوع
- مرة في الاسبوع
- من 1-3 مرات في الشهر
- لا أستهلكه أبدا
- أكثر من 3 مرات في اليوم
- من 2-3 مرات في اليوم

42. عند تناولك للدواجن (دجاج ، ديك رومي) ماذا تفعل بالجلد

- لا اكل الجلد
- اكل بعضه
- اكل الجلد
- لا اكل دواجن

43. عند طهيك للحوم الحمراء (لحم البقر - الابل - لحوم الاغنام) ماذا تفعل بالدهون(الشحوم) الظاهرة؟

- ازيل كل الدهن الظاهر
- اترك بعض الدهن على اللحم
- اترك الدهن على اللحم
- لا اتناول اللحوم الحمراء

44. عند تناولك للحوم الحمراء مثل لحوم الاغنام , لحم الجمل أو البقر، ماذا تفعل بالدهون (الشحوم) الظاهرة؟

- ازيله ولا اكله
- اكل بعض الدهن
- اكل الدهن الظاهر
- لا اكل اللحوم الحمراء

45. كم عدد المرات التي تتناول فيها المأكولات السريعة في المنزل أو خارج المنزل (المأكولات السريعة تتضمن برجر- بيتزا- دجاج مقلي- سمك مقلي- جمبري مقلي- بطاطس مقلية- نقانق- كباب- شاورما)

- مرة كل يوم
- من 4-5 مرات في الاسبوع
- من 2-3 مرات في الاسبوع
- مرة في الاسبوع
- من 1-3 مرات في الشهر
- لا أستهلكها أبدا
- من 2-3 مرات في اليوم

46. ماهو عدد الحصص المستهلكة من الدهون التالية
الحصة = ملعقة طعام
بإمكانك الاختيار أكثر من إجابة

	أكثر من 3 حصص في اليوم	من 2-3 حصص في اليوم	حصة كل يوم	من 4-5 حصص في الاسبوع	من 2-3 حصص في الاسبوع	حصة في الاسبوع	من 1-3 حصص في الشهر	لا أستهلكها أبدا
زبدة	☐	☐	☐	☐	☐	☐	☐	☐
زيت زيتون	☐	☐	☐	☐	☐	☐	☐	☐
زيت دوار الشمس	☐	☐	☐	☐	☐	☐	☐	☐
زيت خضار	☐	☐	☐	☐	☐	☐	☐	☐
سمن	☐	☐	☐	☐	☐	☐	☐	☐
زيت جوز الهند	☐	☐	☐	☐	☐	☐	☐	☐
زيت الفول السوداني	☐	☐	☐	☐	☐	☐	☐	☐
زيت بذور العنب	☐	☐	☐	☐	☐	☐	☐	☐
زيت بذور اللفت	☐	☐	☐	☐	☐	☐	☐	☐
المارجرين (فلورا، زبد دوار الشمس، زبد الصويا، زبد زيت الزيتون)	☐	☐	☐	☐	☐	☐	☐	☐

أخرى (يرجى التحديد)

47. ما هو عدد الحصص التي تستهلكها من الاجبان كاملة الدسم مثل ستايلتون-جبنة شيدر الصفراء مثل كرفت - جبنة كاسات (مثل كرفت بوك) جبنة الحلوم- أجبان كريمية (مثل فلادلفيا أو كيري) بري- أو قودا؟
الحصة = ٣٠ جم بحجم علبة كبريت صغيرة

- ○ حصة كل يوم
- ○ من 4-5 حصص في الاسبوع
- ○ من 2-3 حصص في الاسبوع
- ○ حصة في الاسبوع
- ○ من 1-3 حصص في الشهر
- ○ لا أستهلكها أبدا
- ○ أكثر من 3 حصص في اليوم
- ○ من 2-3 حصص في اليوم

48. كم عدد الحصص التي تستهلكها من الأجبان مثل الايدام- جبن الماعز- كميمبارت- الجبنة البيضاء مثل الفيتا - ايمنتال ؟
الحصة = ٣٠ جم بحجم علبة كبريت صغيرة

- ○ حصة كل يوم
- ○ من 4-5 حصص في الاسبوع
- ○ من 2-3 حصص في الاسبوع
- ○ حصة في الاسبوع
- ○ من 1-3 حصص في الشهر
- ○ لا أستهلكها أبدا
- ○ أكثر من 3 حصص في اليوم
- ○ من 2-3 حصص في اليوم

49. كم عدد الحصص التي تستهلكها من الاجبان قليلة الدسم مثل الموزريللا الطازجة - الجبن الكريمي قليل الدسم- كاتيكي- كوتاج- كوارك؟
الحصة = ٣٠ جم بحجم علبة كبريت صغيرة
الحصة من الأجبان الكريمية او جبنة الكوتاج= 2 ملعقة طعام

- ○ حصة كل يوم
- ○ من 4-5 حصص في الاسبوع
- ○ من 2-3 حصص في الاسبوع
- ○ حصة في الاسبوع
- ○ من 1-3 حصص في الشهر
- ○ لا أستهلكها أبدا
- ○ أكثر من 3 حصص في اليوم
- ○ من 2-3 حصص في اليوم

50. كم عدد الحصص التي تستهلكها من المكسرات والبذور الصحية (بدون اضافات) مثل اللوز الفول السوداني بذور اليقطين؟

الحصة = ٢ ملعقة طعام

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

51. كم عدد الحصص التي تستهلكها من المكسرات والبذور المحلاة أو المملحة مثل الفصفص- الحمص - الفول السوداني- الكاجو- الجوز- بذور دوار الشمس - الفستق- المكسرات الصينية؟

الحصة = ٢ ملعقة طعام

- حصة في اليوم
- من 4-5 حصص في الأسبوع
- من 2-3 حصص في الأسبوع
- حصة في الأسبوع
- من 1 -3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

52. كم عدد الحصص التي تستهلكها من المايونيز أو صوص السلطة ؟
الحصة = 1ملعقة طعام ممتلئة

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

53. كم عدد الحصص التي تستهلكها من المايونيز قليل الدسم او صوص السطة قليلة الدسم؟
الحصة = 1ملعقة طعام ممتلئة

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

54. كم عدد الحصص المستهلكة من عصيدة الشوفان أو الأطباق الحتوية على الشوفان؟
الحصة = نصف كوب

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

55. كم عدد الحصص المستهلكة من خبز الحبوب الكاملة (الخبز الأسمر) أو خبز النخالة؟
الحصة = 1 شريحة متوسطة من الخبز

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

56. كم عدد الحصص المستهلكة من رقائق النخالة (كورن فلكس النخالة)؟
الحصة = 30 جم = 3 ملاعق طعام

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

57. كم عدد الحصص التي تستهلكها من البقول مثل العدس- الحمص- الفول -الفلافل - اللوبيا؟
الحصة = 4 ملاعق طعام ممتلئة من البقول ، 5 ملاعق طعام من الفاصوليا

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

58. كم حصة في الأسبوع العادي تستهلك من الخضروات الطازجة، المجمدة أو المعلبة (لا يشمل البطاطس)؟
الحصة = خضرة متوسطة الحجم (بصل- طماطم- فلفل رومي- كوسا جزر) =نصف كوب 125 مل عصير خضروات = 4 زهيرات بروكلي= ٥ هليون = 3-4 ملاعق ايدام خضار

- حصة كل يوم
- من 4-5 حصص في الأسبوع
- من 2-3 حصص في الأسبوع
- حصة في الأسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

59. كم حصة في الاسبوع العادي تستهلك من الفواكه الطازجة ، المجمدة أو المعلبة؟
الحصة = نصف كوب (125 مل) من عصير الفاكهه تحسب كحد اقصى حصة واحدة يوميا = فاكهه متوسطة الحجم (تفاحة - برتقالة - موزة) = ملعقة ممتلئة من الفواكه مجففة

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الأسبوع
- حصة في الأسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

60. كم حصة من عصيرات الفواكه المعلبه (المصنوعه من عصيرمركز) تستهلك؟
الحصة= كاس عادي ٢٥٠ مل

- حصة كل يوم
- من ٤-٥ حصص في الاسبوع
- من ٢-٣ حصص في الاسبوع
- حصة في الاسبوع
- من ١-٣ حصص في الشهر
- لا استهلكها ابدا
- اكثر من ٣ حصص في ليوم
- من ٢-٣ حصص في اليوم

61. كم عدد الحصص المستهلكه من العسل أو المربى أو الشوكولاته القابلة للدهن مثل النوتيلا (الحصة = 1 ملعقة شاي)؟

- حصة كل يوم
- من 4-5 حصص في الاسبوع
- من 2-3 حصص في الاسبوع
- حصة في الاسبوع
- من 1-3 حصص في الشهر
- لا أستهلكها أبدا
- أكثر من 3 حصص في اليوم
- من 2-3 حصص في اليوم

62. كم عدد الأكواب التي تستهلكها من شاي الأعشاب أو شاي الفواكه مثل(شاي الزنجبيل- الكركديه)؟
الكوب = 250 مل

- كوب كل يوم
- من 4-5 أكواب في الاسبوع
- من 2-3 أكواب في الاسبوع
- كوب في الاسبوع
- من 1-3 أكواب في الشهر
- لا أستهلكه أبدا
- أكثر من 6 أكواب في اليوم
- من 4-6 أكواب في اليوم
- من 2-3 أكواب في اليوم

63. كم عدد الأكواب التي تستهلكها من الشاي الأخضر؟
الكوب = 250 مل

- كوب يوميا
- من 4-5 أكواب في الأسبوع
- من 2-3 أكواب في الأسبوع
- كوب في الأسبوع
- من 1-3 أكواب في الشهر
- لا أستهلكها أبدا
- أكثر من 6 أكواب في اليوم
- من 4-6 أكواب في الأسبوع
- من 2-3 أكواب في اليوم

64. كم كوب تستهلك من الشاي الاحمر (الاسود) وكم فنجان من القهوة بانواعها (العربية او التركية وغيرها) ؟
الكوب = 250 مل
فنجان قهوة عربي أو تركي

- كوب كل يوم
- من 4-5 أكواب في الاسبوع
- من 2-3 أكواب في الاسبوع
- كوب في الاسبوع
- من 1-3 أكواب في الشهر
- لا أستهلكه أبدا
- أكثر من 6 أكواب في اليوم
- من 4-6 أكواب في اليوم
- من 2-3 أكواب في اليوم

65. كم ملعقة شاي من السكر تضيفها في اليوم العادي على الشاي - القهوة أو على حبوب الافطار؟

أكثر من 4 ملاعق ◯ 4 ◯ 3 ◯ 2 ◯ 1 ◯ 0 ◯

66. كم عدد الحصص التي تستهلكها من الحلويات مثل المارشميلو- التوفي- حلويات الجلي ؟
الحصة = حلوى بحجم ملعقة طعام

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

67. كم حصة من الشوكولاته تستهلك ؟
الحصة = كيس صغير من جالكسي مانسترلز (42جم) - كيس صغير مالتيزرز(37 جم)- بيضة الكريم (34 جم) - مارس متوسط الحجم (58 جم) أو (باونتي بالحجم العادي(57جم

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

68. كم حصة من حبوب الافطار(الكورن فلكس) تستهلك؟
الحصة = 30 جم = 3 ملاعق طعام

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

69. كم مرة تستهلك الرز أو المكرونة المطبوخة؟
حصة الرز المطبوخ= 2 ملعقة طعام
حصة المكرونة المطبوخة = 3 ملاعق طعام

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكه أبدا ◯

أكثر من 5 حصص في اليوم ◯ من 4-5 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

70. كم مرة تستهلك الرز والمكرونة السمراء المطبوخة ؟
حصة الرز المطبوخ= 2 ملعقة طعام
حصة المكرونة المطبوخة = 3 ملاعق طعام

مرة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكه أبدا ◯

أكثر من 5 حصص في اليوم ◯ من 4-5 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

71. كم عدد الحصص المستهلكة من الخبز الأبيض؟
الحصة = شريحة خبز متوسطة الحجم = خبز بيقل = كرواسان متوسط = خبز صامولي = شريحة من خبز فرنسي=نصف شريحة من خبز الفواكه أو خبز الشعير أو خبز التورتيلا او خبز البرجر= شريحة من خبز الثوم

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

72. كم عدد الحصص التي تستهلكها من رقائق البطاطس؟
الحصة = 40 جم = كيس متوسط

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

73. كم عدد الحصص المستهلكة من البطاطس (لا تشمل البطاطس المقلية)؟
الحصة = بطاطس متوسطة الحجم

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

74. كم عدد الحصص التي تأكلها من الحلى مثل (الكيك - الجاتو - التارت الحلو - الفطائر المحلاة- الاكلير- أو البودينج)؟
الحصة = شريحة من كيك الشوكولاتة او الجاتو= كيك الكوب= قطعة اكلير= قطعة بسبوسة = كنافة = خلية نحل = بقلاوة= جلي = مهلبية.

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

75. كم عدد المرات التي تستهلك فيها الفطائر المالحة ، فطائر اللحم، المعجنات أو فطائر السجق؟

مرة كل يوم ◯ من 4-5 مرات في الاسبوع ◯ من 2-3 مرات في الاسبوع ◯ مرة في الاسبوع ◯ من 1-3 مرات في الشهر ◯ لا أستهلكه أبدا ◯

أكثر من 3 مرات في اليوم ◯ من 2-3 مرات في اليوم ◯

76. كم حصة من الايس كريم تستهلك؟
الحصة = 1 ايس كريم مارس، مثلجات الفواكه أو غرفة ايس كريم

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

77. كم ملليتر (مل) تستهلك من المشروبات الغازية و مشروبات الطاقة مثل رد بول, بايسون؟
الحصة = الكأس العادي = 250 مل
العلبة = 330 مل

من 660 مل - 990 مل في الأسبوع ◯ 330 مل في الأسبوع ◯ من 330 مل - 660 مل في الشهر ◯ لا استهلكها أبدا ◯

أكثر من 990 مل في اليوم ◯ من 660 مل- 990 مل في اليوم ◯ 330 مل في اليوم ◯ من 1320 مل - 1650 مل في الأسبوع ◯

78. كم ملليتر (مل) تستهلك من المشروبات الغازية قليلة السعرات ؟
الحصة =الكأس العادي = 250 مل
العلبة = 330 مل

من 660 مل - 990 مل في الأسبوع ◯ 330 مل في الأسبوع ◯ من 330 مل - 660 مل في الشهر ◯ لا استهلكها أبدا ◯

أكثر من 990 مل في اليوم ◯ من 660 مل- 990 مل في اليوم ◯ 330 مل في اليوم ◯ من 1320 مل - 1650 مل في الأسبوع ◯

79. كم عدد الحصص التي تستهلكها من البسكويت المحلى مثل دايجستف بالشوكولاتة او الكوكيز؟
الحصة = 1 بسكويت أو كوكيز

حصة كل يوم ◯ من 4-5 حصص في الاسبوع ◯ من 2-3 حصص في الاسبوع ◯ حصة في الاسبوع ◯ من 1-3 حصص في الشهر ◯ لا أستهلكها أبدا ◯

أكثر من 3 حصص في اليوم ◯ من 2-3 حصص في اليوم ◯

80. كم كأس من الماء تستهلك في اليوم العادي؟
الكأس = 250 مل

أكثر من 8 كاسات ◯ 7-8 ◯ 5-6 ◯ 3-4 ◯ 1-2 ◯ أقل من كاسة ◯

81. كم مرة تستهلك وجبة الافطار؟

كل يوم ◯ من 4-5 مرات في الأسبوع ◯ من 2-3 مرات في الأسبوع ◯ مرة في الاسبوع ◯ من 1-3 مرات في الشهر ◯ لا أستهلكه أبدا ◯

82. كم عدد المرات التي تتناول فيها الماكولات التقليدية المحتوية على الرز والدجاج او اللحم؟

مرة كل يوم ◯ من 4-5 مرات في الاسبوع ◯ من 2-3 مرات في الاسبوع ◯ مرة في الاسبوع ◯ من 1-3 مرات في الشهر ◯ لا أستهلكه أبدا ◯

أكثر من 3 مرات في اليوم ◯ من 2-3 مرات في اليوم ◯

83. كم عدد المرات التي تستهلك فيها المأكولات المعلبة (الطعام في علب صفيحية) مثل التونا، الطماطم، الحمص، الفاصوليا؟

مرة كل يوم ◯ من 4-5 مرات في الاسبوع ◯ من 2-3 مرات في الاسبوع ◯ مرة في الاسبوع ◯ من 1-3 مرات في الشهر ◯ لا أستهلكه أبدا ◯

أكثر من 3 مرات في اليوم ◯ من 2-3 مرات في اليوم ◯

84. كم عدد المرات التي تستهلك فيها الأطعمة الجاهزة المصنعه مثل البيتزا المجمدة - اصابع الدجاج أوالسمك أو البرجر الجاهزة للقلي؟

مرة كل يوم ◯ من 4-5 مرات في الاسبوع ◯ من 2-3 مرات في الاسبوع ◯ مرة في الاسبوع ◯ من 1-3 مرات في الشهر ◯ لا أستهلكه أبدا ◯

أكثر من 3 مرات في اليوم ◯ من 2-3 مرات في اليوم ◯

85. كم عدد المرات التي تستهلك فيها السجق، اللحوم الباردة ، السلامي؟

مرة كل يوم ◯ من 4-5 مرات في الاسبوع ◯ من 2-3 مرات في الاسبوع ◯ مرة في الاسبوع ◯ من 1-3 مرات في الشهر ◯ لا أستهلكه أبدا ◯

أكثر من 3 مرات في اليوم ◯ من 2-3 مرات في اليوم ◯

86. كم ملعقة شاي من الملح المضاف تستهلك في اليوم العادي؟

لا اعرف ◯ أكثر من ملعقتين ◯ ملعقتا شاي ◯ ملعقة شاي ◯ نصف ملعقة شاي ◯ ربع ملعقة شاي ◯ اقل من ربع ملعقة شاي ◯

87. كم مكعب من مرقة الخضار، الدجاج ، اللحم أو السمك أو بودرة المرق أو مظروفات الشوربة أو صلصة اللحم الجاهزة تستهلك في الأسبوع العادي؟
المكعب = 1 ملعقة طعام
اذا كنت تطهي عدة حصص , كم متوسط استهلاك الفرد تقريبا

أكثر من 5 ◯ 5 ◯ 4 ◯ 3 ◯ 2 ◯ 1 ◯ 0 ◯ لا أدري ◯

88. كم عدد المرات التي تستهلك فيها الصلصات الجاهزة مثل صلصلة الصويا ، صلصة السمك ؟

مرة كل يوم ◯ من 4-5 مرات في الاسبوع ◯ من 2-3 مرات في الاسبوع ◯ مرة في الاسبوع ◯ من 1-3 مرات في الشهر ◯ لا أستهلكه أبدا ◯
أكثر من 3 مرات في اليوم ◯ من 2-3 مرات في اليوم ◯

89. كم عدد المرات التي تستهلك فيها الطماطم المجففة أو المخللات مثل الزيتون أو مخلل الخيار؟

مرة كل يوم ◯ من 4-5 مرات في الاسبوع ◯ من 2-3 مرات في الاسبوع ◯ مرة في الاسبوع ◯ من 1-3 مرات في الشهر ◯ لا أستهلكه أبدا ◯
أكثر من 3 مرات في اليوم ◯ من 2-3 مرات في اليوم ◯

90. هل تتناول بانتظام أنواع أخرى من الأطعمة غير المدرجة في هذا الاستبيان ، اذا كنت كذلك أرجو تحديد المادة الغذائية وعدد المرات.

1 ____________________
2 ____________________
3 ____________________
4 ____________________

91. نشكركم ونقدر مشاركتكم في هذا الاستبيان، كما نفيدكم بأن معلوماتكم ستبقى سرية وستستخدم لغرض هذه الدراسة فقط. نرجو كتابة اسمكم وعنوانكم البريدي إذا رغبتم في المشاركة في هذه الدراسة في المستقبل

الأسم ____________________
عنوان البريد الالكتروني ____________________