An Investigative Study on University Students' Knowledge and Attitudes towards the Food Dome in the Eastern Province of the Kingdom of Saudi Arabia

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Contents

Appendences

List of Figures

List of Tables

Acknowledgments

I would like to extend my sincerest and heartfelt gratitude to my supervisor Dr Margaret Coffey for her guidance during my doctoral journey. She truly has been a school in my life who taught me the inner roads in academic life and beyond. Much can be said about Dr Margaret Coffey yet words would not make justice to express my deep appreciation. She has been an incredible mentor during my journey. The academic journey with her has been exceptionally enriching and more specially during the pandemic. Her vision as an advisor has been reflected in many ways, and her ultimate concept as a teacher has been to see the success of her students.

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My love and respect to my parents, to my late father and mother who put their trust in me and highly valued my vision of education. Let my success be the reward for their sacrifice. I also certainly value the support of my friends, best friend whose understanding has given me the strength and the undying will to continue my academic work and research.

Last, but truly not least, I thank a very special person, who installed in me and showed the power of education.

Declaration

The thesis named above has been submitted for the degree of Doctor of Philosophy.

I, Alexander Woodman, hereby declare that:

- I am the sole author of this thesis.
- I have fully acknowledged and referenced the ideas and work of others, whether published or unpublished, in my thesis.
- I have prepared my thesis specifically for the degree of Doctor of Philosophy while under supervision at the University of Salford.
- My thesis does not contain work extracted from a thesis, dissertation or research paper previously presented for another degree or diploma at this or any other university.
- As a split site student, my research has been carried out under the supervision of main Supervisors, Dr Margaret Coffey and Dr Anna Cooper-Ryan, from the University of Salford, as well as local Supervisor, Dr Nizar Jaoua, Prince Mohammad bin Fahd University.

Data collection was administered by myself, while following local COVID-19 risk assessment operations and all accredited prevention protocols were applied at all stages.

Since data collection included both male and female participants, a female chaperone was present during two of the research phases in accordance with Saudi cultural norms.

COVID-19 statement

In December 2019, a series of pneumonia cases of unknown cause emerged in Wuhan, Hubei, China, with clinical presentations greatly resembling viral pneumonia. Deep sequencing analysis from lower respiratory tract samples indicated a novel coronavirus, which was named 2019 novel coronavirus (2019-nCoV or COVID-19). As a result of the rapid spread of the virus around the world, the World Health Organization (WHO, 2020) described COVID-19 as pandemic.

Students across the higher education sector have been dramatically impacted by the spread of COVID-19, from travel restrictions to social distancing, isolation measures, quarantines, campus, and border closures. The COVID-19 conditions have specifically affected current enrolled PhD researchers, and this PhD study in particular; its administration and data collection procedures. Thus, over the course of this PhD research, starting March 2020 to November 2021 I have been banned to travel to the United Kingdom. The communications and meetings with supervisors were moved to online platforms.

By March 12th 2020, all social and governmental gatherings and events were suspended or postponed in the Kingdom of Saudi Arabia. The COVID-19 pandemic has forced schools and colleges to close and wreaked havoc on the education system. Starting June 21st 2020, the Ministry of Health of the Kingdom of Saudi Arabia has cancelled/lifted several strict precautions. However, some safety measures have been designated as mandatory until further notice. In addition, students across the higher education sector have been dramatically impacted by the spread of COVID-19, from travel restrictions to social distancing, isolation measures, quarantines, campus, and border closures. The COVID-19 conditions have specifically affected current enrolled PhD researchers, and this PhD study in particular; its administration and data collection procedures. Thus, over the course of this PhD research, from March 2020 to November 2021 I was banned from travelling to the United Kingdom. The communications and meetings with supervisors were moved to online platforms.

In respect of precautionary measures implemented by the Saudi government, and to protect the health of participants, the initial outline of the study and data collection for phases I and II were amended as follows:

Phase I – Quantitative Data Collection among n = 426 participants.

- Data collection took place in 10 separate sessions - five days.
- There was a 4-hour break between each session (twice a day) when room/auditorium and furniture were cleaned and ventilated.
- The number of participants plus the researcher(s) did not exceed 45.
- Non-contact temperature devices were used as part of the initial entry check to identify people who may have a fever.
- Participants and researcher(a) kept social/physical distancing, staying at least 6 feet (about two arms' length/1.8 metres) from one another.
- Participants and the researcher(s) wore masks and were provided with hand sanitisers.
- The printed questionnaires and consent forms were placed in envelopes, sealed, and distributed among participants. Since the study administration was paper-based, the participants were asked to bring their pens/pencils to reduce all possible risks.

Phase II – Qualitative Data Collection among n = 16 participants.

- Data collection took place at Prince Sultan Military College of Health Sciences, where an average classroom is 78 square metres
- Data collection took place in 2 separate days to enable the classroom and furniture to be cleaned and ventilated
- The number of participants did not exceed eight
- Non-contact temperature devices were used as part of the initial entry check to identify people who may have a fever
- Social/physical distancing was implemented, with distances of at least 6 feet (about two arms' length/1.8 metres) being maintained throughout
- During the discussion, all participants wore face masks and used hand sanitisers
- After data collection, contact details of all participants were kept in case a member of the research team or a participant developed COVID-19 symptoms within 21 days of contact

Throughout the PhD research, all any local COVID-19 risk assessment guidelines were followed.

Abbreviations

ANOVA: Analysis of variance

Apps: Applications

ATLS: Arab Teens Lifestyle Study

BMI: Body Mass Index

BPS: British Psychological Society

CDC: Centres for Disease Control and Prevention

CIA: Central Intelligence Agency

COPD: Chronic Obstructive Pulmonary Disease

CVD: Cardiovascular Disease

EMR: Eastern Mediterranean Region

EMRO: Eastern Mediterranean Regional Office

FA: Framework Analysis

FAO: Food and Agriculture Organization of the United Nations

FBDG: Food-Based Dietary Guidelines

FDDG: Food Dome Dietary Guidelines

GASTAT: General Authority for Statistics

GCC: Gulf Cooperation Council

GDP: Gross Domestic Product

GNKQ: General Nutrition Knowledge Questionnaire

IPAQ: International Physical Activity Questionnaire

KACST: King Abdulaziz City for Science and Technology

KAP: Knowledge, Attitudes and Practices

KSA: Kingdom of Saudi Arabia

MENA: (the) Middle East and North Africa

MET: Metabolic Equivalent

MOH: Ministry of Health

MOHAP: Ministry of Health and Prevention

MoMRAH: Ministry of Municipal and Rural Affairs

NCD: Non-communicable disease

NHS: National Health Service

NICE: National Institute for Health and Care Excellence

NIH: National Institutes of Health

NOO: National Obesity Observatory

PA: physical activity

PICO: Population, Intervention, Comparison, Outcome

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PSMCHS: Prince Sultan Military College of Health Sciences

SDL: Saudi Digital Library

SEM: Socio-Ecological Model

SES: Socio-Economic Status

SHIS: Saudi Health Interview Survey

SIGN: Scottish Intercollegiate Guidelines Network

SPSS: Statistical Package for the Social Sciences

SREBQ: Self-regulation of Eating Behaviours Questionnaire

THE: Total Health Expenditure

UAE: United Arab Emirates

UK: (the) United Kingdom

UNDP: United Nations Development Programme

UNIATF: United Nations Interagency Task Force

UNICEF: United Nations Children's Funds

UoS: University of Salford

US: (the) United States

WHO: World Health Organization

WOF: World of Obesity

Abstract

Background: Similar to global and regional trends, Saudi students face significant behavioural changes as they leave their home environment, enter university, and develop new habits, which can include unhealthy diets, skipping meals, dining out, and low levels of physical activity (PA). Evidence suggests that nutrition education may improve the overall nutrition knowledge of students, raising awareness of healthy food choices and influencing attitudes towards a healthy diet. The Food Dome dietary guidelines (FDDG) were developed to prevent the most prevalent diet-related health conditions in the Middle East and North Africa (MENA) region.

Aim: This research aimed to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the FDDG among 18-25-years-old university students in the Eastern Province of the Kingdom of Saudi Arabia (KSA).

Methods: A mixed-methods approach was used to address the research aim and objectives. During Phase I, the Arab Teens Lifestyle Study (ATLS) and Food Dome questionnaire was administered among n = 426 students. During Phase II, focus group discussions were conducted to explore further the knowledge of and attitudes towards the FDDG. The findings from Phases I and II were used to provide short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population.

Results: Out of n = 426 participants, n = 200 (47%) were categorised as normal weight; among these, n = 130 (65%) were males and n = 70 (35%) were females. Of n = 426 participants, 113 (26.5%) were overweight and 73 (17.1%) were obese. The findings of the first objective of this study showed that most of the nutritional PA, and sedentary behavioural factors in the questionnaire did not influence obesity amongst the participants. However, in the obese group (n = 73), more of the males that consumed fruits, French fries, cakes, sweets and doughnuts more than three times per week were likely to be obese, which was not the case for female participants. The analysis of milk and dairy product consumption showed that participants who consumed this food group more than three times per week were significantly more likely to be in the normal weight category. In the obese group (n = 73), participants who consumed milk and dairy products were also more likely to be obese than those who consumed this food group less than three times a week or who did not consume it at all.

The Food Dome questionnaire findings showed that n = 298 (70%) of students reported that they had never heard about the FDDG, and only n = 47 (11%) participants reported following it. Age, gender, and body mass index (BMI) were not significantly associated with knowledge and behaviour in relation to the FDDG. Qualitative findings showed that the food choices of Saudi students largely depended on time, budget, availability, and taste. The proposed recommendations identified through focus group discussions that may improve knowledge, attitudes, and behaviour in relation to FDDG included mobile applications (apps), educational programmes, special offers and more availability of healthy restaurants and gyms at the higher educational institutions.

Conclusion: The unique contribution of this PhD study is the depth of insight into Saudi students' knowledge, attitudes and behaviour in respect of food, food choice, PA and the FDDG, which was previously unknown. Based on the two phases of research, short-term and long-term recommendations were proposed to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population. These recommendations add a unique contribution to the literature and can be incorporated into a future intervention and evaluated to understand what works and what does not in the Saudi context.

Chapter 1 – Introduction

1.1 Chapter overview

Chapter 1 provides the rationale for the importance of understanding knowledge and attitudes about nutrition among students. It discusses the current literature on the behavioural determinants influencing levels of obesity among students in general and in the Eastern Province of the Kingdom of Saudi Arabia (KSA) specifically. This will include cultural factors, transition to higher education, environment and living conditions. This chapter will also provide an overview of the initiatives to reduce obesity rates, followed by the overall aims and objectives of this PhD research.

1.2 Introduction

The association between knowledge, attitude, and behaviour is based on the rationale that an acquaintance of a person with new information leads to the acquisition of knowledge, which may result in changes in attitude and behaviour (Fine et al., 1994; O'Brien & Davies, 2007; Alves & Precioso, 2020; Bin Jeinie, 2021). However, the association between nutritional knowledge and healthy food choices is not as clear as it may seem, showing weak correlations in respect of the hypothesis that increasing knowledge about healthy diets would lead to better dietary habits (Alves & Precioso, 2020; Bin Jeinie, 2021). While arguments about the connection between knowledge, attitude and behaviour are the subjects of ongoing research, it has been suggested that studying the relationship between nutritional knowledge and attitudes of one specific group, i.e., students, offers one possible way to better understand the influence of multiple factors (e.g., environment) on their eating behaviour (Spronk et al., 2014; Al-Qahtani et al., 2019; Nawsherwan et al., 2020).

Over time the prevalence of obesity has increased in many countries worldwide (Ritchie & Roseri, 2016; World Health Organizations (WHO), 2018). Most of the world's population lives in countries where overweight and obesity kill more people than underweight (Ritchie & Roseri, 2016; WHO, 2018). The latest data by WHO reported that in 2016, globally, 39% of adults aged 18 years and over were overweight, and 13% were obese. In 2020, 39 million children under the age of five were overweight or obese (Ritchie & Roseri, 2016; WHO, 2018).

Similar to global trends, over the last three decades, rapid cross-cultural and socio-economic changes have occurred in many Arab countries, resulting in changes of attitudes and behaviours toward western values, including dietary patterns and physical activity (PA) (Musaiger, 2012; Fatima et al., 2013; Al Sabbah & Muhsineh, 2016). As a result, high rates of overweight and obesity have become the most apparent health consequences of unhealthy behaviours of the Arab population, specifically in the KSA (Al Sabbah & Muhsineh, 2016; Alluhidan et al., 2022).

Saudi Arabia is the fifth-largest country in Asia, the second largest in the Arab world, and the largest in Western Asia (House of Saud, 2020). The territory of modern Saudi Arabia consists mainly of four distinct regions: Western Province (Hejaz), Central Province (Najd), Eastern Province (Sharqiya), and Southern Province (Asir) (House of Saud, 2020). With one of the youngest populations in the world, where 51% of the 33.4 million people are under 25 years of age, the KSA has one of the highest obesity and overweight prevalence rates, where 7 out of 10 people are experiencing this health condition (Al Qahtani et al., 2019).

As of 2015, 63.4% of Saudi adults were overweight, and 28.1% were obese (Khoja et al., 2017; WHO, 2017; Al-Qahtani et al., 2019). In addition, the obesity prevalence of KSA was higher than the regional average of 8.7% for women and 6.0% for men (Khoja et al., 2017; WHO, 2017). The national survey (2021) among n = 4,709 Saudi residents in the 13 administrative regions of Saudi Arabia found an overall prevalence of obesity of 24.7% (Althumiri et al., 2021). Although obesity shows a decreasing trend in Saudi Arabia, compared to data from 2015, almost one-quarter of this study sample were obese (Althumiri et al., 2021). Further analysis of this nationwide survey showed that obesity was significantly associated with non-communicable diseases (NCDs) such as type 2 diabetes, hypercholesterolemia, hypertension, lung diseases, rheumatoid arthritis, sleep apnoea, colon diseases and thyroid disorders. Females were more obese (25.5%) compared to of males (17.9%) (Althumiri et al., 2021).

A recent population-based study of Saudi adults (n = 12,154 (n = 5,523 males and n = 6,631 females)) (Al-Qahtani et al., 2021) found that 72.4% of the participants were either overweight (31.9%) or obese (40.5%), which increased with age and peaked among those aged 50–59 years. Males were 1.5 times more likely to be overweight or obese than females. and those who never exercised were 42% more likely to be obese or overweight than those who exercised daily (Al-Qahtani et al., 2021).

Obesity rates in the KSA show regional variation, with the highest rates in the Eastern Province, also known as Ash Sharqiyah, (29%) and central regions (20.5%) and the lowest in the southern regions (8.9%) (Khoja et al., 2017; WHO, 2017; Al-Qahtani et al., 2019). While these data were reported in 2019, the more recent study by Althumiri et al. (2021) showed that the Eastern Province (29.4%) was still the most obese of the Kingdom, followed by Riyadh (26.9%), while the lowest was Baha (14.3%) (Figure 1.1).

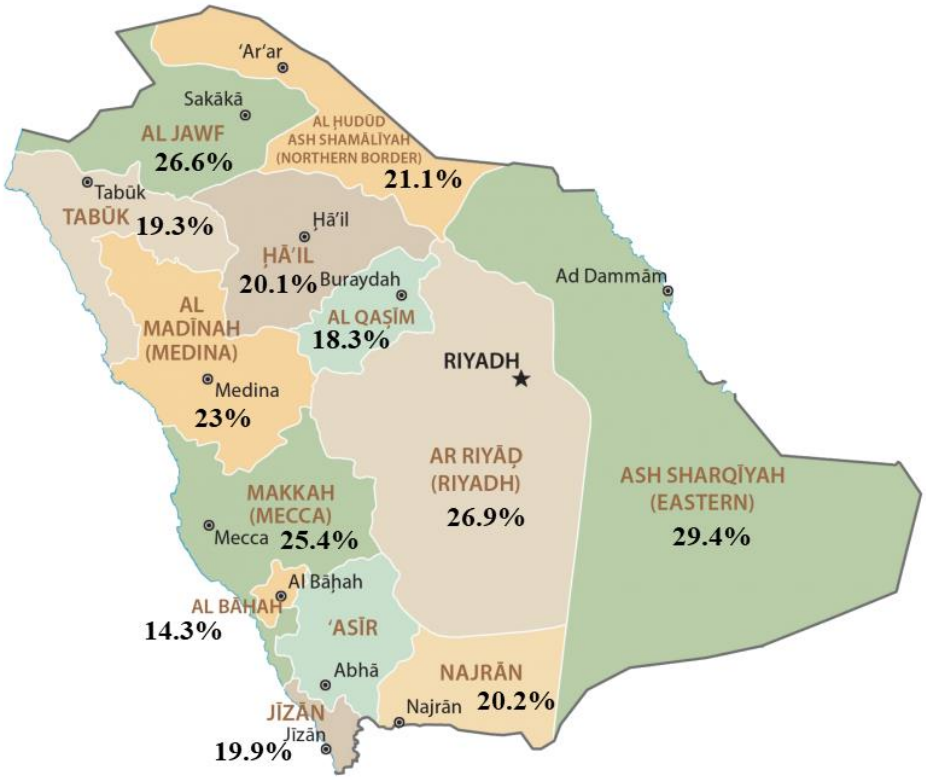


Figure 1.1. The obesity map of the Kingdom of Saudi Arabia developed for this PhD research based on the data by Althumiri et al. (2021).

The average prevalence rate of physical inactivity among the countries of the Gulf Cooperation Council (GCC, namely Bahrain, Kuwait, Oman, Qatar, the KSA, and United Arab Emirates (UAE)) is 46.24%, with the prevalence of physical inactivity among Saudi adults being about 80%, which was higher than in the United States (US), the United Kingdom (UK) 35.9%, and Europe 29.4% (Mok et al., 2019). Thus, changes in the lifestyle have affected not only the diet of the Saudis but the PA of this semi-nomadic nation, who once used to travel long distances daily (Al-Hazzaa, 2018; Kulhánová, 2019; Al-Qahtani et al., 2021). There has been a rapid increase in the use of mostly automatic equipment (e.g.,

cars, elevators), which has reached almost all segments of the Saudi population (Alahmed & Lobelo, 2018; Al-Qahtani et al., 2021; Althumiri et al., 2021, Melebari & Khan, 2022).

There is a body of research that explores level of compliance with certain dietary guidelines (e.g., Healthy Food Plate, Food Dome) that aim to increase nutritional knowledge and encourage behavioural changes to reduce overweight obesity and obesity-related NCD (Boylan et al., 2012; Al-Qahtani & Sundogji, 2016; Almutairi et al., 2018). Albeit, with the understanding that knowledge of the guidelines *per se* does not necessarily mean compliance (Al-Qahtani et al., 2019; Nawsherwan et al., 2020). However, having this knowledge has been found to increase the possibility that a person may rethink their nutritional attitudes and preferences (Boylan et al., 2012; Al-Qahtani & Sundogji, 2016; Almutairi et al., 2018).

To promote healthy nutrition and PA, countries worldwide have developed and implemented Food Based Dietary Guidelines (FBDGs), either nationally or regionally (Food and Agriculture Organization of the United Nations (FAO)/WHO, 1998; Dwyer, 2001; Herforth et al., 2019). While there is no consensus on whether FBDGs positively impact the population's health at large, evidence shows that people who are more knowledgeable about healthy nutrition, or some of the components of FBDGs, tend to make healthier choices (Jezewska-Zychowicz et al., 2019; Balani et al., 2019). Similarly, the Arab Center for Nutrition developed the Food Dome Dietary Guidelines (FDDG) for the Middle East and North Africa (MENA) region, namely Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, UAE, and Yemen, to prevent overnutrition, malnutrition and micronutrient deficiencies and promote PA (Musaiger, 2012). The Food Dome structure considers local habits, traditional food consumption patterns and lifestyles. It is a set of evidence-based dietary recommendations designed to promote healthy eating and regular PA to tackle obesity and obesity-related NCDs in the MENA region (Musaiger, 2012; Montagnese et al., 2019). The development of the FDDG involved scientific and government stakeholders. Nevertheless, while Musaiger (2012) and the Arab Center for Nutrition looked at a number of regional and sociocultural factors, including economic inequality, the rapid shift in diets towards unhealthy foods, and differences in eating patterns in MENA, was not taken into account (Springmann et al., 2020; United Nations Children's Funds (UNICEF), 2020). Moreover, there is no evidence to suggest that FDDG was systematically promoted or distributed to the general public through nationwide campaigns or other means, other than available data posted on the Arab Nutrition

Center website, Food Dome images on various Google platforms, and an article by Musaiger (2012), published in Nutricion Hospitalaria. In addition, no studies have been conducted to assess the general public's knowledge and attitudes towards the FDDG. More detailed critical appraisal of the Food Dome instrument, including its intended use for the entire MENA region are presented in section 2.8.3.

1.3 The importance of nutritional knowledge and attitudes to healthy eating behaviour among students

Health promotion and disease prevention are closely linked to food choices and PA, which include behavioural predispositions associated with intrapersonal and interpersonal factors such as knowledge and attitudes towards consumption of certain types of food and practice of PA (WHO, 2008; WHO, 2017). A better understanding of the relationship between nutritional knowledge and dietary intake in students is important, as evidence suggests that nutrition education is one of the factors that may increase their overall nutrition knowledge, awareness of healthy food choices and influence their attitudes towards healthy nutrition (Shepherd & Raats, 1996; Wardle et al., 2000; Zoellner et al., 2009; Spronk et al., 2014). At the same time, as the concept of nutrition knowledge can be complex, Zoellner et al. (2009) used the term 'nutrition literacy' rather than knowledge and defined this as the degree to which individuals can obtain and understand nutrition information and skills needed to make appropriate nutrition choices. In addition, other attitudinal and situational variables also influence the final food choice, discussed further in the following sections (Zoellner et al., 2009; Spronk et al., 2014).

There is growing evidence to suggest that over the past three decades students are increasingly choosing unhealthy foods due to a lack of knowledge and positive attitudes towards healthy foods, where taste and pleasure are some of the main considerations in food choices (Fath Al Alim et al., 2012; Latzer et al., 2014; Crowley et al., 2019). Thus, diet quality of students from the US, Spain, Italy and Germany was low due to poor knowledge of healthy nutrition (Rozin et al., 1999; Makino et al., 2004). This was consistent with a study among Portuguese university students where overall healthy dietary knowledge was low (Alves & Precioso, 2020). Similar to global and regional trends, Saudi students have been found to experience significant lifestyle changes after leaving their home environment for college/university, including developing new relationships, and establishing positive or negative health-related behavioural patterns (Al-Almaie, 2005; Al-Nakeeb et al., 2012; Al-

Qahtani & Sundogji, 2016). To date, most KSA studies have focused on the daily habits of students, their behaviour, and the prevalence of overweight and obesity rather than evaluating their nutritional knowledge as the source of health issues (Al-Almaie, 2005; Al-Nakeeb et al., 2012; Al-Qahtani et al., 2019). Only a few studies have examined the nutritional knowledge of Saudi students, as discussed in the following paragraphs (Al-Almaie, 2005; Al-Nakeeb et al., 2012; Al-Qahtani et al., 2019).

Poor nutritional knowledge in students has been reported in the MENA region (i.e., Lebanon, UAE, Kuwait, KSA, and Oman), where students have been found to lack appropriate nutritional knowledge and a high tendency towards unhealthy diets and behaviours (Al-Almaie, 2005; Al-Nakeeb et al., 2012; Al-Qahtani et al., 2019; Shatwan & Almoraie, 2022). Studies found that dietary knowledge of both male and female students in the region on the dangers of unhealthy foods and the benefits of fibre-rich diets was unsatisfactory. Some explanations included lack of education about nutrients and/or unavailability of health information, cross-cultural and socio-economic changes shifting the traditional fibre-rich diet of the MENA region toward western dietary patterns (Al-Hazzaa & Musaiger, 2011; Latzer et al., 2014; Al Sabbah & Muhsineh, 2016). As a result, a high prevalence of unhealthy nutrition has been confirmed in many Arab countries, specifically among students (Fath Al Alim et al., 2012; Al Sabbah & Muhsineh, 2016; Shatwan & Almoraie, 2022).

The transition to university is generally recognised as an important period of development, marked by increasing autonomy and independence of students, which entails significant life changes and may be accompanied by less healthy behaviours, such as unhealthy food choices (Arnett, 2000; Nelson et al., 2009; Deforche et al., 2015; Thompson et al., 2021). Young people studying in higher education institutions living away from home are no longer under strict family control over their daily diet. They are free to make their own food choices that are often not healthy (Deforche et al., 2015; Thompson et al., 2021). A systematic review by Li et al. (2022) on the components of the university food environment and what shaped the eating behaviour of students found that the taste of food is of paramount importance for students' food choices, followed by availability and price. The authors also found that the university food environment affects students' eating behaviour most unfavourably, leading to the cultivation of unhealthy food choices (Li et al., 2022). University food environments were characterised by the lack of availability of healthy foods and the higher cost of unhealthy options; expensive fruits and vegetables prevented students from choosing a healthier diet (Li

et al., 2022). The evidence from this systematic review, supported by earlier research worldwide, suggests that students' food choices depend on several components, including the food environment at the university, the price and availability of healthy foods, as well as student perceptions of food, based on taste and price (Pullman et al. 2009; El Ansari et al., 2012; Deforche et al., 2015; Sprake et al., 2018). Further evidence presented in the systematic review by Solomou et al. (2023) on the association of nutritional quality with mental health of university students showed that 36 out of 45 studies found that good nutritional quality of students was associated with better mental health in terms of depression, anxiety, stress, and overall mental well-being. Conversely, an unhealthy diet was found to be associated with depression, stress, anxiety, and other mental health problems. The authors also reported observational data to suggest that stress experienced by students was associated with a deterioration in the quality of their diet, including a reduction in fruit and vegetable consumption and an increase in sweets and fast food intake (Solomou et al., 2023). The evidence from Saudi Arabia indicates consensus with international evidence showing that the transition to higher education is a critical period for Saudi students who face a number of challenges, including changes in the social aspects, new environment, the development of new networks, greater behavioural autonomy, and adaptation to a new lifestyle (Al-Rethaiaa et al., 2010; Khalaf et al., 2013; Al-Drees et al., 2016; Saeed et al., 2017).

Saudi students from different regions have been found to lead an unhealthy lifestyle (e.g., low intake of fruits and vegetables), consume fast food, and tend to be physically inactive, after the transition to higher education (Al-Qahtani, 2016; Almutairi et al., 2018; Abdulrahman et al., 2021). Several factors are strongly associated with Saudi students' daily choices, such as gender, college type, school year, and family structure. For instance, a study by Al-Rethaiaa et al. (2010) among n = 357 male students from Qassim (Central Province) found that most students consumed meals irregularly, with two main meals per day. The majority consumed vegetables and fruits a maximum of two times a week, while about half of the sample consumed fried foods at least three times a week. Similarly, a relatively recent study among students at the University of Dammam (Eastern Province) (n = 562) found that the majority of students (91.3%) consumed fast food, with 85% of males consuming three or more times per week (Al-Qahtani, 2016). Although most students were aware of the benefits of vegetables and fruits and the disadvantages of soft drinks, most consumed a lot of soft drinks and fewer vegetables and fruits (Al-Qahtani, 2016). Almutairi et al. (2018), in a study conducted among n = 1656 students at King Saud University (Central Province), presented

further evidence from Saudi Arabia. The study found that although 94.9% of the students lived with their families, which should have encouraged healthy eating, most made unhealthy food choices and were physically inactive. The results also showed that males were more willing to engage in PA than females. The authors attributed this to cultural considerations; Saudi females have more restrictions for PA than Saudi males (Almutairi et al., 2018). Nevertheless, female students were more concerned about diet and nutrition than male students (Almutairi et al., 2018). Peers and the university environment in which students spend a lot of time were cited as external factors influencing student food choices, which may indicate higher rates of fast food consumption. Family structure has also been found to be an important predictor of participants' PA levels and food choices, i.e., beneficial health effects were seen when parents were educated and their children turn to them for support (Al-Rethaiaa et al., 2010; Al-Qahtani, 2016; Almutairi et al., 2018).

Attitudes towards healthy eating and lifestyles are also shaped by culture, including public perceptions of being overweight, restrictions placed on women, lifestyle in general, and strongly correlate with climate, terrain and the food environment as critically discussed in section 2.7.1 (House, 2012; Alodhayani et al., 2021; Evason, 2022). Inherently, Saudi females have more restrictions than males in terms of PA, as they are expected to stay at home and take care of family members or help with household chores. In contrast, males have more freedom of movement (House, 2012; Alodhayani et al., 2021; Evason, 2022). As a result, Saudi females have been found to be less physically active than males, due to a strong commitment to traditional values as discussed in section 2.7 (Al-Qahtani, 2016; Almutairi et al., 2018; Abdulrahman et al., 2021). Thus, a study by Abdulrahman et al. (2021), among students from six universities in Saudi Arabia, found that male students walk more, attend more sport activities, and like to spend time with friends, while female students spend most of their time studying, preparing for exams, self-isolating for the sake of achievements, and having limited friendships. The authors confirmed a previous hypothesis by Almutairi et al. (2018) suggesting that this could be explained by the strong influence of external factors on PA, including, but not limited to, cultural restrictions, peers, and university environments where students spend a lot of time on studying (Abdulrahman et al., 2021).

A better understanding of the relationship between student nutrition knowledge and diet enables further exploration of how to realistically and practically encourage students to follow nutritional recommendations, make healthy food choices, and be physically active

(French & Stables, 2004; Boeing et al., 2012; Sacks et al., 2015; van den Bogerd et al., 2020). For example, a study among Belgian students showed that asking what strategies might be effective for increasing PA could help develop tailored and effective intervention programmes (Deliens et al., 2014). Macdiarmid et al. (2013) in examining barriers to healthy eating among the UK population, found that the main barriers were social and cultural rather than a lack of skills or knowledge about healthy nutrition. As concluded by Macdiarmid et al. (2013) and confirmed by other researchers from Australia, Pakistan, and Italy, the food choices of students are often based on the availability of resources, facilities for cooking, taste and culture of food, physical environment, and perhaps most importantly, time, class pressure, and food prices (Deliens et al., 2014; Munt et al., 2017; Kabir et al., 2018; Irwin et al., 2019).

Since the college years are among the most important in developing behaviours, as outlined in this section, exploring the relationship between Saudi students' knowledge and attitudes towards FBDGs (e.g., FDDG), and how culture, as well as environment influence behaviour is of great importance (Alves, 2019; Yang et al., 2020; Liu et al., 2021; Al Tell, 2023). However, while most authors in the Gulf and KSA conclude their articles by advising students to follow national FBDGs, none of the studies have attempted to explore knowledge, attitudes, and behaviours in relation to national dietary guidelines, such as the FDDG. International evidence suggests that the food choices of students are often based on the availability of resources, facilities for cooking, taste and culture of food, physical environment, and perhaps most importantly, time, class pressure, and food prices (Harris, Carins & Rundle-Thiele, 2021; Ricotti et al., 2021; Giménez-Legarre et al., 2021). However, in Saudi Arabia, most of the research among students has focused on behavioural patterns, i.e., food choices and PA (Al-Rethaiaa et al., 2010; Al-Qahtani, 2016; Almutairi et al., 2018), rather than on why these behavioural patterns occur. Thus, there is a gap in knowledge about factors related to food choices among Saudi students, whether they are based on knowledge, attitudes, environment or other factors. Having a deeper understanding of the influences on food choices and PA among Saudi students may lead to better knowledge about the additional factors associated with overweight and obesity in the MENA region, which has continued to rise rapidly, particularly among Saudi students in the Eastern Province (Al-Rethaiaa et al., 2010; Al-Qahtani, 2016; Almutairi et al., 2018). As such, this PhD research has become the first to explore knowledge, attitudes, and behaviours in relation to the FDDG in one of the most obese parts of the GCC, namely the Eastern Province of the KSA.

1.4 Aim and objectives of the thesis

This research aims to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the FDDG among 18-25-years-old university students in the Eastern Province of the KSA.

The objectives of the study are:

1. To identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA (Phase I – quantitative).
2. To investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region (Phase I – quantitative).
3. To explore the knowledge of and attitudes towards the FDDG among the target population (Phase II - focus groups).
4. To provide short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population.

1.5 Outline of the thesis structure

This thesis is written over seven chapters:

Chapter 1 provides the rationale for the importance of understanding knowledge and attitudes about nutrition among students. It discusses the current literature on the behavioural determinants influencing levels of obesity among students in general and in the Eastern Province of the Kingdom of Saudi Arabia (KSA) specifically. This will include cultural factors, transition to higher education, environment and living conditions. This chapter will also provide an overview of the initiatives to reduce obesity rates, followed by the overall aims and objectives of this PhD research.

Chapter 2 covers the background of the study, a discussion of the research topic, and its importance. The literature review begins by outlining the search strategy used to identify the literature. Then it defines obesity, critically discussing how it is measured and its impact on the individual and society. A synthesised review of the key determinants of overweight and obesity, including social, environmental, behavioural, and psychological, will be discussed. This is followed by a critical discussion of the evidence related to the prevalence of

overweight and obesity in the Eastern Mediterranean Region (EMR) and GCC. The socio-economic, demographic, and cultural development within the KSA is outlined, followed by statistics on the current rates of overweight and obesity across the country and in the Eastern Province, what is known, and where are the gaps. Next, a synthesised, systematically developed review of the policies and programmes for the prevention and management of obesity in EMR, GCC, and KSA is provided. This is followed by an overview of the MENA region and a critical discussion of the FDDG to explore how feasible the recommendations are for such a heterogeneous region as the MENA. Chapter 2 concludes with a summary of the main findings from the literature and the identified gaps from which the aim and objectives of the study were developed.

Chapter 3 provides an overview of the research methodology and critical discussion of the phases of this research to be completed in chapters 4 and 5. A mixed-methods study was carried out in two phases to explore the relationships between weight, nutritional behaviours, knowledge and attitudes in relation to the Food Dome among 18-25-years-old university students in the Eastern Province of the KSA. The chapter will start with a comprehensive overview of the mixed-methods approach, its advantages, disadvantages, and the rationale for using this approach in this PhD research. This will be followed by a critical discussion of quantitative methods, i.e., questionnaires as an instrument for data collection. Subsequently, a critical discussion of the qualitative methods will be provided, in particular, the rationale for using mixed gender focus groups to answer the objectives of this research (given their potential limitations in the Saudi context).

Chapter 4 is dedicated to the quantitative Phase I study. It provides the rationale for the questionnaire choice, the development and validation of the new questionnaire section (relating to the Food Dome), the pilot study, ethical approval, study sample identification and recruitment. This is followed by a description of the questionnaire administration among the target population and the precautions needed during the COVID-19 pandemic. The findings of Phase I, included the analysis of the target population's socio-demographic characteristics, the findings of Arab Teens Lifestyle Study (ATLS) and the Food Dome questionnaire analysis. This will include overall findings, analysis by age, gender, BMI, and data on knowledge and behaviour related to the Food Dome questionnaire. Chapter 4 will conclude with a summary of the key findings in relation to objectives of Phase I.

Chapter 5 is dedicated to Phase II of this research, i.e., to explore the knowledge of and attitudes towards the FDDG among the target population and gain a more in-depth understanding of the findings from Phase I through focus group discussions. Chapter 5 will begin with the rationale for developing the focus group guide and questions when conducting a cross-language research, a discussion of the focus group composition and size, participant sampling and recruitment, ethics, and how the focus groups were moderated. This is followed by a critical discussion of how the focus groups were analysed, including the rationale for using framework analysis (FA). The findings from Phase II will be presented by the themes and sub-themes derived from FA. This chapter is concluded with a summary of the key findings of Phase II and a reflexive statement.

Chapter 6 discusses the findings of Phases 1 and II of the research. It begins by introducing the thesis, setting out the overall aim of the research, the objectives addressed. This is then followed by the discussion of the overall characteristics of the study samples, as well as power dynamics, in this mixed-gender research setting. This is followed by the discussion of the main findings in relation to the objectives and the literature. The chapter will conclude with a summary of the research phases, thereby addressing the fourth objective of this PhD research, i.e., providing short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population (Chapter 7).

Chapter 7 addresses the last objective of this research by providing short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population. The chapter will start with a brief overview of the study and added value to existing knowledge, followed by short and long-term recommendations for research, policy and practice. This chapter concludes with the strengths and limitations of the research and concluding remarks. Figure 1.2 presents the phases of research.

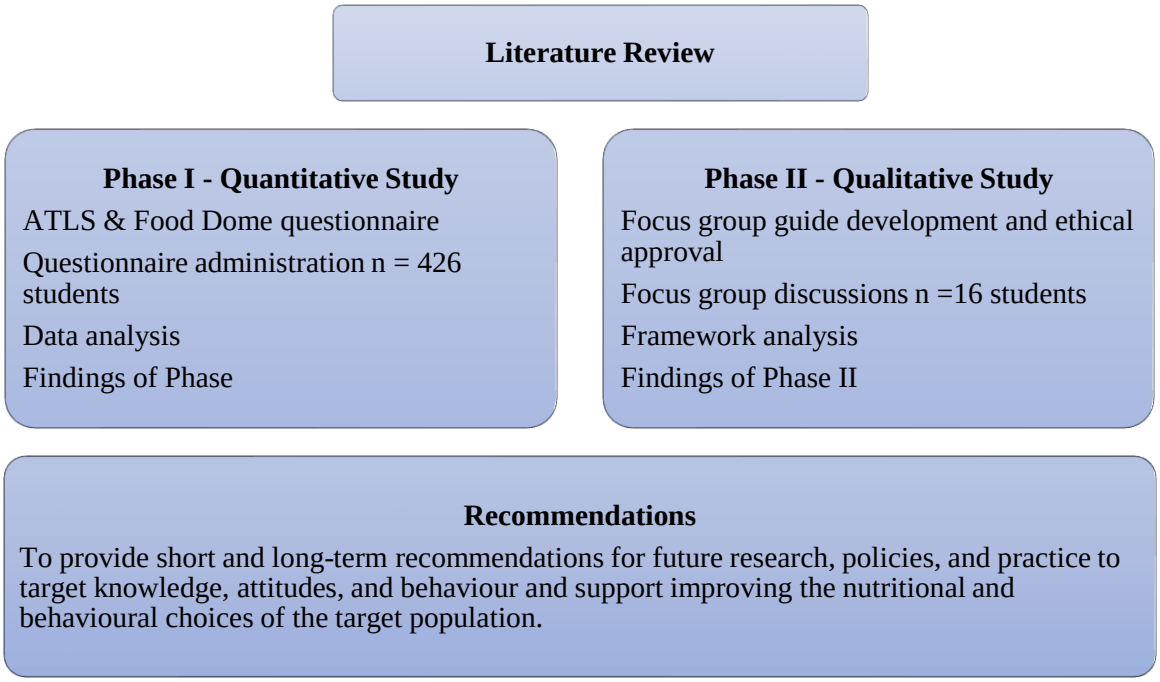


Figure 1.2. Phases of this PhD research.

1.6 Summary of Chapter 1

This chapter has laid the basis for this thesis by providing the rationale for exploring knowledge and attitudes in relation to nutrition and PA behaviours, among Saudi students, given the rising trends in obesity and NCDs in the region. The following chapter critically discusses the literature on this topic, drawing out key gaps in knowledge, which this research aims to address. This chapter laid the foundation for what is known and not known in the existing literature and how the findings of this PhD research hope to add to the evidence base. In addition to the aim of the research, adding new knowledge to the literature is the fundamental goal of the research.

Chapter 2 - Literature Review

2.1 Chapter overview

Chapter 2 covers the background of the study, a discussion of the research topic, and its importance. The literature review begins by outlining the search strategy used to identify the literature. Then it defines obesity, critically discussing how it is measured and its impact on the individual and society. A synthesised review of the key determinants of overweight and obesity, including social, environmental, behavioural, and psychological, will be discussed. This is followed by a critical discussion of the evidence related to the prevalence of overweight and obesity in the Eastern Mediterranean Region (EMR) and GCC. The socio-economic, demographic, and cultural development within the KSA is outlined, followed by statistics on the current rates of overweight and obesity across the country and in the Eastern Province, what is known, and where are the gaps. Next, a synthesised, systematically developed review of the policies and programmes for the prevention and management of obesity in EMR, GCC, and KSA is provided. This is followed by an overview of the MENA region and a critical discussion of the FDDG to explore how feasible the recommendations are for such a heterogeneous region as the MENA. Chapter 2 concludes with a summary of the main findings from the literature and the identified gaps from which the aim and objectives of the study were developed.

2.2 Literature search strategy

The literature search commenced in 2019 and was ongoing throughout the study. The search was conducted via the Saudi Digital Library (SDL), which provides the most extensive collection of e-books, scientific articles, reports, and studies in the MENA region. Eligible articles were also searched through CINAHL, Medline/PubMed (via Ovid database), Scopus, Cochrane Library, Emerald Insight and Web of Science scientific databases. In addition, sources such as Centres for Disease Control and Prevention (CDC), British Psychological Society (BPS), World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), National Health Service (NHS), National Institutes of Health (NIH), and the National Institute for Health and Care Excellence (NICE).

The search started with the development of a manageable search question related to the aims and objectives of this study. The main concepts in the search question were population, intervention, comparison, outcome (PICO) (Schardt et al., 2007; Farrugia et al., 2010).

Relevant literature was identified through an electronic search of studies reported from 1995 (when the first Saudi nutrition report was published) onwards. Databases were searched using Boolean operators[1] (AND, OR, NOT) expressed in English through a combination of words in a single search string. For instance, 'Obesity' AND 'Middle East' AND 'Nutritional Status' OR 'Nutrition Policy' AND 'Saudi Arabia' (Table 2.1, below).

Table 2.1. PubMed search string example - key concepts and terms for literature search.[2]

PubMed explorative search	
Publication dates	1995-2022
Language	English
Search string	"Obesity"[Mesh]) AND "Middle East"[Mesh]) AND "Nutritional Status"[Mesh] OR "Nutrition Policy"[Mesh] AND "Saudi Arabia"[Mesh]) AND "Students"[Mesh] OR "Students, Public Health"[Mesh]

The search results were saved, followed by the search for additional articles within the references of extracted data, including those of grey literature, reports, proceedings, dissertations, and theses produced by government agencies, academic institutions, and researchers whose works were not published by scientific publishers. Topics searched included the global context of obesity, factors and determinants associated with the prevalence of overweight and obesity, the importance of nutritional knowledge and healthy eating behaviour among students, and the prevalence of overweight and obesity in the MENA region and KSA, especially among students. These topics were investigated to understand the evidence base in relation to the study aims, food-based dietary guidelines (FBDG), global, regional, and national policies aimed at reducing rates of obesity. The findings of the search for the literature review are critically discussed in the next sections.

2.3 Definition and measures of obesity

Overweight and obesity are defined by abnormal or excessive fat accumulation that results from an imbalance between energy intake and expenditure and may have an adverse effect on the health of an individual (Bray, 2006; NICE, 2014; CDC, 2017; WHO, 2018). The metric suggested by the WHO to measure overweight and obesity is BMI of weight-for-height, commonly used to categorise overweight and obesity; calculated by dividing the body weight

[1] Boolean operators are words and symbols, such as AND or NOT, that together with keywords, create a logical string that refines a search term to find the most relevant results and sources when using a database or search engine (Ryan, 2022).
[2] Other literature database search strings (not shown) were developed using PubMed strings as a template.

in kilograms by the square of height in metres (Table 2.2, below) (NIH, 1998; NICE, 2014; CDC, 2017; WHO, 2018).

Table 2.2. Classification of weight status by BMI categories (NIH, 1998).

Classification	BMI (kg/m^2)
Underweight	< 18.5
Normal weight	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity Class 1	30.00 – 34.99
Obesity Class 2	35.00 – 39.99
Obesity Class 3	>40.00

Measuring the prevalence of overweight and obesity based on BMI alone may not accurately reflect the full picture, as it does not allow the measurement of total body fat (Sallis et al., 1998; Wardle et al., 2008; Stevens et al., 2012). A muscular person can have a high BMI and yet a low percentage of body fat. At the same time, someone with very little muscle may be considered as a normal weight on the BMI scale and can still have excess body fat. As a result, many professional athletes would be considered clinically obese based on the BMI scale because it does not distinguish muscle weight from fat weight (Harbin et al., 2006; Wardle et al., 2008; Stevens et al., 2012; Buss, 2014; Zierle-Ghosh & Jan, 2022). Hence, in addition to the calculation of BMI, there are a number of other factors to consider that impact a person's weight. BMI may not be the same for different genders, races, ethnic and age groups. For example, studies have found that Asian populations have a higher percentage of body fat with lower BMIs, males have a lower percentage of body fat and higher muscle mass than women, and all adults lose muscle mass with age (Wells, 2007; Wardle et al., 2008; Stevens et al., 2012; Buss, 2014).

Despite its overall usefulness as a research tool, BMI is rather useless when considering a functional ability to measure muscle strength, endurance, functional coverage, range of motion, and motor behaviour (Wardle et al., 2008; Stevens et al., 2012; Buss, 2014; Ghesmaty Sangachin et al., 2018; Zierle-Ghosh & Jan, 2022). BMI does not directly measure body fat; it should not be used as a diagnostic tool. Instead, BMI should be used as a measure to track the weight status of a population and as a screening tool to identify potential weight problems in individuals (Ghesmaty Sangachin et al., 2018; Zierle-Ghosh & Jan, 2022). In addition, BMI is considered a useful epidemiological tool at the population level due to its ease of use and low cost (Ghesmaty Sangachin et al., 2018; Zierle-Ghosh & Jan, 2022). Nevertheless, evidence from a systematic review by Ghesmaty Sangachin et al. (2018) shows

that over 70% of the authors of 126 studies relied on BMI to determine obesity, and only 22% of the studies directly measured body fat using methods such as dual-energy X-ray absorptiometry (Ghesmaty Sangachin et al., 2018). The authors concluded that the use of BMI was justified in large-scale public health studies. However, due to the limitations of these measures, caution is advised when using BMI as the sole measure of obesity in small observational studies (Ghesmaty Sangachin et al., 2018; Zierle-Ghosh & Jan, 2022).

An alternative metric that can give a more accurate picture of a person's weight and health is waist-to-height ratio (WHTR), used in conjunction with BMI, as per NICE (2022). This approach has been found to be useful in assessing central obesity, thereby predicting health risks such as type 2 diabetes, hypertension, or cardiovascular disease (CVD) (NICE, 2022). This conclusion was drawn from data of several studies showing that, along with BMI, WHTR can be used to assess and predict conditions related to body weight in ethnic groups and gender (NICE, 2022). However, the most recent study of 58,742 US military personnel by Nevill et al. (2023) found that adopting a WHTR threshold would result in short people being unfairly classified as obese due to body composition, affecting overall health predictions. The authors also suggested using separate charts for males and females, as there are significant differences between male and female waistlines, to more fairly judge whether they are at high, medium, or low risk of certain health conditions (Nevill et al., 2023).

Anthropometric measurements, first developed in the 19th century as a method used by physical anthropologists to study human variation and evolution in both living and extinct populations, are another alternative for obtaining data on body size, skeletal shape or configuration, skeletal and soft tissue development (Scafoglieri et al., 2013; Biology Dictionary, 2017; Hume & Ackland, 2017). Anthropometric measurements have historically been used as a means of associating racial, cultural and psychological characteristics with physical properties (cited in Fidanza et al., 1991; Gudaji et al., 2017). Common anthropometric measurements obtained include height, weight, triceps skinfold, subscapular skinfold, arm circumference, abdominal circumference, calf circumference, knee height, and elbow width. Anthropometric measurements can be used to estimate total body fat, regional fat, and fat distribution (Scafoglieri et al., 2013; Biology Dictionary, 2017; Hume & Ackland, 2017). Despite many advantages, the anthropometric measurement method can be challenging due to its vulnerability to errors (Sicotte et al., 2010; Bravo et al., 2018). Some of the challenges include the need for careful calibration of equipment, the availability of trained

measurers, multiple measurements (repeating), and participant agreement. Additional factors that can result in errors include changing the participant's posture throughout the process, changing the pressure exerted by the measuring devices, and measuring errors when locating body landmarks in the participants (Jamaiyah et al., 2008; Sicotte et al., 2010; Bravo et al., 2018).

Regardless of the methods used, the collected data must be as error-free, reliable and accurate as possible (Harbin et al., 2006; Wardle et al., 2008; Zierle-Ghosh & Jan, 2022). The widespread and longstanding use of BMI contributes to its usefulness at the population level for making comparisons across time, regions, and population subgroups (Ghesmaty Sangachin et al., 2018; Zierle-Ghosh & Jan, 2022). In contrast, some anthropometric measurements may be socially or culturally unacceptable, such as multiple measurements (repeated) or repeatedly touching participants' waist or hips (Jamaiyah et al., 2008; Sicotte et al., 2010; Bravo et al., 2018). Thus, it would be unethical and inconsistent with the concept of respect for Saudi culture if the researcher were to ask to touch the bodies of participants, even in the presence of female chaperone. Therefore, WTHR measurement would be inappropriate, as well (Jamaiyah et al., 2008; Sicotte et al., 2010; Bravo et al., 2018). In addition, this study was conducted during the COVID-19 pandemic, when social distancing and avoidance of physical contact were paramount. Therefore, BMI was the most appropriate indicator to consider in this research, presented in Chapter 4.

2.4 The global context of obesity

Over the last four decades, malnutrition and obesity have been transformed from a minor public health problem in developed countries to a major global health concern affecting both developed and developing countries (Bray & Popkin, 1998; Cassel, 2010; Global Nutrition Report, 2020). The latest global statistics of obesity (2016) show that more than 1.9 billion adults of 18 years and older were estimated to be overweight, and 650 million were considered obese, representing 13% of the world's population, of which 11% are men and 15% women (WHO, 2018). The same data showed that 41 million children under the age of five and over 340 million children and adolescents aged 5-19 were estimated to be overweight or obese (WHO, 2018). General trends show that the mortality rate is higher in overweight and obese populations (WHO, 2018). If these trends continue, it is estimated that by 2025 2.7 billion adults will be overweight, with over 1 billion affected by obesity and 177

million adults severely affected by obesity, simultaneously increasing the rates of NCDs (World of Obesity (WOF), 2020).

The first study that systematically estimated the prevalence of overweight and obesity among children (<20 years of age) and adults between 1980 and 2015 was conducted by Obesity Collaborators (Obesity Collaborators, 2017). Data from 195 countries (n = 68.5 million persons) have shown that the prevalence of obesity increased for adults from 15.1% to 20.7% and from 4.1% to 4.9% among children. The number of BMI-related deaths in 2015 was reported to be 417,115. This represents approximately 10% of total deaths, 120.1 deaths per 100,000 population, an 11% increase since 1990. In addition, it contributed to all deaths caused by ischemic heart disease (5.0%), ischemic stroke (0.9), and diabetes mellitus (1.9%) (Obesity Collaborators, 2017).

In all, 5% of NCDs are strongly associated with obesity and overweight (Banjare & Bhalerao, 2016). These diseases include diabetes mellitus, CVD, specific types of cancers, and some musculoskeletal disorders (Danaei et al., 2013; Swinburn et al., 2011; Chooi et al., 2018). In addition, physical inactivity has been considered to be the fourth leading risk factor for mortality, and approximately 3.2 million deaths each year are attributable to physical inactivity (Ritchie & Roseri, 2016; WHO, 2018).

Rising obesity rates (see Figure 2.1, below) cause an increase in health care costs and, consequently, a huge economic burden (Danaei et al., 2013; Swinburn et al., 2011; Chooi et al., 2018). According to the latest data by CDC, in 2017, obese people incurred 42% more health care costs than people of normal weight (Seydel et al., 2017). Yusefzadeh et al. (2019), in their systematic review on the economic burden of obesity, reported that obesity accounts for 31.8% of direct costs (health care costs related to obesity) and 68.1% of indirect costs (costs related to reducing productivity and production value). Consequently, obese people require 32% more medical expenses compared to people of normal weight (Yusefzadeh et al., 2019). A more recent systematic review of 41 studies looking into the financial burden due to NCDs showed that the average total costs per year to a patient/household in low- and middle-income countries of chronic obstructive pulmonary disease (COPD) was $7386.71, CVD $6055.99, cancers $3303.81, and diabetes $1017.05 (Kazibwe et al., 2021).

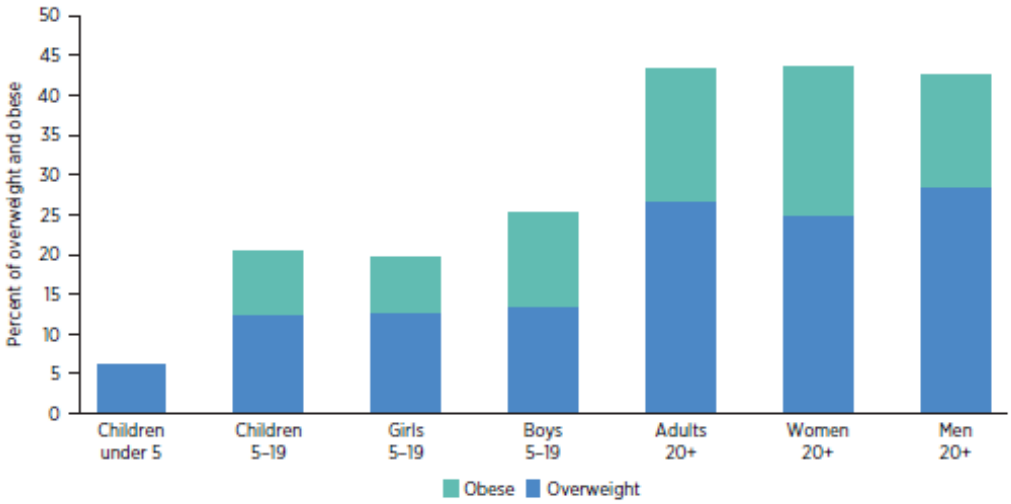


Figure 2.1. Global overweight and obesity rates as of 2016 (World Bank, 2020).

Some of the main factors associated with the global rise in obesity are changing trends in nutrition, greater availability of processed, affordable, and effectively marketed foods, and over-consumption of these foods, in addition to race, ethnicity, as well as culture. For instance, in some countries, cultural values favour larger body size among women as a sign of fertility, healthfulness, or wealth) (Bray, 2006; Hubail & Culligan, 2012; WHO, 2018; Global Nutrition Report, 2020). The following sections discuss some key factors reported in the literature associated with overweight and obesity and considered as the part of this research.

2.5 Key factors and determinants associated with overweight and obesity

Obesity and overweight are the results of a complex combination of biological and psychological factors combined with environmental and social influences (Ng et al., 2011; Alqarni, 2016; Lakerveld & Mackenbach, 2017). According to the Foresight Report (2007), a complex web of social and biological factors that have exposed an inherent human vulnerability[3] to weight gain consists of such factors as media, social, psychological, economic, food, PA, infrastructure, developmental, biological, medical, positive influence and, negative influence by others (Butland et al., 2007). As shown in Figure 2.2 (below), there are a complex array of determinants of obesity, including socio-economic status (SES), ethnic background, urbanisation, genetic, habitual influences, lifestyle patterns, over-

[3] Inherent vulnerability is related to 'sources of vulnerability that are inherent to the human condition and that arise from our corporeality, our neediness, our dependence on others, and our affective and social natures' (Rogers et al. 2012: p. 24).

consumption of high-energy foods, as well as a lack of PA. The obesity system map contains seven subsystems or themes that are highly interconnected (Butland et al., 2007):

- The physiology cluster contains a mixture of biological variables, genetic predisposition to obesity, satiety level and resting metabolic rate, and maintaining body composition from generation to generation (see Figure 2.2).
- The individual activity cluster consists of variables such as recreational, home, occupational, and transport activity levels, parental activity modelling, and learned activity patterns; the higher the fitness level, the easier it is to engage in PA, and vice versa (see Figure 2.2).
- The PA environment cluster includes variables that may facilitate or hinder PA, such as the cost of exercise, perceived environmental barriers, and the ability to walk in a residential environment. It also includes variables reflecting cultural values associated with activity patterns (see Figure 2.2).
- The food consumption cluster includes characteristics of the food market, health food characteristics, the level of abundance and diversity of food, the nutritional quality of food and drink, the energy density of food, and serving size (see Figure 2.2).
- The food production cluster includes many food industry drivers such as the pursuit of growth and profitability, the market price of food, the cost of ingredients, and efforts to improve production efficiency (see Figure 2.2).
- The individual psychology cluster contains variables that describe a range of psychological characteristics from self-esteem and stress to indulgence needs and food literacy levels (see Figure 2.2).
- The social psychology cluster covers variables that influence the social level, such as education, access to media, consumption patterns, television viewing, social acceptability of being overweight, and the importance of an ideal body image (see Figure 2.2).

It is now generally accepted that obesity is primarily caused by the latent biological susceptibility of people interacting with a changing environment, which includes more sedentary lifestyle and increased dietary abundance (Butland et al., 2007; Hill et al., 2013). These patterns vary between populations and throughout a person's lifetime, with the accumulation of excess fat and, therefore, weight being the end result of multiple causal relationships (Butland et al., 2007; Hill et al., 2013).

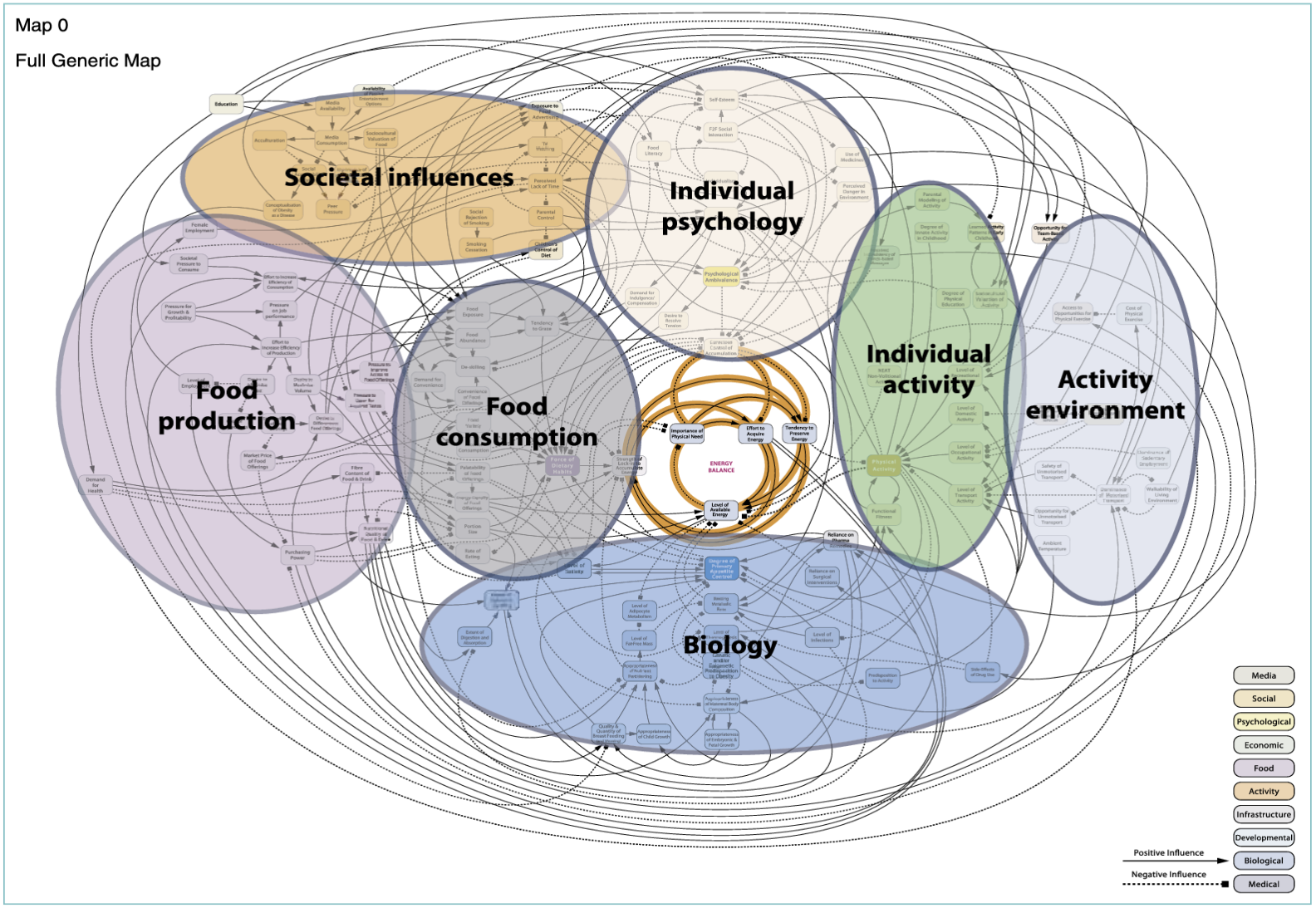


Figure 2.2. The obesity system map with thematic clusters (Butland et al., 2007).

The National Obesity Observatory (NOO) (2010) split these factors into biological factors, activity environment, food environment, and societal influences, which have been mapped in relation to the Socio-Ecological Model (SEM) of public health (see Figure 2.3) (The National Academies Press©, 2007; Hill et al., 2013).

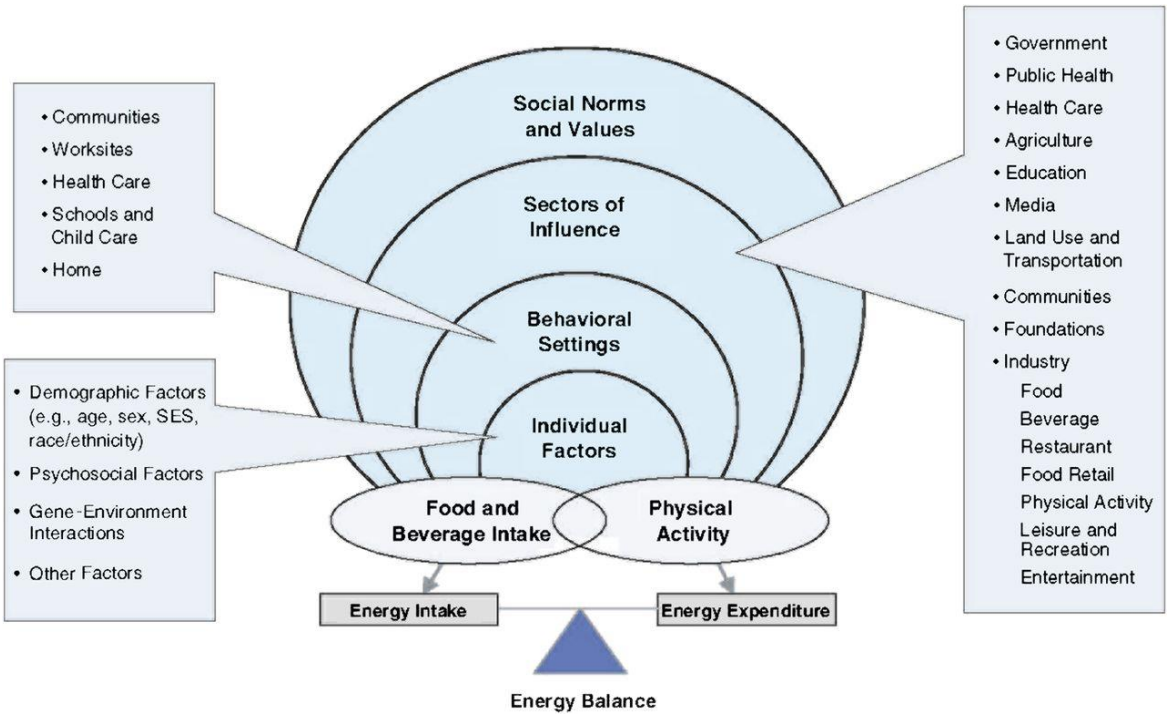


Figure 2.3. The SEM influencers on the prevalence of overweight and obesity (Hill et al., 2013).

The socio-ecological health promotion framework reported by McLeroy and colleagues (1988) is based on ecological systems theory (EST), which argues that several systems or contexts determine human behaviours (McLeroy et al., 1988; Moore et al., 2013). These include the immediate setting, in which a person is involved, such as a home, school, or workplace, as well as relationships within and between these environments. In addition, relationships between settings, which affect the immediate environment (e.g., the education system); and generalised patterns that define the substance and structure of other systems (e.g., societies, social groups), but which are modifiable (e.g., by public policy) (Moore et al., 2013). This framework suggests that many interdependent points in policy, community, organisational, and interpersonal levels affect behaviour (McLeroy et al., 1988; Moore et al., 2013; Hill et al., 2013). This framework has been recommended as a theoretical, methodological and evaluative tool capable of supporting a consistent, comprehensive

approach during the design, implementation, and evaluation of health improvement interventions (McLeroy et al., 1988; Moore et al., 2013; Hill et al., 2013).

Environmental aspects such as walking areas, lack of green spaces, healthy eating areas, and safe playgrounds affect people's diet and PA choices (Eisenberg et al., 2003; El-Behadli et al., 2015). Therefore, it was suggested that people who experience more severe social and economic deprivation also experience more severe psychological distress, which, under the influence of stress, makes them more vulnerable to gaining weight (Eisenberg et al., 2003; El-Behadli et al., 2015). This is why the socio-ecological framework encourages both system-wide interventions, such as those promoted through a health promotion approach, and a clear understanding of how various factors can influence more targeted interventions at other levels in terms of their effectiveness, acceptability, or sustainability (McLeroy et al., 1988; Eisenberg et al., 2003; Moore et al., 2013; Hill et al., 2013).

Discussing all the determinants and factors associated with obesity within a single study would be an impractical and controversial endeavour. Hence, the following sections will address the psychological, behavioural, social and environmental factors, importance of nutritional knowledge, attitudes and behaviour, and PA and inactivity and its association with rising rates of obesity since all these factors are related to the aim and objectives of this research.

2.5.1 Psychological determinants of obesity

Psychological disorders are more likely to be consequences rather than causes or determinants of obesity (Ali & Lindström, 2006; Harriger & Thompson, 2012; Radoszewska, 2017). People become overweight and develop obesity from regularly eating too many calories or living a sedentary lifestyle and taking in more energy than they expend (Ali & Lindström, 2006; Hu, 2008; Harriger & Thompson, 2012; Radoszewska, 2017). The behaviours that create this imbalance are influenced by a complex interaction of biological, psychological, sociological and environmental factors (Brewerton et al., 2015; BPS, 2019).

Evidence shows that those individuals who have had weight problems in the past had more psychological problems, such as lower life satisfaction and more eating disorder symptoms, than those with stable weight (Hu, 2008; Jackson, 2016; Radoszewska, 2017; Bunga, 2018). Moreover, given the negative attitudes of society toward overweight and obese people, they

experience more psychological disorders than people of normal weight (Rand & Macgregor, 1991; Radoszewska, 2017; Bunga, 2018).

Psychologists approach obesity by considering people within the context they live in - their social influences and networks, cultural and societal norms and context, the physical environment and physiological factors, also known as the bio-psycho-social model of obesity (BPS, 2019). Only a bio-psycho-social approach can account for the fact that individuals and environments both have an important role to play in the development of obesity and influence each other (Figure 2.4) (BPS, 2019).

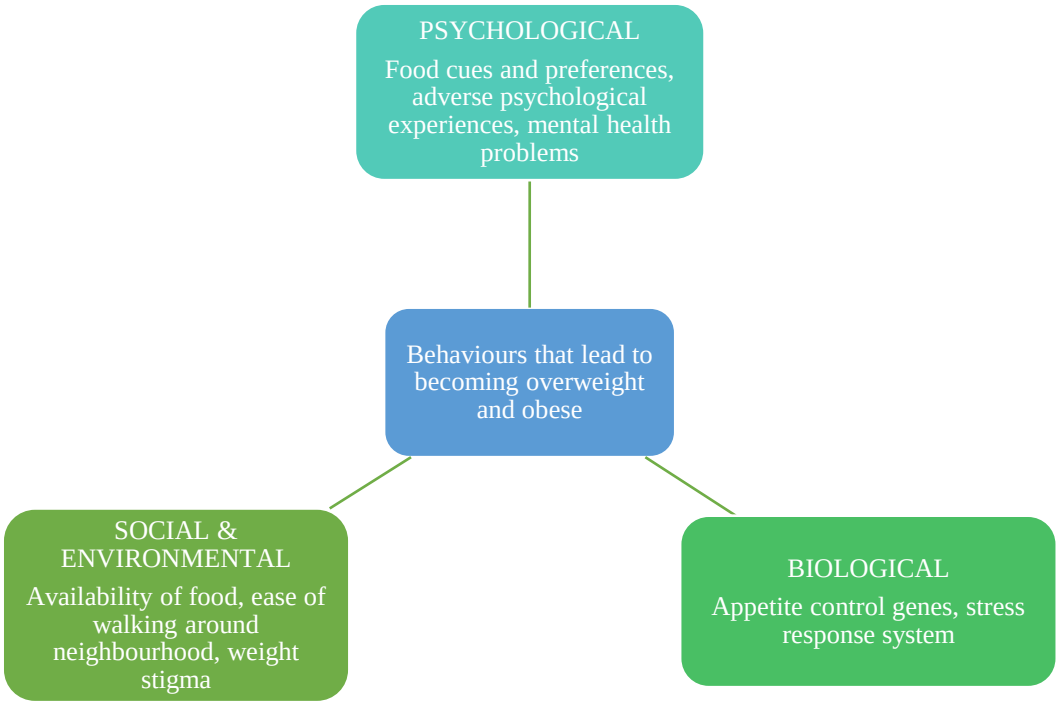


Figure 2.4. A Bio-Psycho-Social approach to obesity (BPS, 2019).

Despite the development of various models that are expected to explain psychological factors associated with obesity, the evidence around the psychological profile and obesity remains the subject of ongoing research to be discussed next (Rand & Macgregor, 1991; Jackson, 2016; Radoszewska, 2017; Bunga, 2018). One of the most compelling illustrations of the psychological consequences of obesity has been reported by Rand and Macgregor (1991). According to a survey after bariatric surgery, morbidly obese participants preferred to have a normal weight but had other health limitations (Rand & Macgregor, 1991). However, more recent studies show that these findings are inconsistent in relation to personality variables (Jackson, 2016; Radoszewska, 2017; Bunga, 2018). There is no evidence that obese people

differ psychologically from non-obese people when it comes to the degree of depression, the incidence of psychopathology, social adjustment, the focus of control, assertiveness and self-consciousness, as well as personality type (Jackson, 2016; Radoszewska, 2017; Bunga, 2018).

Increased body weight can also cause a worsening of negative body perception (Hu, 2008; WOF, 2020). Due to either the negative or positive reaction of society, some obese people may develop anxiety, depression, guilt, somatic symptoms, workplace and educational problems (Ali & Lindström, 2006; Harriger & Thompson, 2012; Sahoo et al., 2015). Furthermore, self-esteem is believed to be associated with the psychological determinants of obesity since it is closely related to the accepted emotional, mental, social, and physical norms (Harriger & Thompson, 2012; Radoszewska, 2017). Still, data on low or high self-esteem as a determinant for obesity are inconsistent (Sahoo et al., 2015; Radoszewska, 2017). Some studies have reported lower levels of self-esteem among overweight or obese people compared to those with normal weight, while other studies have not observed or confirmed this relationship (Rand & Macgregor, 1991; Sahoo et al., 2015; Radoszewska, 2017). Some people find it difficult to recognise and appreciate their talents and abilities due to their struggle with weight, while for others, obesity has relatively little impact (Sarwer & Polonsky, 2016; Chu et al., 2019).

Another psycho-social factor affecting levels of obesity is considered to be the advertising industry, which, on the one hand, has created and promotes an aesthetically ideal body size, and on the other hand, continues to influence the promotion of fast food, sweets, and sugar-sweetened beverages (Ali & Lindström, 2006; Hu, 2008; Jackson, 2016; Radoszewska, 2017). The increased availability of unhealthy, high-calorie foods and their advertisement can lead to overconsumption (Adams et al., 2012). These products are often designed carefully using psychological methods to increase sales (BPS, 2019). Thus, large portions encourage people to eat more, compounding this problem in those who cannot easily recognise the feeling of satiety (Adams et al., 2012; BPS, 2019). In addition, the way food is prepared, produced and displayed, including social media advertising, can increase consumption (Adams et al., 2012).

Certain social conditions and factors can predispose people to weight problems, while obesity creates conditions that lead to psycho-social distress (Rand & Macgregor, 1991; Hu, 2008; Radoszewska, 2017). Psychological problems are important both in the development and the

consequences of obesity, resulting in psychological aspects being taken into account more over the past two decades when designing interventions (Jackson, 2016; Radoszewska, 2017; Bunga, 2018). Therefore, an interdisciplinary approach to obesity management is recommended, considering psychological and social factors as the most important for comprehensive care for overweight and obese people (Rand & Macgregor, 1991; Hu, 2008; Jackson, 2016; Radoszewska, 2017; Bunga, 2018).

Although it is difficult to separate psychological influences from their biological and social causes, there are a number of cognitive, behavioural and emotional influences on eating and active behaviour that are associated with the development of obesity (Sarwer & Polonsky, 2016; BPS, 2019).

These include but are not limited to:

- *Genetic influences and stress* - genes cause some people to overeat in response to environmental problems and stress, which increases the risk of excessive weight gain, both directly and indirectly (McLeroy et al., 1988; Sarwer & Polonsky, 2016; BPS, 2019).
- *Food and emotions* - people often use food to respond to positive and negative emotions (McLeroy et al., 1988; Sarwer & Polonsky, 2016; BPS, 2019). The Masking Hypothesis suggests that people try to mask negative emotions through overeating to improve mood, comfort, and distraction, especially those who try to limit their meals through dietary behaviour (dietary restriction) (McLeroy et al., 1988; Sarwer & Polonsky, 2016; BPS, 2019).
- *Psychological adversity* - adverse childhood experiences (ACE) such as parental or caregiver abuse, mental illness, trauma, and family conflict have all been associated with behaviours that are known to be related to weight gain (McLeroy et al., 1988; Sarwer & Polonsky, 2016; BPS, 2019). Psychological adversity in childhood is a common cause of a range of emotional and behavioural difficulties in adolescence and adulthood, including weight gain directly through the influence of eating behaviour and attitudes (i.e., restrained or emotional eating) and a lack of motivation towards engaging in PA) (McLeroy et al., 1988; Sarwer & Polonsky, 2016; BPS, 2019).

To summarise this section, it is reasonable to state that understanding the multifaceted relationships between SES, ethnicity, urbanisation, genetics, lifestyle habits, high-calorie

intake, and cultural differences can inform the promotion of specific projects aimed at increasing knowledge and attitudes in relation to healthy nutrition, changing behaviour, and reducing obesity (Booth et al., 2001; Hu, 2008; Musaiger et al., 2017; Zhao et al., 2017). This combination will be most effective when the changes are carried out at several levels through individual, social, cultural, and environmental interventions. Behavioural changes have been found to be most effective when each entity (e.g., school, workplace) offers an environment and policy that encourages people to adapt a healthy lifestyle, follow a balanced diet, and perform regular physical activities (Swinburn et al., 1999; Booth et al., 2001; Hu, 2008; Musaiger et al., 2017).

2.5.2 Behavioural determinants of obesity

Behavioural determinants that influence obesity and overweight levels are specific behaviours that promote weight gain through such influences as dietary patterns, decreased PA, increased sedentary behaviour, and environmental factors that influence human behaviour (Hu, 2008; Young et al., 2016; Musaiger et al., 2017). Specific behaviours which can contribute to obesity include nutrition, eating out of home, unhealthy snacking, high consumption of high sugar beverages, breakfast omission, sedentary lifestyle, reduced levels of PA, and energy imbalance (Hu, 2008; Young et al., 2016; Panter et al., 2018). The basic components of energy balance include energy intake, energy expenditure and energy storage (Hill et al., 2012).

Dietary patterns formed at a young age have been found to influence long-term behaviour and impact health in adulthood (Krešić et al., 2009; Sanusi, 2021; Pop et al., 2021). Regular consumption of breakfast has been long associated with a range of benefits, including a greater intake of nutrients for the day, lower BMI, higher cognitive performance, better levels of well-being and quality of life (Manore et al., 2017; Ferrer-Cascales et al., 2018; Shatwan & Almoraie, 2022). Pengpid and Peltzer (2020) in their study among n = 21,972 university students from 28 countries, found that skipping breakfast was associated with insufficient intake of fruits and vegetables, frequent consumption of soft drinks, fats and foods rich in cholesterol. In addition, it was found to be associated with depression, low levels of happiness, post-traumatic stress disorder, loneliness, sleep problems, and poor academic performance (Pengpid & Peltzer, 2020). Further evidence suggests that those who eat breakfast tend to have lower rates of heart disease, high blood pressure and high cholesterol

and are less likely to overeat during the rest of the day (St-Onge et al., 2017; Sievert et al., 2019).

Despite this positive impact on health, some recent studies have not found an association between skipping breakfast and body weight or overconsumption (St-Onge et al., 2017; Sievert et al., 2019; Bonnet et al., 2020). Sievert et al. (2019) conducted a systematic review of 13 randomised controlled trials on the effect of regular breakfast consumption on body weight. The findings showed that regular breakfast consumption can be an inappropriate strategy for weight loss, regardless of established breakfast habits. The authors also found that changing the diet to include breakfast was associated with an increase in total daily calories (Sievert et al., 2019). They suggested that despite the active promotion of breakfast as the most important meal of the day since 1917, there is little evidence to support breakfast consumption as a weight loss strategy, or that it can reduce the risk of being overweight or obese in adults (Sievert et al., 2019). Sievert et al. (2019) concluded that while a regular breakfast may have positive effects such as increased levels of concentration and attention in childhood, caution is needed when recommending breakfast for weight loss in adults as it may have the opposite effect. Furthermore, a systematic review and meta-analysis of seven randomised controlled trials by Bonnet et al. (2020) showed that skipping breakfast resulted in moderate weight loss. Although it has long been argued that skipping breakfast is one of the main factors associated with obesity, evidence from international studies warrants further investigation into whether breakfast consumption affects weight (Allafi et al., 2014; Musaiger et al., 2014; St-Onge et al., 2017; Sievert et al., 2019; Bonnet et al., 2020).

Along with eating behaviours, including breakfast consumption patterns, sedentary lifestyles and physical inactivity are thought to be strongly associated with overweight and obesity (Popkin & Gordon-Larsen, 2004; Hubail & Culligan, 2012; Blüher, 2019). One of the key factors influencing physical inactivity and sedentary lifestyles has been found to be screen time, inactive commuting, and driving, the most common sedentary behaviours prevalent over the past years (Hakala et al., 1999; Bray, 2006; Popkin & Gordon-Larsen, 2004; Blüher, 2019). A systematic review of n = 44 studies by Haghjoo et al. (2022) reported that increasing screen time was associated with increased food intake among participants in the included studies. In addition, the authors reported that TV watching increased snacking behaviour, which was also true for video games and personal computer use. More

importantly, some TV food commercials promote the consumption of junk food and fast food and increase the risk of obesity (Haghjoo et al., 2022).

Extended periods of sedentary behaviour, lack of PA, unhealthy diets and skipping breakfast have been found to lead to low energy expenditure, contribute to weight gain and negative health outcomes in general (Palmer et al., 2009; Bewick et al., 2010; Williams et al., 2015). These patterns are especially common during the transition from adolescence to young adulthood (i.e., students) (Bewick et al., 2010; Martins, 2012; Al-Qahtani et al., 2019). This transition, known as 'emerging adulthood' (Arnett, 2000) allows young people to develop new behavioural patterns, including diet, PA, and other weight-related behaviours. At this time, they can either develop sustainable healthy or unhealthy behaviour, leading to negative consequences such as the development of overweight, obesity, and obesity-related NCDs (Daborn et al., 2005; Martins, 2012; Al-Qahtani et al., 2019). Hence, studying the choice of food and PA patterns during university/college, as well as the reasons leading to such a choice, is of great importance, especially among Saudi students due to the country's topography and environment, presented in section 2.7.

2.5.3 Social determinants of obesity

A vast field of research into gene-environment interactions has developed based on the concept that the increasing prevalence of obesity among genetically predisposed individuals indicates that social and environmental determinants may be important in understanding the overweight and obesity epidemic (Popkin & Gordon-Larsen, 2004; Hubail & Culligan, 2012; Blüher, 2019). Multiple reports and studies have emphasised the importance of social determinants as fundamental influences on health and disease, particularly on the growth of obesity rates (Bray, 2006; Hu, 2008; Hubail & Culligan, 2012; Blüher, 2019). These social determinants include factors reflecting socio-demographic (i.e., gender, race/ethnicity, SES) and psychosocial (i.e., stress, workload, depression and anxiety) influences, as well as neighbourhood characteristics, social structures, and the environment (Hubail & Culligan, 2012; Ahmed et al., 2014).

It is well known that socio-economic resources (e.g., household wealth, household food security and level of maternal education are often associated with each other) largely determine dietary choices and options for PA (Hu, 2008; Ahmed et al., 2014). Further evidence shows that poor literacy levels are a social problem associated with a growth in overweight/obesity (Hakala et al., 1999; Popkin & Gordon-Larsen, 2004; Hubail & Culligan,

2012). Prospective studies in developed countries have indicated that lower parental education levels were a risk factor for childhood obesity (Shepherd et al., 2006; Hu, 2008; Ahmed et al., 2014). For instance, manifestations of low educational levels in parents with lower socio-economic backgrounds have been suggested to be associated with infant feeding preferences, with a tendency to bottle feed their babies more often since they are less aware of the benefits of breastfeeding than parents with a higher level of socio-economic background (Hanson, 1999; Bartick et al., 2013; Temple Newhook et al., 2017). Furthermore, findings of a study in Germany showed that less-educated and low-income people tended to be more obese than their respective counterparts (McLaren, 2007; Dinsa et al., 2012).

Jeffery & French (1996) also suggested that healthy nutrition choices and a healthy weight were more common in women with higher SES, which was later confirmed by Lamerz et al. (2005), although the causes of SES and obesity in women are not well understood. It has been suggested that women with lower SES do not have many options for healthy food choices due to food accessibility. As a result, people from lower socioeconomic backgrounds in many developed countries are more overweight and less physically active (Lamerz et al., 2005; Hu, 2008; Blüher, 2019). At the same time, in some ethnic groups and cultures, body weight is considered one of the indicators of high SES (e.g., Middle East), where the higher SES, the lower the rates of PA and the higher the obesity rates (Musaiger et al., 2004).

In sum, social determinants do not uniformly influence obesity. Instead, they are often modified by a range of variables, such as socio-demographic characteristics, including education, occupation, marital status (Hakala et al., 1999; Popkin & Gordon-Larsen, 2004; Ng et al., 2011; Musaiger et al., 2013; Anuradha et al., 2015). They also include more important variables, including the characteristics of the area, social structures and social environment, which link with the complexities/challenges of the SEM (Hu, 2008; Ng et al., 2011; Musaiger et al., 2013; Anuradha et al., 2015).

Hu (2008) suggested that social determinants require attention to ‘causes of causes’ going beyond the individual to explore potential determinants that arise at multiple levels. Hence, change efforts should also focus on additional determinants identified in SEM that influence important behaviours associated with obesity risk (Ali & Lindström, 2006; Hill et al., 2013). Environmental interventions must be integrated with education and behaviour change programmes so that students and public at large can benefit from supportive PA and nutritional environments (Ball & Crawford, 2005; Hu, 2008).

2.5.4 Environmental determinants of obesity

There is growing recognition of the importance of the environment in shaping specific behaviours that influence the prevention or the growth of overweight and obesity rates (Booth et al., 2001; van der Horst et al., 2008; Suglia et al., 2016; Blüher, 2019). An obesogenic environment is believed to increase the prevalence of obesity, specifically in the youth (Hu, 2008; Suglia et al., 2016). This is mainly explained by several environmental factors associated with obesity: television watching, low PA, lower SES, unhealthy diets such as consuming sugar-containing beverages, and breakfast omission (Hu, 2008; van der Horst et al., 2008; Suglia et al., 2016).

The influence of the environment consists of the interconnection of several factors, e.g., SES, the proximity of supermarkets, the concentration of cafes and fast-food restaurants, and the availability of recreation areas for PA. Each of these factors can positively or negatively influence eating behaviour and PA patterns (Zhao et al., 2017; Blüher, 2019). Thus, unfavourable environments in the KSA, such as few parks or recreational areas, long distance to farmers' markets, and increased access to fast-food restaurants or convenience stores, are associated with higher BMI scores, consistent with global trends (Hu, 2008; Agrawal et al., 2015; Khoja et al., 2017; Qahtani et al., 2019; Salem et al., 2022). Further evidence suggests a link between childhood obesity and the environment, namely the influence of home, neighbourhood, schools, universities, and workplaces in the future (Zhao et al., 2017; Blüher, 2019).

It has been hypothesised that health policies adopted for a particular environment can influence obesity levels and overweight rates, with even small environmental changes affecting large segments of the population daily (Zhao et al., 2017; Blüher, 2019). For instance, food canteens in schools, universities, and workplaces affect everyone in a particular area. By offering and promoting a healthy diet (menu), these entities may positively impact the behavioural changes of consumers (Musaiger et al., 2017; Zhao et al., 2017; Blüher, 2019).

Nevertheless, environmental support for healthy eating and PA is often unevenly distributed throughout the population, including limited access to healthy nutrition and recreation centres (Booth et al., 2001; Hu, 2008; Smith et al., 2017). While poor maintenance of behavioural change is often seen with individual interventions, this can be partly explained by the failure to change the entire environment, where it is often difficult to make healthy choices (Booth et

al., 2001; Hu, 2008; Smith et al., 2017). In this regard, it has been suggested that community-based interventions are necessary to ensure access to healthy food and PA despite people's SES (Young et al., 2016; Musaiger et al., 2017; Radoszewska, 2017).

2.5.5 Nutrition knowledge, attitudes, behaviour and obesity

Obesity is shown to be a multifactorial health condition caused by both non-modifiable factors such as age, gender, ethnic group and family characteristics, and modifiable factors such as PA level, nutritional knowledge, attitudes, and behaviour (Fine et al., 1994; O'Brien & Davies, 2007; López-Hernández et al., 2020). There is a consensus that studying nutritional knowledge, attitudes, and behaviour of a particular group of people or individuals provides a better understanding of the social, psychological and behavioural factors influencing their nutritional choices (Worsley, 2002; Musaiger & Al-Hazzaa, 2012; Nawsherwan et al., 2020). However, some researchers argue that understanding or knowledge is not a solution as it is still questionable to what degree knowledge influences the attitudes and behaviour of individuals when choosing food (Guthrie et al., 1999; FAO, 2014; Nawsherwan et al., 2020). Hence, while knowledge may provide the individual with the information necessary to make a behavioural change, attitude may determine whether the individual is motivated to make that change (Brinberg et al., 2000; FAO, 2014). The following paragraphs briefly introduce the knowledge-attitude-behaviour association regarding dietary choices and food preferences.

The knowledge delivery models that typically characterise individual nutrition education programmes are based on the assumption that a knowledge deficit exists in overweight and obese individuals (Spronk et al., 2014; Al-Qahtani et al., 2019; Nawsherwan et al., 2020). Further evidence has shown that while people are aware of what they should eat, their knowledge about the relationship between diet and disease is less robust (Parmenter et al., 2000; O'Brien & Davies, 2007). This suggests that increased knowledge alone does not lead to behavioural change due to fragmented knowledge delivery, i.e., the lack of a relationship among the characteristics of a healthy diet, the concept of obesity, its consequences (i.e., NCDs), and other SES factors (Zhou et al., 2017; Sogari et al., 2018; López-Hernández et al., 2020).

Given the strong relationship between ethnicity, culture, and food, it is likely that there are significant differences between communities in terms of attitudes, beliefs, and customs that influence nutritional knowledge and eating patterns in diverse populations (Guthrie et al.

1999; Waxman, 2004; FAO, 2014; Nawsherwan et al., 2020). In addition, internal and external factors can influence people's food choices, including nutritional content of products, accessibility, and price (Waxman, 2004; FAO, 2014).

In recent years, there has been a tremendous increase in scientific research and knowledge about the relationship between diet and health (Wardle et al., 2000; Hendrie et al., 2008). The increase in scientific data about the association between diet and health has served as the basis for policies aimed at promoting health through national campaigns to educate the general public about healthy nutrition and develop environmental planning (e.g., enhance neighbourhood walkability with access to healthy eating places) that enables the general population to lead healthy lives (Guthrie et al., 1999; Waxman, 2004; Zoellner et al., 2009).

Attitudes represent an individual's subjective feelings about an issue (e.g., whether following a healthful diet is important) or an object (e.g., whether low-fat foods taste good) (Guthrie et al., 1999; FAO, 2014). In this case, attitudes include belief about a diet-health association, the importance of healthy products compared with other food characteristics (e.g., taste), the importance of following specific dietary guidelines, and perceived barriers to dietary change (Guthrie et al., 1999; FAO, 2014). Many behavioural theorists consider attitudes to be crucial predictors of behaviour (Axelson & Brinberg, 1989; Bray, 2006; FAO, 2014). For instance, the knowledge about the health problems associated with being overweight is universal, but obesity remains a growing health problem in society (Bray, 2006; NICE, 2014; CDC, 2017; WHO, 2018). It is an important step in promoting healthy nutrition to identify nutritional knowledge, attitudes, and behaviours of specific social groups that may affect their food choices. This may include, but is not limited to, what types of knowledge are most needed and how much knowledge average individuals can reasonably be expected to assimilate (Brinberg et al., 2000; FAO, 2014).

A study by Martins (2012) conducted among students at the University of Bournemouth (the UK) showed that most respondents had a basic knowledge of health and nutrition, but health concerns did not have a decisive influence on their food choices (Martins, 2012). Instead, they followed their taste buds (Martins, 2012). It was also suggested that a possible reason for this behaviour was the way nutrition information was presented. Participants perceived it as difficult to understand and support (Martins, 2012). These findings are consistent with those obtained by Aikman et al. (2006) among Syracuse University (New York, NY) students. The authors reported that the participants either did not know or did not use the nutritional value

of the foods when choosing foods. The taste of the food largely determined both the attitude and the choice of most foods of the students. Aikman et al. (2006), Zhou et al. (2017), and López-Hernández et al. (2020) suggested that to promote healthy nutrition effectively, knowledge of the nutritional value of foods must be increased in line with increased information on the relationship between healthy nutrition and health outcomes.

A systematic review of 46 studies by Boylan, Louie and Gill (2012), examining attitudes towards content, source, tailoring and comprehension of dietary guidelines, reported that guidelines were found to be confusing (Boylan et al., 2012). Simple, clear, specific, realistic, and in some cases, tailored guidelines were preferable by respondents. However, there has been limited research on the perception of the message format. According to Boylan, Louie and Gill (2012), most studies assessed attitudes toward the guidelines without assessing whether or how behaviour changed in response to the guidelines. Moreover, the relationship between knowledge and behaviour change is complex, as highlighted by models such as the theory of planned behaviour, the theory of reasoned action, and the combination of the two - an integrative behaviour change model (Ajzen, 1991; Shepherd & Raats, 1996; Boylan et al., 2012). Consequently, Boylan, Louie and Gill (2012) suggested that in order to make guidelines more effective, a closer examination of people's attitudes to recommendations and any subsequent behaviour changes is needed. A recent systematic review (Nawsherwan et al., 2020) of 29 research studies assessing nutritional knowledge among university students found that students lacked nutritional knowledge and did not follow any dietary guidelines. Students did not eat the recommended portions of vegetables, fruits, and fibre, nor did they reduce their sugar, sodium, and saturated fat intake (Al-Nakeeb et al., 2012; Al-Qahtani & Sundogji, 2016; Al-Qahtani et al., 2019).

These examples show that the evaluation of nutrition education campaigns is often restricted to basic awareness of the key messages with a less extensive assessment of how such interventions change dietary behaviour resulting in reduced rates of overweight and obese populations (Boylan et al., 2012; Spronk et al., 2014; Nawsherwan et al., 2020). In addition, despite the wealth of knowledge gained about the effects of diet on health and specific diseases, relatively little is known about how and why people choose foods in their diet or effectively influence their choices. These factors can include marketing and economic variables, social, cultural, religious, or demographic factors (Zhou et al., 2017; Sogari et al., 2018; López-Hernández et al., 2020). Nutrition, especially healthy eating, is vital to life and

is one of the main factors of health, which is why it is important to study nutritional knowledge, attitudes and behaviour of the public from different perspectives, including cultural and ethnic backgrounds (Al-Qahtani et al., 2019; Nawsherwan et al., 2020).

2.5.6 Physical activity and obesity

The WHO defines PA as any movement of the body produced by skeletal muscles that requires energy expenditure (WHO, 2020a; World Obesity, 2022). Regular PA helps prevent overweight, and obesity and can improve mental health, quality of life, overall health and well-being (WHO, 2020a; World Obesity, 2022). Additional evidence suggests that regular PA can help prevent and manage NCDs such as heart disease, stroke, diabetes, and breast and colon cancer (WHO, 2018). All forms of PA can provide health benefits if performed regularly, with sufficient duration and intensity (WHO, 2018; Alluhidan et al., 2022).

Studies state that although PA plays an important role in preventing NCDs, it has been argued that the role of PA in preventing obesity is overstated (Leitzmann, 2017; Pippi et al., 2022). Prospective observational population-based studies of adults over the past 20 years have shown conflicting findings regarding the effect of PA on body weight and obesity (Leitzmann, 2017; Chaabane et al., 2020; Pippi et al., 2022). It is well-established that the body uses energy in three main ways: during rest (basal metabolism), the breakdown of food, and PA. There is little control over the basal metabolic rate, which consumes most of the energy and accounts for 60–80% of total energy expenditure, while body movement and body size may determine the energy expenditure caused by PA (Leitzmann, 2017; Pippi et al., 2022; World Obesity, 2022). Nevertheless, a lack of PA increases the risk of cancer, heart disease, stroke and diabetes by 20-30% and reduces life expectancy by three to five years (WHO, 2020a; CDC, 2022). In contrast, regular PA lowers blood pressure and reduces the risk of developing hypertension, type 2 diabetes, stroke, and heart attack. Research also shows that regular PA can significantly reduce the risk of dementia and Alzheimer's disease (WHO, 2020a; World Obesity, 2022).

Despite this well-established evidence and data on the benefits of PA in maintaining a healthy lifestyle, rather than losing weight, according to the latest WHO data (2020a), one in four adults does not meet the recommended level of PA, with 28% of adults aged 18 being physically inactive. The latest worldwide pooled analysis of 358 population-based surveys with 1.9 million participants found that women have been less active than men, averaging 31.7% for inactive women and 23.4% for inactive men (Guthold et al., 2018). More than 80%

of adolescents are not sufficiently physically active. It has been estimated that up to 5 million deaths per year could be prevented if the world population were more active (Stein & Börjesson, 2019; WHO, 2020a; World Obesity, 2022). Inactivity rates are twice as high in high-income countries compared to low-income countries. In high-income countries, 26% of males and 35% of females are not physically active compared to 12% of males and 24% of females in low-income countries (Stein & Börjesson, 2019; WHO, 2020a; World Obesity, 2022).

PA remains the subject of ongoing research in the MENA region, with males being more physically active compared to females (Al-Hazzaa, 2018; Chaabane et al., 2020; Costa-Font & Györi, 2020; Al-Qahtani et al., 2021). A systematic review and meta-analysis by Chaabane et al. (2020), who studied 229 PA surveys with n = 203,617 participants from 20 MENA countries reported that 49.2% of adults (>19-years-old) and 74.4% of youths (≤19-year-old) were physically inactive and sedentary. The authors also found that in most countries in the MENA region, more males than females are involved in PA, with adult participation higher than youth participation. In addition, compared to the global average estimates, regional PA prevalence estimates for the MENA were found to be lower in both adults and youth (Chaabane et al., 2020).

The patterns reported in the MENA region in relation to less female participation in PA are reflected in the studies conducted across KSA over the past decades (Memish et al. 2014, Al-Hazzaa and AlMarzooqi, 2018; Al-Qahtani et al., 2021). Thus, an earlier study by Memish et al. (2014), namely the Saudi Health Interview Survey (SHIS) among n = 10,735 participants found that 46.5% did not engage in any regular PA, and 50% spent over 3 hours daily watching TV. The recent study by Al-Hazzaa and AlMarzooqi (2018) developed a descriptive review of PA initiatives in Saudi Arabia found that while Saudi females had more energy and motivation for the PA than males, they also reported more barriers (Al-Hazzaa and AlMarzooqi, 2018). Barriers cited by females included lack of time and social support, low self-efficacy, and lack of funds or resources. Additional barriers occurred at the individual level (e.g., health conditions), at the social/cultural/political level (e.g., women's traditional roles, lack of social support and use of housekeepers), and the environmental level (e.g., hot weather and lack of sports facilities) (Al-Hazzaa and AlMarzooqi, 2018). More recently, the Bulletin of Household Sports Practice National Survey administered among n = 26,000 families from 13 administrative regions across Saudi Arabia found that only 17.40%

overall practice regular PA (Al-Qahtani et al., 2021). This study highlighted gender differences in participation, i.e., 28.3% of males, compared to 8.9% of females (Al-Qahtani et al., 2021). A study by Aljehani et al. (2022) showed that of n = 375 female university students, the majority of participants (91%) spent more time walking compared to moderate (66%) and vigorous PA (57%) for at least 10 minutes at a time over 7 days (Aljehani et al., 2022). The authors suggested that the results of their study, consistent with existing data, provide a clear rationale for the importance of public policies to increase PA among women (Aljehani et al., 2022).

As can be seen from the data presented above, there is a general pattern in the MENA region with females less physically active compared to males (Al-Hazzaa, 2018; Chaabane et al., 2020; Costa-Font & Györi, 2020; Al-Qahtani et al., 2021). Over the years, Saudi women's views on PA continue to be heavily influenced by social and cultural norms; where barriers included limited opportunities for PA, class load, gender role, and the need to meet cultural standards, while facilitators included assessment of positive outcomes, health outcomes associated with the overweight and obesity, as well as family support (Hodges, 2017; Sharara et al., 2018; Aljehani et al., 2022). As such, social patterns, public mindsets, and culture are critical barriers or enablers of PA for women, rather than a perceived low level of knowledge or a dress code (Al-Hazzaa & AlMarzooqi, 2018). Consequently, studying patterns of PA among the target population (i.e., students) may provide more data on barriers and facilitators to being physically active or inactive by gender.

2.6 Study region

2.6.1 The prevalence of obesity and its determinants in the EMR and GCC

Obesity has emerged as an ever-increasing global challenge leading to alarming health problems, becoming a major threat to health and quality of life in Arab populations (Alqarni, 2016; WHO, 2017; Al-Kadi et al., 2018; Al-Qahtani et al., 2019). Similar to global trends, the burden of overweight, obesity and obesity-related NCDs in the countries of the EMR and GCC has greatly increased over the last three decades, reaching epidemic status (Musaiger et al., 2012; WHO, Eastern Mediterranean Regional Office, (EMRO), 2019).

The highest levels of overweight in 16 EMR countries are reported in Kuwait, Egypt, UAE, KSA, Jordan and the Kingdom of Bahrain, with overweight/obesity prevalence varying from 74% to 86% in females and from 69% to 77% in males (James et al., 2004; Monteiro et al.,

2004; WHO (EMRO), 2019). Currently, half of the adult females in the region (50.1%) and two in five males (43.8%) are overweight or obese. In addition, over 15% of children and more than half of adolescents are overweight or obese (WHO (EMRO), 2019). Six GCC states, namely KSA, Kuwait, UAE, Qatar, Bahrain, and Oman, are among the countries with extremely high rates of obesity and overweight. About 30% of the population in these countries is obese, and more than 60% are overweight (Samara et al., 2019).

The rapid growth in wealth and speedy development of Gulf countries has been found to have contributed to lifestyle and behavioural changes of the population, leading to growing rates of overweight and obesity (Musaiger et al., 2012; Obesity Collaborators, 2017; Mahmood, 2022). These changes have included lower rates of PA, and unhealthy dietary patterns, including the consumption of fatty and sugar-sweetened foods, and soft drinks (Musaiger et al., 2012; Samara et al., 2019). Hoque et al. (2020), in their scoping review of dietary intake in the Gulf countries between 2009 and 2019, found that the majority of the population does not meet recommended intakes of fruits and vegetables (which was found to be well below the recommended five servings per day), while unhealthy food consumption is on the rise. Other determinants of obesity in the Gulf countries include extreme outdoor temperatures and culture, which have been found to greatly influence the lifestyle choices and daily routines of the population (Musaiger, 2011; Samara et al., 2019). Thus, it has been reported that the rise in wealth of the average person has been one of the contributing factors to overweight, which can be perceived as a sign of high SES, beauty, fertility, and prosperity both among males and females (Malik & Bakir, 2007; Musaiger, 2011; Samara et al., 2019; Salem et al., 2022).

Research on the determinants and factors associated with obesity among students of GCC states, as the most affected group, indicates that examining students' knowledge, attitudes and behaviours regarding food choices and PA patterns is critical (Samara et al., 2019; Almansour et al., 2020; Cheema et al., 2021). With more than half of the population in the Gulf countries under the age of 30, regional studies among Gulf university students showed that student influx reached about 12.2 million, with a compound annual growth rate of 0.7% compared to 2014 (Alpen Capital, 2021). Similar to global trends, university students in the Gulf states undergo significant changes when entering higher education, including emotional and psychosocial changes that directly affect their food choices and PA (Khawaja et al., 2019; Samara et al., 2019; Almansour et al., 2020; Hoque et al., 2020; Cheema et al., 2021).

Studies among Qatari and Kuwaiti students have shown that better knowledge was associated with healthier food choices and regular PA (Almansour et al., 2020; Cheema et al., 2021). On the contrary, studies from Saudi Arabia show that although Saudi students recognise the importance of healthy eating, they do not eat healthy food and tend to skip meals and not practice regular PA (Epuru & Al Shammary, 2014; Alissa et al., 2015; Al-Qahtani et al., 2019). Similarly, students from the UAE showed a lack of knowledge and were considered heavy consumers of unhealthy food. In terms of attitudes and preferences, consumption of added sugar is widespread, with white sugar being the most preferred sweetener by UAE students (Haroun et al., 2017; Khawaja et al., 2019; Abboud et al., 2019). Patterns reported in the UAE and Saudi Arabia can also be seen in the lifestyle of students in Bahrain (Alalwan et al., 2019; Elmusharaf et al., 2022). The evidence suggests significant gaps in knowledge about nutrition among Bahrainis, especially nutrient sources, the definition of healthy snacks, and the relationship between diet and disease (Canavan & Fawzi, 2019; Alalwan et al., 2019; Elmusharaf et al., 2022). Bahraini students, like Gulf students in general, are also highly dependent on the food environment, including the availability and affordability of food. Similarly, a synthesis of data from the Sultanate of Oman shows that Omani students perceive environmental and socio-cultural factors, the rapid modernisation of Omani society, lack of support from family, friends and teachers, lack of self-motivation and role models as barriers to healthy food choices and regular PA (Kilani et al., 2012; Labban, 2015; Al-Mahrouqi, 2019). Moreover, the marketing and advertising of ultra-processed foods high in fat, sugar and salt among students has been identified as a significant contributing factor of nutrition patterns among the youth of the GCC (Kilani et al., 2012; Labban, 2015; Al-Mahrouqi, 2019; Samara et al., 2019; Almansour et al., 2020). As can be seen, in the Gulf, it is common for people to have positive attitudes towards healthy eating and regular PA despite the lack of knowledge. However, behaviours favour unhealthy food, a lack of PA, and the prevalence of a sedentary lifestyle (Samara et al., 2019; Al-Mahrouqi, 2019; Almansour et al., 2020; Hoque et al., 2020; Cheema et al., 2021).

The next section will discuss the study setting, geography and climate, SES of the KSA, culture and traditions that are of great importance in the daily lives of students and the general public.

2.7 Study setting – The Kingdom of Saudi Arabia

2.7.1 Culture, topography and society

The roots of modern Saudi Arabia can be traced back 600 million years, when this desert land was underwater (Knauerhase, 1975; Bowen, 2014; Vision 2030, 2022). Historically, Saudi Arabia was a land of Bedouins, camels, tribes, and merchants. The current Islamic monarchy was founded by the Al Saud royal family in a region that was unified by King Abd Al-Aziz ibn Al Saud (1876-1953) (Nevo, 1998; Bowen, 2014; Vision 2030, 2022). Modern Kingdom is the largest economy in the Middle East, with a population of over 35 million. The KSA is also known as the honourable "Land of The Two Holy Mosques: - Masjid al – Haram in Makkah and Masjid an – Nabawi in Madinah (Knauerhase, 1975; Bowen, 2014).

Religion [Islam] plays a vital role in culture, traditions, family, social life, and the entire government of Saudi Arabia (House, 2012; Alodhayani et al., 2021). Saudis are polite and modest people. They will most often agree and accept the ideas and suggestions of others. Even if they seem to disagree with another person, Saudis will remain silent so as not to offend anyone. Saudi people prefer to observe rather than to talk (House, 2012; Alodhayani et al., 2021; Evason, 2022). "My people and my land are yours,"[4] is how one can describe the hospitality and generosity of Saudis (Helaissi, 1959; Evason, 2022). Within Islamic and Bedouin culture, it is a great honour for a Saudi to be able to feed a traveller or anyone who appears on one's doorstep (Helaissi, 1959; Evason, 2022).

"A Bedouin may not influence his tribe, but the tribe clearly has a strong influence on the Bedouin."[4] The family is the central pillar of Saudi society, the basic cell of social organisation in traditional and modern Saudi Arabia (House, 2012; Joseph, 2018; Evason, 2022). The family is considered a small society, a financial security system, and the main source of love, honour, and joy. Families in Saudi Arabia tend to be patrilineal and patrilocal, meaning the bride moves into her husband's house upon marriage, and the family line is passed down through the father. Traditionally, many families live with extended family members, especially in rural areas such as the Bedouins (House, 2012; Joseph, 2018; Evason, 2022). However, the nuclear family structure (i.e., a family group made up of only a father, mother, and children) has become more common due to rapid urbanisation over the past few decades (Knauerhase, 1975; Bowen, 2014; Joseph, 2018; Evason, 2022).

[4] National proverb.

Historically, marriages in Saudi Arabia were often arranged by either relatives or a matchmaker (Al-Hakami & McLaughlin, 2016; Joseph, 2018). Although nowadays, it is increasingly common for young people in cities to point out someone they are interested in to their parents, who then "arrange" the marriage. Men hold the most power and are responsible for the basic income, safety and security of the family. They are expected to work outside the house, earn money and provide for their families (Bowen, 2014; Joseph, 2018; Evason, 2022). Women have traditionally assumed responsibility for the home space as caregivers and the backbone of the family. They are expected to take care of their husband and children, prepare meals, and give love and warmth to the family while living with their parents or moving into their husband's household (House, 2012; Joseph, 2018; Evason, 2022).

Saudi Arabia is a patriarchal society where men have a strict code of conduct for women that they must adhere to (House, 2012; Hawamdeh & Raigangar, 2014; Joseph, 2018; Evason, 2022). Until 1969, there were no public schools for girls, and not a single woman worked outside of the house (Miller-Rosser et al., 2006; Jawhar et al., 2022). Starting in the 1970s, women were gradually allowed to receive an education but were not permitted to choose certain majors, i.e., engineering, architecture and political science. Thus, gender segregation continued to exist, which affected the psychology of women, as they were more silent, less expressive, and gave way to men (House, 2012; Hawamdeh & Raigangar, 2014; Al-Amer et al., 2018). Before the ongoing transformations as part of Vision 2030, gender inequality in favour of males was found among all spheres of society (House, 2012; Hawamdeh & Raigangar, 2014; Al-Amer et al., 2018). Saudi women have faced many challenges in exercising their rights and privileges with limited access to employment opportunities and were deprived of economic independence (House, 2012; Hawamdeh & Raigangar, 2014). They were also not allowed to drive for many years, which limited their mobility and freedom (Alsadaan et al., 2021; Jawhar et al., 2022).

With the implementation of the Saudi Vision 2030,[5] there have been numerous changes in the role of the family and its dynamics (Joseph, 2018; Evason, 2022; Vision 2030, 2022). In recent years, there has been a significant leap forward in women's empowerment due to the crucial role of gender equality in the sustainable growth, development of the nation, and the achievement of the global sustainable development goals (AlMofawez, 2016; Alsadaan et al.,

[5] Saudi Vision 2030 - a strategic plan to reduce Saudi Arabia's dependence on oil, diversify its economy, and develop public service sectors such as health, education, infrastructure, recreation, and tourism (Vision 2030, 2022).

2021; Alnasser, 2022). The government has taken decisions aimed at significantly increasing women's participation in the labour market and access to public services. More women are educated (often ahead of men in universities) and are starting to work in their speciality. As of October 2017, women made up 20% of the Saudi Shura Council - Consultative Assembly of Saudi Arabia. In 2018, the government lifted the ban on women driving and travelling alone (Family Affairs Council, 2019). As of 2021, the proportion of women in the total workforce in Saudi Arabia was 18.75% (World Bank, 2021a). In addition, 17.7% of Saudi women are currently engaged in entrepreneurial activities, which is comparable to 17% of Saudi men (Habib et al., 2022). While these numbers are quite small compared to global data, with a female participation rate of just over 50%, it is nonetheless significant progress for Saudi society compared to the 20th and the early 21st centuries (World Bank, 2021a; Habib et al., 2022).

As can be seen legislators have made it easier for women to enter the labour sector by encouraging a mixed-gender environment. Nevertheless, the perceptions towards Saudi women in the workplace continue to fluctuate (Parveen, 2022; Habib et al., 2022). Thus, a recent study by Alhawsawi and Jawhar (2023) found that statistics showing changes in women's participation in the labour force mask deeper barriers to inequality. The authors reported a dually opposite influence of the family in the Saudi context, which can promote or hinder a woman's freedom of action and empowerment (Alhawsawi and Jawhar, 2023). The social structure may also disempower women; where empowerment does not simply entail education and employment (Al-Bakr et al., 2017; Sian et al., 2020; Alhawsawi & Jawhar, 2023). Factors such as incentives, career paths, workplace gender perspectives, individual perceptions of self-worth, interpersonal skills, traditional and contemporary understandings of empowerment, and social factors tend to influence the degree and nature of participation of women in labour market and society (Al-Bakr et al., 2017; Sian et al., 2020; Alhawsawi & Jawhar, 2023). Despite these factors, Saudi women are actively participating in the development of the economy in higher numbers than ever before (Alfarran, 2021; Parveen, 2022). Moreover, due to the pandemic and its restrictions, Saudi women have been able to work and receive education remotely, which has had a positive impact on their careers and communication with the opposite gender, although online (Aldossari & Calvard, 2021; Alfarran, 2021; Parveen, 2022; Habib et al., 2022). In sum, while Vision 2030 (2022) states that it is committed to women's empowerment through education and employment, traditional perceptions of women's role in society continue to influence women's ability to balance work

and family (Alsuhaibani & Gresham, 2021). Saudi women's activities are neither entirely individual and private, nor entirely collective and collaborative with colleagues (i.e., males), but consist of commitment to and resistance to contextual issues of individuality, balance in society, and being heard (Alfarran et al., 2018; Alfarran, 2021; Parveen, 2022; Habib et al., 2022). At the same time, although the Saudi women are often trapped in a family with a traditional culture and do not enjoy independence and autonomy, they still believe that they have the potential to contribute to the development of their country and get truly empowered (Alsuhaibani & Gresham, 2021; Alhawsawi & Jawhar, 2023).

Saudi Arabia has a desert climate, with the exception of the southwestern part of the country, where the climate is semi-arid (Vincent, 2008; United Nations Development Programme (UNDP), 2011). Almost two-thirds of the country is made up of arid steppes and mountains, and the rest is sandy desert. The average summer temperature is about 45 °C, but indications up to 54 °C are not unusual. Heat becomes intense shortly after sunrise and lasts until sunset. As a result, the air temperature is considered one of the most important climatic factors, since even a slight change in air temperature affects the daily activity of people (Abdul Salam et al., 2014; Dasari et al., 2021; Bawadekji et al., 2022). Changes in weather conditions and a sharp increase in extreme weather phenomena are some of the most significant factors in social vulnerability (i.e., the susceptibility of social groups to the adverse impacts of nature), significantly threatening the living conditions of the Saudis (Vincent, 2008; World Bank, 2021b; Dasari et al., 2021).

Despite the tradition of a fibre-rich diet, Saudi Arabia is not an ideal country for agricultural growth since it cannot produce enough food to feed a growing population due to harsh and hot temperatures, low rainfall, limited arable land, lack of fertile soil, permanent reservoirs, and water resources (Hariri-Rifai & Hariri-Rifai, 1990; Akers, 2007; Musaiger, 2012; House, 2012). Before 1970, when food production was limited by high temperatures and scarce water resources in the desert landscape, farming was done on a small scale. In the 1980s, Saudi Arabia began to modernise its agricultural system to increase food self-sufficiency by providing farmers with free loans, land, and water for irrigation (Zahrani & Baig, 2014; Al-Otaibi, 2015; Baig, 2017). This intensive farming has led to significant water scarcity and resulted in the loss of two-thirds of Saudi Arabia's groundwater supply. Consequently, in the 2000s, Saudi Arabia made an essential shift in strategy towards more sustainable agricultural practices. This shift resulted in the government ordering farmers not to plant crops with high

water requirements such as wheat, barley and green fodder. Currently, only 2.1 million km^2, or 1.6% of the country area, is suitable for agriculture, which contributes to having one of the world's lowest amounts of arable land per capita (Baig, 2022). As such, Saudi Arabia is heavily dependent on imports from other countries for its food needs, importing 80% of its food (Baig et al., 2019; Alhothali et al., 2021). This has resulted in an unprecedented increase in the price vegetables and fruits, and a shift from the traditional healthy diet towards the Western diet, especially those high in animal fats and refined sugar, which are more affordable (Alhothali et al., 2021; Abdulrahman et al., 2021; Bin Sunaid et al., 2021).

Traditional Saudi cuisine has been based on the availability of local produce and is one of the hallmarks of their rich cultural heritage (Hariri-Rifai & Hariri-Rifai, 1990; Akers, 2007; Musaiger, 2012; House, 2012). The traditional healthy fibre-rich diet of Saudis included dates, wheat, rice, beans, camel milk, and camel meat. Saudi dishes are usually mildly spicy and consist mainly of rice with lamb or chicken. Kabsa (rice and meat) is a favourite dish throughout the country. It is made with camel meat and served with appetizers such as hummus (chickpea sauce). Rice is also often served with vegetables and a green salad. Seafood is popular on the coasts, including a variety of fish. The dessert usually includes dates eaten with bitter Saudi coffee (Musaiger, 2012; House, 2012). The latest study by Bawazeer et al. (2021) on different eating patterns and their relationship to the socio-demographic and lifestyle characteristics of Saudis found that people who eat traditional Saudi whole grains have a low BMI. Traditional foods had lower total calories and more dietary fibre than non-traditional foods, which improved insulin resistance and protected against chronic diseases (Musaiger, 2012; Bawazeer et al., 2021).

For centuries, traders, pilgrims and Bedouins (with their families) travelled in ancient trade and caravans on the Arabian Peninsula (Knauerhase, 1975; Ross, 1981; Kurpershoek, 2001; House, 2012). The journey was extremely difficult and risky, often taking a month or more to cross the Arabian Peninsula. Passage through was possible only in the cooler hours of the day and less severe seasons of the year (Knauerhase, 1975; Ross, 1981; Kurpershoek, 2001; House, 2012). Thus, prior to industrialisation, Saudis led a simple and active lifestyle with the physical demands of everyday life requiring regular PA, often carrying wood and water used for heating and cooking. They also walked long distances and did agricultural work, which kept them in good physical shape (Kurpershoek, 2001; House, 2012). Until the middle of the

20th century, the physical requirements of daily life may have been sufficient to maintain a reasonable level of fitness across the country (Akers, 2007; Musaiger, 2012; House, 2012).

In a country that has historically been nomadic and underpopulated, the late 20th and early 21st centuries brought rapid and exceptional changes after the oil discovery (Kurpershoek, 2001; House, 2012; Vision 2030, 2022). As a result, from the 1940's, petroleum has been the base of the Saudi economy, leading to rapid development, industrialisation and urbanisation, and an annual population growth of over 2% (General Authority for Statistics (GASTAT) 2016; Vision 2030, 2022). In 1965, the KSA government estimated that 50% of the population were Bedouin, nomads or semi-nomads. In 1972, with a population of n = 5,074,000, 25% were Bedouin. (Shamekh, 1977; Suwaed, 2015). Currently, with a total population of over 35 million (Central Intelligence Agency (CIA), 2023), only 1,381,000 are Bedouin (Joshua Project, 2023). This has led to a rapid rise in living standards and an increase in the use of mostly automatic equipment that has reached all segments of the Saudi population (El Bilali & Ben Hassen, 2020; Abdulrahman et al., 2021; Bin Sunaid et al., 2021).

From 1973-1974, after the expansion of oil exports, the creation of a road network, and motorisation of traffic became one of the central tasks of the government (Looney, 1989; Aldagheiri, 2009; López Moreno & Orvañanos, 2015; Mansuri et al., 2015). Currently, the network of roads and highways has a total length of 221,372 km, which corresponds to 6.16 meters for every Saudi (World Data, 2023). The transport road network in Saudi Arabia has contributed to the development of the country, bringing direct benefits in the development of some sectors such as mining, agriculture, industry and trade (Aldagheiri, 2009; López Moreno & Orvañanos, 2015; Mansuri et al., 2015). In addition to these positive changes towards increasing the quality of life, there have been significant changes in physical behaviour of Saudis, a shift to sedentary lifestyles and low levels of PA (Almutairi et al., 2018; El Bilali & Ben Hassen, 2020; Abdulrahman et al., 2021; Bin Sunaid et al., 2021).

The rapid growth of urbanisation and associated infrastructure have also changed urban ecosystems, significantly affecting the quality of life of urban residents (López Moreno & Orvañanos, 2015; UN-Habitat, 2016). According to the Ministry of Municipal and Rural Affairs (MoMRAH), approximately 82.1% of the total population lives in cities and 17.9% in rural areas, including the Eastern Province (93.2%), Riyadh (90.9%), Holy Mecca (87.6%), Northern Borders (86.7%), Tabuk (85.9%), and Jouf (84.5%) (UN-Habitat, 2016). Alongside

urbanisation and industrialisation, MoMRAH is actively involved in the design of green spaces and parks to create recreational opportunities and protect the Kingdom's ecosystem. MoMRAH's long term vision is to create one park for every 2500-5000 people. Moreover, one of the goals of Saudi Vision 2030 is to increase green space per capita and improve the quality of life of urban residents in Saudi cities (UN-Habitat, 2016; Addas, 2020; Vision 2030, 2022). Despite such a positive attitude and efforts by the Saudi government, these plans are questionable since they lead to an increase in the use of the water resources of a desert country where there are no permanent rivers or lakes and very little rainfall (Vincent, 2008; Al-Hazzaa & AlMarzooqi, 2018). Moreover, even with the presence of parks and green spaces, the patterns of use of these territories are very different from those shown in the West (Vincent, 2008; López Moreno & Orvañanos, 2015; Almalki et al., 2022).

Use of parks in Saudi Arabia is highly dependent on socio-demographic factors such as age, gender, educational level, and occupation (Schipperijn et al., 2013; Dadvand et al., 2016; Al-Hazzaa & AlMarzooqi, 2018). While Saudi females place more importance on city gardens/parks than males, they also state that they rarely visit them alone, mostly going with their husbands, friends, or parents (Addas, 2020; Zahra et al., 2022). In contrast, males can visit gardens/parks whenever they want (Addas, 2020; Zahra et al., 2022). The motives for using city parks are physical activities of children, refreshment of the mind, gathering people with family, friends, relatives and children, and get away from everyday life (Al-Hazzaa & AlMarzooqi, 2018; Addas, 2020; Zahra et al., 2022). Thus, even with sufficient green spaces and parks, they are rarely used for PA by either men or women but rather are reserved for leisure and are considered good places for children and families (López Moreno & Orvañanos, 2015; Al-Hazzaa & AlMarzooqi, 2018; Addas, 2020; Zahra et al., 2022).

To summarise this section, it is important to highlight that for centuries, Saudi Arabia, one of the most populous and wealthy countries in the Middle East with a unique cultural heritage, had to constantly adapt to weather conditions, harsh terrain, and the continued influence of the West (Abdul Salam et al., 2014; Dasari et al., 2021; Bawadekji et al., 2022). Although Saudis have remained true to their traditions and kept pace with globalisation without neglecting the values of religion and family, the traditional healthy cuisine and PA patterns have been affected the most, leading to overconsumption and an increase in diet-related diseases, as well as sedentary lifestyles (House, 2012; Al-Raddadi et al., 2019; Salem et al., 2022). However, to argue that this is mainly due to Western influence would be imprecise;

the unwise use of scarce natural sources led to a poor food environment and import of most products. While imported healthy foods are expensive for Saudis, especially the youth, they have switched their preferences to cheap and satiating food. The role of modern technology, misleading advertising and SES should not be underestimated. As a result, Saudi Arabia and the Eastern Province are currently one of the regions with the highest rates of obesity in the Gulf states (House, 2012; Al-Raddadi et al., 2019; Salem et al., 2022).

2.7.2 Prevalence of overweight and obesity in the KSA

The territory of modern Saudi Arabia consists mainly of four distinct regions: Western Province (Hejaz), Central Province (Najd), Eastern Province (Sharqiya), and Southern Province (Asir) (House of Saud, 2020). The population of the Kingdom is one of the youngest in the world. Thus, 51% of the 33.4 million people are under 25 years of age, with the global average median age of 29.6 years in 2015 and half of the world population was older than 29.6 years (CIA, 2020; UNDP, 2020). Over the past four decades, Saudi Arabia has witnessed rapid urbanisation and changes in SES that have ultimately had a substantial impact on the lifestyle of Saudis, shifting away from traditional values and customs towards more westernised behaviours such as dietary changes, sedentary lifestyle, eventually leading to high levels of overweight and obesity. (Khoja et al., 2017; Qahtani et al., 2019; Salem et al., 2022). As of 2015, 63.4% of Saudi adults were overweight, and 28.1% were obese (Figure 2.5, below) (DeNicola et al., 2015; WHO, 2017). According to the latest regional studies, KSA has the third most obese GCC population after Kuwait (Khoja et al., 2017). Saudi Arabia's obesity prevalence is higher than the regional average at 10.3% for females and 7.5% for males (Global Nutrition Report, 2020). Furthermore, according to the lates Global Nutrition Report (2020), KSA has shown no progress towards achieving the target for obesity, with an estimated 45.5% of adult females, 34.3% of males, and 6.1% of children being obese.

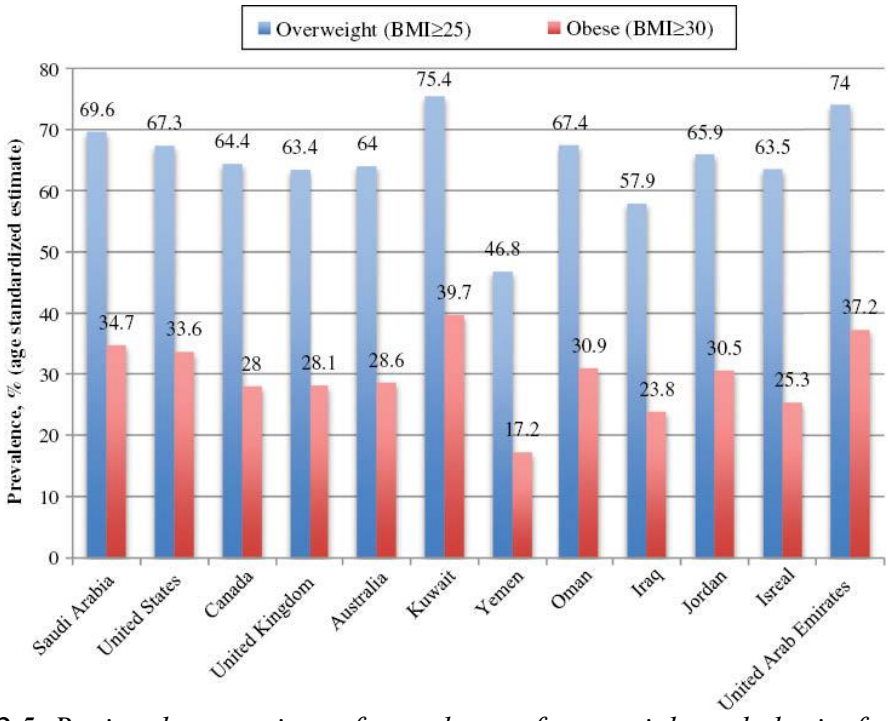


Figure 2.5. *Regional comparison of prevalence of overweight and obesity for adult population (DeNicola et al., 2015).*

The growing rates of overweight and obesity have resulted in an increased risk of obesity-related NCDs such as cancer, CVDs, and diabetes. In KSA, NCDs are estimated to account for 73% of all deaths, of which 37% due to CVDs, (WHO, 2018; Al-Raddadi et al., 2019; Al-Qahtani, 2019). The prevalence of hypertension and diabetes ranged from 26.0% to 50.7% and 9.3% to 46.8% in males and 20.9% to 57.2% and 6% to 53.2% in females (Figure 2.6, below) (United Nations Interagency Task Force (UNIATF), 2017).

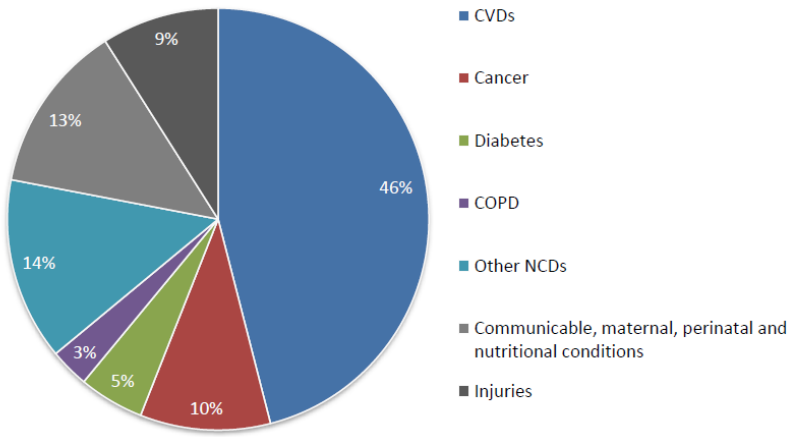


Figure 2.6. NCDs country profile proportional mortality in Saudi Arabia (UNIATF, 2017).

Diabetes prevalence has increased by 99% over the recent decade in Saudi Arabia, from 1.4 million cases in 2009 to 2.7 million in 2019 (Alluhidan et al., 2022). Obesity was found to be associated with an increased risk of dyslipidaemia in addition to hypertension in males, increased risk of prediabetes, diabetes and dyslipidaemia in females (Al-Raddadi et al., 2019; Salem et al., 2022). As it has been mentioned in Chapter 1, the obesity rates vary depending on the geographical regions of the KSA. The highest rates of obesity being reported in the Eastern Province (29%) and central regions (20.5%) and the lowest in the southern regions (8.9%) (Figure 2.7, below) (Alkahtani & Awad, 2016; Al-Qahtani et al., 2019).

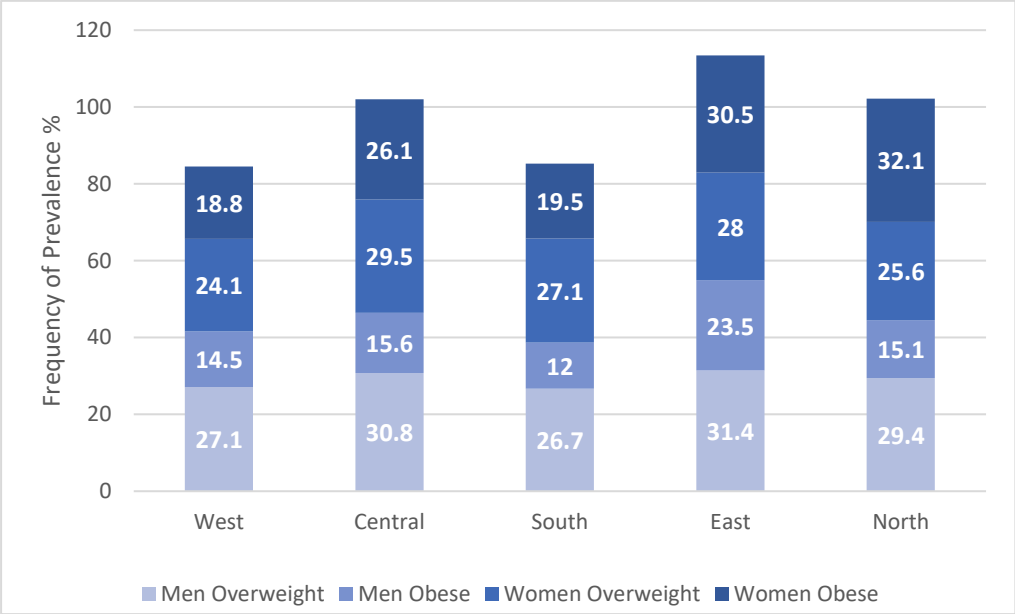


Figure 2.7. Data on the prevalence of overweight and obesity among Saudi males & females in different regions of the KSA, developed for this research based on the references cited within the text.

Based on this data on overweight and obesity prevalence in the KSA, the following sections explore regional differences in rates of overweight and obese populations, substantiating the rationale for considering Eastern Province as a study setting with students as a study sample.

2.7.3 Lifestyle changes and dietary patterns in the Eastern Province

The Eastern Province is the largest in the KSA by area (710,000 km^2), representing more than 36% of the country's total area and one of the most important regions (House of Saud, 2020). The capital is Dammam, with a population of 5.3 million, the third most populous region in the KSA. The Eastern Province, as the most industrialised part of the Kingdom and the third-

largest oil-producing region in the world. It is a strategic gateway to international trade activity and commercial markets (Asharqia Chamber, 2019; Aramco, 2022).

The economic growth and prosperity of the Eastern Province have resulted in distinct changes in the lifestyle of the population, especially among the students (Saleh et al., 2017; Asharqia Chamber, 2019; Al-Qahtani et al., 2019). As it has been mentioned, the regional comparison of obesity rates in the KSA indicated that numbers vary, with the highest rates of obesity in the Eastern Province (29.4%). Hence, Figure 2.8 (below) was developed for this research to show how the rates of overweight and obesity in the Eastern Province continue to rise over the years due (Al-Almaie, 2005; Al-Nakeeb et al., 2012; Al-Qahtani & Sundogji, 2016; Al-Qahtani et al., 2019). Changes in lifestyles are specifically reflected in the overall body weight of the Eastern Province students; with those found to be overweight ranging from 11.7% to 20.5% and obese from 9.5% to 20.5% (Saleh et al., 2017; Asharqia Chamber, 2019; Al-Qahtani et al., 2019).

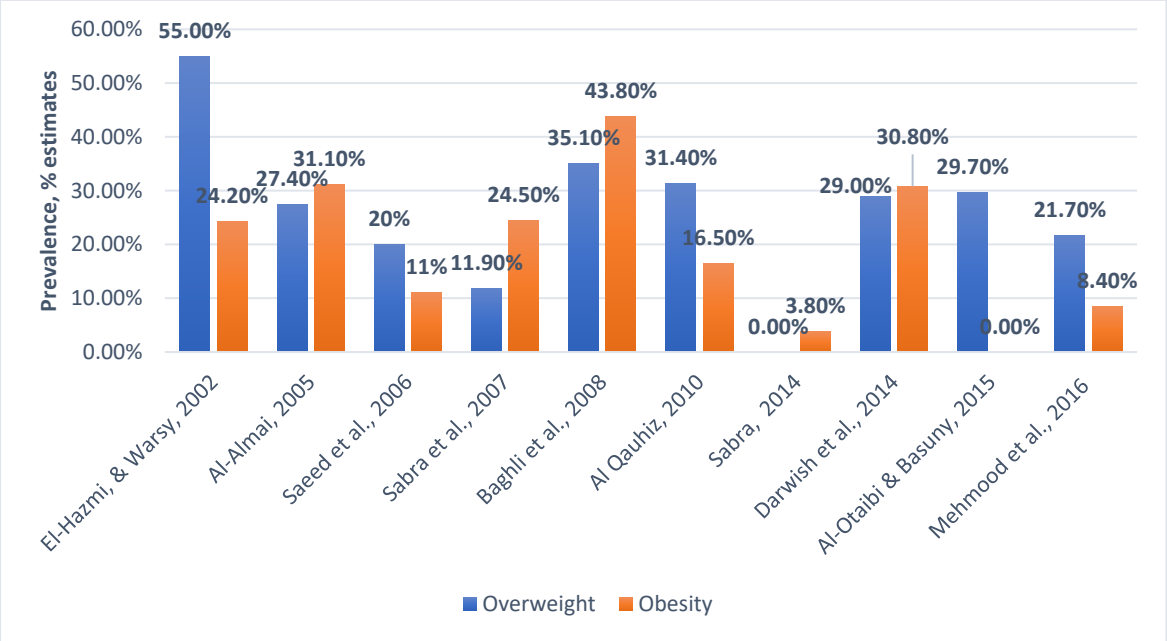


Figure 2.8. Data on the prevalence of overweight and obesity in the Eastern Province developed for this research, based on the references cited within the text and figure.

A number of studies have been conducted among students of the Eastern Province to explore the prevalence of overweight and obesity, as well as their food choices. A cross-sectional study conducted at Health Science College in Dammam among n = 260 female students showed that 35.7% had snacks as their meal, and 46.9% were eating while watching

television; 82.7% of the students consumed fast food one to six times/week, and 73.1% consumed soft drinks more than seven times/week (Sabra, 2014). An earlier study by Sabra et al. (2007) among male university students in Dammam showed that the prevalence of overweight and obesity was 24.5% and 22.6%, respectively.

Epuru and Al Shammary (2014), in their study on nutrition knowledge and its impact on food choices among Saudi students, reported that both genders had poor nutritional knowledge and awareness, which influenced their food choices and dietary patterns. About one-quarter (26%) of males and 32% of females believed they had adequate nutritional education. Although 70% of the study participants indicated that fruits and vegetables are healthy, only 10% believed that dairy products are good for health. In addition, psychological factors (i.e., emotions and food cravings) rather than physiological hunger (56% versus 44%) were strong motivations to eat (Epuru & Al Shammary, 2014). The study also found that obese students (85%) were more eager to gain more nutritional knowledge and consequently improve their health, self-confidence, and body shape (Epuru & Al Shammary, 2014).

More recent research among medical students at Dammam University reported that students recognised the importance of leading a healthy diet and being physically active. However, their behaviour was quite the opposite of their positive attitudes (Al-Qahtani, 2016). Regardless of the academic standing (i.e., freshman, sophomore, junior, senior) and gender, there was a high percentage (91.3%) of poor nutritional behaviours among students (e.g., a high percentage of fast food and soft drinks intake) and very low percentage of students who regularly engaged PA (Al-Qahtani, 2016). These findings are supported by earlier studies carried out in various regions of the KSA, reporting that students consumed meals irregularly with two main meals daily, vegetables and fruits were consumed only twice per week, and fried foods at least three times a week (Al-Rethaiaa et al., 2010; Al-Qahtani, 2016).

These data show that although Saudi students acknowledge the importance of healthy nutrition, they do not follow a healthy diet and tend to skip meals, eat unhealthy snacks, consume fast food, and do not practice regular PA (Epuru & Al Shammary, 2014; Alissa et al., 2015; Al-Qahtani et al., 2019). When looking into literature (including that from KSA), there is a common pattern where authors conclude that findings highlight the urgent need for nutrition education among this population (Al-Hazzaa & Musaiger, 2011; Epuru & Al Shammary, 2014; Alissa et al., 2015). Despite the existing evidence in the literature about the health and disease-specific effects of diet, relatively little is known about how and why

students choose the foods that make up their diets or how to influence their attitude effectively (Shepherd & Raats, 1996; Rozin et al., 1999; Aikman et al., 2006; Alissa et al., 2015). Moreover, none of the studies conducted in the Eastern Province examined students' knowledge, attitudes, and behaviours in relation to FDDG that which could add new value to existing data and further suggest clear, concrete projects or strategies to prevent obesity.

Against the backdrop of rising rates of overweight and obesity in the population, specifically students, nutrition education remains an important element of strategies to improve their nutrition choices, PA, and health as such (Musaiger, 2012; Epuru, 2014; Al-Qahtani & Sundogji, 2016; Al-Qahtani et al., 2019; Al-Khaldi, 2018; Salem et al., 2022). The next section will discuss global, regional, and local intervention programmes implemented to promote healthy nutrition, various educational and outreach activities, and whether the GCC and KSA populations knew about or followed these programmes.

2.8 Global and regional policies to influence food choices

2.8.1 Food-based dietary guidelines global patterns

Food-based dietary guidelines (FBDG) attempt to provide guidance to communities about food, diet, and health in a specific, culturally appropriate way and offer feasible recommendations for various foods, nutrition, and health policies and programmes to improve population health and nutrition behaviour (Albert, 2007; Diethelm et al., 2012; Musaiger, 2012; Springmann et al., 2020). Originally, nutritional guidelines were created to help people avoid hunger and starvation during World Wars I and II. Over the years, during peace times, food guidelines and nutritional policies have expanded to contribute to public health (Nestle, 2002, cited in Smitasiri & Uauy, 2007). Nutritionists and policymakers have strived to create a solid scientific basis for FBDGs and illustrate how food, diet, and nutrition affect health throughout the lifespan (Nestle, 2002, cited in Smitasiri & Uauy, 2007; Diethelm et al., 2012; Springmann et al., 2020).

FBDGs are a consistent and easily understood representation of population nutritional goals to encourage healthy dietary behaviours and improve public health (FAO/WHO, 1998; Dwyer, 2001; Herforth et al., 2019). The development of the FBDGs has stimulated a deeper understanding of the role of nutrients and foods in achieving optimal health. As a result, in 1992, during the International Conference on Nutrition, the WHO Action Plan endorsed that

governments should provide the public with nutritional advice relevant to different age groups and lifestyles and appropriate to the country's population (FAO/WHO, 1992).

The basis for the development of an FBDG at the national or regional level should include estimates of food and nutrient intake, food stocks, take into account diet-related diseases and prevalence of NCDs, as well as cultural preferences (FAO/WHO, 1998; Musaiger, 2012; Herforth et al., 2019). While national or regional FBDGs differ in their specificity, there are common elements, including food group descriptions (e.g., legumes, nuts, animal products, fruits and vegetables), graphical representations, frequency of food consumption, and serving sizes, that should be considered by all FBDGs (FAO/WHO, 1998). In addition, since countries classify group foods differently (i.e., differences in indigenous foods of each culture, along with the differences in the cultural definitions of food and what constitutes a usual dietary pattern), FAO/WHO does not provide specific recommendations on food groups (FAO/WHO, 1998). However, there is consistency in respect of several dietary recommendations, including consuming plenty of fruits and vegetables, dairy products and legumes; and avoiding excessive consumption of salt, unhealthy fats, carbohydrates, or sugar, among others (FAO/WHO, 1998; Barbosa et al., 2016; Springmann et al., 2020).

FBDGs in different countries were developed in accordance with 'WHO Global Strategy on Diet, Physical Activity and Health' to advise national nutrition policies, nutrition education, intersectoral action, and collaboration (FAO/WHO, 1998; WHO, 2006). This collaboration has been achieved through an open process of discussion with government and scientists in different areas (e.g., education and health systems) (FAO/WHO, 1998; Dwyer, 2001; Keller & Lang, 2008). As a result, many countries (87%) and regions have developed their own nutritional guidelines, often in partnership with, or facilitated by government, international health and food agencies/organisations. Some regions have developed regional nutritional guidelines, such as the Nordic Nutrition Recommendations, FBDG in Latin America and the Caribbean, or Food Dome guidelines for the MENA region (FAO/WHO, 1998; Musaiger, 2012; Herforth et al., 2019). FBDGs have been promoted globally as an important part of national food and nutrition policies to educate the public and guide policymakers and other stakeholders about healthy eating (Smitasiri & Uauy, 2007; Diethelm et al., 2012; Springmann et al., 2020).

Guidelines consist of written messages (e.g., UK 8 tips for eating well (NHS, 2019)), commonly depicted in visual food images (e.g., German 3-D food pyramid (Stehle, 2007)).

The purpose of these messages may vary depending on the aim, audience, and application (FAO/WHO, 1998; Brown et al., 2011; Herforth et al., 2019). Overall, nutritional guidelines must be scientifically credible and easy to understand and follow for the general public (Albert, 2007; Herforth et al., 2019). To implement and promote the FBDGs, WHO and FAO (1998) recommended using various media to reach all age groups and consider different literacy levels. All food distribution services and nutrition programmes should receive information about the FBDGs, adapt and implement them (FAO/WHO, 1998; Waxman, 2004). FBDGs are mainly implemented through written/electronic information provided by the health sector (FAO/WHO, 1998; Waxman, 2004). Integrating FBDGs into health promotion strategies is expected to increase the health impact of specific dietary patterns and the intake of healthy/unhealthy food groups (Waxman, 2004; Springmann et al., 2020).

Analysis of national and regional FBDGs of 85 countries by Springmann et al. (2020) showed that the use of FBDGs might be associated with a reduction in premature mortality at 15% (13% to 16%) on average. Across regions, the reduction in mortality ranged from 6% in Africa to 19% in North America. At the country level, the reduction in premature mortality ranged from 4% for Nigeria to 30% for Bulgaria (Springmann et al., 2020). Globally, approximately 43% of the total reduction in mortality was due to a decrease in the prevalence of obesity (19%), overweight (11%) and underweight (13%) (Springmann et al., 2020). Furthermore, changes in food composition were reported with increased intake of whole grains (19%), vegetables (11%), fruits (10%), legumes (5%), fish (3%), nuts and seeds (1%), as well as reduced intake of processed and red meat (4% and 3%, respectively) (Springmann et al., 2020). On the other hand, this analysis also showed that less than half of all countries with national FBDGs had implemented any of their recommendations, and no country has implemented all the recommendations at the same time. Therefore, for FBDGs to have a greater impact on nutritional behaviour changes, clear and consistent policy support is required (Springmann et al., 2020).

Several studies have directly measured the perceived or actual use of FBDGs by consumers and indicated that FBDGs might be a useful method for leading a healthy lifestyle (Brown et al., 2011; Herforth et al., 2019). Nevertheless, Cambell (1996) showed that although 58% of Americans had heard about Food Pyramid, only 13% said they understood it. Furthermore, there is a tendency for non-compliance with national FBDGs in food choices in everyday life (Food Marketing Institute, 1997). Thus, a study of food marketing trends in the US found that

only 27% of US shoppers used American Food Pyramid information to make changes to their food purchases (Food Marketing Institute, 1997).

Chile has become one of the few countries to have evaluated its FBDG – Chile Food Pyramid (Olivares, 2004, cited in Brown et al., 2011), including the assessment across three different types of institutional settings and population groups. First, a clinical study found that patients with diet-related chronic illnesses were encouraged to eat more fruits and vegetables but had not heard of reducing animal fat (Olivares, 2004, cited in Brown et al., 2011). Secondly, research in schools (Chile) found that children recognised the Food Pyramid but did not understand its parts (Olivares, 2004, cited in Brown et al., 2011). Thirdly, an internet consumer survey among the population of Chile showed that only 30% of consumers knew about healthy lifestyle patterns, while 60% knew about the Food Pyramid. Moreover, the majority (80%) of participants expressed willingness to change their diet if being educated about Chile Food Pyramid (Olivares, 2004, cited in Brown et al., 2011).

As seen from this literature review, almost all countries have initiated and implemented FBDGs. Nevertheless, there are inconsistencies in knowledge, attitudes, and behaviour toward FBDGs among the general public (Albert, 2007; Diethelm et al., 2012; Springmann et al., 2020). It was reasoned that, given the varying relationships between dietary patterns, sociodemographic characteristics, and lifestyle factors that may or may not motivate populations to follow dietary recommendations, it is important to provide nutrition education and counselling in diverse settings after the implementation of an FBDG (Albert, 2007; Diethelm et al., 2012; Springmann et al., 2020).

Following global trends, the Arab states have embarked on policies and promotional programmes to reduce obesity and obesity-related NCDs (Musaiger, 2012; Samara et al., 2019). The sections below present literature on the design process and implementation of nutritional guidelines in GCC.

2.8.2 Food-based dietary guidelines in GCC and KSA

Over the past decades, social, economic, political changes and urbanisation have dramatically impacted the dietary patterns in Eastern Mediterranean countries, leading to overnutrition in some countries and malnutrition, as well as micronutrient deficiencies in others (FAO/WHO, 1992; WHO/FAO, 2003; Musaiger, 2012; Montagnese et al., 2019). Traditional foods have been replaced by fast foods, soft drinks, and increased meat consumption. The share of

energy derived from fibre-rich products decreased due to more consumption of foods high in fat, vegetable oils, and high-calorie foods (FAO/WHO, 1992; WHO/FAO, 2003). In addition, physical inactivity is reported to be one of the highest in the world, varying across the Gulf region and reaching almost 70% in Saudi Arabia (Al-Baho et al., 2016; Kulhánová et al., 2019).

As a result, eleven countries in the MENA region established rules for the types of foods and beverages available in schools, and five countries banned vending machines from their premises (Musaiger, 2012; Montagnese et al., 2019; Al-Jawaldeh et al., 2020). Countries including Bahrain, Iran, Jordan, Kuwait, Lebanon, Oman, Qatar and Saudi Arabia have banned the sales or provision of products such as soft drinks, potato crisps and sweet biscuits in schools (WHO, 2018). These policies also included implementing measures such as the taxation of soft drinks adopted by Saudi Arabia and the UAE, the ban on soft drinks and junk food in hospitals in Qatar, workplace health programmes in governmental institutions, nutrition and/or PA programmes in the school environment in Qatar, the UAE, Bahrain and Oman (Samara et al., 2019).

Nutrition education and awareness became essential for developing strategies to improve the health of the Gulf population (FAO/WHO, 2006, cited in Musaiger, 2012). The need for the establishment of dietary guidelines for Arab countries has been emphasised at several conferences and meetings organised in the MENA region by the WHO EMRO, FAO, as well as UNICEF (FAO/WHO, 2006, cited in Musaiger 2012). It was suggested that the dietary guidelines for Arab countries should consider the following criteria:

1. The pictorial presentation used for the guidelines should reflect the culture of the region and should be common and acceptable to all Arab countries
2. The foods illustrated in each food group should be common and widely consumed by Arab people
3. The food groups should focus on food that can contribute to the prevention of most diet-related diseases prevalent in the MENA region
4. Daily servings for each group should be provided, taking into consideration the current serving sizes used in the region
5. Due to the high prevalence of obesity and other chronic diseases, PA recommendations should be considered in these guidelines

6. Specific nutrition recommendations for vulnerable groups should be provided (FAO, 1995, cited in Musaiger, 2012).

As a result, the Arab Center for Nutrition developed the (FDDG for the GCC and the MENA region (Musaiger, 2012). The FDDG was designed to be used to prevent overweight, obesity, under-nutrition, and micro-nutrient deficiencies, specifically in the MENA region (Musaiger, 2012). They are based on biological factors, genetics, cultural, environmental, and demographic data of these countries (Musaiger, 2012).

As the current research focuses on the knowledge, attitudes and behaviour in relation to Food Dome, it is reasonable to critically discuss the nutritional guidelines developed in all GCC states with the aim of justifying the focus on the FDDG. Being presented briefly in this part of the thesis, the national guidelines for each GCC are explained in more detail in Appendix 1, which provided comprehensive data on policies and programmes for the prevention and management of obesity in GCC. After this brief presentation of the FBDGs in the Gulf countries, the next part of this section focuses on nutrition programmes and guidelines developed in Saudi Arabia as the study setting.

- *Omani Healthy Plate* is a visual representation of a nutritional guide, which promotes the daily consumption of various foods from each of the six food groups in proportions consistent with food recommendations (FAO, 2009). These recommendations were aimed at the Omani population over two years old to prevent overweight, obesity and diet-related NCDs (Alasfoor et al., 2013; Mabry et al., 2014).
- *Kuwait national programme for healthy living: first 5-year plan 2013-2017* was a health promotion initiative among Kuwaitis (Behbehani, 2014). The aim was to reduce the number of diet-related NCDs and empower Kuwaitis to make healthy choices and follow a healthy lifestyle (Behbehani, 2014).
- *The Qatar Dietary Guidelines* is a shell-shaped plate containing six food groups with a proportion of different foods (Supreme Council of Health of Qatar, 2015). The guidelines focus on the quality of food choices, with advice on quantity as well. The guidelines emphasise plant-based foods, i.e., vegetables, fruit, whole grain cereals, legumes, nuts and seeds (Supreme Council of Health of Qatar, 2015).
- *Nutrition Clinics Management & Prevention of Obesity in Bahrain* were formed to offer early and comprehensive long-term care to obese patients based on high-quality, efficient services to decrease its prevalence and the associated morbidity and

mortality factors (Gharib et al., 2012). The priority was the improvement in general health and a reduction in health risk factors. In addition, weight management programmes were offered, including dietary changes, general exercise, and behaviour modification.

- *United Arab Emirates Dietary Guidelines* is divided into six food groups with details on serving size recommendations and water consumption (Ministry of Health and Prevention (MOHAP), 2019). Guidelines aimed to support and strengthen a healthy lifestyle through a healthy diet and PA, reduce calories by reducing sugar, fat (especially saturated and trans-fat) and salt intake; follow healthy eating patterns, and replace unhealthy foods with healthy foods (MOHAP, 2019).

The need to prevent the rising trends in overweight/obesity and NCDs in the KSA led the Saudi government, in collaboration with a number of scientists and nutritionists, to design and implement the National Programme on Healthy Living (Al-Shehri et al., 2013; Memish et al., 2014; Al-Shehri et al., 2016). In this regard, the Ministry of Health (MOH, 2016), initiated and planned clinical guidelines to assist healthcare providers in preventing the increase in overweight and obesity (Al-Shehri et al., 2016). The guidelines were based on those from the Scottish Intercollegiate Guidelines Network (SIGN, 2010 cited in Al-Shehri et al., 2016), which the National Obesity Control Programme reviewed with the assistance of the Obesity Control Programme Scientific Committee (Al-Shehri et al., 2016).

The SIGN for the KSA was developed considering the Saudi environment, nutritional habits, culture and was intended for implementation at primary, secondary, and tertiary care levels in Saudi Arabia. The SIGN was expected to be followed by hospital patients under the guidance of health care providers (Al-Shehri et al., 2016). The guidelines were structured for preventive and curative aspects of overweight and obesity, with the main goal being to offer healthcare professionals tools to help prevent and control overweight and obesity among patients (Al-Shehri et al., 2016). However, SIGN has been limited to use only under healthcare professionals' guidance. Consequently, there was a need for understandable nutritional guidelines for the general public without the need for guidance from health care providers.

One such user-friendly guideline was expected to be Food Palm, developed earlier by the MOH for general public daily use, as per FAO recommendations (2012). The Food Palm aimed at improving the lifestyle patterns of Saudis and reducing obesity rates. The

development process included a review of dietary patterns in Saudi Arabia, diet-related diseases prevalent in Saudi Arabia, existing guidelines, and a graphic that would appropriately display the recommendations in a meaningful way, i.e., palm, chich symbolises vitality, growth and prosperity (MOH, 2012; Coats et al., 2019). Food Palm was designed based on the FDDG and provided details on particular food groups, recommended serving sizes, and daily consumption. This approach should allow the general public to adopt a healthy lifestyle, reduce fast food consumption, and increase PA levels (MOH, 2012; Al-Shehri et al., 2016; Coats et al., 2019).

The Food Palm was expected to be distributed among all communities to improve their eating and PA behaviours (MOH, 2012; Al-Shehri et al., 2016). However, this did not happen, furthermore the Food Palm was only developed in English and not translated into Arabic, although 99% of the Saudi and GCC population speaks Arabic (Montagnese et al., 2019). There is a gap in research regarding the distribution and promotion of the Food Palm among Saudis. The only available source of information about the Food Palm for the general public was a YouTube link showing the development process rather than how to use it. In addition, there is no further research on the findings and outcomes of the Food Palm implementation (MOH, 2012; Montagnese et al., 2019).

As can be seen from the evidence set out in this section, all GCC states developed their national guidelines and additional programmes to reduce the rates of overweight and obesity (Musaiger, 2012; Montagnese et al., 2019; Samara et al., 2019). However, only Qatar, Bahrain and Abu Dhabi (UAE) have developed follow-up procedures to assess the outcome measures of implemented strategies or guidelines. The rest of the Gulf countries have issued nutrition guidelines without further follow-up procedures or revision strategies (Musaiger, 2012; Montagnese et al., 2019; Samara et al., 2019). No research has been carried out in the GCC studying people's knowledge, attitudes towards the guidelines, or behavioural changes based on the guidelines. Neither of these guidelines has been studied for effectiveness informed by the general public. The only available evidence of the positive changes in obesity rates in EMR countries was reported by WHO (2014), showing global progress in creating and enabling policies to promote healthy nutrition and behaviour (WHO, 2014). These findings were an overall evaluation for EMR and other participating countries, without any assumptions about the effectiveness of specific guidelines for the Gulf states (WHO, 2014). (Musaiger, 2012; Montagnese et al., 2019; Samara et al., 2019).

The arguments presented above suggest that the GCC national nutrition strategies are well-intentioned and evidence-based initiatives that mostly remain on paper with little added value in terms of practical implication and follow-up (Musaiger, 2012; Montagnese et al., 2019; Samara et al., 2019). GCC FBDGs are not promoted, and no published articles show that the general public practices them. In addition, they are written in English, while 99% of the population of the Gulf speaks Arabic. The only guidance developed in English and Arabic is the FDDG, intended for use in Arab countries and the MENA region.

In sum, the FDDG, as opposed to the other guidelines, formed the focus of this study. A brief rationale for this is that it outlines broader factors leading to a healthy lifestyle, and alongside this, information is available about the development process, which is not the case with the Food Palm, and the FDDG are available in Arabic and English (Musaiger, 2012). A detailed discussion and explanation of the development and structure of the FDDG is presented in the next section.

2.8.3 Food Dome dietary guidelines for the MENA region

The MENA is a unique region, benefiting from a privileged geographic location with access to large markets, a young and increasingly educated population, comparative advantages in manufacturing, renewable energy and tourism (FAO 2021; Katoue et al., 2022; Organisation for Economic Co-operation and Development, 2023). The region has similar linguistic, cultural, and historical roots. However, the countries within it differ significantly in the progress they have made in their economic background, governmental structures, education systems, health systems, and agriculture (e.g., Egypt versus Yemen) (Wang & Yazbeck, 2017; Belhaj & Soliman, 2021). Additional differences between countries in the MENA region include per capita national income, total health expenditure (THE) as a share of gross domestic product (GDP), life expectancy, and average years of schooling (Wang & Yazbeck, 2017; FAO 2021; Belhaj & Soliman, 2021).

There are substantial challenges of unequally distributed food and food security (FAO, 2021; UNICEF, 2022). According to the most recent report by FAO (2021), healthy diets are unaffordable for more than 50% of the MENA region's population, higher than the global average of 38%, posing serious challenges to achieving global nutrition goals (FAO, 2021; UNICEF, 2022). According Belhaj and Soliman (2021), the proportion of the MENA population suffering from acute food insecurity is 20%, which is considered high for its share of the world's population of 6%. No country in the region is on track to meet the World

Health Assembly 2025 (WHA) targets for anaemia in women of reproductive age or obesity in adults (Wang & Yazbeck, 2017; FAO 2021; Belhaj & Soliman, 2021; FAO, 2021). For example, the burden of undernourishment, and high prevalence of stunting is found more often in low-income countries (varying from 7.4% in Palestine to 49.1% in Yemen), while an increased prevalence of overweight and obesity, associated with NCDs, are found in countries with high income levels in the region (e.g., KSA, UAE, Bahrain) and micronutrient deficiencies are found alongside food insecurity (Ghattas et al., 2020; Katoue et al., 2022; Mohsen et al., 2022). These disparities, along with ongoing demographic and epidemiological shifts, pose challenges to the equity and efficiency of MENA health systems (Katoue et al., 2022; Mohsen et al., 2022), and were factors leading to the development of the Arab Food Dome dietary guidelines (Musaiger, 2012; Mate et al., 2017; FAO, 2021; UNICEF, 2022).

The Arab Food Dome is considered to be an evidence- and theory-based set of dietary guidelines designed to promote a healthy lifestyle and tackle obesity and obesity-related NCDs in the MENA region (Musaiger, 2012; Montagnese et al., 2019). The Food Dome structure considers local habits and traditional food consumption patterns, lifestyle, and health status that can be followed daily without the guidance of health care professionals (Figure 2.9).

The FDDG was designed with the use of eight specific steps (Musaiger, 2012):

1) *Identification of the current nutrition problems* – At the time of the Food Dome development, two types of nutritional problems were apparent in the Arab countries: those associated with nutrient deficiency such as underweight, anaemia and goitre, and those associated with changes in lifestyle and dietary habits such as heart disease, obesity, diabetes, osteoporosis and some types of cancer (Figure 2.9, below) (Musaiger, 2012; Montagnese et al., 2019).
2) *Identification of current food consumption patterns* - Food in the MENA region is increasingly processed with the result that grain/cereal products tend to be refined and, therefore, fibre content is lost (Musaiger, 2012; Montagnese et al., 2019). Although the intake of fruit and vegetables positively impacts the prevention of certain chronic diseases such as hypertension, CVDs, and some types of cancer, it was found that the percentage of people with a low intake of fresh fruit and vegetables (below five servings/day) ranged from 79% in Egypt to 95.7% in Syria (Musaiger,

2012). In addition, collaborators of the Arab Center for Nutrition considered inadequate intake of some micronutrients in the region, such as iron, calcium and vitamins D and C, which were also below the recommended daily allowances (RDA) (Figure 2.9, below) (Musaiger, 2012).

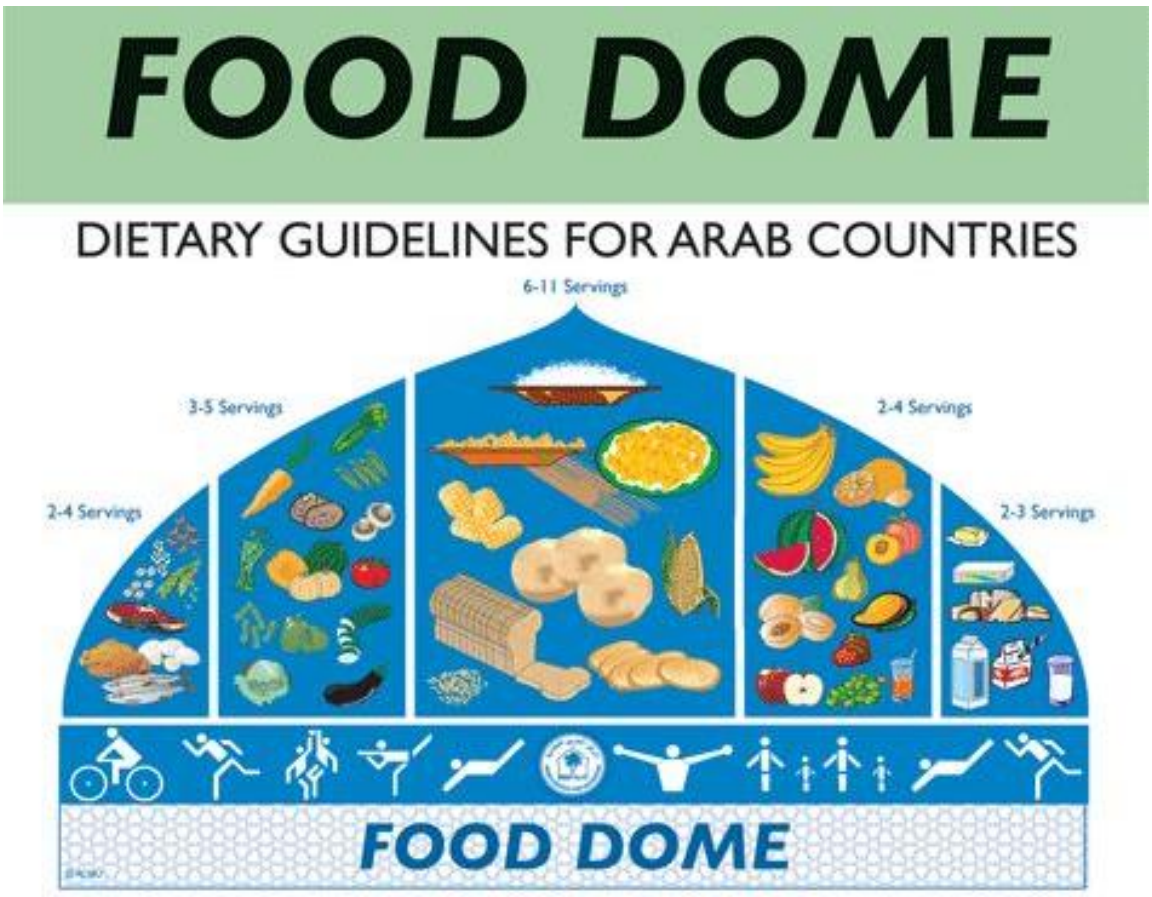
3) *Identification of food groups used in the region* - Since there is no standard reference used for food grouping (FAO/WHO, 1992), and it may vary regionally, five food group guidelines were selected for the Food Dome. These were cereals and their products; vegetables; fruit; milk and dairy products; and meat, chicken, fish, eggs, legumes and nuts (Musaiger, 2012; Montagnese et al., 2019).
4) *Identification of specific foods within each group* - Food Dome guidelines included foods that Arab people commonly consume in the five food groups. Information on these foods was obtained from food consumption surveys carried out in the region. Then a careful selection was made to obtain the foods which could be illustrated in each food group (Figure 2.9, below) (Musaiger, 2012).
5) *Grouping of each food item* - Each food item provides the essential nutrients needed for Arab people. Hence, consuming the specific foods listed in each group (depending on the serving size suggested) is expected to provide most of the essential nutrients needed for the body and wellbeing (Figure 2.9, below) (Musaiger, 2012; Montagnese et al., 2019).
6) *Identification of the serving sizes for each group* - Serving sizes for each group of foods were used as an estimated guide to provide adequate nutrients and energy for the whole day. Serving sizes of food used in Arab countries have been found to be similar to those recommended in international guidelines (e.g., Food Pyramid, Eatwell Guide). There were some amendments within the meat group of the FDDG due to the wide range of meat options (Figure 2.9, below) (e.g., 50-80 g of meat, chicken or fish) (Musaiger, 2012).
7) *Incorporating physical activity into the food guidelines* - As discussed previously, urbanisation and changes in SES in the MENA region have negatively affected the population's PA levels. Life has become more sedentary, and the practice of exercise has declined in all age groups, which has become one of the main risk factors for the high prevalence of obesity and obesity-related NCDs (WHO (EMRO), 2019; Montagnese et al., 2019). Therefore, PA was included in the FDDG. According to these guidelines, adults should undertake at least 30 minutes of PA on most days,

while children and adolescents should undertake at least 60 minutes of moderate PA on most days (Figure 2.9, below) (Musaiger, 2012).

8) *Identification of the pictorial illustration for the food guidelines* - The illustrations used for the food guidelines should reflect the culture of the targeted people. In addition, it should be simple and easy to understand so that it can be used as an educational tool for all age groups and genders. After sketching several pictorial illustrations, it was found that the dome illustration was more suitable and an acceptable design, as it reflects the culture and religious background of all Arab people. The dome can be seen in most mosques and churches in the region (Musaiger, 2012; Montagnese et al., 2019). The food groups were presented as vertical columns and not in a horizontal way to explain that all foods are equal from their nutritional point of view, and the only difference is in the amount of food that should be eaten from each group (Figure 2.9, above) (Musaiger, 2012).

The FDDG reflects the WHO EMRO recommendations of a user-friendly guide, respecting regional and cultural traditions regarding nutrition and access (Musaiger, 2012). The guidelines were developed both in English and Arabic, since 99% of the MENA region population speaks Arabic. As can be seen from Figure 2.9, the FDDG is divided into different sections, each of which represents a food group proportional to recommended amounts (Musaiger, 2012). A wide range of foods commonly consumed by Arabs is featured, including traditional foods such as Arabic flatbread, cream cheese and laban[6] in the milk and dairy group, and seeds and nuts. At the base of the Dome people are encouraged to engage in PA (Musaiger, 2012). In addition, specific recommendations are included for vulnerable groups: women of reproductive age, pregnant or lactating women, infants and preschool children (up to six years of age), schoolchildren and adolescents, and people over 50 years of age (Musaiger, 2012). Finally, recommendations are included for preventing cataracts and macular degeneration (prevalent in the MENA region), as well as adequate vitamin D intake and exposure to sunlight to reduce risk factors for osteoporosis after menopause. However, there are no recommendations for water and beverages, nor the consumption of salt, sugar and fats (Musaiger, 2012).

[6] Laban - a fermented dairy-based milk widely made in African and Arabian countries.



Food groups and suggested daily servings

Food Group	Servings	Serving sizes
Cereals and their products	6-11	1 slice, ¼ Arabic flat bread, 30g cornflakes, ½ cup cooked cereals (rice, wheat, oats, macaroni), 6 small crackers (use whole meal cereals)
Vegetables	3-5	1 cup raw leafy vegetables or cooked vegetables, ¾ cup vegetable juice
Fruit	2-4	1 medium piece of fruit (banana, apple, mango, pear), ½ cup fresh, frozen or canned fruit , ¾ cup fruit juice.
Milk and dairy products	2-3	1 cup of milk, laban or yoghurt, 45g of cheese, 1 tablespoon cream cheese , 1 ½ tablespoon labnah(use low fat dairy product).
Meat, chicken, fish, eggs, legumes and nuts	2-4	50-80g of meat, chicken or fish, one egg, 2 tablespoons of peanut butter, ½ cup legumes, ⅓ cup nuts, 2 tablespoons of seeds.
Physical activity	Daily	Medium activity like walking (30 minutes for adults and 60 minutes for children, most days).

Figure 2.9. Food Dome dietary guidelines (Musaiger, 2012).

Musaiger (2012) recognised that FDDG could play a significant role in the prevention and treatment of malnutrition and overnutrition, diet-related NCDs such as obesity, CVDs, diabetes and some cancers. However, trends of hunger, food insecurity and malnutrition, as

shown in earlier paragraphs, create a lack of capacity in existing food systems to support Musaiger's hypothesis that the FDDG could be the absolute solution for the entire MENA region to lead a healthy lifestyle (Mate et al., 2017; FAO, 2021; UNICEF, 2022). The food environment of some countries in the MENA region is solely dependent on food imports, especially wheat and other major cereals with GCC countries importing 90% of their food (Belhaj & Soliman, 2021). On the other hand, the application of national/regions nutritional guidelines (e.g., FDDG) may be a useful tool in the swiftly developing and economically stable countries in the region, such as Saudi Arabia, which is stepping up efforts to ensure food security through increased imports and investment in agricultural projects abroad (FAO, 2021; Baig, 2022).

Musaiger (2012) further emphasised that the content and application of the Food Dome should be evaluated to explore how the general public perceives and uses it, as well as its effectiveness. Since the publication of FDDG, it was included in a number of systematic reviews exploring FBDGs. For instance, a systematic review by Montagnese et al. (2019) extensively analysed the FDDG and recommended paying more attention to the ongoing ethnic, social and cultural evolution, giving due attention to ethnic diversity. In contrast, Coats et al. (2019), in their review of FBDGs of Arabic-speaking countries concluded that the Food Dome reflects the recommendations of *Promoting a Healthy Diet for the WHO Eastern Mediterranean Region: User-Friendly Guide* while adhering to regional and cultural food practices (WHO, 2012). Klapp et al. (2022) in their analysis of national dietary recommendations for plant-based diets and animal product replacements found a significant lack of information on current FBDGs worldwide, including the FDDG in terms of ethical, environmental, religious and economic aspects that play a role in people's food choices. There is no evidence to suggest that the FDDG was systematically promoted or distributed to the general public through nationwide campaigns or other means, other than being posted on the Arab Nutrition Center website, Food Dome images available on various Google platforms, and the Food Dome article by Musaiger (2012), published in Nutricion Hospitalaria. No studies have been conducted to assess the general public's knowledge and attitude towards FDDG. This PhD research has become the first to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the Food Dome among 18-25-years-old university students in the Eastern Province of the KSA.

2.9 Summary of Chapter 2

Chapter 2 provided an overview of the research with the rationale for the study setting, culture, history, SES, target population, policies, and programmes for preventing and managing obesity in the EMR, GCC, and KSA. The principal points of discussion were global obesity data, determinants of overweight and obesity prevalence as a complex web of social and biological factors. This data was supplemented by a critical discussion of the KSA, its historical and cultural development and how various factors have influenced it to become one of the most obese populations in the world. Further discussion looked into the lifestyle of university students and importance of the link between nutritional knowledge and attitudes towards healthy behaviour choices. International and national initiatives to prevent rising rates of obesity, with a critical discussion of the added value of FBDGs in general and their impact on public health in the GCC and Saudi Arabia were discussed.

Chapter 2 highlighted the gaps in the literature, i.e., what is known and not known in relation to the research topic, thereby informing the aim and objectives of the study and laying the foundation for the methodology adopted in this research, to be discussed in Chapter 3. A critical discussion of the literature showed that Saudi Arabia is one of the most obese countries in the EMR, with the country's Eastern Province seeing a steady increase in obesity trends and obesity-related NCDs. Saudi youth (i.e., students), who make up over half of the population, are considered to be the most affected group. Although there is ample literature about Saudi students' food choice, less is known about knowledge and attitudes towards healthy food choices in general and FBDGs (i.e., FDDG) in particular. Thus, there is a gap in knowledge about factors related to food choices among Saudi students, whether they are based on knowledge, attitudes, environment or other factors. There is no evidence to suggest that the FDDG was systematically promoted or distributed to the general public through nationwide campaigns or other means, other than being posted on the Arab Nutrition Center website, Food Dome images available on various Google platforms, and the Food Dome article by Musaiger (2012), published in Nutricion Hospitalaria. No studies have been conducted to assess the general public's knowledge and attitude towards FDDG. This PhD research has become the first to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the Food Dome among 18-25-years-old university students in the Eastern Province of the KSA.

Chapter 3 - Research Methodology

3.1 Chapter overview

Chapter 3 provides an overview of the research methodology and critical discussion of the phases of this research to be completed in chapters 4 and 5. A mixed-methods study was carried out in two phases to explore the relationships between weight, nutritional behaviours, knowledge and attitudes in relation to the Food Dome among 18-25-years-old university students in the Eastern Province of the KSA. The chapter will start with a comprehensive overview of the mixed-methods approach, its advantages, disadvantages, and the rationale for using this approach in this PhD research. This will be followed by a critical discussion of quantitative methods, i.e., questionnaires as an instrument for data collection. Subsequently, a critical discussion of the qualitative methods will be provided, in particular, the rationale for using mixed gender focus groups to answer the objectives of this research (given their potential limitations in the Saudi context).

3.2 Research design: mixed-methods

This research used a mixed-methods approach, including quantitative and qualitative research techniques, to strengthen the findings and answer the research aim and objectives outlined in section 1.4 (Bryman, 1988; Sale, Lohfeld & Brazil, 2002; Bryman, 2006). Mixed-method research combines the strengths of each methodology and minimises the weaknesses (Bryman, 2006; Creswell & Plano Clark, 2007; Schoonenboom & Johnson, 2017). This approach has been found to be advantageous in public health study and practice since it requires a purposeful mixing of methods in data collection, data analysis, and interpretation of the evidence. Purposeful data integration enables researchers to generate a more panoramic view of their research landscape, viewing phenomena from different viewpoints and through diverse research lenses (Creswell & Plano Clark, 2007; Denzin & Lincoln, 2017).

Quantitative methods typically provide numerical descriptions and estimates of the size and distribution of effects and allow tests for statistical significance (Kothari, 2004; Bamberger et al., 2010). This approach emphasises objective measurements, statistical, mathematical, or numerical analysis of data collected through surveys, questionnaires, and polls or by processing existing statistical data using computational methods (Kothari, 2004). Quantitative research is often described as a positivist experimental approach for collecting numerical data and generalising it across groups of people or explaining a particular phenomenon (Creswell

& Plano Clark, 2007; Schoonenboom & Johnson, 2017). At the same time, quantitative methods are generally not applied in natural settings and have been critiqued because they do not allow participants to explain their choice or the meaning of the answers (Carr, 1994).

Qualitative research is often described as taking a naturalistic interpretive approach, studying phenomena from within and taking the perspectives of research participants as a starting point (Flick, 2009; Holloway & Wheeler, 2010; Silverman, 2011). Kirk and Miller (1986) defined qualitative research as a "particular tradition in social science that fundamentally depends on observing people in their own territory and interacting with them in their own language, on their own terms" (Kirk & Miller, 1986, p. 9; Pope & Mays, 2006*).* The naturalist approach explores the meanings people place on their experiences in the social world and how they understand that world around them (Holloway & Wheeler, 2010; Silverman, 2011).

Over the years, researchers have criticised the different research designs; qualitative research has been criticised for lacking objectivity and generalisability, while quantitative has been criticised for the lack of participants' voice and meaningful interpretation (Bryman, 2006; Gelo et al., 2008; Dillman et al., 2014; Creswell & Plano Clark, 2017; McKim, 2017). In addition, arguments have been raised about the challenges of mixing these two methods due to their ontological and epistemological differences (Sale et al., 2002; Denzin & Lincoln, 2017). Thus, researchers who use mixed-methods are generally not considered research 'purists' (Creswell and Plano Clark, 2007), and those who strictly use qualitative or quantitative methods rarely embrace a mixed-methods approach (Tashakkori, Teddlie & Teddlie, 1998; Gelo et al., 2008). Some, such as Sale et al. (2002), have objected to the combination of these methods on philosophical grounds, i.e., the quantitative paradigm is based on positivism, while the qualitative paradigm has its basis in interpretivism and constructivism (Guba & Lincoln, 1994; Sale et al., 2002).

Using mixed-methods is neither rooted in positivism nor interpretivism but rather is based on pragmatism, offering a different approach whereby the researcher focuses on which methods can answer the research questions posed (Creswell & Plano Clark, 2007; Dillman et al., 2014). The main difference between the two methods is how they see reality (Creswell & Plano Clark, 2017; McKim, 2017). The quantitative theorists believe "in a single reality that can be measured reliably and validly using scientific principles," while qualitative theorists "believe in multiple constructed realities that generate different meanings for different

individuals, and whose interpretations depend on the researcher's lens" (Onwuegbuzie & Leech, 2005, p. 270).

Morgan identifies three widely held ideas of pragmatism that emphasise that pragmatists focus on the nature of experience, as opposed to other philosophies that emphasise the nature of reality (Morgan, 2014). Three characteristics/benefits of pragmatism, highlighted by Morgan (2014), include:

- "Actions cannot be separated from the situations and contexts in which they occur" (Morgan, 2014, p. 26). This world is a world of unique human experience in which, instead of universal truths, there are justified beliefs that are formed as people repeatedly take action in similar situations and experience the results. Repeated experiences of predictable outcomes generate their justified beliefs.
- "Actions are linked to consequences in ways that are open to change" (Morgan, 2014, p. 26). If the situations of action change, their consequences will change, even though the actions are the same. The philosophy of pragmatism states that it is impossible to experience the same situation twice. Therefore, justified beliefs about a possible outcome are also conditional, meaning that people's beliefs about how to act in a situation are inherently conditional (Morgan 2014).
- "Actions depend on worldviews that are socially shared sets of beliefs" (Morgan, 2014, p. 27). Pragmatists believe that no two people have the same experience, so their worldviews cannot be the same. However, there is always a different degree of shared experience between two people, resulting in a different degree of shared belief. The likelihood of acting in the same way in a similar situation and attaching similar meanings to the consequences of these actions depends on the degree of shared belief in this particular situation. Thus, worldviews can be individually unique and socially shared (Morgan 2014).

As it can be seen, pragmatism uses abductive reasoning, which moves back and forth between both qualitative and quantitative studies (Moffatt et al., 2006; Morgan, 2008). However, qualitative research on its own could also be interdisciplinary and combine both types of reasoning (e.g., usage of inductive reasoning/analysis first followed by confirmation through deductive reasoning) (Denzin & Lincoln, 2005). Secondly, pragmatism relies on

inter-subjectivity[7], which captures the polarity between quantitative objectivity and qualitative subjectivity. Thirdly, pragmatic mixed-methods reasoning is transferable, meaning learning something from one method in a setting and applying it to a different method and setting (Moffatt et al., 2006; Morgan, 2008). The use of mixed-methods has become an approach to address the critiques of quantitative and qualitative methods by combining the strengths of both methods and providing richer data and a greater depth of understanding of the research phenomenon (Kushman, 1992; Collins et al., 2006).

Mixed-methods research in population health allows for greater insight into public health issues through a combination of epidemiological and social science methods (Denzin & Lincoln, 2005; Moffatt et al., 2006; Morgan, 2008). This approach explains the complex phenomenon in a manner that is understandable for specialists and non-specialists. Mixed-methods approaches look into a problem pragmatically, aiming to solve the problem, and are policy-oriented (Ivankova et al., 2006; Morgan, 2008).

Bryman (2006) formulated a list of reasons for performing mixed-methods research:

1) *"Credibility* – employing both approaches enhances the integrity of the findings.
2) *Context* – the combination is justified in terms of qualitative research providing contextual understanding coupled with either generalisable, externally valid findings or broad relationships among variables uncovered through a questionnaire/survey.
3) *Illustration* – the use of qualitative data to illustrate quantitative findings, often referred to as putting "meat on the bones" of "dry" quantitative findings.
4) *Utility* or *improving the usefulness of findings* – refers to a suggestion, which is more likely to be prominent among articles with an applied focus, that combining the two approaches will be more useful to practitioners and others.
5) *Confirm and discover* – this entails using qualitative data to generate hypotheses and using quantitative research to test them within a single project.
6) *Diversity of views* – this includes two slightly different rationales – namely, combining researchers' and participants' perspectives through quantitative and qualitative research respectively, and uncovering relationships between variables

[7] Inter-subjectivity is the dimension representing 'the emphasis on processes of communication and shared meaning that are central to any pragmatic approach' (Morgan, 2007, p. 72).

> through quantitative research while also revealing meanings among research participants through qualitative research" (p. 106).

With the extensive evidence of arguments, a number of reasons formed the rationale to consider mixed-methods for this research. First, capturing a holistic understanding of a given theme/topic often requires data from a range of perspectives, which leads to the use of quantitative and qualitative methods (Steckler et al., 1992; Bryman, 2006; Pasek, 2012). Thus, the quantitative phase of this research investigated knowledge and behaviours in relation to the Food Dome of the target population, including dietary choices, PA, and sedentary behaviour. While the qualitative phase, i.e., the focus groups, allowed a deeper understanding of the knowledge and attitudes identified through the questionnaire to be explored. This method also provided insight into participants' daily habits, allowing for personal stories to be heard and thereby gaining more information about what could influence and improve the dietary patterns of the target population (Steckler et al., 1992; Denzin & Lincoln, 2005; Moffatt et al., 2006; Morgan, 2008; Pasek, 2012).

The combination of quantitative and qualitative methods is advantageous for this study as using a single method would not be sufficient to address the aim and objectives comprehensively (Ivankova et al., 2006; Creswell & Plano Clark, 2007). Within both methods, unique methodological and ethical issues should be recognised. Pertinent to the Saudi social and cultural reality (Bryman, 2016; Grigoryan et al., 2018; Shou et al., 2022). Since most research instruments have been developed in the context of a Western culture, there may be concerns about the sensitivity of research tools in capturing culturally specific elements in a diverse setting, i.e., Saudi Arabia. This can lead to challenges when applying Western research instruments to a non-Western culture of Saudi Arabia (Coffey et al., 2014; Hassan et al., 2019 Shou et al., 2022). These challenges include, but are not limited to, language barriers, incomprehensible modes of expression, and different cultural and social norms, i.e., mixed-gender environment. Thus, the development and use of culturally appropriate instruments is important to bring attention to considerations ranging from the study design to participant inclusion (Grigoryan et al., 2018; Shou et al., 2022). One potential solution might be for researchers new to cross-cultural research to collaborate with field researchers who have established long-term relationships with the communities or target population of the study setting. People with established community connections can guide the

development of the research phases (including the data collection tools) following local ethical standards and best practices (Broesch et al., 2020; Barrett, 2020).

A deeper consideration of how to choose a study setting, involve target communities, and develop culturally sensitive research protocols and instruments will allow researchers to address a number of challenges when doing a study in a culturally diverse setting (Coffey et al., 2014; Broesch et al., 2020; Shou et al., 2022). In this PhD research, the researcher considered these challenges and systematically addressed them. This process included the use of the ALTS questionnaire developed specifically for the MENA region (in Arabic and English), the development and translation of the Food Dome questionnaire based on best practices in the development and application of a new research instrument (see section 4.2), and the development of a focus group guide that adhered to and respected the sensitive cultural environment of Saudi Arabia (see section 5.2). In terms of cross-language barriers, prior to this study, the researcher had spent seven years in Saudi Arabia and had a basic knowledge of the Arabic language, especially the slang used by students. A bilingual chaperone was invited to help with translation or interpretation (Squires, 2009; Squires et al., 2013). In addition, prior to data collection, participants were asked about their preferred language of communication, with English being their chosen medium. However, despite this, during the focus groups, participants were encouraged to express their thoughts in the language of their choice, which the chaperone would translate. A more detailed discussion of the rationale for using the English language survey tool in Phase II in an Arabic-speaking country can be found in section 5.2.

This research included two phases of data collection: Phase I – quantitative data collection through a questionnaire and Phase II – qualitative data collection through focus group discussions. The rationale for both phases is presented in the following sections, and the application of each method is presented within the relevant chapters, i.e., Chapter 4 (Phase I) and Chapter 5 (Phase II).

3.3 Quantitative study Phase I – questionnaire overview

Questionnaires offer an objective means of collecting information about the knowledge, beliefs, attitudes, and behaviour of the target population about the purpose of the study (Hollander, 2004; Creswell & Plano Clark, 2007; Dillman et al., 2014; McKim, 2017). The questionnaire is often seen as the basis for collecting quantitative data, which must be very carefully compiled; otherwise, the study can easily fail (Kothari, 2004). Therefore, it is the

responsibility of the researcher to study the main elements of the questionnaire, the general form, the sequence of questions, the wording, and formulation (Creswell & Plano Clark, 2007; Dillman et al., 2014).

The questionnaire design is paramount to ensure that accurate data are collected so the findings can be interpreted and summarised (Del Greco, Walop & McCarthy, 1987; Smith, 1991; Jenn, 2006). The questionnaire should contain clear instructions and questions, follow a logical order, and avoid complex filtering. The responses of participants serve as a basis to structure detailed formulations of research findings, answering the research aim and expanding the existing theories (Hollander, 2004; Creswell & Plano Clark, 2007; Dillman et al., 2014; McKim, 2017).

A valid questionnaire should be structured considering the following steps: feasibility of the objectives of the study, readability, clarity of wording, and layout (Jenn, 2006). The validity of a questionnaire is its ability to measure what it is intended to measure, i.e., the questions should be structured in such a way that the respondent can understand the objective of the questions (Del Greco et al., 1987; Smith, 1991; Jenn, 2006). Hence, while designing a valid questionnaire and discussing the methods and process, a justification for each question should be given in relation to the relevant objective. Whereas the responses are expected to provide the researcher with the opportunity to investigate, review, reason, and analyse provided answers in relation to the research objectives (Jenn, 2006; Roopa & Rani, 2012).

A reliable questionnaire should be drawn up and applied in such a way that all respondents are asked the same questions in an identical format and responses recorded in a uniform manner (Del Greco et al., 1987; Boynton & Greenhalgh, 2004). Reliability, as it applies to questionnaires, is the ability to create reproducible results, that is, consistent with repeated samples and different researchers over time. Differences in findings should arise from differences between participants, not from variations in how the items are understood or how different observers interpret the responses (Del Greco et al., 1987; Jenn, 2006).

In sum, a good questionnaire should be valid, reliable, clear, succinct, and interesting. It should be composed of a simple and specific language, require one answer for one measurement/question, consider all possible likelihoods of response, and ensure questions do not overlap/cross each other (Jenn, 2006; Roopa & Rani, 2012). The ultimate outcome of a successful questionnaire is to produce variability in responses. Otherwise, the researchers will

be left with considerable uncertainty about why they asked the question and what they learned from the information. Lastly, the questionnaire should minimise social desirability, i.e., checking the consistency of individual responses, ensuring that there is little incentive for socially desirable responses, keeping anonymity, and combining/comparing with other measures (Peat et al., 2001; De Vaus, 2002; Kothari, 2004; Jenn, 2006; Roopa & Rani, 2012).

In this study, developing a valid and reliable questionnaire was essential. Therefore, the components of a reliable and valid questionnaire, its strengths and limitations were carefully studied, critically discussed and followed to develop a new questionnaire to address the second objective of this research (i.e., to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region) (Peat et al., 2001; Boynton & Greenhalgh, 2004; Jenn, 2006). The process of the questionnaire development, validation, pilot study, translation and administration are presented in Chapter 4.

The next section of this chapter is dedicated to the qualitative phase of this research, i.e., critical discussion and rational for considering focus groups in this research.

3.4 Qualitative study Phase II – focus groups

The choice of data collection methods in qualitative research should be based on the research question with a critical assessment of whether the selected method can address the research aim (Russell & Gregory, 2003; Cleland, 2017; Busetto et al., 2020). Qualitative research shows how people perceive and experience their lives, influenced by social, cultural, and professional positions. When exploring the experience of people, their opinions, views and motivations, interviews and focus groups are some of the most common techniques in qualitative studies (Cleland, 2017; Busetto et al., 2020).

Interviews are one of the most reliable, widely used, and familiar methods of collecting qualitative data, primarily because of their use in one-to-one or face-to-face conversations between two people with a specific structure and purpose (Russell & Gregory, 2003; Brooks et al., 2018; Busetto et al., 2020). Interview questions are used to obtain an understanding of the subjective experience, opinions and motivations of a person (Brooks et al., 2018; Busetto et al., 2020). Individual interviews are an ideal method for collecting qualitative data, especially when researchers need highly personalised information from participants (Russell & Gregory, 2003; Brooks et al., 2018; Busetto et al., 2020). Kvale (1996) explains, "Qualitative research interviews are attempts to understand the world from the subjects' point

of view, to unfold the meaning of peoples' experiences, to uncover their lived world prior to scientific explanations" (p. 1). On the other hand, interviews allow for a deep examination of the research question from a single point of view, demonstrating different aspects of the topic with each respondent, rather than drawing holistic or objective conclusions in relation to the research question (Kvale, 1996; Brooks et al., 2018; Busetto et al., 2020).

Focus groups are appropriate when the researcher considers the dynamics regarding the research question and offers flexibility in expressing the thoughts and ideas of the study participants (Gibbs, 1997; Gill et al., 2008; Lowton, 2018; Sim & Waterfield, 2019). Focus groups inform researchers about how a particular group of society, i.e., Saudi students, perceive a topic. Researchers analyse what participants think based on information about the range of ideas and feelings on specific topics and highlight differences of opinion between groups based on their knowledge, attitudes, beliefs, and behaviours (Wilkinson, 1998; Colucci, 2007; Gill et al., 2008).

Evidence from the Gulf region, including Saudi Arabia, suggests that effective research (either quantitative or qualitative) requires consideration of culture and its influence (Thomas, 2008; Hawamdeh & Raigangar, 2014; Al-Amer et al., 2018). Moreover, culture provides the context in which gender roles, identities and stereotypes unfold within a local community or society and in the outside world as discussed in section 2.7.1 (Hawamdeh & Raigangar, 2014; Al-Kuwari et al., 2021; Al-Amer et al., 2018). Therefore, researchers are expected to be culturally aware, reflective and adjust research methodologies to compensate for cultural norms to obtain a reliable and rich data (Gazzaz, 2009; Al-Kuwari et al., 2021). In this regard, the question of whether qualitative data collection methods should include mixed-gendered or gender-segregated approaches remains a matter of ongoing debate in the Gulf and KSA to be critically discussed in the next paragraphs (Thomas, 2008; Hawamdeh & Raigangar, 2014; Kuwari et al., 2021; Al-Amer et al., 2018).

The literature on gender and social norms argues that different norms apply in different contexts depending on the culture, which can largely influence gender differences in social behaviour and attitudes, particularly evident in the Gulf region (Okasha, 2003; Gazzaz, 2009; Al-Kuwari et al., 2021). A recent study in Qatar examining perceptions of important societal health issues using focus groups, with the participation of both males and females, found that given the conservative region and cultural norms participants may be hesitant to ask questions, comment, or challenge the views of other participants perspectives, as this may be

perceived as a sign of impoliteness (Al-Kuwari et al., 2021). While the authors included both male and female participants, they did not indicate whether the study was mixed or gender-segregated. Efforts were made to try to establish this, however, these were unsuccessful as the email addresses provided in the manuscript did not work and neither calls nor text messages were answered (Al-Kuwari et al., 2021). An earlier study by Donnelly et al. (2018) on the perception of PA among the Qatari population separated participants by gender due to the social, cultural and religious context of Qatar. The authors hypothesised that this approach would enable participants to feel more comfortable to share their thoughts and perceptions (Donnelly et al., 2018). Nevertheless, the participants were less active, which Donnelly et al. (2018) attributed to social and cultural influences, among other factors. Gazzaz (2009) conducted gender-segregated interviews on perceptions of nursing as a career choice in Saudi Arabia. The author found that her gender (i.e., female) had also influenced the communication with male participants; and only the presence of her husband helped male students relax and feel at ease during interactions. The author stated: "Being of the same gender, he tried to “break the ice” and helped to create a relaxed atmosphere in which the interviews were conducted. Despite all these measures, some male students were more inhibited and guarded than their female counterparts" (p. 213). Similar patterns were reflected in Hawamdeh and Raigangar’s (2014) research on quality interviewing and methodological issues in the Gulf setting. The authors stated that hierarchical relationships were evident in the interaction between interviewee and interviewer, as well as during mixed-gendered group interviews. This was especially noticeable in the early stages, when the participants took on a subordinate role and seemed to want the interviewer to direct and guide the interview (Hawamdeh & Raigangar, 2014). Participants showed a certain preference for direct requests for information about activities and facts and were unable to properly develop their stories, they were also hesitant to ask questions, comment, or challenge others' opinions. Similar to Al-Kuwari et al. (2021), Hawamdeh and Raigangar (2014) suggested that the lack of response to other people's stories may be related to cultural communication, e.g., communication with the opposite gender continues to be a social and psychological barrier despite to all the changes currently taking place in the Gulf. As can be seen, politeness and modesty, reluctance to enter into any disputes, are characteristic features not only of the Saudis described in section 2.7.1, but is also a regional pattern (House, 2012; Alodhayani et al., 2021; Evason, 2022).

For decades, gender segregation in the public domain has been a cornerstone of Saudi culture, which led to the creation of vast, separate women-only or men-only public spaces (al-Rasheed 2013; Doumato 2009; Le Renard, 2014). However, with the implementation of Saudi Vision 2030, a number of changes have taken place in the Kingdom, including those that allow women to drive a car, travel without the permission of a father, husband, brother or guardian, be in the same environment as men, work in the same workplace or in common social areas of university campus, although formal education is still segregated by gender (Vision 2030, 2022). Further synthesis of the literature shows that while focus group participants may not strive to be active and highly involved, central concepts related to the Gulf region, i.e., social values such as collectively, group membership, consensus, harmony, and communication can support the use of focus groups in this context (Thomas, 2006; Hawamdeh & Raigangar, 2014; Kuwari et al., 2021; Al-Amer et al., 2018). Conversely, face-to-face interviews may lack detailed data given gender sensitivity, as shown by Hawamdeh and Raigangar (2014). Moreover since, as it was discussed in section 2.7.1, Saudis are more likely to agree and accept the ideas and suggestions of others, remain silent, and observe rather than speak, face-to-face interviews could lead to a lack of dynamics due to inherent shyness and self-doubt in communicating freely, especially with foreigners (Hawamdeh & Raigangar, 2014; Kuwari et al., 2021; Al-Amer et al., 2018). Although previous studies have identified communication with the opposite gender as another limitation of qualitative research, based on the researcher's seven-year observations of student life on campus, gender-related legislative changes in the KSA, and observations of students' daily communication regardless of gender, it was hypothesised that mixed-gender focus groups involving peers could promote better communication and allow a complete picture of Food Dome knowledge, attitudes and behaviour to be established through unhindered communication rather than the hierarchical approach of using a question and answer approach as described by Gazzaz (2009) and Hawamdeh and Raigangar (2014).

Focus groups have been used in five main theoretical and/or practical ways in health-related research, each of which is discussed below:

- *Studies of lifeworld and health beliefs* – to explore and develop more specific understandings of people's knowledge and attitudes towards health and illness. For instance, women's experiences post-partum, the experience of living in a nursing

home, the experience of living with multiple sclerosis, heart attacks, or nutrition (Wilkinson, 1998; Davis et al., 2019).

- *Assessment of health status and health care needs* – to obtain an index or measurement of individuals' health status or health care needs, including assessments of the quality of life (e.g., about breast cancer or asthma). Other indexes derived from focus group research include people's satisfaction with their health conditions or the health services offered (e.g., general practice or public health services) (Wilkinson, 1998; Davis et al., 2019).
- *Health education and health promotion* – in the context of health education, focus groups are especially useful in exploring topics such as identifying barriers that prevent ethnic minority women from using cervical screening, knowledge about teenage pregnancy, and the use of contraception. In addition, focus groups have been used to assess beliefs and attitudes, develop teaching materials and programmes, as well as evaluate educational programmes (Wilkinson, 1998; Davis et al., 2019).
- *Participatory and social action research* – focus groups have been widely used in the planning and developing of health-related social action programmes. For instance, smoking prevention, nutrition in the workplace, and family planning (Wilkinson, 1998; Davis et al., 2019).
- *Evaluation and marketing of products and services* – focus groups are also known for evaluating the success of interventions that promote health, prevent disease, and early intervention or social action programmes. Further, focus groups have been used in service evaluation, public relations, evaluation of mental health services, abortion services, public health care in the community, and hospital administration. In addition, focus groups facilitate the marketing of health care services and products (Wilkinson, 1998; Davis et al., 2019).

As part of nutritional research, focus groups are appropriate to explore the complexities of knowledge and attitudes toward food choices, diet and other nutrition-related behaviours (Cason & Wenrich, 2002; James, 2004). This type of research also allows respondents to qualify, clarify, and build a discussion on each other's responses, thus providing more thoughtful and enriching information through multiple views on the same topic (Krueger 1997; Morgan & Krueger, 1998). Focus groups elicit information to allow researchers to determine why an issue is important and what is important (Morgan, 1988).

Despite the advantages, there are also limitations, some of which can be overcome with careful planning and moderation, but others are inevitable and inherent in this approach (Colucci, 2007; Hallas, 2014). For example, the researcher or moderator has less control over the data obtained than in quantitative research. The moderator allows participants to talk to each other, ask questions, and express doubts and opinions while having little control over the interaction, rather than generally keeping participants' attention on the topic. Another potential limitation of focus groups is that participants speak in a specific context, within a specific culture. Therefore, sometimes it may be difficult for the researcher to clearly understand the entire meaning of a statement or message since the researcher may not be from the same or similar culture (Mitchell & Branigan, 2000; Krueger & Casey, 2002; Breen, 2006).

Reliability and validity are key factors in quantitative and qualitative research. While reliability and validity in quantitative research depend on instrument construction, in qualitative research, "the researcher is the instrument" (Patton, 2014, p. 14). Reliability and validity are key aspects of all research, including qualitative study (e.g., focus groups) (Golafshani, 2003; Noble and Smith, 2015; Brigitte, 2017). Validity and reliability in qualitative studies, depend on the trustworthiness, rigour and quality of the data collection methods, with researchers asserting that the rigour of a qualitative study is equated with the concepts of reliability and validity (Golafshani, 2003; Noble and Smith, 2015).

Rigour is a desirable goal that is achieved by incorporating the philosophical perspectives inherent in qualitative research and the strategies specific to each methodological approach, including the verification methods that must be observed in the research process (Morse et al., 2002; Houser, 2016). Close attention to the reliability and validity of scientific research is especially important in qualitative work, where the subjectivity of the researcher can obscure the interpretation of data and where the scientific community often questions the research results (Golafshani, 2003; Noble and Smith, 2015; Brigitte, 2017). Emerging researchers or doctoral students should undertake smaller-scale projects and, simultaneously, gain the necessary baseline experience (Brigitte, 2017).

This research ensured the reliability and validity of a qualitative study through credibility, transferability, dependability, and confirmability. In this study, validity was achieved by asserting the precision in which the results accurately reflect the data. From the onset, the researcher recognised that there are many realities, hence clearly and accurately represented

the participants' points of view. Reliability was achieved through the consistency of analytical procedures, including consideration for personal and research biases that may have influenced the results. Through careful record keeping, this study demonstrated a clear decision path and the provision of consistent and transparent data interpretation. During the analysis, a comparison case/search for similarities and differences between participants was created to ensure that different points of view are represented, including verbatim records of participants' thoughts to confirm results while maintaining neutrality. This study also aimed to achieve generalisability, i.e., the transferability of the findings to other settings and applicability in other contexts (Noble and Smith, 2015; Brigitte, 2017). An independent researcher should be able to obtain similar or comparable results, hence the entire process was aimed at demonstrating clarity in terms of the underlying data analysis processes. Two experienced researchers (i.e., supervisors) were engaged to reduce research bias. Lastly, with a key strategy for understanding researcher bias called reflexivity, the researcher actively engaged in critical self-reflection about potential biases and predispositions that might be brought into qualitative research (see section 5.11) (Noble and Smith, 2015; Brigitte, 2017).

Chapter 5 discusses the composition of the focus group, the development of the focus group guide and questions, recruiting and moderating, recording, transcribing, analysing and reporting the focus group findings that were carefully studied, critically discussed and followed.

3.5 Summary of Chapter 3

This research adopted mixed-methods, a comprehensive approach that allows tackling the research aim using more than one method. Two phases of the research, i.e., quantitative and qualitative, were conducted separately (see chapters 4 and 5). The findings of each phase were combined and presented as part of discussion (see Chapter 6). Based on the literature review presented in chapters 1 and 2 and rationale for the research methodology, the next chapters will address the aim and objectives of this research. This research aims to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the FDDG among 18-25-years-old university students in the Eastern Province of the KSA.

Chapter 4 - Quantitative Study – Phase I

4.1 Chapter overview

Chapter 4 is dedicated to the quantitative Phase I study. It provides the rationale for the questionnaire choice, the development and validation of the new questionnaire section (relating to the Food Dome), the pilot study, ethical approval, study sample identification and recruitment. This is followed by a description of the questionnaire administration among the target population and the precautions needed during the COVID-19 pandemic. The findings of Phase I, included the analysis of the target population's socio-demographic characteristics, the findings of Arab Teens Lifestyle Study (ATLS) and the Food Dome questionnaire analysis. This will include overall findings, analysis by age, gender, BMI, and data on knowledge and behaviour related to the Food Dome questionnaire. Chapter 4 will conclude with a summary of the key findings in relation to objectives of Phase I.

This chapter covers the process of addressing the following objectives:

1. To identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA (Phase I – quantitative).
2. To investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region (Phase I – quantitative).

4.2 Questionnaire methods - search, selection and development

4.2.1 Process of questionnaire selection for Phase I – review of the literature

A systematic literature search was conducted to identify previously validated, used or adapted questionnaires in the KSA or the MENA region that would address the objectives of Phase I. The search was conducted via the SDL, which provides an extensive collection of e-books, scientific articles, reports, and studies for the MENA region and worldwide. This was supported by searching for eligible articles conducted through CINAHL, Medline/PubMed (via Ovid database), Scopus, Cochrane Library, Emerald Insight and Web of Science scientific databases.

Relevant literature was identified through an electronic search of studies reported from 1995, when the first nutrition report of the Saudis was published, to 2020, when Phase I of this

research was initiated. The literature search was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. The copy of the PRISMA flow diagram on the questionnaire identification, screening, exclusion and inclusion is presented in Appendix 2 (Moher et al., 2009; Wolfenden et al., 2014; Panter et al., 2018).

The following inclusion criteria were used:

- Studies with similar aim/objectives and including 18-25-year-old students/participants
- National KSA and regional (MENA region) studies measuring the prevalence of overweight and obesity
- Studies using a questionnaire as the data collection method, including items/sections on attitudes and behavioural determinants influencing the rates of obesity (e.g., dietary habits, PA, sedentary lifestyle) and nutritional knowledge
- Studies that have used international questionnaires/surveys assessing behavioural factors and attitudes influencing the rates of overweight and obesity
- Studies relating to the Food Dome

The exclusion criteria were:

- Systematic reviews with and without meta-analysis
- Editorials
- Studies not relating to the objectives of the current research

Databases were searched using Boolean operators (AND, OR, NOT) expressed in English through a combination of words in a single search string. For instance, ‘Students’ AND ‘Nutrition Policy’ AND ‘Nutrition Surveys’ OR ‘Questionnaire Design’ OR ‘Health Knowledge, Attitude, Practice’ (Table 4.1)

Table 4.1. PubMed search string example - key concepts and terms for questionnaire search.[8]

PubMed explorative search	
Publication dates	1995-2020
Language	English
Search string	"Students"[Mesh] "Nutrition Policy"[Mesh]) AND "Nutrition Surveys"[Mesh]) OR "Questionnaire Design"[Mesh]) OR "Health Knowledge, Attitudes, Practice"[Mesh]

[8] Other literature database search strings (not shown) were developed using PubMed strings as a template.

The database search resulted in n = 629 articles. An additional n = 23 articles were included, sourced from the reference lists of searched papers. After removing duplicates (n = 225), the relevant articles and publications were screened in two stages. During the first stage, the titles and abstracts of the studies were screened, and non-relevant studies were excluded (n = 391). During the second stage, the full text of the remaining studies was explored to determine their relevance. As a result, thirteen articles with questionnaires were included for the final review and assessment of inclusion and exclusion criteria.

Appendix 3 summarises the literature search process, the inclusion and exclusion criteria of questionnaires, related and non-related to the objectives of the current research. The following information was extracted from n = 13 articles:

- *General information* – authors and study title
- *Study Design* – questionnaire, adapted or developed for particular research
- *Inclusion criteria #1* – questionnaires with items/sections on behaviour influencing the rates of obesity (e.g., dietary habits, physical activity, sedentary lifestyle), nutritional knowledge and attitudes
- *Inclusion criteria #2* – 18-25-year-old students/participants
- *Comparison* - other studies using the same questionnaire

4.2.2 Summary of findings of included papers

Extended details of the findings of included n = 13 studies can be found in Appendix 3. These thirteen studies were further explored for the consideration and whether they could address this research aims and objectives. Five of the studies used self-administered questionnaires assessing students' knowledge, attitude, and behaviour towards nutrition and PA: Rasheed (1999), Baig et al. (2015), Saeed et al. (2017), Al Bshabshe et al. (2018), Mansour et al (2020). The information on whether the authors had used or adopted previously validated questionnaires or developed a new questionnaire for the particular study was not available in the text of these five articles. Upon requesting this detail, no response was obtained to emails and they were not considered for further use (Appendix 3).

Two studies did not provide full copies of the questionnaires that were developed or adapted for the Saudi setting; a study by King Abdulaziz City for Science and Technology (KACST, 1995) and Almutairi et al., 2018). Upon requesting this detail, no response was obtained to emails and as such they were not considered for further use (Appendix 3).

Four studies used previously validated questionnaires that had the potential to address the first objective of the current research (i.e., identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA), these were International Physical Activity Questionnaire (IPAQ) by Craig et al., (2003), Self-regulation of Eating Behaviours Questionnaire (SREBQ) by Kliemann et al., (2016a), General Nutrition Knowledge Questionnaire (GNKQ) by Kliemann et al., (2016b), Guidelines for Assessing Nutrition-Related Knowledge, Attitudes, and Practices (KAP) manual for the Food and Agriculture Organisation of the United Nations by Marías & Glasauer (2014). Although these questionnaires only partially met the inclusion criteria for the current study (e.g., either assessed nutritional behaviours, PA, or the age group of 18-25-year-old students/participants), because of their validity reported by previous researchers and the fact that particular sections of the questionnaires could potentially be used or adapted for this study, these four questionnaires were included for further consideration.

Two studies developed and validated questionnaires to be used among the Saudi population: Saudi Health Interview Survey (SHIS) by Memish et al. (2014) and ATLS by Al-Hazzaa & Musaiger (2011) (Appendix 3). The authors of these studies provided complete details of the process of development, validation, and dissemination of the questionnaire within the papers. They also noted that these questionnaires were available for further adaptation and use.

A further exercise was undertaken to establish questionnaires' strengths and limitations in relation to the objectives of the current research. Appendix 4 summarises the appraising factors for considering or rejecting questionnaires that either entirely or partially addressed the objectives of this study. Four international questionnaires (i.e., GNKQ, SREBQ, IPAQ, KAP by FAO) that had been validated, and either used or adapted among different populations only partially addressed the inclusion criteria developed based on the research objectives. These questionnaires assessed either nutritional behaviours or levels of PA. Separate questions within these questionnaires had the potential to be adapted to address the objectives of this research (e.g., GNKQ question #4 - Do you think these foods are a good source of protein? or IPAQ – Part 2, question #12 - During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?). However, this would reduce the validity and reliability of the measures, as they would include the individual components of the questionnaire, which was validated as a whole instrument, rather than its

separate components (Peat et al., 2001; Roopa & Rani, 2012). Furthermore, none of the questionnaires specifically covered the second objective (i.e., to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region).

Of the two national studies included, the SHIS (Memish et al., 2014) questionnaire was found to address the inclusion criteria of this research (i.e., nutritional behaviours, levels of PA, and the questionnaire had previously been used on Saudis aged 15 years and over). The authors reported that the PA section was developed based on the validated IPAQ questionnaire, but the entire SHIS survey had not undergone a validation process. The SHIS findings have served as the basis for literature reviews and reports presented in Appendix 4, but to date, the questionnaire has not been adapted, used, or recommended by other researchers (Memish et al., 2014).

Finally, the ATLS questionnaire addressed the first inclusion criteria of the current research (i.e., items/sections on behavioural determinants of obesity (e.g., dietary habits, PA, sedentary lifestyle), and the second inclusion criteria partially (i.e., participants 14-19 years of age). Since its implementation in the MENA regions, the ALTS questionnaire has been used in several studies among different age groups and populations. Moreover, the ALTS has been validated and reported as a reliable instrument to be used in future studies (Al Khalaf et al., 2013; Kilani, 2013; Tayyem et al., 2014; Hamrani et al., 2015; Albawardi et al., 2017; Alhakbany et al., 2018; Al-Mahrouqi, 2019). The ALTS questionnaire is presented in Appendix 4 and is discussed in section 4.2.3.

Based on the evidence presented from this systematic search and after evaluating the individual questionnaires, considering the inclusion and exclusion criteria, as well as the objectives of the current research, the ATLS questionnaire was considered to be the most suitable, valid, and reliable instrument to address the first objective. That is to identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA.

To address the second objective (i.e., to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region), as no previous questionnaire existed, a new questionnaire was developed for this research. This was done

based on the recommendations in the FDDG and KAP manual by FAO, as well as evidence to be set out in sections 4.2.3.2 and 4.2.4.

The next sections of this chapter will present the details of the ALTS questionnaire and the development and design of a new questionnaire to address the first two objectives of this research.

4.2.3 Outline of the Arab Teens Lifestyle Study and Food Dome questionnaire

This section describes the process of use of the ATLS questionnaire for the current research, as well as the design of the Food Dome questionnaire to explore the knowledge of and behaviour towards the FDDG among the target population. Official permission to use the ATLS questionnaire was obtained from the author of the questionnaire Professor Hazzaa Al-Hazzaa who provided details of the ATLS questionnaire and its analysis, as well as computational instructions (see, ATLS questionnaire permission for Phase I of this research is presented in Appendix 5).

The final questionnaire for this research consists of the sections discussed below.

- The ATLS questionnaire designed by Al-Hazzaa & Musaiger, (2011) is made up of four parts:
    a. *Socio-demographic questions and BMI questions*
    b. *Physical Activity/Inactivity*
    c. *Sedentary Behaviours*
    d. *Dietary Habits*
- Food Dome questionnaire was developed for this research, based on the FDDG, KAP manual, and evidence in developing a valid questionnaire to be discussed in section 4.2.3.2 (Peat et al., 2001; Jenn, 2006; Musaiger, 2012, FAO, 2014).

The ALTS & Food Dome questionnaire can be seen in Appendix 6.

4.2.3.1 Part One – The ATLS questionnaire

The ATLS project was an initiative instigated by Emeritus Professor Hazzaa Al-Hazzaa (Princess Nora bint Abdul Rahman University, Lifestyle and Health Research Centre) and Abdulrahman Musaiger (Head of Arab Center for Nutrition) to assess the lifestyle habits influencing obesity rates in the MENA region, including PA patterns, sedentary and eating behaviours. This included frequent fast food consumption, eating occasions away from home,

large portion sizes, high consumption of beverages high in sugar, and breakfast omission (Al-Hazzaa et al., 2011a).

For the current study, all parts of the ATLS questionnaire were used in the original validated version, with minor modification to be presented in the next paragraphs.

- ***Socio-demographic questions and anthropometric measurements section*** – contains anthropometric variables to calculate BMI, including body weight and height. The socio-demographic questions of the ALTS were limited to questions relating only to age, school and district. Due to the age group of the participants in this research, two additional questions related to marital status and having children were included based on the recommendations for developing a valid questionnaire (Peat et al., 2001; Jenn, 2006; Roopa & Rani, 2012; Musaiger, 2012; FAO, 2014). It can be argued that questions on marital status and having children can be considered confusing and sometimes offensive to those who were in partnerships and could not marry, were not married, or did not want to marry, do not want to have or cannot have children (Hughes et al., 2016). However, this question was included in the current study to assess how marital status and children may influence participants' lifestyle and eating behaviours. This is because it has been reported in several studies that marital status and children are factors associated with rates of overweight and obese population in Saudi Arabia (Abdelal et al., 2009; Affenito et al., 2012; Memish et al., 2014; Al Khalaf et al., 2013).
- ***Physical activity/inactivity section*** – to assess levels of physical activity/inactivity, ATLS used a self-reported questionnaire developed based on IPAQ (Al-Hazzaa & Al-Ahmadi, 2003). This part of the questionnaire was designed to collect information on the frequency, duration, and intensity of light, moderate, and vigorous-intensity physical activities during a typical (usual) week. In addition, the PA questionnaire covers such domains as transport, the household, fitness, and sports activities (Al-Hazzaa et al., 2011a). The wording and design of the questions have been kept as in the original questionnaire, except for the word "high-school," which was changed to "university/college."
- ***Sedentary behaviour section*** - aims to determine behavioural factors about daily time spent watching TV, playing video games, and using the computer and the internet, as well as the number of sleeping hours (day and night) (Al-Hazzaa et al., 2011a). The

number of sleeping hours and sedentary behaviours was included in this section as studies in different age groups, and populations suggest a connection between short sleep duration and obesity (Marshall et al., 2008; Al-Hazzaa et al., 2011a). No changes or modifications were made to this section.

- ***Dietary habits section*** – consists of ten specific questions designed to collect the frequency of certain dietary habits of participants. These include questions on how many times per week participants consume breakfast, sugar-sweetened drinks including soft beverages, vegetables (cooked and uncooked), fruits, milk and dairy products, sweets and chocolates, energy drinks, and fast foods (both western and Arabic fast food). Participants were asked to answer using a scale of zero intakes to a maximum intake of 7 days per week (Al-Hazzaa et al., 2011a). No changes or modifications were made to this section.

The ATLS questionnaire has been validated and shown to be highly reliable for its target population, with an Intra-Class Correlation (ICC) of 0.85 (Al-Hazzaa et al., 2011a; Al-Hazzaa et al., 2011b). In addition, the ATLS questionnaire results were subjected to the Cronbach Alpha test to assess the internal consistency reliability of a set of test items (Huck, 2008; Bonett & Wright, 2015). During the development study, the 42-item ATLS questionnaire yielded an acceptable Cronbach Alpha value of 0.7 (Al-Hazzaa et al., 2011a; Al-Hazzaa et al., 2011b).

4.2.3.2 Part Two – Food Dome questionnaire

The FDDG was developed to provide healthy nutrition recommendations for Arab people and reduce the risk of nutrition-related diseases (Musaiger, 2012). While the Food Dome is considered as a comprehensive guideline that can be practiced by the general public of Gulf and MENA regions, there is currently no corresponding questionnaire to explore knowledge, attitudes, and behaviour in relation to these guidelines. This research has become the first of its kind that developed and validated the Food Dome questionnaire to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region.

Questions were developed based on the rationale for developing a reliable and valid questionnaire (Krosnick, 1991; Peat et al., 2001; Roopa & Rani, 2012; Lenzner, 2014). According to Krosnick (1991), the likelihood that respondents will offer satisficing responses is a function of three factors: question difficulty, respondent ability, and respondent motivation. Accordingly, the more difficult it is to understand the question, and the lower the

cognitive abilities and motivation of the respondents, the more likely it is that the questionnaire will give satisfactory but inaccurate answers. This may lead to a decrease in the correctness/accuracy of the primary data (Krosnick, 1991; Peat et al., 2001; Roopa & Rani, 2012; Lenzner, 2014). Thus, in developing the Food Dome questionnaire, all these components have been considered to design a questionnaire that would minimise task difficulty and respondents could easily understand and answer the questions, thereby avoiding possible cognitive and motivation burdens (Krosnick, 1991; Cacioppo et al., 1996; Roopa & Rani, 2012; Lenzner, 2014).

To be consistent with the ATLS questionnaire design, Food Dome questions were closed-ended with multiple choices so that participants could fill out the questionnaire on their own. Close-ended questions are useful for producing answers that can be easily compared and analysed. Hence, a structured questionnaire with close-ended questions was considered appropriate to address the second objective of the current research (De Vaus, 2002; Jenn, 2006; Roopa & Rani, 2012). However, the last question of the Food Dome questionnaire contained an open-ended question with no options or predefined categories: "What support would you like to receive to learn more about the FDDG for Arab people?" This enabled participants to reply in their own words without being limited by a fixed set of possible responses (De Vaus, 2002; Kothari, 2004; Jenn, 2006; Roopa & Rani, 2012). This question was designed to inform the fourth objective of this research, i.e., to provide short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population.

The question order blocks were developed to complement the order of the FDDG (see section 2.8.3), which included the following components:

- *Food groups* - questions aimed to assess knowledge, attitudes and behaviours in relation to five food groups recommended in the Food Dome guidelines (i.e., cereals and their products; vegetables; fruit; milk and dairy products; and meat, chicken, fish, eggs, legumes and nuts) (Musaiger, 2012; FAO, 2014; Montagnese et al., 2019).
- *Daily, weekly servings of specific foods* - questions aimed to understand knowledge, attitudes and behaviours in respect of the consumption of specific food groups daily or weekly (Musaiger, 2012; Montagnese et al., 2019).

- *Serving sizes* – as discussed in section 2.5.1, there is evidence that consumption serving sizes of portions among the public has increased (Musaiger, 2012; Yamoah, 2019). Individual serving sizes are influenced by several factors: packaging, labelling, advertising, and portion size. Several studies have shown that people tend to choose significantly larger portions than recommended ones (Bryant & Dundes, 2005; Rolls, Roe & Meengs, 2007; Yamoah, 2019). Thus, the Food Dome questionnaire included questions relating to knowledge, attitudes and behaviours in relation to choosing serving sizes.

As a result, the 15-item Food Dome questionnaire was developed and subjected to Cronbach Alpha test. Pilot data were collected from students for reliability analysis. The data values were converted to numerical values and a reliability analysis was applied to find the value of Cronbach's Alpha. Each question (i.e., variable) gave more than 0.75 of the acceptable value. The total Cronbach Alpha values were 0.985, which was significant, since an acceptable Cronbach Alpha value must be greater than 0.75. Thus, the Food Dome questionnaire has a significant reliability value. In addition, five experts determined content validity and considered whether the instrument adequately covered all the content it needed to address, the variables and all relevant parts of the subject matter it intended to measure (Dr. Mark Olson, Dr. Zachary Mngo, Dr. Lamia Al-Jamea, Dr. Fatimah Al-Yami, and Dr. Haidar Sabbagh). The content validation process highlighted the suitability of the new questionnaire to address the second objective of current research (i.e., to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region).

Further attention was given to the ways of administration of the questionnaire, i.e., paper-based or web-based questionnaire. Therefore, it was essential to review the existing literature and critically discuss the strengths and limitations of paper-based or web-based questionnaires. The next section presents a summary of the evidence, based on which the rationale for the ALTS and Food Dome questionnaire administration was decided.

4.2.4 Strengths and limitations of paper-based and web-based questionnaires

One of the most significant factors to consider while conducting quantitative research using a questionnaire is how the questionnaire will be distributed, i.e., should it be web- or paper-based (Cook et al., 2000; Cobanoglu, Warde & Moreo, 2001; Idleman, 2003). This may influence the response representativeness and response rate (Cook et al., 2000; Greenlaw & Brown-Welty, 2009). The model for collecting questionnaire data in research has

traditionally been the paper questionnaire, a simple and tangible way of communicating between participant and researcher (Ebert et al., 2018).

In recent years, paper-based data-collection methods have been challenged by the implementation of web-based questionnaires. The latter has been found to affect response rates (i.e., lower rates in comparison with paper-based questionnaires) but have lower costs and produce slightly lower numbers of missing answers compared to paper-based questionnaires (Cook et al., 2000; Greenlaw & Brown-Welty, 2009). The latest available studies conducted among students on the effectiveness of either web-based or paper-based surveys have shown that online responses typically elicit lower response rates than in-class administration of surveys (Dommeyer et al., 2004; Porter et al., 2004). However, these observations vary in different cultural contexts (Dommeyer et al., 2004; Nair et al., 2008) and are over ten years old, and the use of technology has changed over time. Therefore, in order to collect and maintain good survey response rates, it is essential to understand the characteristics of the study sample (e.g., Saudi students) and their perceptions of the survey. The researcher can then decide which method to use based on the initial demographic and cultural data about the target population (Carini et al., 2003; Idleman, 2003; Greenlaw & Brown-Welty, 2009).

In Saudi Arabia, email communication is mostly used by people working in administrative or management positions (Simsim, 2011; Alkahtani et al., 2015). Furthermore, according to the latest available data and the experience of researcher's in communicating with Saudi students, although the younger generation of the Kingdom (i.e., students) have been found to use the internet for chatting and entertainment via social media, they are not sufficiently familiar with email services effectively (Simsim, 2011; Alkahtani et al., 2015). Therefore, considering the ongoing debates about web- or paper-based studies and taking into consideration the email culture in the KSA, the decision was made to conduct a paper-based questionnaire among the target population for Phase I of this research to have both the response rates and representativeness (Simsim, 2011; Alkahtani et al., 2015).

This stage of research was then followed by the ethical approval by the Ethics Committee of the University of Salford (UoS), the translation of the Food Dome questionnaire into Arabic, and a pilot study which is discussed in the following section.

4.2.5 Translation of the research instrument

Translation can be a difficult process, as a well-translated instrument in cross-cultural research needs to display three types of equivalence: semantic (equivalence in words and sentences), conceptual (equivalence in the concepts being discussed) and normative (the capacity to address social norms in a particular culture) (Harkness & Schoua-Glusberg, 1998; Forsyth et al., 2007; Mohler et al., 2016). Once ethical approval had been received from the UoS Ethics Committee (HSR1920-016), the questionnaire was translated by two different translators from the Translation Unit of Prince Sultan Military College of Health Sciences (PSMCHS). One translator was aware of the aim of the study to have an understanding of the original tool that would aid the interpretation and translation (Beaton et al., 2007; Tsang et al., 2017). The second translator was not aware of the aim of the study and translated the survey into Arabic without any prior knowledge of the content.

Several points were considered before translating the questionnaire from English into Arabic. First, it was acknowledged that language differences could not create a tool identical to the original language of the questionnaire (Harkness & Schoua-Glusberg, 1998; Hunt & Bhopal, 2004). Second, translators considered multinational, multicultural, or multiregional factors, as it is requested in similar research studies (i.e., "3MC" questionnaires). In particular, when translating the questionnaire, the translators took into account differences between Saudi and Western societal factors, including language and culture (Harkness & Schoua-Glusberg, 1998; Mohler, Dorer, Jong & Hu, 2016).

Once the translation by two translators was complete, the researcher reviewed the questionnaire. Discrepancies between the two translators relating to terms translated were discussed and resolved with the participation of an impartial bilingual translator not involved in previous translations (Beaton et al., 2007; Tsang et al., 2017).

4.3 Ethics

As the research involved human participants, ethical approval was sought and obtained on 03/08/2020 from the Ethics Committee of the UoS (HSR1920-016, Appendix 7). All participants were informed that participation in the research was entirely voluntary, and refusal would not result in any sanctions. Also, once they agreed to participate, participants were free to leave the study at any time without giving a reason. Finally, participants were assured that no part of their information could be traced back to them, and all information

provided would be treated as confidential. This information was provided in the 'Participant Consent Form' and 'Participant Information Sheet presented in Appendix 8.

4.4 Data protection statement

The current study is constructed on two fundamental principles: informed consent and anonymity. During the pilot study and study administration, all participants were identified by their ID number on any database where information was saved. All documents were stored safely at PSMCHS, with limited accessibility only available to the researcher. According to the recent report Data Privacy Frameworks in the MENA region conducted by the Global System for Mobile Communications (GSM, 2019) in collaboration with PricewaterhouseCoopers (PwC, 2017), Saudi Arabia does not have a specific data protection law, and the original personal data protection law for this country is under review by the Shura Council in accordance with Shari 'a principles. However, Saudi Arabia partially aligns with the General Data Protection Regulation (GDPR). For these reasons, the researcher considered GDPR legislation concerning personal data storage and transfer to a third party or outside the UK and the KSA, as well as following the requirements of the University of Salford about data storage and transfer. Details of data collection will only be disclosed for lawful and data processing purposes. All data associated with the research is password-protected, accessible only to the researcher involved in the project, and will be stored for five years.

4.5 Pilot study

Before administering a questionnaire, it is advisable to conduct a "pilot study" to evaluate its components, including questions development, the process of administration, and the data produced (Kothari, 2004; Roopa & Rani, 2012). The pilot study affects the replication and rehearsal of the primary questionnaire by showing its strengths and weaknesses. From the outcomes and experience of conducting a pilot study, improvements can be made to the questionnaire and the method of delivery if needed (Peat et al., 2001; Kothari, 2004; Jenn, 2006; Roopa & Rani, 2012).

A pilot study helps to identify whether: 1) the questions are appropriately formed; 2) the wording of the questions will achieve desired results; 3) the questions are placed in the best order; 4) all respondents understand the questions; 5) additional or specifying questions are needed or some need to be removed (van Teijlinge & Hundley, 2002; Peat et al., 2001;

Kothari, 2004; Jenn, 2006; Roopa & Rani, 2012). Another advantage of undertaking a pilot is that it may give advance notice about where the initial research project can fail (i.e., developing and testing the adequacy of research instruments, assessing the feasibility of a (full-scale) study/survey). Moreover, it may show where research procedures have not been followed (i.e., assessing whether the research protocol is realistic and feasible) (van Teijlinge & Hundley, 2002; Peat et al., 2001; Kothari, 2004; Jenn, 2006; Roopa & Rani, 2012).

In addition to their advantages, pilot studies may also have several limitations: 1) the possibility of making inaccurate predictions or assumptions based on pilot data; 2) problems arising from contamination (when researchers use some or all of their pilot data as part of the main study); 3) problems related to funding (i.e., determine what resources (finance, personnel) are needed for the planned study (van Teijlinge & Hundley, 2002; Kothari, 2004; Jenn, 2006; Roopa & Rani, 2012). Furthermore, completing a pilot study is not a guarantee for the success of the full-scale questionnaire since pilot studies do not have a statistical foundation and are mostly based on small numbers (van Teijlinge & Hundley, 2002; Boynton & Greenhalgh, 2004).

With all its advantages and disadvantages, a pilot study was necessary for preliminary testing of all the features of the Food Dome questionnaire. Although the sample size of pilot studies remains unclear and there is no consensus, recommendations vary from 10 to 12 participants per group, depending on the main purpose of the study (Julious, 2005; Thabane et al., 2010; Lewsi et al., 2021). In this study, 12 students from those institutions that agreed to participate were initially invited to participate in the pilot study. Of these 12, 10 actually participated. Hence, a pilot study was conducted among n = 10 students (n = 6 males, n = 4 females) from the Eastern Province. Furthermore, as the pilot included both male and female participants, in respect to the Saudi setting and culture, a qualified and adequately trained chaperone (i.e., a female student enrolled in research to communicate with the female participants) was invited to be present during the data collection. Before the start of the pilot study, the purpose of the questionnaire was explained to participants, and written informed consent was taken. Participants were informed that their participation was voluntary and that they could withdraw from the pilot study at any time (Manti & Licari, 2018; NHS, 2020).

It should be noted that all stages of this research were conducted during the ongoing COVID-19 pandemic. Therefore, all precautions mentioned in the COVID-19 statement were adhered to and respected, including hand hygiene, cleaning and disinfection of surfaces and the

environment. Additionally, participants' temperatures were measured prior to the study. Environmental surfaces were cleaned and sanitised following the recommendations by WHO (2020), *"Cleaning and disinfection of environmental surfaces in the context of COVID-19."*

Body weight was measured without shoes and with minimal clothing to 100g using a calibrated portable scale (Seca 750, Medical Measuring Systems and Scales, Hamburg, Germany). To obtain meaningful values, the scale was checked so that the pointer of the scale read "0" by moving the adjusting wheel, following the Seca 750 scale manual presented in Appendix 9 (Seca, 2020). Height was measured to the nearest cm while the subject was in the full standing position (Frankfort horizontal plane) without shoes using a calibrated portable stadiometer. The researcher and chaperone were present in the room if any participant had questions about the questionnaire (Jenn, 2006; Manti & Licari, 2018; NHS, 2020).

The duration for participants to complete the questionnaire was recorded to determine the time needed during the study administration among the target population (this was recorded as ranging from 12-15 mins) (Jenn, 2006). The researcher explained the uncertainties highlighted by participants (presented in the next paragraphs) and documented them to improve the final instrument. The complete feedback of pilot study participants and queries are shown in Appendix 10 (Jenn, 2006). Two important comments were addressed during the data collection:

- *Arabic spelling* – the Word Doc was converted into a PDF and then printed as per recommendation by participants since some letters of the Arabic Alphabet were lost when printing the Word file. Considering the uniqueness of the Alphabet, future researchers are also recommended to convert the Word Doc into PDF to maintain the letters.

Some participants indicated that item #52 (see below) created confusion, expressing the view that the food group variables were too broad and difficult to select:

#52 Experts classify foods into groups. Please, choose five food groups recommended specifically for the MENA region. (Tick one box per answer)

- Cereals and their products
- Vegetables
- Fruit

- Milk and dairy products
- Meat, chicken, fish, eggs, legumes and nuts
- Vegetables and legumes/beans
- Fruits and vegetables

This item was designed to assess knowledge of the five food groups of the Food Dome; hence, the last two options were added that participants could choose from, along with the five correct options out of seven. However, the question was kept as is, and no changes were made as this was infeasible considering the number of food groups in Food Dome, which was five, and two more were added to check the knowledge about food groups recommended to Arab people, as per FDDG. Out of ten participants, only one expressed such concern.

Based on the pilot study findings and validation of the Food Dome questionnaire, the instrument was deemed able to be administered to the study sample. Therefore, the next sections present study sample calculation, recruitment, and study administration.

4.6 Study sample calculation

The research participants included students from higher educational institutions in the Eastern Province of the KSA. Their ages ranged from 18-25 years. As of autumn 2020, the latest data from the GASTAT (2016) of the KSA indicated that the youth population of the Eastern Province numbered 694,269. Hence, the minimum sample size needed in the Eastern Province was determined so that the sample proportion would be within ±0.05 of the population proportion with a 95% confidence level (Daniel, 1999; Al-Hazzaa & Musaiger, 2011). Therefore, the population proportion has been assumed to be 0.50 as this magnitude yields the maximum possible sample size required (Daniel, 1999; Al-Hazzaa & Musaiger, 2011) that can be determined as follows:

$$n = {Z_{\alpha/2}}^2 * p * (1 - p) / E^2$$

Based on these indicators and previous studies performed in this region, n = 384+ participants were recruited for Phase I of this research. Considering the sample size of n = 384+ and reviewed standards on the responsiveness and representativeness, a response rate of ≥ 80% was targeted.

4.7 Target population recruitment strategy

Seventeen higher educational institutions in the Eastern Province of KSA were contacted via e-letter. From July to September 2020, a cover letter was sent to the heads of the Universities to determine whether they would be interested in contributing to the research. Contact details were extracted from their official web pages, and a follow-up call was made to ensure that the e-letter was delivered. The cover letter provided information regarding the length of the questionnaire and method of questionnaire administration, as well as the precaution measures for COVID-19 (Dillman, 2011; MOH, 2020).

Ethical recruitment is central to good research practice, along with providing participants with an information sheet about the study, and if participants are happy to participate, asking them for written informed consent (Duke & Bennett, 2010; Hunt et al., 2013). In this research, invitations included the date(s) of data collection, the recipient's name and address, and an appropriate salutation (Czaja & Blair, 2005, Dillman, 2011). This was followed by a description of what was requested, assurances that answers would be kept confidential, and that participation was voluntary.

The invitation also explained why the respondent is important to the study, how the target population has been decided, and a statement concerning whom to contact with questions (Czaja & Blair, 2005, Dillman, 2011). Information was provided regarding the length of the questionnaire (e.g., attaching a copy of the questionnaire), the method of questionnaire administration, and informed consent to be signed before data collection (Duke & Bennett, 2010; Hunt et al., 2013).

Three of the 17 institutions gave initial agreement to participate, and the students of two institutions actually participated in the final data collection. Participation was voluntary after the representatives of institutions and students read the consent forms and expressed their willingness to participate by signing the informed consent (Ridley, 2009; Heath & Walker, 2011). As a result, n = 426 students from the two higher educational institutions[9] of the Eastern Province participated in the research. The organisational secretaries contacted the researcher to set a mutually convenient date and time for the study among the target population.

[9] For the purposes of this study, to maintain anonymity and not violate GDPR, the names of the institutions that agreed to participate were coded as 1 and 2.

Institution 1 is a pioneering student-centred educational hub in the KSA dedicated to having a transformative impact on society through sustainable innovation in education, research, and creativity. The institution's location in the Eastern Province, curriculum, and research are particularly suited to serve the business, industrial and public needs of the KSA, as well as the region's economic development interests. In addition to educational programmes, Institution 1 has many state-of-the-art facilities. These include healthcare and counselling services centre, sports centre (i.e., gym), cafeteria, students housing, students' clubs and organisations. While some of these facilities, e.g., cafeterias, allow males and females to share the same environment, others, such as gyms, operate separately for both genders. Despite this segregation, gyms with separate rooms are fully equipped for students to be able to work out. The gyms are open from 11:00 am to 5:00 pm weekdays and include amenities such as workout benches, dumbbell and barbell sets, treadmills, exercise bikes, a rowing machine, elliptical trainers. Cafeterias offer a rich menu of various meals, most of which are fast foods from world-famous fast food chains such as KFC, Burger King, Shawarma Time, JJ Chicken, Subway.

Institution 2 aims to develop and stimulate creativity and innovation in scientific research. It aims not only to educate healthcare providers, but also to ensure that they can put their knowledge into practice on a daily basis. The curriculum and research at Institution 2 are closely linked to medical education and research. Similar to Institution 1, Institution 2 offers a number of facilities, including sports centre with separate halls for males and females, cafeteria, and students housing. The sports centre is furnished with similar equipment as the first institution and operates from 10:00am to 4:00pm weekdays. The menu of cafeteria includes meals of such brands as Shawarma Time, JJ Chicken, Pizza Hut, and Shatiraty.

Looking at student accommodation, both institutions are located in urban settings in the Eastern Province and have on-campus housing with separate buildings for males and females. However, most Saudi students live with their families, and even those who come from other regions rent an apartment to live with their families, rather than on campus, which is consistent across studies in the Kingdom (Al-Rethaiaa et al., 2010; Al-Qahtani, 2016; Almutairi et al., 2018). Even though students live with their families and return home after classes, they spend most of the day on campus (approximately from 8:00am to 4:00pm), which, as later stages of the study showed, affects their lifestyle choices (i.e., nutrition and PA) (see Chapter 5).

4.8 Study administration

Once students (n = 426) agreed to participate in the research, a mutually convenient date and time were agreed upon with the representatives of institutions 1 and 2. To reduce any possible risk of COVID-19, the administrations of the two institutions agreed to collect the data at one place, i.e., PSMCHS. The data collection took place in a lecture room in 10 sessions over five days, with a 4-hour break between sessions. The number of participants did not exceed 45 plus the researcher to allow for social distancing as per MOH (2020) recommendations.

All precaution measures followed during the pilot study were respected and adhered to during study administration. The printed questionnaires and consent forms were placed in envelopes, sealed, and distributed among participants. The study administration was paper-based, and participants were asked to bring their own pens/pencils to reduce all possible risks (MOH, 2020; Saudi Press Agency (SPA), 2020; WHO, 2020b). Before the questionnaires were given out, the aim and objectives of the study were explained, and participants signed the informed consent form.

The recording of temperature, weight and height took approximately 40 minutes, while study administration (i.e., survey) took around 30 minutes for each session. After data collection, participants were thanked for their contribution and again reminded of the anonymity of the study and the protection of their data. Study administration was followed by the analysis of findings and development of statistical data to report the findings.

4.8.1 Statistical analysis of ATLS and Food Dome questionnaire

Statistical analysis was performed using IBM Statistical Package for the Social Sciences version 25.0 (SPSS Inc., Illinois, USA). Data analysis and interpretation began with descriptive statistics, which have several applications (George & Mallery, 2002; Pallant, 2011). These include describing the characteristics of the sample, checking variables for any violation of the assumptions underlying the statistical techniques used to address research questions, and addressing specific questions (George & Mallery, 2002; Pallant, 2011).

BMI was determined based on the ratio of participants' weight (in kilogrammes, kg) to the square of their height (in square metres, m^2). The results were then converted into four BMI categories with the following cut-points for BMI: (1) <18.5kg/m^2 underweight; (2) 18.50-24.99kg/m^2 normal weight, (3) 25.00-29.99kg/m^2 overweight; (4) 30.00kg/m^2 and above

obese, as specified by the NIH Adult BMI Classification, developed by WHO (Table 2.2) (NIH, 1998; Dwyer et al., 2015; WHO, 2021).

When producing descriptive statistics, it is recommended to present at least one form of central tendency (or average), either the mean, median, or mode (Pallant, 2011; Kahn, 2020). In addition, one form of variability is usually the standard deviation (George & Mallery, 2002; Pallant, 2011; Kahn, 2020). The normality test has been applied and found the significant bell curve, to confirm the sufficient sample size (Figure 4.1).

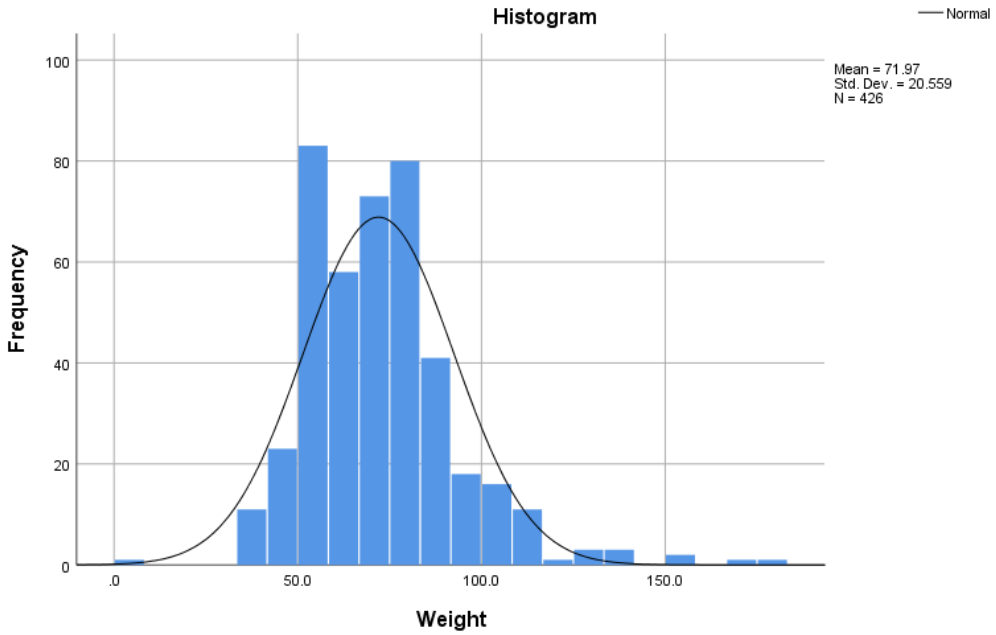


Figure 4.1. An example of a normal distribution (Gaussian) curve for the weight variable for this study sample.

For the ATLS questionnaire, the data was analysed following ATLS questionnaire computation,[10] and the following key research papers were used to allow comparison:

1. Al-Hazzaa, H. M., Abahussain, N. A., Al-Sobayel, H. I., Qahwaji, D. M., & Musaiger, A. O. (2012). Lifestyle factors associated with overweight and obesity among Saudi adolescents. *BMC public health*, *12*(1), 1-11.
2. Khalaf, A., Ekblom, Ö., Kowalski, J., Berggren, V., Westergren, A., & Al-Hazzaa, H. (2013). Female university students' physical activity levels and associated factors—a

[10] Hazzaa Al-Hazzaa (2012). ATLS Analysis Guidance - https://lh-hsrc.pnu.edu.sa/wp-content/uploads/2018/11/ATLS-Questionnare-Computations-Analyses-Instruction.pdf

cross-sectional study in southwestern Saudi Arabia. *International journal of environmental research and public health*, *10*(8), 3502-3517.

3. Kilani, H. (2013). Assessment of Life Style, Physical Activity, Nutrition Status, Sleep Duration, and BMI among Schools' Adolescents in Oman (14-18): A Research Proposal. *Canadian Journal of Clinical Nutrition*.
4. Alhakbany, M. A., Alzamil, H. A., Alabdullatif, W. A., Aldekhyyel, S. N., Alsuhaibani, M. N., & Al-Hazzaa, H. M. (2018). Lifestyle habits in relation to overweight and obesity among Saudi women attending health science Colleges. *Journal of epidemiology and global health*, *8*(1-2), 13.
5. Al-Qahtani, M. F., Alghareeb, A. I., Alramadan, Z. S., & Ismail, M. S. (2019). Determinant of overweight and obesity among females' adolescents in the Eastern Province of Saudi Arabia, Cross-Sectional Study.

For the Food Dome questionnaire, it was important to correctly and clearly encode the variables so that future researchers could easily understand what was measured and how (Ruel et al., 2015; Bala, 2016). Therefore, in this research, for knowledge-based questions SPSS numeric variables were used to encode correct responses (i.e., meet the FDDG recommendations) to 1 and those responses that were incorrect (i.e., did not meet FDDG recommendations) to 0. The overall knowledge data was obtained by adding each question to get the total knowledge marks and converting it to a percentage. The statistical analysis through SPSS has taken these percentage values to compare each demographic character. The average through mean for the percentage values have been calculated for each age group to find the difference. To check the assumptions, both for the ALTS and Food Dome section of the questionnaire, a number of tests were used, see Table 4.2 below (Al-Hazzaa et al., 2012; Pallant, 2016).

Table 4.2. Statistical tests used, the reasons why and examples.

Tests	Reasons & Examples
Independent *t*-test	*To determine differences in a continuous dependent variable (e.g., height) between two groups (e.g., males females).*
	- Sedentary behaviour - to compare screen time with metabolic equivalent (MET) of males and MET of females - Nutritional choices - to compare food consumption patterns with MET for males and MET for females - Food Dome data - to compare knowledge of FDDG among males and females
Analysis of variance (ANOVA)	*To determine whether or not there is a statistically significant difference between one independent variable (i.e., age, gender, nationality) and more than two different groups (i.e., BMI classification – underweight, normal weight, overweight, obese).*
	- MET of males or females and BMI classifications - Screen time of males or females and BMI classifications - Food consumption frequency of males and females and BMI classifications - Knowledge of FDDG and age groups - Knowledge of FDDG and BMI classifications
Chi-square (χ^2) test for independence	*To assess the associations the relationship/association between two categorical variables.*
	- Gender and age groups - Walking intensity and BMI categories - Screen time and BMI categories - Food groups' consumption frequency and gender - Food groups' consumption frequency and BMI categories - Age and behaviour in relation to FDDG - Gender and behaviour in relation to FDDG - BMI categories and behaviour in relation to FDDG

The significance, also known as the probability value (*p*-value), was calculated to determine the likelihood that a particular analysis result is reliable with a statistical significance within $p \leq 0.05$ and 95% confidence level (George & Mallery, 2002; Pallant, 2016; Kahn, 2020). The findings of the analysis of the ATLS and Food Dome questionnaire are reported in the following sections.

4.9 Phase I findings

This section will present the findings of the ATLS and Food Dome questionnaire, which consisted of the following parts:

- Part One: Demographic questions – questions 1 – 7
- Part Two: Physical Activity/Inactivity – questions 8 – 34
- Part Three: Sedentary Behaviours – questions 35 – 40
- Part Four: Dietary Habits – questions 41 – 50
- Part Five: Food Dome – questions 51 – 66
  - Knowledge questions – questions 51 – 53 and 55 – 61
  - Behaviour questions – questions 54, 62 – 66

4.9.1 Part One: socio-demographic data of study sample

Part one of the ATLS and Food Dome questionnaire captured the demographic data of the study sample (questions 1 – 7). A total of n = 426 students (n = 133 females, n = 293 males) from two higher educational institutions in the Eastern Province of KSA took part in the survey. 96.5% were Saudi, and 3.5% were non-Saudi, with ages ranging from 18 to 25 years (Table 4.3). N = 389 participants were single and had no children; of these, n = 267 (68.6%) were male, and n = 122 (31.4%) were female. Saudi nationals comprised n = 411 of students, of which n = 279 (67.9%) were male, n = 132 (32.1%) were female (Table 4.3).

Table 4.3. Demographic data of study sample (n = 426).

Variable	Males n (%)	Females n (%)	Total n (%)
Marital Status			
Divorced	1 (100)	0 (0)	1 (100)
Married	15 (34.9)	28 (65.1)	43 (100)
Single	262 (69.1)	117 (30.9)	379 (100)
Others	0 (0)	3 (100)	3 (100)
Children			
1	2 (16.7)	10 (83.3)	12 (100)
2	3 (21.4)	11 (78.6)	14 (100)
3	4 (44.4)	5 (55.6)	9 (100)
More than 3	2 (100)	0(0)	2 (100)
No children	267 (68.6)	122 (31.4)	389 (100)
Nationality			
Saudi	279 (67.9)	132 (32.1)	411 (100)
Non-Saudi	1 (6.7)	14 (93.3)	15 (100)

The mean (M) ages of males and females were M = 22 (SD ±1.83) and M = 21 (SD ± 1.73), respectively (Table 4.4, below). Chi-square used to determine associations between gender and age groups showed that there were more females in 18-20 age group, while males were prevalent in the 21-23 and 24-25 age groups; the finding was found to be statistically significant ($\chi^2 = 60.54$, $p = 0.000$). When looking at the participants' weight, males were heavier (M = 76.70 (SD ± 20.50)) than females (M = 61.57 (SD ± 16.51)). Males were taller (M = 172.8 (SD ± 12.1)) than females (M = 159.57 (SD ± 7.27)). Lastly, mean BMI for males was higher (M = 25.58 (SD ± 6.57)) compared to females (M = 24.14 (SD± 6.27)) (Table 4.4).

Table 4.4. Descriptive characteristics of study sample (n = 426).

Variable	**Gender**			**Chi-square**
Age (year)	**Males n (%)**	**Females n (%)**	**Total n (%**	***p*-value**
	293 (68.8)	133 (31.2)	426 (100)	
18 – 20	69 (46.6)	79 (53.4)	148 (34.7)	$X^2 = 60.54$; $p = 0.000$*
21 – 23	166 (86.0)	27 (14.0)	193 (45.3)	
24 – 25	58 (68.2)	27 (31.8)	85 (20)	
	M(SD)	**M(SD)**		
	22 (1.83)	21 (1.73)	-	
Weight (kg)	76.70 (20.50)	61.57 (16.51)	-	
Height (cm)	172.8 (12.1)	159.54 (7.27)	-	
Body Mass Index	25.58 (6.57)	24.14 (6.27)	-	

*Significant at 95%

Table 4.5 (below) shows that out of n = 426 participants, n = 200 (47%) were categorised as normal weight; among these, n = 130 (65%) were males and n = 70 (35%) were females. In the overweight category of the n = 113 (26.5%), n = 83 (73.5%) were males and n = 30 (26.5%) were females. There were n = 73 (17.1%) students in the obese category; of these, n = 54 (74%) were males, and n = 19 (26%) were females. As for the underweight category of the n = 40 (9.4%), there were n = 26 (65%) males and n = 14 (35%) females. As it can be from Table 4.5, the prevalence of being overweight or obese was 43.6% across the entire sample.

Table 4.5. Distribution of study sample in each BMI category by gender (n = 426).

Variable BMI	**Males n (%)**	**Females n (%)**	**Total n (%)**
Underweight	26 (65)	14 (35)	40 (9.4)
Normal Weight	130 (65)	70 (35)	200 (47)
Overweight	83 (73.5)	30 (26.5)	113 (26.5)
Obese	54 (74)	19 (26)	73 (17.1)

The socio-demographic questions were followed by physical activity/inactivity questions from ATLS (Part Two: questions 8 – 34), used to explore the potential influence of PA (i.e., a behavioural factor) on the weight of Saudi students in the Eastern Province.

4.9.2 Part Two: descriptive analysis of physical activity/inactivity as per ATLS

Part two of the ATLS and Food Dome questionnaire (questions 8 – 34) explored physical activity/inactivity. The initial analysis of the PA questions looked into the types of PA practiced by participants, frequency per week and minutes (Table 4.6).

Table 4.6 describes the types of PA for the study sample, broken down into more detailed tables in Appendix 11. As it can be seen from Table 4.6, the most frequently reported type of PA was walking (n = 320, 75%), followed by jogging/running (n = 242, 57%). Furthermore, most participants reported using the staircase (n = 389, 91.5%). However, in terms of the detail about PA, i.e., how many minutes were spent undertaking given types of activity, this was not reported by most participants. Thus, while the ATLS data on PA is able to show that participants reported they performed PA, most participants, did not indicate the length of time spent on each PA (see Appendix 11).

Table 4.6. ATLS data of study sample physical activity in respective totals (n = 426).

Physical Activity	Number of respondents for PA n (%)	Number of respondents who provided number of minutes/times n (%)	Number of respondents who did not answer number of minutes n (%)
Walking	320 (75)	44 (10)	276 (65)
Using staircase	389 (91.5)	39 (9.1)	351 (82.4)
Jogging/Running	242 (57)	34 (8)	208 (49)
Cycling	88 (20.7)	19 (4.5)	69 (16.2)
Swimming	104 (24.4)	20 (4.7)	84 (19.7)
Moderate Intensity Sports	126 (30)	126 (30)	300 (70)
Vigorous Intensity Sports	167 (39)	167 (39)	259 (61)
Self-defence sports	48 (11.3)	16 (3.8)	32 (7.5)
Strength training	123 (29)	27 (6)	96 (23)
Household work	261 (61.3)	37 (8.7)	224 (52.6)

Each activity was assigned a MET value. As per the ATLS analysis computation recommendations, the MET activity was classified into two categories moderate (i.e., slow walking, moderate walking, jogging & running, cycling, swimming, moderate-intensity

sports) and vigorous (i.e., self-defence, weight training, household activity, dancing, high-intensity sports) (see section 4.8.1).

Analysis of variance (ANOVA) was used to determine whether or not there is a statistically significant difference between MET of males or females and BMI classifications, i.e., underweight, normal weight, overweight, obese. There were no significant effects of MET moderate ($F = 0.18$, $p = 0.91$) and MET vigorous ($F = 1.07$, $p = 0.37$) on the BMI categories of males (i.e., underweight, normal weight, overweight, obese). There was no significant effect of MET moderate ($F = 1.91$, $p = 0.16$) and MET vigorous ($F= 0.31$, $p = 0.82$) on the BMI categories of females (i.e., underweight, normal weight, overweight, obese) (Table 4.7)

Table 4.7. MET activity stratified by gender and BMI categories.

BMI	**Male M(SD)**		**Female M(SD)**	
	METs-min/week of moderate intensity PA	METs-min/week of vigorous intensity PA	METs-min/week of moderate intensity PA	METs-min/week of vigorous intensity PA
Underweight	62.73 (52.17)	46.36 (15.67)	120^	90.00 (42.43)
Normal weight	78.72 (121.91)	97.69 (170.35)	42.00 (26.51)	128.48 (193.57)
Overweight	70.67 (78.68)	59.49 (36.92)	50.00 (39.69)	70.00 (30.98)
Obese	90.00 (67.53)	76.88 (55.82)	60.00 (42.43)	60.00 (0.00)
ANOVA *p*-value	$F = 0.18$ $p = 0.91$	$F = 1.07$ $p = 0.37$	$F = 1.91$ $p = 0.16$	$F = 0.31$ $p = 0.82$

^ *Only one sample. When there is one sample under this category, standard deviation cannot be applied (George & Mallery, 2002).*

To further explore behavioural factors influencing the rates of obesity, a Chi-square test was used to determine the association between PA mins per week (as reported in Table 4.6) and BMI categories (see Table 4.8). No significant differences were found for the MET moderate ($\chi^2 = 2.96$ $p = 0.40$) and MET vigorous ($\chi^2 = 5.74$ $p = 0.13$) activity and BMI categories (Table 4.8, below).

Table 4.8. The proportion of physical activity levels in relation to BMI categories.

	Activity category	Underweight n (%)	Normal weight n (%)	Overweight/ obese n (%)	Chi-square *p*-value
MET Moderate	Inactive (<180 METs-min/wk)	12 (100)	59 (95.2)	46 (90.2)	$\chi^2 = 2.96$ $p = 0.40$
	Active (180+ METs-min/wk)	0(0)	3 (4.8)	5 (9.8)	
MET Vigorous	Inactive (<180 METs-min/wk)	13 (100)	82 (91.1)	62 (96.9)	$\chi^2 = 5.74$ $p = 0.13$
	Active (180+ METs-min/wk)	0(0)	8 (8.9)	2 (3.1)	

The overall physical activity/inactivity analysis of the ATLS questionnaire showed that walking was the most practiced PA by n = 327 (77%), which is why a Chi-square test was used to determine the association between walking intensity and BMI of males and females. No significant differences were found for intensity (i.e., slow, moderate, fast, none) of daily walking and BMI categories either for males (χ^2 =14.69; p = 0.1) and females (χ^2= 10.35; p = 0.32), including those who were obese n = 73 (Table 4.9).

Table 4.9. Association of walking with BMI categories.

Variable	Males n (%)				Female n (%)			
	Underweight	Normal weight	Overweight	Obese	Underweight	Normal weight	Overweight	Obese
Physical Activity								
Slow Walk	3 (13)	9 (39.1)	5 (21.7)	6 (26.1)	1 (11.1)	4 (44.4)	1 (11.1)	3 (33.3)
Moderate Walk	12 (6.8)	87 (49.4)	51 (29)	26 (14.8)	7 (9)	40 (51.3)	22 (28.2)	9 (11.5)
Fast Walk	2 (6.9)	7 (24.1)	13 (44.8)	7 (24.1)	0(0)	8 (66.7)	3 (25)	1 (8.3)
None	9 (13.8)	27 (41.5)	14 (21.5)	15 (23.1)	6 (17.6)	18 (52.9)	4 (11.8)	6 (17.6)
Chi-square *p*-value	$\chi^2 = 14.69$ $p = 0.1$				$\chi^2 = 10.35$ $p = 0.32$			

The analysis of PA showed that more than half of the study sample practiced walking as a form of PA, although only a very small proportion of the study sample indicated the number of minutes per PA. Furthermore, no significant difference was found between moderate and vigorous MET and BMI categories. This pattern was also true for the types of walking (i.e., slow, moderate, fast, none) and BMI categories. Findings in relation to the first objective of the current research (i.e., to identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA) showed that the PA was not significantly associated with the BMI of the participants.

4.9.3 Part Three: descriptive analysis of sedentary behaviours as per ATLS

Part three of the ATLS and Food Dome questionnaire (questions 35 – 40) explored sedentary behaviours (i.e., screen time, including watching TV, playing video games, computer, and social media) that might influence the weight of Saudi students in the Eastern Province. A cross-tabulation was applied using Chi-square test to determine the association between screen time and BMI categories for males and females, which indicated a significant association (Table 4.10). Thus, males with more than two hours screen time were more likely to be in the normal weight category than those who spent less than two hours ($\chi^2 = 9.75$; $p = 0.021$). While females who had less than two hours screen time were more likely to be in normal weight category than those who spent more than two hours of screen time ($\chi^2 = 8.97$; $p = 0.03$) (Table 4.10).

Table 4.10. Analysis of screen time behaviours influencing the BMI of study sample (n = 426).

	Males BMI				**Females BMI**			
	Underweight n (%)	**Normal weight n (%)**	**Overweight n (%)**	**Obese n (%)**	**Underweight n (%)**	**Normal weight n (%)**	**Overweight n (%)**	**Obese n (%)**
Screen Time								
< 2 hours	15 (9.6)	58 (36.9)	55 (35)	29 (18.5)	13 (15.7)	41 (49.4)	15 (18.1)	14 (16.9)
≥ 2 hours	11 (8.1)	72 (52.9)	28 (20.6)	25 (18.4)	1 (2)	29 (58)	15 (30)	5 (10)
Chi-square *p*-value	$\chi^2 = 9.75$ $p = 0.021$*				$\chi^2 = 8.97$ $p = 0.03$*			

*Significant at 95%.

This was followed by comparing screen time average duration in minutes with BMI categories among males and females (Table 4.11, below). Analysis of variance (ANOVA) was used to determine whether or not there is a statistically significant difference between one independent variable (i.e., screen time of males and females separately) which has a number of different levels (BMI categories). There was a significant effect of screen time and BMI categories. Males with the highest mean of screen time were in the underweight category (M = 2.02 (SD ±2.21)), (F = 3.32, $p = 0.02$). Females with the highest mean of screen time were in the overweight category (M = 1.58 (SD ±1.71)), (F = 3.18, $p = 0.03$) (Table 4.11).

Table 4.11. Screen time stratified by gender and BMI categories.

Variable	BMI Classification - Male M (SD)				BMI Classification - Female M (SD)			
	Underweight	Normal weight	Overweight	Obese	Underweight	Normal weight	Overweight	Obese
Screen time hour/day	2.02 (2.21)	1.98 (1.86)	1.21 (1.62)	2.01 (2.20)	0.14 (0.53)	1.11 (1.47)	1.58 (1.71)	0.92 (1.47)
ANOVA *p*-value	F = 3.32 *p* = 0.02*				F = 3.18 *p* = 0.03*			

*Significant at 95%.

Findings from this section, in relation to the first objective of the current research (i.e., to identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA) showed that screen time was significantly associated with the BMI of the participants. Males who spent less than two hours of screen time per day were less likely to be in the normal weight categories than those who spent more than two hours. Females who spent less than two hours of screen time per day were more likely to be in the normal weight category than females who spent more than two hours.

4.9.4 Part Four: descriptive statistics of nutritional behaviours as per ATLS

Part four of the ATLS and Food Dome questionnaire (questions 41 – 50) explored nutritional behaviours that might influence rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA. Nutritional behaviour questions collected data on how many times per week participants consumed breakfast, sugar-sweetened drinks including soft beverages, vegetables, fruits, milk and dairy products, sweets and chocolates, energy drinks, and fast foods. Participants were asked to answer using a scale of zero to a maximum intake of 7 days per week. Analysis of variance (ANOVA) was used to determine whether or not there is a statistically significant difference between one independent variable (i.e., food consumption frequency of males and females separately) and different groups (i.e., BMI categories) (Table 4.12, below). The only significant effect was found for sweet consumption and BMI categories for males. Thus, males who consumed sweets more frequently M = 3.19 (SD ± (2.47) were more likely to be in the underweight category, (F = 3.70, $p = 0.01$). The frequency of consumption (times/week) of breakfast, vegetables, fruits, milk and dairy products, fast food, French fries, sweets, doughnuts, as well as energy drinks intake were not found to be statistically significant different by BMI category (Table 4.12).

Table 4.12. Frequency of food consumption behaviours in relation to BMI categories by gender.

Variable Frequency/week	**Males M (SD)**					**Females M (SD)**				
	Underweight	**Normal weight**	**Overweight**	**Obese**	**ANOVA *p*-value**	**Underweight**	**Normal weight**	**Overweight**	**Obese**	**ANOVA *p*-value**
Breakfast	3.50 (2.70)	4.14 (2.44)	4.02 (2.62)	4.02 (2.34)	*F= 0.47; p* = 0.70	4.07 (2.34)	3.93 (2.55)	3.57 (2.50)	3.22 (2.71)	*F= 0.42; p* = 0.74
Vegetables	4.69 (2.05)	3.39 (2.23)	3.65 (2.10)	3.78 (2.48)	*F= 2.54; p* = 0.06	3.79 (2.08)	3.74 (2.06)	4.13 (2.18)	2.63 (1.74)	*F= 2.18; p* = 0.09
Fruits	3.65 (2.15)	2.85 (2.18)	3.46 (2.45)	2.59 (2.44)	*F= 2.51; p* = 0.06	2.50 (1.95)	3.11 (2.17)	2.73 (1.93)	2.95 (2.07)	*F= 0.47; p* = 0.70
Milk/dairy products	4.23 (1.86)	4.22 (2.40)	3.87 (2.13)	4.17 (2.37)	*F= 0.44; p* = 0.72	3.86 (2.48)	3.59 (2.22)	3.50 (1.48)	4.42 (2.73)	*F= 0.86; p* = 0.47
Fast food	3.81 (2.25)	2.85 (2.03)	3.00 (1.54)	2.96 (2.08)	*F= 1.76; p* = 0.15	2.21 (1.85)	2.26 (1.62)	2.33 (1.42)	2.05 (1.68)	*F= 0.12; p* = 0.95
French fries/potato chips	2.38 (2.12)	2.34 (1.80)	2.27 (1.65)	2.50 (1.98)	*F= 0.19; p* = 0.91	3.50 (2.68)	2.31 (1.80)	2.50 (2.15)	1.63 (1.30)	*F= 2.59; p* = 0.06
Cake/doughnut	2.08 (1.79)	2.26 (1.90)	1.67 (1.57)	2.06 (1.78)	*F= 1.84; p* = 0.14	2.50 (1.63)	2.63 (2.17)	3.33 (2.55)	3.32 (2.31)	*F= 1.16; p* = 0.33
Sweets	3.19 (2.47)	2.92 (2.00)	2.06 (1.91)	2.59 (2.08)	*F= 3.70; p* = 0.01*	3.12 (1.67)	3.13 (2.33)	3.63 (2.28)	3.47 (2.48)	*F= 0.39; p* = 0.76
Energy drinks	2.08 (2.21)	1.32 (1.93)	1.11 (1.65)	0.96 (1.78)	*F= 2.36; p* = 0.07	1.86 (2.66)	0.67 (1.47)	1.27 (1.68)	0.89 (1.91)	*F= 2.21; p* = 0.09

*Significant at 95%.

A cross-tabulation was applied using a Chi-square test to explore whether there was an association between the frequency of consumption of food groups and gender (Table 4.13). The only statistically significant association was found for fast food consumption. Males were significantly more likely to consume fast food more than three times per week compared to females, while females were significantly more likely than males to eat fast food less than three times a week ($\chi^2 = 12.23$ $p = 0.001$). Consumption of other foods, such as breakfast, vegetables, fruits and dairy products, was not statistically associated with gender (Table 4.13).

Table 4.13. Food groups consumption frequency of study sample stratified by gender (n = 426).

Food Consumption Frequency	Males		Females		Chi-square *p*-value
Breakfast	**N**	**%**	**N**	**%**	
≥ 3 times	93	31.7	40	30.1	$\chi^2 = 1.90$, $p = 0.39$
< 3 times	162	55.3	69	51.9	
No Breakfast	38	13.0	24	18.0	
Vegetables					
<3	63	21.5	32	24.1	$\chi^2 = 3.27$, $p = 0.20$
≥ 3 times	199	67.9	94	70.7	
None	31	10.6	7	5.3	
Fruit					
<3 times	89	30.4	50	37.6	$\chi^2 = 5.28$, $p = 0.07$
≥ 3 times	152	51.9	70	52.6	
None	52	17.7	13	9.8	
Dairy (milk, yogurt and cheese products)					
<3 times	58	19.8	26	19.5	$\chi^2 = 0.64$, $p = 0.73$
≥ 3 times	215	73.4	95	71.4	
None	20	6.8	12	9.0	
Fast Food					
<3 times	100	34.1	70	52.6	$\chi^2 = 12.23$, $p = 0.001$*
≥ 3 times	164	56.0	52	39.1	
None	29	9.9	11	8.3	

*Significant at 95%.

Further analysis was conducted to explore the frequency of food consumption and association with BMI categories, using a Chi-square test (Table 4.14).

Table 4.14. Analysis of nutritional behaviours of study sample in relation to BMI categories (n = 426).

Variable	Males n (%)					Female n (%)				
	Underweight	Normal weight	Overweight	Obese	Chi-square *p*-value *	Underweight	Normal weight	Overweight	Obese	Chi-square *p*-value *
Breakfast intake										
≥ 3 times	6(6.5)	44 (47.3)	27 (29)	16 (17.2)	$\chi^2 = 6.65$ $p = 0.35$	3 (7.5)	18 (45)	14 (35)	5 (12.5)	$\chi^2 = 6.72$ $p = 0.35$
< 3 times	13 (8.0)	74 (45.7)	44 (27.2)	31 (19.1)		9 (13)	40 (58)	11 (15.9)	9 (13)	
No Breakfast	7 (18.4)	12 (31.6)	12 (31.6)	7 (18.4)		2 (8.3)	12 (50)	5 (20.8)	5 (20.8)	
Vegetable intake										
≥ 3 times	20 (10.1)	80 (40.2)	62 (31.2)	37 (18.6)	$\chi^2 = 10.53$ $p = 0.10$	10 (10.6)	52 (55.3)	22 (23.4)	10 (10.6)	$\chi^2 = 7.19$ $p = 0.30$
< 3 times	6 (9.5)	35 (55.6)	14 (22.2)	8 (12.7)		4 (12.5)	13 (40.6)	8 (25)	7 (21.9)	
None	0 (0)	15 (48.4)	7 (22.6)	9 (29)		0(0)	5 (71.4)	0(0)	2 (28.6)	
Fruit intake										
≥ 3 times	17 (11.2)	61 (40.1)	51 (33.6)	23 (15.1)	$\chi^2 = 13.93$ $p = 0.03$*	6 (8.6)	38 (54.3)	14 (20)	12 (17.1)	$\chi^2 = 6.55$ $p = 0.36$
< 3 times	7 (7.9)	49 (55.1)	17 (19.1)	16 (18)		7 (14)	24 (48)	15 (30)	4 (8)	
None	2 (3.8)	20 (38.5)	15 (28.8)	15 (28.8)		1 (7.7)	8 (61.5)	1 (7.7)	3 (23.1)	
Dairy products Intake										
≥ 3 times	22 (10.2)	95 (44.2)	57 (26.5)	41 (19.1)	$\chi^2 = 13.04$ p =0.04*	8 (8.4)	47 (49.5)	26 (27.4)	14 (14.7)	$\chi^2 = 12.39$ $p = 0.05$*
< 3 times	3 (5.2)	25 (43.1)	24 (41.4)	6 (10.3)		6 (23.1)	13 (50)	4 (15.4)	3 (11.5)	
None	1 (5)	10 (50)	2 (10)	7 (35)		0(0)	10 (83.3)	0(0)	2 (16.7)	
Sugar-sweetened drinks										
≥ 3 times	16 (10.3)	72 (46.2)	36 (23.1)	32 (20.5)	$\chi^2 = 23.77$ p =0.001*	9 (14.3)	30 (47.6)	14 (22.2)	10 (15.9)	$\chi^2 = 14.19$ $p = 0.03$*
< 3 times	7 (9.9)	36 (50.7)	13 (18.3)	15 (21.1)		4 (10.3)	16 (41)	14 (35.9)	5 (12.8)	
None	3 (4.5)	22 (33.3)	34 (51.5)	7 (10.6)		1 (3.2)	24 (77.4)	2 (6.5)	4 (12.9)	
Fast food intake										
≥ 3 times	17 (10.4)	64 (39)	51 (31.1)	32 (19.5)	$\chi^2 = 4.58$ $p = 0.23$	5 (9.6)	30 (57.7)	10 (19.2)	7 (13.5)	$\chi^2 = 0.94$ $p = 0.56$
< 3 times	8 (8)	51 (51)	27 (27)	14 (14)		6 (8.6)	36 (51.4)	18 (25.7)	10 (14.3)	
None	1 (3.4)	15 (51.7)	5 (17.2)	8 (27.6)		3 (27.3)	4 (36.4)	2 (18.2)	2 (18.2)	

French fries/potato chips intake										
≥ 3 times	13 (11.9)	46 (42.2)	24 (22)	26 (23.9)	$\chi^2 = 15.59$ $p = 0.02$*	8 (16)	27 (54)	10 (20)	5 (10)	$\chi^2 = 7.80$ $p = 0.25$
< 3 times	6 (4.3)	67 (47.5)	49 (34.8)	19 (13.5)		3 (4.3)	38 (54.3)	17 (24.3)	12 (17.1)	
None	7 (16.3)	17 (39.5)	10 (23.3)	9 (20.9)		3 (23.1)	5 (38.5)	3 (23.1)	2 (15.4)	
Cake/doughnut/biscuit intake										
≥ 3 times	13 (12.5)	54 (51.9)	18 (17.3)	19 (18.3)	$\chi^2 = 16.28$ $p = 0.01$*	7 (11.1)	30 (47.6)	15 (23.8)	11 (17.5)	$\chi^2 = 9.37$ $p = 0.15$
< 3 times	5 (4)	49 (39.5)	47 (37.9)	23 (18.5)		5 (9.4)	26 (49.1)	15 (28.3)	7 (13.2)	
None	8 (12.3)	27 (41.5)	18 (27.7)	12 (18.5)		2 (11.8)	14 (82.4)	0 (0)	1 (5.9)	
Sweets/chocolates intake										
≥ 3 times	16 (11.7)	74 (54)	23 (16.8)	24 (17.5)	$\chi^2 = 22.00$ p =0.001*	10 (13.2)	38 (50)	18 (23.7)	10 (13.2)	$\chi^2 = 7.11$ $p = 0.31$
< 3 times	6 (5.6)	38 (35.2)	45 (41.7)	19 (17.6)		3 (7)	21 (48.8)	12 (27.9)	7 (16.3)	
None	4 (8.3)	18 (37.5)	15 (31.3)	11 (22.9)		1 (7.1)	11 (78.6)	0(0)	2 (14.3)	
Energy drinks intake										
≥ 3 times	10 (17.9)	24 (42.9)	14 (25)	8 (14.3)	$\chi^2 = 8.86$ $p = 0.18$	5 (19.2)	11 (42.3)	8 (30.8)	2 (7.7)	$\chi^2 = 9.25$ $p = 0.16$
< 3 times	6 (7.5)	37 (46.3)	25 (31.3)	12 (15)		1 (7.7)	4 (30.8)	5 (38.5)	3 (23.1)	
None	10 (6.4)	69 (43.9)	44 (28)	34 (21.7)		8 (8.5)	55 (58.5)	17 (18.1)	14 (14.9)	

*Significant at 95%.

As shown in Table 4.14, breakfast, vegetables, fast food consumption and energy drink intake were not significantly associated with the BMI of male and female participants. However, fruit consumption was statistically significant with the BMI categories of males ($\chi^2 = 13.93$; $p = 0.03$) but not females ($\chi^2 = 6.55$; $p = 0.36$). The consumption of dairy products was statistically significant for the BMI of both males ($\chi^2 = 13.04$ $p = 0.04$) and females ($\chi^2 = 12.39$ $p = 0.05$). This pattern was also true for sugar-sweetened drinks associated with males' ($\chi^2 = 23.77$ $p = 0.001$) and females' ($\chi^2 = 14.19$; $p = 0.03$) BMI categories. Although fast food consumption and energy drink intake were not statistically significantly associated with BMI, French fries ($\chi^2 = 15.59$; $p = 0.02$), cake/doughnuts ($\chi^2 = 16.28$; $p = 0.01$), and sweets/chocolate ($\chi^2 = 22.00$; $p = 0.001$) was significantly associated with the BMI of males, although not significant for females. Males who consumed French fries less than three times per week were more likely to be in normal weight category. Males who consumed cake/doughnuts and sweets/chocolate more than three times per week were more likely to be in normal weight category (Table 4.14).

In the obese group (n = 73), more of the males that consumed fruits, French fries, cakes, sweets and doughnuts more than three times per week were likely to be obese, which was not the case for female participants (Table 4.14). The analysis of milk and dairy product consumption showed that participants who consumed this food group more than three times per week were significantly more likely to be in the normal weight category. In the obese group (n = 73), participants who consumed milk and dairy products were also more likely to be obese than those who consumed this food group less than three times a week or who did not consume it at all. Regarding the association of fast food consumption with being overweight or obese, this study found no such association (Table 4.14).

This stage was followed by the analysis of nutritional behaviours (times per week) and their difference with MET moderate and MET vigorous for males (Table 4.15). For females MET vigorous was considered (Table 4.15), but MET moderate was not considered since there were missing values (i.e., number of minutes) as show in Table 4.16. While the ATLS data on PA clearly shows that participants performed PA, most participants did not indicate the length of time spent on each PA, specifically females. An independent sample *t*-test was used to compare food consumption patterns with MET for males and MET for females and none of them showed statistical significance (Table 4.16).

Table 4.15. Nutritional behaviours relative to physical activity levels for males.

Variables (days/week)	Males					
	MET Moderate			MET Vigorous		
	Inactive (<180 METs-min/wk) Mean (SD)	Active (180+ METs-min/wk) Mean (SD)	***t*-test *p*-value**	Inactive (<180 METs-min/wk) Mean (SD)	Active (180+ METs-min/wk) Mean (SD)	***t*-test *p*-value**
Breakfast	4.45 (2.62)	4.88 (2.85)	*t = 0.66; p* = 0.50	4.19 (2.33)	3.88 (2.10)	*t = 0.33; p* = 0.75
Vegetable	3.81 (2.29)	3.13 (2.10)	*t = 0.42; p* = 0.46	3.86 (2.10)	5.25 (1.58)	*t = 1.36; p* = 0.18
Fruit	3.51 (1.93)	2.63 (1.77)	*t = 0.22; p* = 0.41	3.75 (2.38)	4.25 (2.31)	*t = 1.93; p* = 0.06
Milk/dairy products	4.42 (2.14)	3.13 (1.46)	*t = 0.106; p* = 0.14	4.19 (2.31)	4.63 (2.45)	*t = 1.44; p* = 0.16
Fast food	2.78 (2.45)	2.50 (2.45)	*t = 0.69; p* = 0.99	2.79 (1.82)	2.63 (2.07)	*t = 0.34; p* = 0.74
French fries	2.36 (1.68)	2.75 (1.98)	*t = 0.54; p* = 0.42	2.13 (1.65)	2.63 (1.85)	*t = 0.07; p* = 0.95
Cake/doughnut	2.27 (1.76)	2.00 (2.62)	*t = 0.69; p* = 0.65	1.86 (1.76)	2.13 (1.46)	*t = 0.14; p* = 0.89
Sweets/candy intake	2.89 (1.92)	2.38 (3.02)	*t = 0.49; p* = 0.54	2.50 (1.93)	2.75 (1.83)	*t = 1.25; p* = 0.22

Table 4.16. Nutritional behaviours relative to physical activity levels for females.

Variables (days/week)	Females		
	MET Vigorous		
	Inactive (<180 METs-min/wk) Mean (SD)	Active (180+ METs-min/wk) Mean (SD)	***t*-test *p*-value**
Breakfast	4.00 (2.13)	4.50 (0.71)	*t = 0.33; p* = 0.75
Vegetable	3.97 (2.09)	6.00 (0.00)	*t = 1.36; p* = 0.18
Fruit	2.97 (1.82)	5.50 (0.71)	*t = 1.93; p* = 0.06
Milk/dairy products	3.91 (2.01)	6.00 (1.41)	*t = 1.44; p* = 0.16
Fast food	2.44 (1.78)	2.00 (1.41)	*t= 0.34; p* = 0.74
French fries	2.59 (1.92)	2.50 (2.12)	*t = 0.07; p* = 0.95
Cake/doughnut	3.22 (2.07)	3.00 (4.24)	*t = 0.14; p* = 0.89
Sweets/candy	3.63 (2.37)	1.50 (0.71)	*t = 1.25; p* = 0.22

In sum, findings in relation to the first objective of the current research showed that males who consumed sweets more frequently were more likely to be underweight. Males were more likely to consume fast food more than three times per week than females, while females were more likely to eat fast food less than three times a week. Fruit consumption was statistically significant for BMI categories in males but had no significance on the BMI of females. The consumption of dairy products was statistically significant for the BMI of both males and not

females, i.e., participants who consumed dairy products were more likely to be in normal weight category. This pattern was also true for sugar-sweetened drinks. Although fast food and energy drinks were not statistically significantly associated with the BMI of participants, the consumption of French fries, cake/doughnuts, and sweets/chocolate was significantly associated with the BMI of males. However, this pattern was not significant for females. Lastly, the nutritional behaviours and their association with MET moderate and MET vigorous showed no statistical significance for males or females.

The ATLS analysis (i.e., parts two-four) covered the first objective of the current research. Findings of all three parts are summarised in 4.10 in line with the summary of findings for the second objective of the current research. The second objective aimed to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region. This was achieved by looking into part five of the ALTS & Food Dome questionnaire, questions 51 – 66 to be presented in the next section.

4.9.5 Part Five: FDDG questionnaire findings

Part five of the ALTS & Food Dome questionnaire aimed to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region. This part of the questionnaire included questions 51 – 66. This part of analysis included descriptive statistics on knowledge and behaviour in relation to FDDG (see section 4.9.5.1), as well as the association of demographic data in relation to knowledge behaviour towards the FDDG (see section 4.9.5.2).

4.9.5.1 Knowledge and behaviour in relation to FDDG

The analysis of part five – Food Dome questionnaire – began by looking at descriptive statistics on the knowledge and behaviour elements of the questionnaire presented in Table 4.17. The first question (№ 51) in the Food Dome questionnaire incorporated the elements of knowledge, attitudes, and behaviour in relation to the FDDG. Responses indicated that of n = 426 participants only n = 47 (11%) participants were following the FDDG, while more than half of the sample had never heard about them n = 379 (89%) (Table 4.17, below).

Despite the lack of knowledge about the FDDG, looking at question № 52, which asked participants to choose five food groups that experts recommend for the MENA region more than half of participants correctly identified the food groups as per FDDG [question № 52] (Table 4.17, below). Of these five groups, the least knowledge was about cereals (n = 254

(59.6%)) compared to vegetables (n = 259 (60.8%)), fruit (n = 335 (78.6%)), milk and dairy, products (n = 349 (81.9%)), meat, chicken, fish, eggs, legumes and nuts (n = 326 (76.5%)). Further analysis of recommended weekly consumption of five food groups showed that less than half of the study sample provided correct answers as per FDDG [questions № 53]. Thus, only n = 174 (40.8%) indicated cereals and their products, n = 164 (38.5%) vegetables, n = 135 (31.7%) fruit, and n = 134 (31.5%) milk and dairy products to be consumed daily (Table 4.17). Even fewer participants, n = 12 (2.8%), indicated correctly that meat, chicken, fish, eggs, legumes and nuts should be consumed 3-4 times per week (Table 4.17, below).

An analysis of knowledge about the recommended portion of cereals and their products [question № 56], foods rich in iron [question № 57], the colour of vegetables recommended for Arabs [question № 58], and types of meat recommended for Arabs [question № 59] showed that none of the participants identified the correct answer. Only n = 57 (13.4%) correctly indicated that one serving size of meat, chicken, and fish should not exceed 50-80g [question № 60] and less than half of study sample n = 148 (34.7%) correctly indicated that the amount of energy from fat should not exceed 30% of daily calories as per FDDG [question № 61].

Table 4.17. Knowledge and behaviour in relation to the FDDG of study sample (n = 426).

Part A. Knowledge of FDDG of study sample (n = 426).				
Questionnaire questions^	**Potential answers**	**Participant responses n (%)**		
Knowledge – Behaviour				
(51) Do you follow the recommendations by Food Dome dietary guidelines designed specifically for the MENA region?	Yes, I follow Food Dome guidelines	47(11)		
	No, I do not follow Food Dome guidelines	81 (19)		
	No, I have not ever heard about such guidelines	187 (43.9)		
	No, I do not know, but if I knew I would follow specific dietary guidelines	111 (26.1)		
Knowledge		**Correct Answer n (%)**	**Wrong Answer n (%)**	**Not sure n (%)**
(52) Experts classify foods into groups. Please, choose five food groups recommended specifically for the MENA region.	Cereals and their products	254 (59.6)	43 (10.1)	129 (30.3)
	Vegetables	259 (60.8)	42 (9.9)	125 (29.3)
	Fruit	335 (78.6)	52 (12.2)	39 (9.2)
	Milk and Dairy Products	349 (81.9)	38 (8.9)	39 (9.2)
	Meat, chicken, fish, eggs, legumes and nuts	326 (76.5)	21 (4.9)	79 (18.5)
	Vegetables and legumes, beans	339 (79.6)	41 (9.6)	46 (10.8)
	Fruits and vegetables	61 (14.3)	365 (85.7)	0 (0)

(53) How many times per week do experts recommend Arab people to eat the following foods?		**Once a week n (%)**	**3-4 times per week n (%)**	**5 times a week n (%)**	**Daily n (%)**	**Not sure n (%)**
	Cereals and their products	46 (10.8)	100 (23.5)	50 (11.7)	174 (40.8)	56 (13.1)
	Vegetables	60 (14.1)	103 (24.2)	50 (11.7)	164 (38.5)	49 (11.5)
	Fruit	48 (11.3)	133 (31.2)	55 (12.9)	135 (31.7)	55 (12.9)
	Milk and dairy products	62 (14.6)	119 (27.9)	51 (12.0)	134 (31.5)	60 (14.1)
	Meat, chicken, fish, eggs, legumes and nuts	4 (0.9)	12 (2.8)	9 (2.1)	12 (2.8)	389 (91.3)
(56) According to the Food Dome what size is a recommended portion of cereals and their products?		**Correct Answer n (%)**		**Wrong Answer n (%)**	**Not sure n (%)**	
	30g cornflakes	0 (0)		248 (58.2)	178 (41.8)	
	¼ Arabic flat bread	0 (0)		266 (62.4)	160 (37.6)	
	6 small crackers	0 (0)		304 (71.4)	122 (28.6)	
	½ Arabic flat bread	0 (0)		355 (83.3)	71 (16.7)	
	½ cup cooked cereals (rice, wheat oats, macaroni)	0 (0)		243 (57.0)	183 (43.0)	
	100g cornflakes	0 (0)		328 (77.0)	98 (23.0)	
(57) Do you think these foods are typically rich source of iron?	Poultry (chicken)	0 (0)		274 (64.3)	152 (35.7)	
	Spinach	0 (0)		102 (23.9)	324 (76.1)	
	Broccoli	0 (0)		118 (27.7)	308 (72.3)	
	Beans	0 (0)		229 (53.8)	197 (46.2)	
	Nuts	0 (0)		249 (58.5)	177 (41.5)	
	Grains (whole wheat, fortified cereals)	0 (0)		213 (50.0)	213 (50.0)	
	Dried fruits	0 (0)		252 (59.2)	174 (40.8)	
(58) What colour vegetables are recommended for Arabs to eat more often?	Red (tomatoes, beets)	0 (0)		389 (91.3)	37 (8.7)	
	Blue/ purple (eggplant)	0 (0)		270 (63.4)	156 (36.6)	
	Dark green (spinach, broccoli)	0 (0)		126 (29.6)	300 (70.4)	
	Orange (carrot)	0 (0)		177 (41.5)	249 (58.5)	
(59) What types of meat are recommended to Arabs?	Fish	0(0)		89 (20.9)	337 (79.1)	
	Chicken	0(0)		129 (30.3)	297 (69.7)	
	Lean meat	0(0)		232 (54.5)	194 (45.5)	
	Red meat (lamb)	0(0)		339 (79.6)	87 (20.4)	
(60) According to the Food Dome, what do you think is one serving size of meat, chicken, fish?	50-80g	57 (13.4)		0 (0)	0(0)	
	100-120g	0(0)		369 (86.6)	0(0)	
	200g	0(0)		0(0)	0(0)	
(61) According to the Food Dome, the amount of energy from fat should not exceed....	30% of daily calories	148 (34.7)		0(0)	0(0)	
	10% of daily calories	0(0)		278 (65.3)	0(0)	
	50% of daily calories	0(0)		0(0)	0(0)	

Part B. Behaviour of study sample in relation to the FDDG (n = 426).

Questionnaire questions	**Questionnaire responses**	**Participant responses n (%)**				
		2-3 serv. per day	**2-4 serv. per day**	**3-5 serv. per day**	**6-11serv. per day**	**Not sure n (%)**
(54) How many servings of the following foods do you eat as a minimum on a daily basis?	Cereals and their products	252 (59.2)	49 (11.5)	26 (6.1)	0 (0)	99 (23.2)
	Vegetables	147 (34.5)	93 (21.8)	84 (19.7)	4 (0.9)	98 (23.0)
	Fruit	167 (39.2)	89 (20.9)	65 (15.3)	1 (0.2)	104 (24.4)
	Milk and dairy products	163 (38.3)	81 (19.0)	92 (21.6)	2 (0.5)	88 (20.7)
	Meat, chicken, fish, eggs, legumes and nuts	161 (37.8)	92 (21.6)	73 (17.1)	6 (1.4)	94 (22.1)

		< 5 times n (%)	≥ 5 times n (%)	Not sure n (%)
(62) How many times a week do you consume the following foods?	Cereals & their products	287 (67.3)	86 (20.2)	53 (12.4)
	Vegetables	248 (58.3)	141 (33)	37 (8.7)
	Fruit	263 (61.7)	116 (27.2)	47 (11.0)
	Milk & dairy products	193 (45.3)	119 (46.7)	34 (8.0)
	Meat, chicken, fish, eggs, legumes and nuts	174 (40.9)	223 (52.3)	29 (6.8)
(63) Which of the following vegetables do you consume at least 5 times per week?		**Yes n (%)**	**No n (%)**	**Not Sure n (%)**
	Spinach	104 (24.4)	322 (75.6)	0 (0)
	Broccoli	108 (25.4)	318 (74.6)	0 (0)
	Lettuce	273 (64.1)	153 (35.9)	0 (0)
	Carrot	220 (51.6)	206 (48.4)	0 (0)
	Pumpkin	74 (17.4)	352 (82.6)	0 (0)
	Yellow bell pepper	123 (28.9)	303 (71.1)	0 (0)
(64) Which of the following products do you consume regularly (i.e., daily)?	30g cornflakes	136 (31.9)	189 (44.4)	101 (23.7)
	1/4 Arabic flat bread	207 (48.6)	131 (30.8)	88 (20.7)
	6 small crackers	151 (35.4)	186 (43.7)	89 (20.8)
	1/2 Arabic flat bread	232 (54.5)	118 (27.7)	76 (17.8)
	1/2 cup cooked cereals (rice, wheat oats, macaroni)	319 (74.9)	44 (10.3)	63 (14.7)
	100g cornflakes	89 (20.9)	216 (50.7)	121 (28.4)
(65) Thinking about the choice of meat/fish. Which of the following meat do you prefer?	Fish	284 (66.7)	142 (33.3)	0 (0)
	Chicken	311 (73)	115 (27)	0 (0)
	Lean Meat	211 (49.5)	215 (50.5)	0 (0)
	Red Meat (lamb)	235 (55.2)	191 (44.8)	0 (0)
	I don't eat meat	67 (15.7)	359 (84.3)	0 (0)

^Blue colour indicates the correct recommendation by FDDG.

Further analysis looked into behaviour in relation to FDDG. As can be seen, none of the participants consumed cereals and their products 6-11 servings per day, less than half n = 163 (38.3%) consumed 2-3 servings of milk and dairy products, and even fewer (n = 92 (21.6%)) consumed meat, chicken, fish, eggs, legumes and nuts 2-4 servings [question № 54]. In addition, only n = 84 (19.7%) and n = 65 (15.3%) consumed 3-5 servings of vegetables and fruit, respectively [question № 54] (Table 4.17, above).

Food group weekly consumption patterns [question № 62 revealed that less than half of the study sample, n = 119 (46.7%), consumed milk and dairy products more than five times per week (Table 4.17, above). Even fewer participants, n = 86 (20.2%), consumed cereals and their products, n = 141 (33%) vegetables, and n = 116 (27.2%) fruit more than five times per week patterns [question № 62]. In contrast, more than half of the study sample, n = 223 (52.3%), consumed meat, chicken, fish, eggs, legumes and nuts more than five times a week, which was against the recommendations of FDDG, and only n = 174 (40.9%) consumed this

food groups less than five times per week as per FDDG patterns [question № 62]. In terms of vegetables, lettuce (n = 273 (64.1%)) and carrots (n = 220 (51.6%)) were the vegetables that were most consumed at least 5 times per week (consistent with FDDG) [question № 63]. More than half of the study sample, n = 319 (74.9%), consumed cooked cereals (rice, wheat oats, macaroni), which was the least recommended in this food group [question 64]. Lastly, questions on meat/fish choice showed that participants consumed chicken n = 311 (73%) and fish n = 284 (66.7%) more than other types of meat, which was consistent with the recommendations of the FDDG [question № 65] (Table 4.17, above). The summary analysis of the final open-ended question on how the participants would like to be informed about the Food Dome, showed a preference for mobile applications (apps) [question № 66].

Findings on the knowledge and behaviour in relation to FDDG showed that most participants lacked knowledge of the guidelines and their recommendations for the Arab people. While more than half of the study sample indicated the correct food groups as indicated in the FDDG, less than half knew the recommended serving sizes and weekly consumption patterns. None of the participants knew what types of cereals and their products were recommended for the Arab population. Similarly, none of the participants knew the colour of vegetables and the source of iron-rich foods. Despite the lack of knowledge, some nutritional choices of participants were consistent with the FDDG. Less than half of the study sample consumed five food groups per FDDG, but particular choices were consistent with FDDG, including types of vegetables, meat and fish. Taking into consideration this emerging data, further analysis was undertaken to determine whether there were differences between knowledge and behaviour of participants in relation to FDDG by age, gender and BMI categories. Findings are presented in the next section.

4.9.5.2 Age, gender, BMI analysis of knowledge and behaviour towards FDDG

To establish differences between knowledge and behaviour in relation to FDDG by age, gender and BMI categories the average number of correct answers for the percentage values were calculated for each variable, as described in 4.8.1. Analysis of variance (ANOVA) was used to determine whether or not there were statistically significant differences between knowledge and age groups, as well as BMI classifications (Table 4.18, below). There was no significant effect of age ($F = 0.17$, $p = 0.85$) and BMI categories ($F = 0.27$, $p = 0.85$) on knowledge of the FDDG. Furthermore, an independent sample *t*-test was applied, to compare the mean scores of FDDG knowledge and the average percentage values for each gender.

There was no significant effect statistically ($t = 0.40$; $p = 0.69$) for gender despite females (M = 38.36, SD ± 11.15) having higher knowledge than males (M = 37.88, SD ± 11.89) (Table 4.18).

Table 4.18. Age, gender, BMI analysis of knowledge in relation to FDDG (n = 426).

Mean by Age Group (SD)			**Mean by Gender (SD)**		**Mean by BMI Category (SD)**			
18-20-years	**21-23-years**	**24-25-years**	**Male**	**Female**	**Underweight**	**Normal Weight**	**Overweight**	**Obese**
38.43 (12.05)	37.70 (11.54)	38.07 (11.28)	37.88 (11.89)	38.36 (11.15)	38.21 (13.44)	37.54 (12.68)	38.75 (9.72)	38.16 (10.51)
ANOVA *p*-value	F = 0.17 $p = 0.85$		t = 0.40 $p = 0.69$		F = 0.27 $p = 0.85$			

Note: Unit of measurement was percentage for each mean values.

The age, gender, and BMI analysis of FDDG knowledge was followed by the analysis of association between age, gender, BMI and behavioural patterns in relation to FDDG. A Chi-square test of independence was used to determine the relationship between age and food consumption patterns in relation to FDDG. There was a significant association between age and question № 51. Participants aged 21-23 years were more likely either to know, follow or not to follow FDDG ($\chi^2 = 18.38$; $p = 0.005$) (Table 4.19, below). Further findings on association between age and food consumption, food group/types preferences showed that there was no significant difference. However, these findings require discussion against the objectives of this research and evidence in the literature to present the complete picture and allow a comparison for future studies.

The number of participants who reported consumption of five food groups in FDDG [question № 62] was higher among the 21-23 age group in all the categories except for meat, chicken, fish, eggs, legumes and nuts (Table 4.19, below). However, a Chi-square test of independence showed that this was not significant ($\chi^2 = 12.49$; $p = 0.13$). The number of participants who reported consumption of vegetables as per FDDG was higher in 21-23 age group, still a Chi-square test of independence showed that there was no significant difference ($\chi^2 = 5.86$ $p = 0.83$). This pattern was consistent for the choice of cereals and their products, where more participants in 21-23 age group chose products as per FDDG. A Chi-square test of independence showed that there was no significant difference ($\chi^2 = 13.13$; $p = 0.22$). Lastly, for the question № 65 although the number of participants who reported preference of red meat, fish, as per lean meat and chicken FDDG was higher among the 21-23 age group; a

Chi-square test of independence showed that there was no significant association between age and choice of meat and fish ($\chi^2 = 9.08$; $p = 0.34$) (Table 4.19).

Table 4.19. Age analysis in relation to behaviour toward the FDDG.

Questionnaire questions	Questionnaire responses	Frequency by age group, n (%)			
		18-20-years	21-23-years	24-25-years	Chi-square *p*-value
(51) Do you follow the recommendations by Food Dome dietary guidelines designed specifically for the MENA region?	Yes, I follow Food Dome guidelines	18 (38.3)	20 (42.6)	9 (19.1)	$\chi^2 = 18.38$ $p = 0.005$*
	No, I do not follow Food Dome guidelines	31 (38.3)	38 (46.9)	12 (14.8)	
	No, I have not ever heard about such guidelines	65 (34.8)	95 (50.8)	27 (14.4)	
	No, I do not know, but if I knew I would follow specific dietary guidelines	34 (30.6)	40 (36)	37 (33.3)	
(62) How many times a week do you consume following foods?	Cereals & their products **≥ 5 times**	76 (33.9)	99 (44.2)	49 (21.9)	$\chi^2 = 12.49$ $p = 0.13$
	Vegetables **≥ 5 times**	70 (32.7)	105 (49.1)	39 (18.2)	
	Fruit **≥ 5 times**	56 (29.5)	97 (51.1)	37 (19.5)	
	Milk & dairy products **≥ 5 times**	71 (38.4)	89 (48.1)	25 (13.5)	
	Meat, chicken, fish, eggs, legumes and nuts **< 5 times**	12 (57.1)	6 (28.6)	3 (14.3)	
(63) Which of the following vegetables do you consume at least 5 times per week?	Spinach	40 (38.5)	36 (34.6)	28 (26.9)	$\chi^2 = 5.86$ $p = 0.83$
	Broccoli	42 (38.9)	42 (38.9)	24 (22.2)	
	Lettuce	93 (34.1)	123 (45.1)	57 (20.9)	
	Carrot	76 (34.5)	100 (45.5)	44 (20)	
	Pumpkin	26 (35.1)	33 (44.6)	15 (20.3)	
	Yellow bell pepper	43 (35)	50 (40.7)	30 (24.4)	
(64) Which of the following products do you consume regularly (i.e., daily)?	30g cornflakes	49 (36)	83 (46.3)	24 (17.6)	$\chi^2 = 13.13$ $p = 0.22$
	1/4 Arabic flat bread	55 (26.6)	101 (48.8)	51 (24.6)	
	6 small crackers	50 (33.1)	68 (45)	33 (21.9)	
	1/2 Arabic flat bread	59 (25.4)	111 (47.8)	62 (26.7)	
	1/2 cup cooked cereals (rice, wheat oats, macaroni)	106 (33.2)	147 (46.1)	66 (20.7)	
	100g cornflakes	23 (25.8)	42 (47.2)	24 (27)	
(65) Thinking about the choice of meat/fish. Which of the following meat do you prefer?	Fish	91 (32.0)	131 (46.1)	62 (21.8)	$\chi^2 = 9.08$ $p = 0.34$
	Chicken	116 (37.3)	136 (43.7)	59 (19)	
	Lean Meat	75 (35.5)	97 (46)	39 (18.5)	
	Red meat (lamb)	68 (28.9)	116 (49.4)	51 (21.7)	
	I don't eat	15 (22.4)	35 (52.2)	17 (25.4)	

*Significant at 95%.

The age analysis was followed by the analysis of the association between gender and behaviour in relation to FDDG. A Chi-square test of independence was used to determine the relation between gender and behaviours towards FDDG. There were no significant gender association in behaviours towards FDDG (Table 4.20). Thus, although the number of males

who either know, follow or not to follow FDDG was higher than females [question № 51], a Chi-square test of independence showed no significant gender association ($\chi^2 = 1.92$; p = 0.59) in responses. Furthermore, the number of males who consumed five food groups as per FDDG [question № 62] was higher compared to females, yet, a Chi-square test of independence showed no significant difference ($\chi^2 = 5.95$; p = 0.20). Similarly, the number of males who consumed vegetables [question № 63], cereals and their products [question № 64], red meat [question № 65] as per FDDG was higher compared to females, however, this difference was not significant for vegetables ($\chi^2 = 7.04$; p = 0.22), cereals and their products ($\chi^2 = 2.91$; p = 0.71) and the choice of meat and fish ($\chi^2 = 4.93$; p = 0.29) (Table 4.20).

Table 4.20. Gender analysis in relation to behaviour toward the FDDG (n = 426).

Questionnaire questions	**Questionnaire responses**	**Frequency by gender, n (%)**		
		Male	**Female**	**Chi-square *p*-value**
(51) Do you follow the recommendations by Food Dome dietary guidelines designed specifically for the MENA region?	Yes, I follow Food Dome guidelines	32 (68.1)	15 (31.9)	$\chi^2 = 1.92$ $p = 0.59$
	No, I do not follow Food Dome guidelines	53 (65.4)	28 (34.6)	
	No, I have not ever heard about such guidelines	135 (72.2)	52 (27.8)	
	No, I do not know, but if I knew I would follow specific dietary guidelines	73 (65.8)	38 (34.2)	
(62) How many times a week do you consume following foods?	Cereals & their products **≥ 5 times**	149 (66.5)	75 (33.5)	$\chi^2 = 5.95$ $p = 0.20$
	Vegetables **≥ 5 times**	145 (67.8)	69 (32.2)	
	Fruit **≥ 5 times**	142 (74.7)	48 (25.3)	
	Milk & dairy products **≥ 5 times**	138 (74.6)	47 (25.4)	
	Meat, chicken, fish, eggs, legumes and nuts **< 5 times**	16 (76.2)	5 (23.8)	
(63) Which of the following vegetables do you consume at least 5 times per week?	Spinach	66 (63.5)	38 (36.5)	$\chi^2 = 7.04$ $p = 0.22$
	Broccoli	66 (61.1)	42 (38.9)	
	Lettuce	186 (68.1)	87 (31.9)	
	Carrot	143 (65)	77 (35)	
	Pumpkin	42 (56.8)	32 (43.2)	
	Yellow bell pepper	89 (72.4)	34 (27.6)	
(64) Which of the following products do you consume regularly (i.e., daily)?	30g cornflakes	96 (68.4)	43 (31.6)	$\chi^2 = 2.91$ $p = 0.71$
	1/4 Arabic flat bread	143 (69.1)	64 (30.9)	
	6 small crackers	96 (63.6)	55 (36.4)	
	1/2 Arabic flat bread	165 (71.1)	67 (28.9)	
	1/2 cup cooked cereals (rice, wheat oats, macaroni)	220 (69)	99 (31)	
	100g cornflakes	64 (71.9)	25 (28.1)	
(65) Thinking about the choice of meat/fish. Which of the following meat do you prefer?	Fish	199 (70.1)	85 (29.9)	$\chi^2 = 4.93$ $p = 0.29$
	Chicken	209 (67.2)	102 (32.8)	
	Lean Meat	151 (71.6)	60 (28.4)	
	Red meat (lamb)	172 (73.2)	63 (26.8)	
	I don't eat	41 (61.2)	26 (38.8)	

Lastly, the analysis of the association between BMI categories and behaviour in relation to FDDG was conducted. A Chi-square test of independence was used to determine the relationships between BMI categories and behaviours in relation to FDDG. There were no significant BMI association in behaviours towards FDDG (Table 4.21, below). Thus, while the number of participants who followed, did not know and wanted to follow FDDG was higher in normal weight category, those who did not follow FDDG was higher in overweight [question № 51]. However, a Chi-square test of independence showed no significant difference ($\chi^2 = 15.61$; $p = 0.76$). Furthermore, a Chi-square test of independence showed no significant difference either for food groups ($\chi^2 = 17.81$; $p = 0.12$ [question № 62]), vegetable choice ($\chi^2 = 13.08$ $p = 0.60$ question № 63), meat and fish consumption ($\chi^2 = 1.31$; $p = 0.999$, [question № 65]) (Table 4.21). Lastly, although the number of participants who chose cooked cereals most often, the least recommended in FDDG, were also in normal weight category, a Chi-square test of independence showed no significant difference ($\chi^2 = 10.57$; $p = 0.78$ [question № 64]) (Table 4.21, below).

Table 4.21. BMI analysis in relation to behaviour toward the FDDG (n = 426).

Questionnaire questions	**Questionnaire responses**	**Frequency by BMI category, n (%)**				
		Underweight	**Normal Weight**	**Overweight**	**Obese**	**Chi-square *p*-value**
(51) Do you follow the recommendations by Food Dome dietary guidelines designed specifically for the MENA region?	Yes, I follow Food Dome guidelines	4 (8.5)	26 (55.3)	12 (25.5)	5 (10.6)	$\chi^2 = 15.61$ $p = 0.76$
	No, I do not follow Food Dome guidelines	7 (8.6)	30 (37)	34 (42)	10 (12.3)	
	No, I have not ever heard about such guidelines	19 (10.2)	91 (48.7)	43 (23)	34 (18.2	
	No, I do not know, but if I knew I would follow specific dietary guidelines	10 (9)	53 (47.7)	24 (21.6)	24 (21.6)	
(62) How many times a week do you consume following foods?	Cereals & their products **≥ 5 times**	19 (8.5)	102 (45.5)	54 (24.1)	49 (21.9)	$\chi^2 = 17.81$ $p = 0.12$
	Vegetables **≥ 5 times**	23 (10.7)	88 (41.1)	58 (27.1)	45 (21)	
	Fruit **≥ 5 times**	20 (10.5)	83 (43.7)	59 (31.1)	28 (14.7)	
	Milk & dairy products **≥ 5 times**	18 (9.7)	81 (43.8)	55 (29.7)	31 (16.8)	
	Meat, chicken, fish, eggs, legumes and nuts **< 5 times**	0 (0)	17 (81)	1 (4.8)	3 (14.2)	
(63) Which of the following vegetables do you consume at least 5 times per week?	Spinach	9 (8.7)	48 (46.2)	29 (27.9)	18 (17.3)	$\chi^2 = 13.08$ $p = 0.60$
	Broccoli	3 (2.8)	54 (50)	37 (34.3)	14 (13)	
	Lettuce	27 (9.9)	124 (45.4)	75 (27.5)	47 (17.2)	
	Carrot	16 (7.3)	106 (48.2)	67 (30.5)	31 (14.1)	
	Pumpkin	5 (6.8)	34 (45.9)	25 (33.8)	10 (13.5)	
	Yellow bell pepper	9 (7.3)	62 (50.4)	41 (33.3)	11 (8.9)	

(64) Which of the following products do you consume regularly (i.e., daily)?	30g cornflakes	11 (8.1)	71 (52.2)	29 (21.3)	25 (18.4)	χ^2=10.57 p = 0.78
	1/4 Arabic flat bread	17 (8.2)	103 (49.8)	58 (28)	29 (14)	
	6 small crackers	16 (10.6)	77 (51)	37 (24.5)	21 (13.9)	
	1/2 Arabic flat bread	19 (8.2)	107 (46.1)	62 (26.7)	44 (19)	
	1/2 cup cooked cereals (rice, wheat oats, macaroni)	29 (9.1)	149 (46.7)	93 (29.2)	48 (15)	
	100g cornflakes	8 (9)	37 (41.6)	31 (34.8)	12 (14.6)	
(65) Thinking about the choice of meat/fish. Which of the following meat do you prefer?	Fish	25 (8.8)	130 (45.8)	80 (28.2)	49 (17.3)	χ^2=1.31 p = 0.999
	Chicken	25 (8)	146 (46.9)	87 (28)	53 (17)	
	Lean Meat	17 (8.1)	100 (47.4)	60 (28.4)	34 (16.1)	
	Red meat (lamb)	23 (9.8)	107 (45.5)	63 (26.8)	42 (17.9)	
	I don't eat	7 (10.4)	31 (46.3)	18 (26.9)	11 (16.4)	

This comprehensive analysis of the ATLS and Food Dome questionnaire allowed to first two objectives of the research to be addressed, generating novel patterns, confirming evidence and recording gaps (as highlighted in the summary below), leading to further investigation during qualitative phase of research (Chapter 5).

4.10 Phase I summary

This chapter covered Phase I of this PhD research, by addressing the first two objectives:

1. To identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA (Phase I – quantitative).
2. To investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region (Phase I – quantitative).

The findings of the first objective of this study showed that most of the nutritional PA, and sedentary behavioural factors in the questionnaire did not influence obesity amongst the participants. While fruit intake was significantly associated with the normal weight of male participants, it did not affect the weight of females. Although most of the study sample skipped breakfast and consumed vegetables less than three times a week, this behaviour was not associated with overweight or obesity. Regarding the association of fast food consumption with being overweight or obese, this study found no such association. In contrast, male participants who consumed fast food, sweets, or energy drinks were significantly more likely to be of normal weight; while the consumption of unhealthy foods was not reflected in the weight of the female participants. The analysis of milk and dairy

product consumption showed that participants who consumed this food group more than three times per week were significantly more likely to be in the normal weight category.

In the obese group (n = 73), more of the males that consumed fruits, French fries, cakes, sweets and doughnuts more than three times per week were likely to be obese, which was not the case for female participants. At the same time, participants in the obese group (n = 73) who consumed milk and dairy products were also more likely to be obese than those who consumed this food group less than three times a week or who did not consume it at all.

The second part of the first objective of this research aimed to identify PA behaviours influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA. This research found no statistically significant evidence to confirm that being less physically active is associated with overweight and obesity, including those who were obese n = 73. While walking was the most commonly practiced PA, it was not associated with the BMI categories of participants. In terms of sedentary behaviours, although the males spent more than two hours of screen time daily, they were not overweight or obese; on the contrary, they were significantly more likely to be of normal weight. At the same time, females who spent less than two hours of screen time were more likely to have a normal weight. However, no association was found with overweight and obesity among females.

The second objective of this research aimed to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region. While most of the study sample reported that they had never heard about FDDG (89%), 59.6% indicated food groups correctly as per FDDG. Nevertheless, fewer than half of the participants chose the correct answers on knowledge of the weekly recommended consumption frequency in each food group. Moreover, none of the participants gave correct answers in respect of cereals and their products, the colour of vegetables and the types of meat recommended for Arabs, or foods rich in iron. Age, gender, and BMI were not statistically significantly associated with knowledge, attitudes and behaviour in relation to the FDDG. These aspects were consistent across the entire sample, allowing to suggest that further research in proposing recommendations may not require specific consideration for age, gender or BMI. The interpretation of these findings, together with the interpretation of the Phase II findings, will be addressed in the discussion chapter, where the findings will be critically discussed in relation to the current evidence base.

Chapter 5 (focus group discussions) was anticipated to provide insights about the target populations' attitudes towards the FDDG and food choices in general. This approach allowed participants to explain, critique, and share experiences, opinions, observations, preferences, and beliefs about their PA and nutritional behaviours. The rationale for the focus group method was presented in section 3.4. In Chapter 5, the process of focus group administration, data collection and analysis are presented.

Chapter 5 - Qualitative Study – Phase II

5.1 Chapter overview

Chapter 5 is dedicated to Phase II of this research, i.e., to explore the knowledge of and attitudes towards the FDDG among the target population and gain a more in-depth understanding of the findings from Phase I through focus group discussions. Chapter 5 will begin with the rationale for developing the focus group guide and questions when conducting a cross-language research, a discussion of the focus group composition and size, participant sampling and recruitment, ethics, and how the focus groups were moderated. This is followed by a critical discussion of how the focus groups were analysed, including the rationale for using framework analysis (FA). The findings from Phase II will be presented by the themes and sub-themes derived from FA. This chapter is concluded with a summary of the key findings of Phase II and a reflexive statement.

5.2 Focus group guide and questions

The data collection tool in focus group research is the discussion guide, which can elicit information to meet the research objectives (Morgan, 1996; Gibbs, 1997; Ryen, 2016; Lowton, 2018; Sim & Waterfield, 2019). “In essence, the moderator uses the guide as a resource to maintain the balance between the researchers’ focus and the group’s discussion” (Morgan, 1997, p. 48). Hence, sufficient time and careful attention must be given to developing the discussion guide (Morgan, 1996; Gibbs, 1997).

The focus group guide flow depends on the nature of the group and the specific function of the study; the questions should be well-written, clear, concise, open-ended and unbiased (Beauchamp & McCullough, 1985; Morgan, 1996). In addition, questions should be sufficiently stimulating to keep the discussion active and ongoing; relevant to participants; capable of providing factual data; lead to detailed responses and rich data; clear, avoid ambiguity; written and pronounced in language that participants understand (Ryen, 2016; Lowton, 2018; Sim & Waterfield, 2019). In this regard, open-ended questions can provide a wealth of information about participants’ opinions and feelings, resulting in a greater variety of responses (Davis et al., 2019). The diction and tone of questions are important because the information and quality largely depend on these factors (Gill et al., 2008; Lowton, 2018; Sim & Waterfield, 2019).

A focus group discussion is a dynamic exercise, and time should be allowed to explore new points raised from the prepared discussion guide; this process is critical to the success of a group discussion (Krueger & Casey, 2000; Lowton, 2018; Davis et al., 2019). Most focus group guides have approximately twelve to fifteen questions. This number of questions allows for additional follow-up questions (Lowton, 2018; Davis et al., 2019).

The guide for the current research was carefully designed to explore participants' attitudes, opinions and experiences in relation to the study aim and objectives. Developing a culturally sensitive discussion guide was paramount to appreciate the local culture and adhering to ethical standards, thereby avoiding controversial and provocative themes (Hennink, 2007). Hence, the focus group guide was developed based on the FDDG, taking into consideration the cultural norms of the Saudi population. Questions were designed to be clear and simple, free of difficult language and specific terminology, allowing all participants to actively contribute to discussion (Krueger & Casey, 2000). No questions about prohibited foods/drinks and those considered *haram*[11] were included (i.e., alcoholic beverage or pork) (Hennink, 2007; Musaiger, 2012).

When there is a language barrier between researchers and participants, research becomes known as cross-language research, with subsequent language-related challenges (Temple, 2002; Croot et al., 2011; Squires et al., 2013). Temple (2002) first used the term "cross-language" to describe qualitative research that uses a translator or interpreter at any stage of the research process. Thus, the most critical factor in cross-language research, regardless of the methodological approach, is that it must include the use of translators (Squires, 2009; Croot et al., 2011; Squires et al., 2013). Since the 2000s, cross-language qualitative research has expanded significantly, methods have been developed, and several general methodological considerations have emerged (Lowton, 2018; Sim & Waterfield, 2019). There is consensus in cross-language research that translation can pose a threat to the reliability of qualitative data (Mitchell & Branigan, 2000; Squires, 2009). Therefore, the background and experience of the translator matters, as translators can generate qualitative data through translation processes and participation in data analysis (Wilkinson, 1998; Mitchell & Branigan, 2000; Squires, 2009). Consequently, interpreters with translation work experience are always recommended for cross-language studies to minimise threats to the

[11] Haram - forbidden by Islamic law (Merriam Webster, 2021).

validity of the results associated with translation (Squires, 2009; Lowton, 2018; Sim & Waterfield, 2019).

Guidelines for developing focus group guides state that some familiarity of the researcher with the language commonly used by research participants (i.e., Arabic) is important for effective communication and for developing an adequate understanding of participants' experiences and beliefs (Wilkinson, 1998; Mitchell & Branigan, 2000; Squires, 2009). If the researcher chooses to conduct the data collection in Arabic, the translation can be done either before the start of the analysis or after the analysis (Chen & Boore, 2010; Al-Amer et al., 2016; Aloudah, 2022). In the first approach, data is collected in Arabic and then translated and analysed in English; in the second approach, data are collected and analysed in Arabic, and the results are translated into English. Translation includes the interpretation that conveys meaning, not just word-to-word translation, which overlaps with what concerns qualitative research analysis (Chen & Boore, 2010; Al-Amer et al., 2016; Aloudah, 2022).

Analysing the translated data can affect the accuracy of the analysis, since different languages assume different epistemological assumptions and positions (Castro et al., 2010; Al-Amer et al., 2016; Aloudah, 2022). Thus, a study by Al-Amer et al. (2016) on language translation challenges with Arabic speakers participating in qualitative research studies found difficulties in the translation process, especially in data management regarding metaphors, medical terminology, text connotation, and keeping the meaning between original and translated data. Aloudah (2022), in a scoping review of 31 studies on how researchers conducted qualitative research with Arabic-speaking participants asserted, that because there are no translation guidelines for qualitative studies (unlike quantitative ones), ambiguous translation might affect data integrity and results. Translators are often inconsistent when interpreting the same interview or focus group at different times, with identified differences such as augmentation, generalisation, and omission of information (Al-Amer et al., 2016; Aloudah, 2022). By comparison, conducting research and analysis in a pre-agreed language has been found to help bridge the gap between the meaning perceived by the participants and the interpretation of the results (Lopez et al., 2008; Castro et al., 2010).

This rationale and data from previous studies formed the basis for the choice of language for the focus groups in this PhD research, presented in this paragraph. Prior to this research, the researcher had spent seven years in Saudi Arabia and had a basic knowledge of the Arabic language, especially the slang used by students (Mitchell & Branigan, 2000; Squires, 2009).

The chaperone was a bilingual professional available to help with translation or interpretation (Squires, 2009; Squires et al., 2013). In addition, prior to data collection, participants were asked about their preferred language of communication, with English being the choice. During the focus groups, they were encouraged to express their thoughts in the language of their choice, which the chaperone would translate.

During Phase I, detailed data were generated in respect of the knowledge and behaviours of participants in relation to PA, nutrition, and the Food Dome. However, the attitudes of participants were only partially explored. To create a comprehensive focus group guide, the findings of Phase I were reviewed, highlighting the objectives that were completely addressed I and those that needed further exploration during Phase II. This exercise allowed to map out what was found and where is the gap in knowledge that require further exploration (Table 5.1).

Table 5.1. Emerging data from Phase I as a basis to develop focus group guide for Phase II.

Objective 1: To identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA.			
ATLS	**Summary of key points in relation to the whole sample**	**Rationale**	**Question(s)**
Physical Activity	Walking was the most popular moderate sport activity among participants, n = 327 (77%). The majority of participants reported they were practicing moderate-intensity daily walking n = 254 (60%)	Rates of PA have been fully addressed through the questionnaire. However, since the current research was conducted during the COVID-19 pandemic, additional questions were included in the focus groups to explore how participants' attitudes and behaviours changed since becoming a student, and during the pandemic.	*Have your PA behaviours changed since you became a student? [Probe: In what way? What about sedentary behaviour? Has the pandemic led to any changes in your PA or sedentary behaviour levels?]*
Sedentary Behaviours	The majority of the study sample n = 240 (56%) spent less than two hours of screen time per day.	Sedentary behaviour questions have been fully addressed in the survey. However, since the current research was conducted during the COVID-19 pandemic, additional questions were included in the focus groups to explore how participants' attitudes and behaviours changed since becoming a student, and during the pandemic	*What about sedentary behaviour? Has the pandemic led to any changes in your sedentary behaviour levels?*
Nutritional Behaviours	The majority of participants consumed breakfast less than three times per week n = 231 (54%) and this behaviour was not found to be associated with overweight and obesity.	Questions were included to explore students' breakfast attitudes and preferences, and the factors related to skipping breakfast. Answers may shed a light on relationship between having breakfast or skipping it and the relation to BMI.	*Tell me about your breakfast habits? [Probe: Do you eat breakfast? What do you prefer to eat for breakfast? If you skip breakfast, why is that?]*

	Fruit consumption was statistically significantly associated with BMI categories of males, who were more likely to be in normal weight category ($\chi^2 = 13.93$; $p = 0.03$). For females there was no significant association.	These contradictory findings created basis for developing questions about fruit preferences to explore the attitudes of participants. Answers may shed the light on the difference between the genders	*What is your preference for fruits? [Probe: Do you choose by considering colour, taste, smell, nutritional benefits, country of origin?]*
	Consumption of dairy products was statistically significant for the BMI of both males ($\chi^2 =$ 13.04 p = 0.04) and females (χ^2 = 12.39 p = 0.05). Participants who consumed dairy products more than three times per week were more likely to be in normal weight category.	Attitude questions were included to explore the types of milk and dairy products participants prefer (e.g., natural yoghurt vs sugar-sweetened yoghurt, or low-fat milk vs high-fat milk).	*What kinds of dairy products do you have/consume? [Probe: Why do you chose these dairy products? Do usually prefer to consume milk and dairy products with other products?]*
	More than half of the participants n = 216 (51%) consumed fast food more than three times per week. However, no significant association were found in BMI categories.	Attitude questions were asked to explore students' fast food consumption preferences, and how they may explain this finding.	*What are your thoughts on fast food consumption? [Probes: What kind of fast food do you prefer? Has your fast food consumption changed since becoming a student? In what way?]*
Objective 2: To investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region.			
Knowledge & Behaviour	N = 298 (70%) reported that they had never heard about FDDG, and only n = 47 (11%) participants reported following the FDDG. None of the participants gave correct answers for cereals and their products, colour of vegetables and the types of meat recommended for Arabs. None of the participants gave correct answers for foods rich in iron.	Despite the lack of knowledge about FDDG, daily behaviours in respect of food choice were close to those recommended in the FDDG, with the lowest consumption being of cereals. However, participants were not aware of separate components of healthy nutrition recommended to Arab people. Questions were included to explore participants knowledge of and attitudes towards FDDG.	*What do you know about nutritional guidelines? [Probes: Are there any that you know of that relate specifically to Arab people? What about the Food Dome dietary guidelines?]* *Please take a look at the Food Dome. What do you think of the different food groups recommended in the Food Dome? [Probe: What about the portion sizes?]*
	Of the five groups, the lowest levels of knowledge were seen in respect of cereals and their products (59.6%). Less than half of the participants chose the correct answers on knowledge of the weekly consumption frequency in each food group Only n = 86 (20.2%) consumed cereals and their products more than 5 times a week (as per FDDG). The preference (n = 319 (74.9%)) was for cooked cereals (rice, wheat oats, macaroni).	One of the findings of the overall Food Dome analysis was the lack of knowledge about cereals and their products, as well as the infrequency of their consumption. There was a preference for cooked cereals, the least recommended by the FDDG. Therefore, this question will explore the attitudes of students and their preference for cooked over raw cereals.	*What are your thoughts on cereals? How often do you eat cereals? [Probes: What part do you think cereals should play in your diet? What kinds of cereals do you eat? How do you feel about raw cereals compared to cooked?]*

	Only n = 104 (24.4%) consumed spinach and broccoli n = 108 (25.4%) as recommended by the Food Dome in relation to dark green vegetables.	According to the FDDG, Arab people are encouraged to eat dark green vegetables like spinach and orange-coloured vegetables like carrots. However, none of the participants knew the colour of the vegetables recommended for Arab people. Therefore, a question on the preferences and choice of vegetable colour was developed to explore participants attitudes	*What do you take into consideration when choosing vegetables? [Probe: Is it colour, taste, smell, country of origin?]*

The focus group guide aimed to explore knowledge of and attitudes towards the FDDG among university students and provide insights on the emerging data from Phase I as shown in Table 5.1. Krueger and Casey (2000) provide useful guidance on the different categories of questions and how they should be used during the focus group discussions. Their approach was adapted in the current study:

- **Opening question(s)** – An opening question that is factual and establishes the commonality of participants.
    1. Can you tell me about your life as a student? [Probe: what about your living arrangements as a student?]
- **Introductory questions –** A series of introductory questions that introduce participants to the topic and initiate conversation.
    2. Can you tell me about any changes in your lifestyle since you became a student, particularly in terms of diet and physical activity? [Probe: Do you cook for yourself? Do you eat out more? Do you eat with other students? What are the main influences on your food choices?]
    3. Have your physical activity behaviours changed since you became a student? [Probe: In what way? What about sedentary behaviour? Has the pandemic led to any changes in your physical activity or sedentary behaviour levels?]
- **Transition questions –** A series of questions moving the discussion to the central topics of a focus group.
    4. What do you think constitutes a healthy lifestyle? [Probes: Can you describe a 'healthy lifestyle' to me? Can you tell me where you get most of your lifestyle information/advice from?]
    5. Tell me about your breakfast habits? [Probes: Do you eat breakfast? What do you prefer to eat for breakfast? If you skip breakfast, why is that?

6. What are your thoughts on cereals? How often do you eat cereals? [Probes: What part do you think cereals should play in your diet? What kinds of cereals do you eat? How do you feel about raw cereals compared to cooked?]
7. What kinds of dairy products do you have/consume? [Probe: Why do you chose these dairy products?]
8. What do you take into consideration when choosing vegetables? [Probe: Is it colour, taste, smell, nutritional benefits, country of origin?]
9. What is your preference for fruits? [Probe: Do you choose by considering colour, taste, smell, nutritional benefits, country of origin?]
10. What are your thoughts on fast food consumption? [Probes: What kind of fast food do you prefer? Has your fast food consumption changed since becoming a student? In what way?]

- **Key questions –** Two to five key questions in relation to study aims and objectives.

11. What do you know about nutritional guidelines? [Probes: Are there any that you know of that relate specifically to Arab people? What about the Food Dome dietary guidelines?]
12. Please take a look at Food Dome. What do you think about the different food groups recommended in the Food Dome? [Probe: What about the portion sizes?]
13. Which foods or food groups would be the most difficult to add to your diet?
14. What do you think would motivate/excite students to follow the Food Dome dietary guidelines? [Probe: What kinds of information would you think they would like to get/find useful]?
15. What would be the best way to give students information about the Food Dome? [Probe: an app, poster, social media commercial, booklet, brochure].

- **Ending question –** An ending question to encourage participants to state their final position on key topics and reflect on the entire discussion (Krueger & Casey, 2000).

16. Summing up, having considered the lifestyle of students and the guidelines available is there anything further that you think could be done to improve your lifestyle as students? [Probe: Any feedback, ideas, observations, and comments would anyone like to add in relation to the current research and Food Dome dietary guidelines?]

While the focus group guide was designed to meet the research objectives, the researcher also felt that the discussion could take on a life of its own, which would influence or determine the order in which the questions were covered (Krueger & Casey, 2000; Gill, Stewart, Treasure

& Chadwick, 2008). Hence, a number of probes to discussion questions were developed, as highlighted above, and can be seen in full in Appendix 12, which includes the opening discussion and closing comments.

This stage of research was followed by the ethical approval by the Ethics Committee of the UoS to be presented in the next section in line with the data protection statement.

5.3 Ethics and data protection statement

As the research involved human participants, ethical approval was sought for the focus groups and obtained from the Ethics Committee of the UoS (HSR1920-016, Appendix 13). The Local Covid-19 Risk Assessment for Research Projects was included with this application, which can be found in Appendix 14.

Focus group discussions cannot be completely confidential or anonymous because the material is shared with other group members during the discussion (Morgan, 1996; Ryen, 2016; Lowton, 2018; Sim & Waterfield, 2019). Therefore, from the onset, it was clarified that the contribution of each participant would be shared with other group members, who were encouraged to maintain the confidentiality of what they heard during the meeting (Beauchamp & McCullough, 1985; Morgan, 1996; Lowton, 2018; Sim & Waterfield, 2019). All participants were informed that participation in the research was entirely voluntary, and refusal would not result in any sanctions. Once they agreed to take part, participants were free to leave the study at any time without giving a reason. Furthermore, participants were assured that none of the information they provided could be traced back to them, and all information provided would be treated as confidential by the researcher. This information was provided in the 'Participant Consent Form' and 'Participant Information Sheet' (Appendix 8).

All participants were given unique identifiers to ensure anonymity and confidentiality. Names and contact details were stored on the password-protected computer of the researcher. Data collected from the focus group discussion via digital voice recorders were stored securely. Audio data and transcripts were kept on the password-protected computer, and only the researcher had access to the raw data. During data analysis, the unique identifiers were maintained, and any quotes used were anonymised using pseudonyms (i.e., participant 1 (P.1)). This stage was followed by the composition and size of focus groups, sampling and recruitment of participants, informed and supplemented with literature data.

5.4 Composition and size of focus group

Group composition refers to the characteristics of the participants in the group discussion and how these can affect group consistency, either supporting or preventing productive discussion (Morgan, 1988; MacIntosh, 1993; Kitzinger, 1995; Krueger & Casey, 2002; Breen, 2006). The literature indicates that a focus group should not be too heterogeneous (i.e., mixed) in terms of gender or SES or too homogeneous (i.e., similar) in certain characteristics to address the research objective and for participants to express their understanding of the topic of the discussion (Morgan 1988; Gibbs, 1997; Krueger & Casey, 2002; Breen, 2006). At the same time, there is no definitive formula for group composition, as each group will differ depending on the research context, aim, and participants (Kitzinger, 1995). It is important to note that focus group participants may only attempt to offer insights about an entire category of people (e.g., students) (Bloor et al., 2001; Krueger & Casey, 2002).

Focus group size depends on the purpose of the research, subject of discussion, study sample, and the level of detail required to address the aim and objectives of the research (Betts, Baranowski & Hoerr, 1996; Bauer et al., 2004; Breen, 2006). Small groups (i.e., six participants) risk being limited in the discussion, while large groups (i.e., ten participants) can be chaotic, difficult for the researcher to handle, and frustrating for participants who may feel they cannot express their thoughts fully (Breen, 2006). Stewart and Shamdasani (2014) suggest that it is better to slightly over-recruit for a focus group and potentially manage a slightly larger group than to recruit not enough and risk cancelling the session or having an unsatisfactory discussion since there will be one or two participants who will be absent (Stewart & Shamdasani, 2014). Additional evidence suggests that small groups are preferred when participants have something to say about the research topic or are familiar with the content. On the other hand, large groups work well when research is designed to explore materials or ideas, and participants do not necessarily need to have sufficient knowledge of the topic to be discussed (Kamberelis & Dimitriadis, 2013; Stewart & Shamdasani, 2014).

Based on the rationale set out in this part and in section 3.4, careful selection of participants was undertaken and to be presented in the next section. It was also essential to create an environment suitable for a productive discussion that would address the objectives of Phase II and provide more insights into the emerging data from Phase I (Gill et al., 2008; Sim & Waterfield, 2019).

5.5 Focus group sampling

In qualitative research, sample selection profoundly affects the final quality of the research (Coyne, 1997; Carlsen & Glenton, 2011; Tiedje et al., 2014; Patton, 2014). Although sampling procedures in qualitative studies are not as strictly regulated as in quantitative studies, this flexibility in sampling can be confusing for some researchers, leading to biases (Carlsen & Glenton, 2011; Patton, 2014). At the same time, researchers have been criticised for not describing their sampling strategies sufficiently, making it difficult to interpret the findings and hindering study replication (Coyne, 1997; Carlsen & Glenton, 2011; Tiedje et al., 2014; Patton, 2014). The precise nature of the study directs the profile of the sample of participants, where the sample can be random (e.g., every fourth student) or purposive/convenience (i.e., participants who meet the criteria to address the research aim) (Stephenson et al., 1998).

This research applied purposive sampling to select key informants, promote group interaction, and capture the diverse characteristics of participants (i.e., gender, age) as well as knowledge, attitudes, and behaviour in relation to Food Dome (Morese, 1991; Morgan et al. 1998; Salkind, 2010; Tiedje et al., 2014). According to Patton (1990), the logic and power of purposive sampling lie in the selection of cases that are rich in information, from which much can be learned about issues central to the purpose of the study. At the same time, with purposive sampling, there is a risk that the researcher may exclude several subgroups from the sample, leading to biased research findings. Lastly, purposive sampling is not an efficient method of collecting data from a large population (Morgan et al., 1998; Salkind, 2010; Tiedje et al., 2014).

Given the advantages and disadvantages of this sampling method, the rationale for using purposive sampling in this research included the following points:

- The complex phenomenon of this research, i.e., the first study to explore the knowledge of and attitudes towards the FDDG among the target population
- Findings from Phase I
- To provide short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population.

Recruitment was undertaken through the questionnaires used in Phase I. In the last line of the questionnaires, participants were asked to indicate whether they would like to participate in a focus group discussion and were asked to provide e-mails if they agreed. Of n = 426 participants, n = 84 agreed to participate. Their surveys were subsequently arranged by age groups (i.e., 18-20-years, 21-23-years, 24-25-years), gender (i.e., males, females), and marital status. Nevertheless, of these n = 84 participants, only n = 28 provided legible e-mail addresses. These n = 28 participants were invited to participate in focus group discussions, thereby contribute to addressing the third objective of this research, i.e., to explore the knowledge of and attitudes towards the Food Dome among the target population and the emerging findings of Phase I.

Once the sampling was complete, the recruitment of the participants started. The stages of recruitment are presented in the next section, followed by moderating the focus groups.

5.6 Focus group recruitment

Recruitment of the participants for the focus group discussions is one of the fundamental tasks of focus group research, where the aim of the research should direct the recruitment process (Gibbs, 1997; Wilkinson, 1998; Bloor et al., 2001), e.g., whether the study participants are members of the general community or represent specific sub-groups of the population (e.g., 18-25-years-old university students). Once the sampling procedure had been completed, invitations (n = 28) to participate in a focus group discussion were sent. Twenty-eight participants were approached to facilitate potential over-recruitment, as per recommendations to over-recruit a little and potentially manage a slightly larger group than under-recruit and risk cancelling a session or having an unsatisfactory discussion (Stewart and Shamdasani, 2014).

The invitations were written politely, systematically and informatively and sent via e-mail (Breen, 2006; Gill et al., 2008). The importance of the research was clearly and informally explained, why participants had been invited, what would be done with the findings, and who would benefit from the study (Krueger & Casey, 2002). Care was taken over the invitation wording to ensure it did not seem coercive (Morgan & Krueger 1993; Krueger & Casey, 2002).

While developing an invitation e-mail for the current study, the following points were included (see Appendix 15):

- Preliminary/tentative date, time and location
- Approximate length of the meeting (e.g., 1-1.5 hours)
- Aim and objectives of the research
- Points to be discussed
- Anticipated results - recommendations to target knowledge, attitudes, and behaviour to support improving the nutritional and lifestyle choices of the target population based on the findings
- Use of information received - provide recommendations for future research, policies, and practice with respect to improving nutritional and physical activity behaviours among 18-25-years-old university students
- Precautions aimed to reduce the risk of COVID-19 spread
- A statement that the participants' consent would be requested for participation

Date(s), time, and location were selected that did not conflict with popular activities or features, checked through official Islamic and Gregorian calendars for the year 2021 (e.g., national holidays) (Gibbs, 1997; Krueger & Casey, 2002). A reminder e-mail was sent two weeks after the first. When sending out invitations, no distinction was made between the number of male and female participants. As a result, of the n = 28 invitees, n = 16 agreed to participate. Once the participant agreed to participate, a personalised follow-up e-mail, including a greeting and appreciation for agreeing to participate, was sent with additional details about date options for the session (Morgan & Krueger 1993; Krueger & Casey, 2002).

This was followed with the focus group discussions that took place in two sessions. The process of data collection and moderation of focus groups are presented in the following section.

5.7 Procedures and moderating focus groups

Once the date and location of the group discussion were coordinated with all participants (see section 5.6), the researcher arrived early to arrange the seating at PSMCHS, equipment and to welcome participants (Breen, 2006; Gill et al., 2008). Before starting the focus group discussion, precautionary measures were taken to reduce the risk of possible spread of COVID-19 among participants (MOH, 2020; WHO, 2020). In order to maintain the privacy and confidentiality of the participants, no one else was allowed into the room (Oliver, 2010). Similar to Phase I, the focus group discussions included male and female participants. In respect with the Saudi setting and culture, a qualified chaperone (i.e., a female student

enrolled in research) was invited to communicate with the female participants. The discussion was audio-recorded, and notes were taken on a portable computer (Breen, 2006; Gill et al., 2008).

In this research, before staring the discussion, participants were reminded about the aim and objectives of the research and their role in the discussion (Krueger & Casey, 2002; Oliver, 2010). Participants were reminded that if they were unwilling to participate, they had the right to withdraw at any time and were asked to sign the informed consent. At the beginning of the session, the researcher introduced himself and the chaperone to make the environment comfortable and friendly (Sim & Waterfield, 2019). At this stage, the recording had not begun to maintain the anonymity of the participants (Oliver, 2010; Ryen, 2016; Sim & Waterfield, 2019). Once the introductory part was over, the focus group discussion started.

Moderating a focus group discussion is a balance between flexibility and ensuring that the conversation does not stray too far from the research objectives (Breen, 2006; Gill et al., 2008). The discussion should include everyone and not concentrate on one person, given the importance of getting answers from as many people as possible for complete coverage of study questions (Krueger & Casey, 2000; Lowton, 2018; Davis et al., 2019). Consideration should be given to the timing and pace of the discussion, ensuring that all questions are covered in sufficient detail by the end of the session (Morgan 1988; Gibbs, 1997; Krueger & Casey, 2002).

The discussion schedule aimed to enable all questions to be covered within 5-10 minutes per question and an approximate time for entire discussion to be 1-1.5 hours (Morgan, 1988; Gibbs, 1997; Krueger & Casey, 2002). Most of the discussion was spent exploring participants' attitudes, asking them to share and compare experiences and discuss to what extent they agreed or disagreed with each other (Gill et al., 2008). The group discussion was facilitated by keeping it focused and preventing a single participant from dominating the discussion to provide all participants with ample opportunity to contribute, and understand differences of opinions fairly (Breen, 2006; Gill et al., 2008).

During the focus group discussions, specific points can emerge and contribute to study aims and objectives. Hence, whatever was expressed or discussed was recorded and documented accurately (Krueger, 2014). The focus group discussion concluded with the collection of final comments, thoughts, and arguments made by participants (reported in section 5.9). Upon

concluding the focus group discussion, the researcher thanked the participants for their contribution, emphasising that their contribution would help to develop future interventions or programmes (Gibbs, 1997; Krueger & Casey, 2002).

Once data collection for Phase II was complete, the researcher began the data analysis process using the framework analysis (FA) approach, discussed below.

5.8 Data analysis – Framework Analysis

Analysis of focus group data is essential for understanding individual contributions as well as the big picture by identifying themes and sub-themes that have arisen in the discussion, driven by the research aim and objectives (Morgan, 1988; Gibbs, 1997; Krueger & Casey, 2002). Analysis ranges from descriptions to interpretations and recommendations. Furthermore, while analysing focus group data, consideration should be taken of the group dynamics and generated comments to synthesise different points of view into meaningful conclusions. Hence, in this research framework analysis (FA) was applied to achieve these goals (Lacey & Luff, 2007; Smith & Firth, 2011; Gale et al., 2013).

The FA method represents a wide group of analysis methods, often called thematic analysis or qualitative content analysis, highlighting similarities and differences in qualitative data, thereby drawing descriptive and explanatory conclusions grouped by themes (Lacey & Luff, 2007; Smith & Firth, 2011; Gale et al., 2013). This method is not aligned to any particular epistemological, philosophical or theoretical approach and can be used with a range of qualitative approaches, such as focus groups, interviews, observation, and documentary analysis. The FA method is not necessarily related to the creation of social theory but can greatly facilitate continuous comparison methods by analysing data across the entire pattern of qualitative analysis (Gale et al., 2013; Parkinson et al., 2016).

As with all research methods, this method should be considered in light of its advantages and disadvantages (Ward et al., 2013; Parkinson et al., 2016). FA provides the researcher with a systematic structure that is visual and transparent, allowing other researchers to follow the methods and processes accomplished to produce the findings and draw conclusions (Gale et al., 2013; Ward et al., 2013). It also provides a step-by-step guide to the management and thematic analysis of data, which is particularly helpful as its systematic nature helps to effectively organise and refine the data (Gale et al., 2013). Another important strength of FA

is that coding and charting enable the researcher to view emerging themes (thematic analysis) and look across cases (case analysis), which can help to identify patterns (Gale et al., 2013).

There are also some limitations associated with FA. First, as with all qualitative methods, it is time-consuming and resource-intensive (Gale et al., 2013). Moreover, understanding the terminology is challenging and can be confusing because there is no consensus in the qualitative analysis literature on the use of terms, in particular "codes," "topics," and "categories" (Spencer et al., 2014; Parkinson et al., 2016). It is important to understand the basic analytical stages that will ensure rigour. Otherwise, building a theoretical framework, thematic charts, and summarising data can be challenging if the data are ambiguous. Another potential limitation is viewing its five stages (described below) as mechanical steps to be followed, which is why researchers must remain focused on their aims and objectives (Furber, 2010; Gale et al., 2013; Spencer et al., 2014; Parkinson et al., 2016).

Considering all the advantages and disadvantages of this method, FA provided a systematic and flexible structure for the data management and analysis of the current research, allowing the development and maintenance of transparent records (Spencer et al., 2014; Parkinson et al., 2016). Moreover, the distinct stages of FA facilitated transparency of the data analysis process and enhanced rigour (Ezzy, 2002; Bulpitt & Martin, 2010). The analysis, the results, and how the research support the theory have been documented. Patterns and relationships were identified, developing plausible explanations and ensuring that findings are open to further discussion, development, and critique (Ezzy, 2002; Gale et al., 2013).

The next sections present the five stages of FA followed by the researcher to analyse focus group discussion data.

5.8.1 Familiarisation

Becoming familiar with the focus group discussions by using the audio recording, transcripts, and any contextual or reflective notes that the researcher made during data collection is a vital stage in FA (Jootun et al., 2009; Furber, 2010; Gale et al., 2013). During Phase II, two focus groups were conducted, and audio recordings were transcribed by the researcher personally. Before starting the data sorting process, the researcher became familiar with the voice recordings and transcripts to develop an overview of the main ideas and themes expressed or discussed by the participants (Ritchie et al., 2013; Furber, 2010).

The transcription process allowed immersion in the data (Figure 5.1, below). The transcripts of the recordings were printed out, had large margins and adequate line spacing on the paper, providing space for coding and notes. This was followed by reading, re-reading, and listening to the audio recordings. Notes made during the discussion and listening to the recordings enabled an understanding of the context and characteristics of the focus groups (Jootun et al., 2009; Furber, 2010). The study aims and objectives were constantly referred to during the familiarisation process. Recurring phrases, thoughts, words, and ideas related to the aims and objectives of the study, findings of Phase I, and emergent data were highlighted. Notes were made on the margins of transcripts (Jootun et al., 2009; Furber, 2010; Gale et al., 2013). The extracts from the familiarisation process of this research are presented in Appendix 16, i.e., how the transcripts were annotated and a technique used such as pen colours.

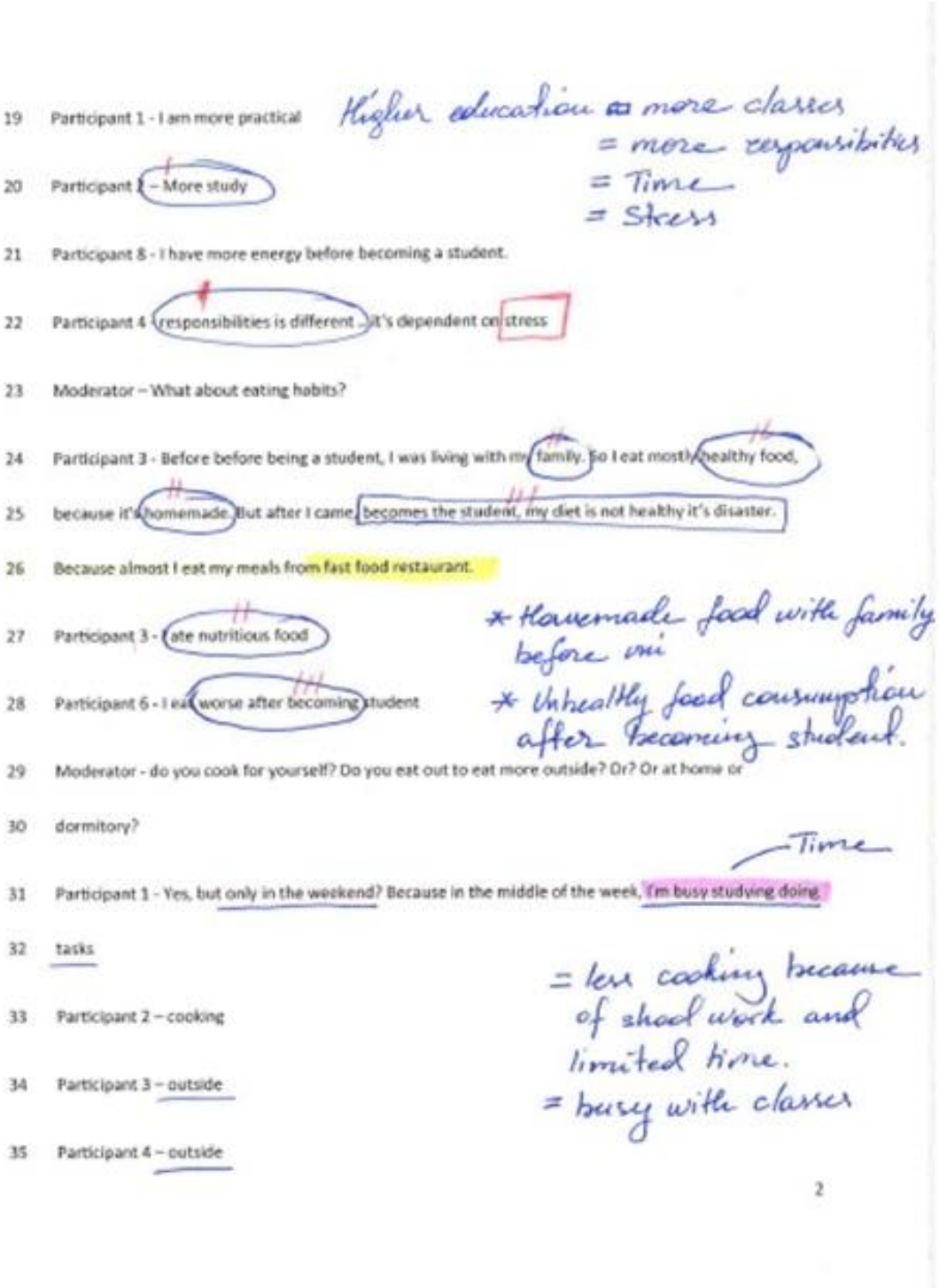


Figure 5.1. Examples from focus group discussion familiarisation stage.

This stage was followed by the identifying thematic framework presented in the next section.

5.8.2 Identifying a thematic framework

This phase enables the organisation of data in a meaningful and manageable way for retrieval and exploration during the mapping and interpretation stages (Ritchie et al., 2013; Furber,

2010). Recurring phrases, thoughts, words, and ideas related to the aim and objectives of the study, emerging data highlighted and annotated during the familiarisation stage were grouped into similar initial categories or codes denoting *a priori* themes[12] in an Excel file (Ritchie et al., 2013; Furber, 2010). As a result, five *a priori* themes were identified and used as the basis for the thematic framework (Table 5.2). These were 'knowledge, attitudes and behaviour about Food Dome,' 'the best way to inform students about the Food Dome,' 'physical activity and sedentary behaviour,' 'nutritional attitudes and behaviour,' and the 'impact of COVID-19.' The full version of the thematic framework stage is brought in Appendix 17.

Table 5.2. Extracts from thematic framework stage.

Preliminary outline *a-priori* themes	**Quotations from the raw text**	**Notes from familiarisation to outline sub-themes**
Knowledge, Attitudes & Behaviour about Food Dome	Food what? No	More assumptions less awareness about FD
	No, no Joosten [background]	Lack of knowledge about FD.
	Yeah, I think heard about the food dome. it's like a system a healthy system to to Joosten eat a specific number of vegetables of cereal.	One participant heard about FD
	Is this a media or what is this?	Interest to learn more about FD
	First time	
	for Arab countries? Who made it, oh initiated?	Heard, seen vs known or followed FD
	I have seen this before	
	Attitudes	
	It's interesting	Remarks on usefulness and helpfulness
	this is helpful	
	for me it's it's a word that we like it's for variety of food	Remarks on mental health and daily activity
	More coordinated	
	It also improves your mental health.	
	It's concentrated on daily activity	
	First time I see it. I have to read it.	Willingness to learn more about FD before giving feedback
	For me it's right	
	It makes the balance of what the body need	
	It's like it's for variety of food where should increase vegetables	

The printed files were manually annotated according to *a priori* defined themes and new emerging themes. Additional reading was undertaken to clarify and ensure consistency with emerging data (Ritchie et al., 2013; Furber, 2010; Parkinson et al., 2016). Initially identifying *a priori* themes to guide the development of categories, then validating the

[12] The term 'theme' has multiple interpretations in different qualitative research methods. For instance, it is a way to describe a structural unit of meaning essential to present qualitative results (Streubert & Carpenter, 1995); a recurring regularity identified within or cutting across categories (Polit & Hungler, 1999); or core meanings used at the level of interpretation (Graneheim and Lundman, 2004).

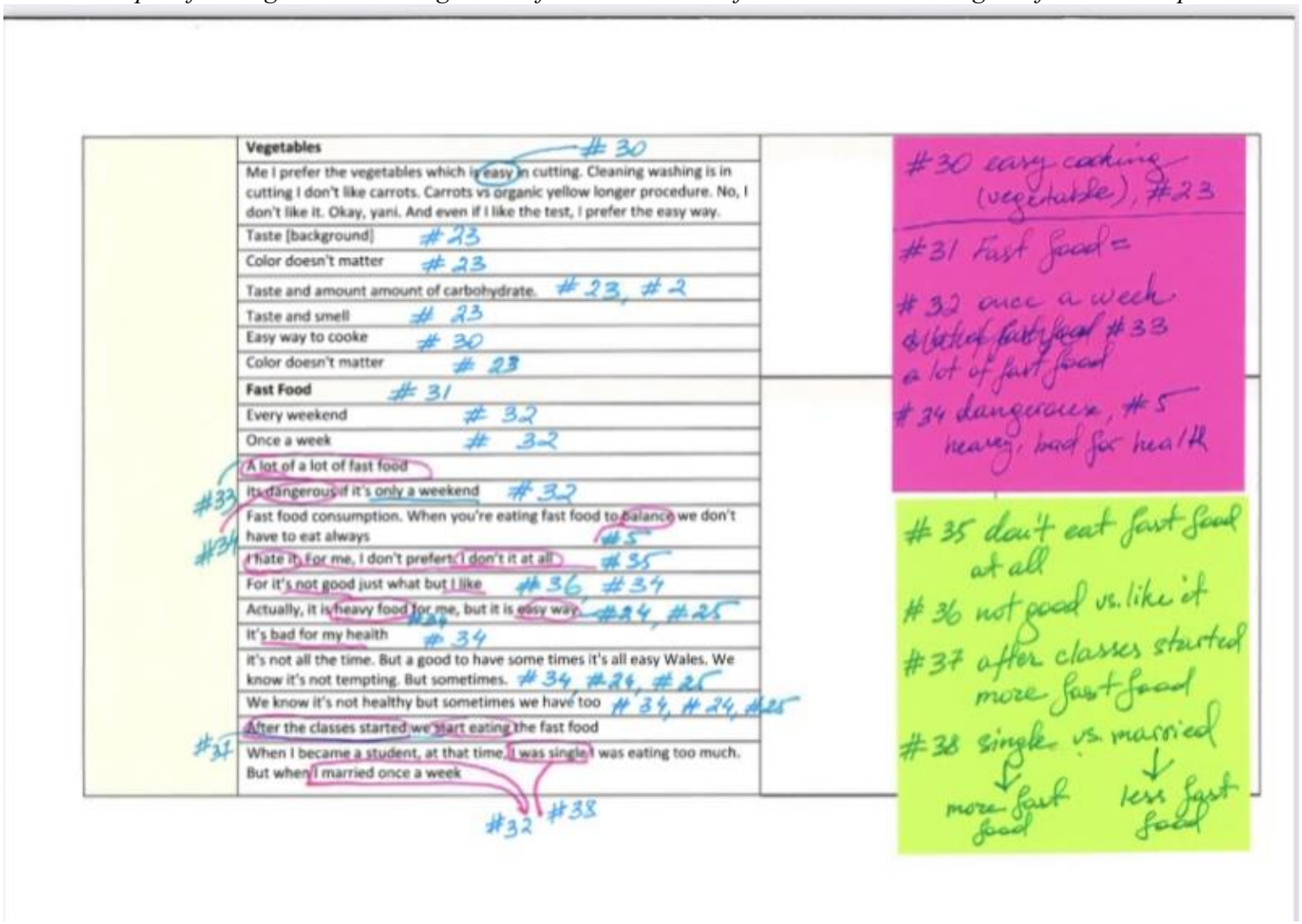
categories based on the collected data and revisiting them in light of emerging data was a productive process in developing the framework. Once the thematic framework was developed, the indexing process started (Jootun et al., 2009; Furber, 2010; Gale et al., 2013).

5.8.3 Indexing

The purpose of indexing is to organise the transcripts into the framework categories by systematically applying the thematic framework to each transcript (Lacey & Luff, 2007; Furber, 2010; Gale et al., 2013). Data can be indexed in two ways: (i) themes from the thematic framework can be coded and annotated in the margins of the transcripts alongside the corresponding text; or (ii) data can be copied from the transcript and pasted into another file, such as an MS Word document (Ritchie et al., 2003).

In the present study, option (i) was taken. To be more immersed in the data, the researcher printed and annotated transcripts by hand rather than interacting with them on a screen (Figure 5.2, below). For instance, statements about "Food Dome knowledge" noted in the margin in the first transcript (focus group 1) were indexed. The researcher then looked for evidence of this topic in the second transcript (focus group 2). During the indexing phase, the initial thematic framework was refined, some themes were merged, and new categories were developed (Furber, 2010), e.g., 'students' lifestyle.' After the indexing was completed, the indexed transcripts were printed out to create thematic charts (Furber, 2010; Gale et al., 2013; Ward et al., 2013).

Figure 5.2. Example of coding and annotating themes from the thematic framework in the margins of the transcripts.



5.8.4 Charting

Data were indexed according to the thematic framework, which was summarised using charts. Charting (Ritchie & Spencer, 1994) involves refining the data in the transcripts into manageable sections of text (Furber, 2010). Lacey & Luff (2009) identify two types of charts, 'thematic' and 'case.' Thematic charting provides data for each theme across all discussions, while case charting provides data for each case across all themes (Furber, 2010; Gale et al., 2013).

The present study developed thematic charts using MS Word and PowerPoint. Table 5.3 (below) is an example of a thematic chart indicating how the data were managed and handled. In the thematic charting, it was important to include all the data in the charts and not discard them if they did not meet the research objectives. The full version of thematic charting can be seen in Appendix 18. Framework analysis thematic charting of focus group discussions.

Visualising data in charts helped the researcher to understand and interpret the dataset as a whole, and data that might not have initially appeared relevant became important (e.g., students' lifestyles). Thus, the emergent theme, i.e., 'students' lifestyle,' was cited as an important factor that impacted the lifestyle, health, nutrition and PA of participants. This stage of FA facilitated data analysis in the next stage, i.e., mapping and interpretation (Furber, 2010; Gale et al., 2013). Mapping and interpretation allow visual and narrative presentation of the findings, leading to an understanding of patterns.

The next section discusses the process of mapping and interpreting of qualitative data of this research.

Table 5.3. Examples of thematic charting.

Initial Themes	Quotations from the Raw Text	
Healthy Lifestyle	'Enough sleep.' *#1* 'Healthy food and water' *#2*	#1 = sleep #2 = healthy food = water, more vegetables, avoid junk food, variety of food, homemade food #3 = mental health #4 = PA = gym, fitness, #47 #5 = balance = #1 + #2 + #3 + #4 + relationship with others; balance of what the body need [Food Dome]
	'Sleep' *#1*	
	'Mental health' *#3*	
	you have to 'fix your meals with the vegetables that comes not only fries,' *#2* it has to be with vegetables	
	Sleep very well sleep early 'go to a gym' *#4*	
	most 'avoid especially like for eating junk food so and oily food' *#2* yeah it's less of those things	
	'Healthy food' *#2* and fitness *#4*	
	for me I think we have 'to have a balance' *#5* not only food even your walk even when you are studying given the relationship with the teachers is a part of the healthy lifestyle okay I think	
	Source of information about healthy lifestyle	
	I get this one from the 'hospital' *#6*. And also I get it from the 'social media' *#7*	#6 = healthy guidelines from hospital #7 = social media and apps as source of information
	'Applications' [background] *#7*	
	'Twitter, Instagram, YouTube' [background] *#7*	
	Knowledge of dietary guidelines & FD	
	'That some some food. I need to get some portions of some type of food more than another. Like, for me, I don't consume much carbs. I take protein that is more protein that is I'm calling to the gym. more vegetables, less fruits.' *#2*	#8 = rules, guidelines, healthy food, healthier diet #9 = heard about some guidelines, think there is one for Bahrain and KSA, no, food what?, healthy system to eat, media?, for Arabs?, seen this before, first time, have to read #10 = diabetic following guidelines from hospital, for me it's right [Food Dome]
	'rules' *#8* to make your 'diet healthier.' *#2* Okay, 'some kind of guidelines that make your diet healthier.' *#8*	
	'Some kind of guidelines that make your diet healthier' *#8*	
	Yes, I think I 'heard' *#9* one for Saudi Arabia and another one in United Arab Emirates	
	I 'think there is one intermidiet' *#9* between Bahrain and Saudi Arabia	
	Yeah, I 'am ***diabetic***. I have some nutritional guide to follow' *#10*	
	Yes, 'It's meat, fruit, protein' *#8 = #2*	
	rules to make your diet healthier *#8*	
	If you want to 'eat healthy' *#2* you 'need nutritional guidelines' *#8*	

1a = #1 + #2 + #3 + #4

Balanced life between healthy food, PA, mental health and relationship

2a = #6 + #7

Digital platform & health facilities as source - apps, social media,

3a = #8 + #9

Assumptions vs knowledge rules, guidelines to eat healthy, heard, seen, first time

4a Health condition [diabetic] to follow specific diet

5.8.5 Mapping and interpretation

This stage aims to move beyond data management toward understanding it (Ritchie et al., 2013). Ritchie and Spencer (1994) describe this as pulling together key data characteristics to map and interpret the dataset as a whole. Depending on the aim or objectives of the study, this stage of FA may take slightly different forms and may lead to a visual and/or narrative presentation of the findings. “It is often more gradual, and our confidence in the way we have made meaning of the data emerges gradually, after testing it over time” (Parkinson et al., 2016, p. 23).

This interpretation stage is generally perceived as the most difficult to perform and the most difficult to clarify in terms of what was done and how it was achieved (Gale et al., 2013; Parkinson et al., 2016). To complete the mapping stage of this FA, the researcher created a PowerPoint document (Figure 5.3, below) with the objective for Phase II placed at the top to be constantly referenced (Furber, 2010; Gale et al., 2013; Parkinson et al., 2016)**.** To make the process transparent and traceable, the researcher used arrows to clarify concepts, represent the range and nature of phenomena in the data, create typologies, and establish relationships. The outcome of the mapping and interpretation of the data resulted in the themes and sub-themes that were included within the PowerPoint document (Figure 5.3, below) (Bulpitt & Martin, 2010).

Main themes and the corresponding sub-themes derived from the mapping stage are presented and discussed in the next sections, along with the findings.

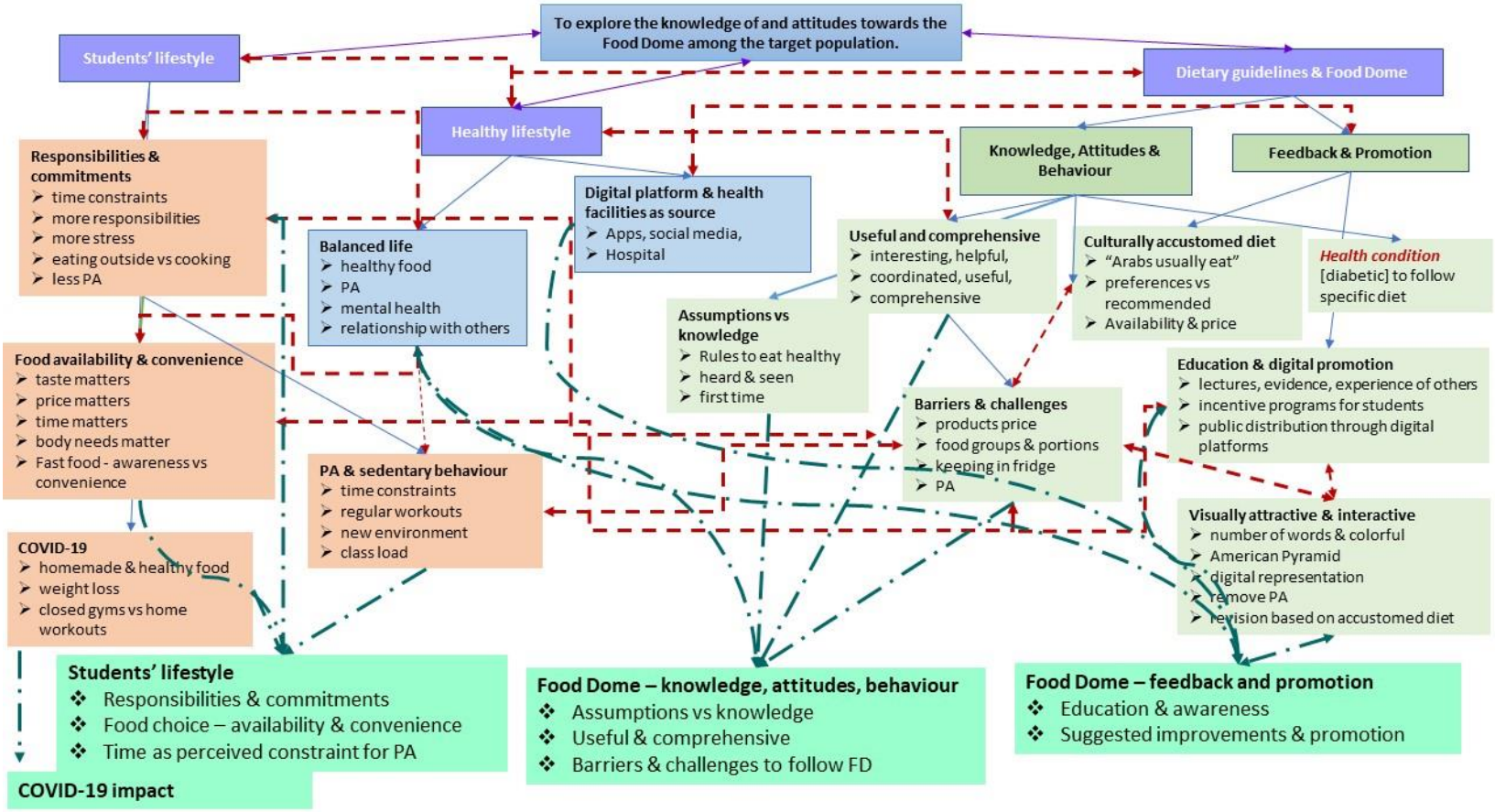


Figure 5.3. The themes and sub-themes to emerge from the focus group discussions.

Highlights based on the objective of Phase II

Emergent themes and sub-themes

The relationship between codes, emergent themes and sub-themes

The rationale for main themes and sub-themes

5.9 Findings of Phase II

In this section, the findings of the FA are presented and discussed to address the objective of Phase II as well as the emerging findings of Phase I. The findings will begin with the characteristics of the participants, followed by presenting three categories of themes and sub-themes that emerged from the focus group discussions. The chapter concludes with a summary of key findings and a reflexive statement.

5.9.1 Characteristics of focus group participants

In total, n = 16 students took part in the focus group discussions, n = 8 in each (Table 5.4, below). The mean age of the participants was M = 22.22 (SD ±1.93), the majority of participants were males, n = 11, alongside n = 5 females, of which two participants were married. All participants were living with their families at home rather than on campus.

Table 5.4. Demographic data of focus groups' participants (n = 16).

Variable	Males n (%)	Females n (%)	Total n (%)
Age (year)			
18 – 20	3 (18.75)	0 (0)	3 (18.75)
21 – 23	5 (31.25)	3 (18.75)	8 (50)
24 – 25	3 (18.75)	2 (12.5)	5 (31.25)
Gender	11 (68.75)	5 (31.25)	16 (100)
Marital Status			
Divorced	0 (100)	0 (0)	0 (0)
Married	1 (6.25)	1 (6.25)	2 (12.5)
Single	10 (62.5)	4 (25)	14 (87.5)
Others	0 (0)	0 (0)	0 (0)
Children			
1	1 (6.25)	1 (6.25)	2 (12.5)
2	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)
More than 3	0 (0)	0 (0)	0 (0)
No children	10 (62.5)	4 (25)	14 (87.5)
Nationality			
Saudi	11 (68.75)	5 (31.25)	16 (100)
Non-Saudi	0 (0)	0 (0)	0 (0)

The socio-economic progress of Saudi Arabia since the launch of the Saudi Vision 2030 has led to a transition from traditional values of the national culture to a more modern and west-oriented values, with the younger generation being more free, confident and unhindered in their communication (Vision 2030, 2017; Al-Ahdal & Al-Awaid, 2018; Thompson, 2019). However, the focus group participants in this research showed slightly different

characteristics and behavioural patterns in communication. They appeared to lack confidence in communication and in openly sharing their thoughts/views. During discussion, it appeared that students either felt uncomfortable interacting with the researcher, and the chaperone, or in participating in a mixed-gender discussion. They were hesitant when speaking and elaborating on their daily habits, preferences, choices, and concerns regarding the questions asked. Instead, most of them tended to speak only when one of the participants would start to answer to a question. These patterns were especially evident for the female participants, who were less active and preferred to communicate mostly through gestures or nodding. One example includes the PA discussion in FDDG, where the males were more active and sociable, while the females tended to nod when the other female participants shared their thoughts.

> *"Remove that exercise sign. It's not related to food." (P.15, 21-23y., male, single)*
>
> *"In my humble opinion physical activity shouldn't be there." (P.11, 21-23y., female, single)*
>
> *"I agree, they are talking about the food and they are talking about physical activities doesn't make sense." (P.14, 18-20y., male, single)*
>
> *"I think it should stay there, like eat healthy and exercise." (P.9, 24-25y., male, single)*

Considerable efforts were made by the researcher and chaperone helped to break the ice to a degree and facilitate as productive discussion as possible, encouraging both males and females speak freely.

While being one of the most generous people in the world, who will share their last meal with a guest, at the same time, Saudis tend to be shy and cautious in talking about prices or having fewer opportunities to buy something beyond their daily budget. Students in this research appeared to substitute the word 'price' with the word 'availability.'

The last observation for the focus group participants characteristics was the language barrier, which often prevented participants from freely expressing, although they were encouraged to speak Arabic, which their fellow participants could translate. In this context, Saudi students, with their inherent pride, appeared to be embarrassed if their knowledge of the English language was insufficient to enable them to take part in the discussion.

Despite these challenges and complications, with the contribution and input of the students, the focus group discussions led to a number of insightful findings. The next sections present three categories of themes and sub-themes that emerged from the focus group discussions.

5.9.2 Findings – themes and subthemes of focus groups

The purpose of two focus group discussions was to explore the knowledge of and attitudes towards the Food Dome among the target population and investigate further the emerging data from Phase I. Three themes arose from the discussions, with the sub-themes illustrated in Figure 5.4

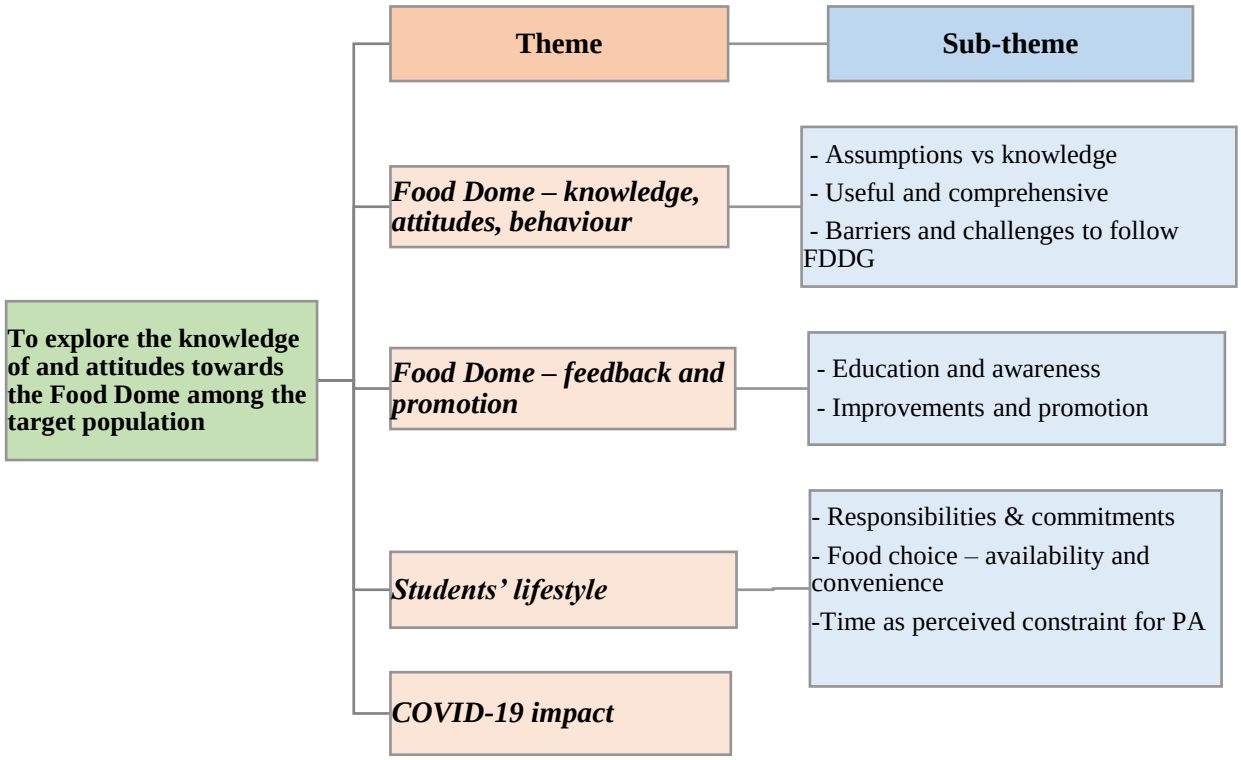


Figure 5.4. The main themes and sub-themes to emerge from focus group discussions.

The next sections are dedicated to presenting the findings for each theme and sub-theme supplemented with the feedback, thoughts, comments and ideas by the students.

5.9.3 Food Dome – knowledge, attitudes, behaviour

The first theme derived from the discussion was 'Food Dome – knowledge, attitudes, behaviour.' This discussion began by asking students about their general knowledge of what constitutes a healthy lifestyle, followed by questions on general nutritional guidelines, which led to a discussion about FDDG. This approach enabled the researcher to understand the

participants' views, not only in relation to FDDG, but also students' perceptions of healthy lifestyle, enabling insights into how their knowledge may relate to attitudes and behaviour in relation to food choice as discussed in chapters 1 and 2. Based on this discussion, three sub-themes derived during FA, presented and explored in the following sub-sections.

5.9.3.1 Assumptions vs knowledge

When asked to share their thoughts on a healthy lifestyle and its components, most participants gave examples of individual factors that they would consider as part of a healthy lifestyle. These factors included sleep time, drinking water, PA, mental health, and healthy food, including more vegetables, less oily and fried food.

> *"Get enough sleep time. Healthy food and water." (P.6, 18-20y., male, single)*
>
> *"Mental health." (P.4, 21-23y., female, single)*
>
> *"Hold on to sports. More physical activity." (P.5, 24-25y., female, married)*
>
> *"You have to fix your meals with the vegetables that comes not only fries, it has to be with vegetables." (P.11, 21-23y., female, single)*
>
> *"Sleep very well sleep early go to a gym." (P.12, 24-25y., male, married)*
>
> *"Healthy food and fitness." (P.13, 21-23y., female, single)*
>
> *"Most avoid especially like for eating junk food so and oily food yeah it's less of those things." (P.15, 21-23y., male, single)*

One participant identified social factors (e.g., relationships), alongside physical factors, such as diet and PA to be the important in leading a healthy lifestyle.

> *"For me I think we have to have a balance not only food even your walk even when you are studying given the relationship with the teachers is a part of the healthy lifestyle okay I think." (P.14, 18-20y., male, single)*

These questions were followed by the discussion on participants' knowledge and attitudes in relation to nutritional guidelines in general and the FDDG in particular. Students had a general idea of the overall goal of nutritional guidelines. They considered that they should illustrate balance in relation to specific food types and portion sizes (e.g., more vegetables

less fruits) to make the diet healthier. Participants also acknowledged that to eat healthily one needed nutritional guideline.

> *"That some some food. I need to get some portions of some type of food more than another. Like, for me, I don't consume much carbs... more vegetables, less fruits." (P.4, 21-23y., female, single)*

> *"If you want to eat healthy you need nutritional guidelines." (P.12, 24-25y., male, married)*

> *"Some kind of guidelines that make your diet healthier." (P.16, 21-23y., male, single)*

In the course of the discussion, one participant noted that she had heard about some nutritional guidelines for Saudi Arabia and UAE, while another participant indicated that he had heard about a guideline developed for Bahrain and Saudi Arabia.

> *"Yes, I think I heard one for Saudi Arabia and another one in United Arab Emirates."* (*P.5, 24-25y., female, married)*

> *"I think there is one intermidiet* [referring to intermediate] *between Bahrain and Saudi Arabia." (P.8, 24-25y., male, single)*

Further discussion led towards the question on the knowledge of FDDG. Most participants had never heard about these dietary guidelines; while a few stated that they had heard or seen Food Dome before, rather than knowing or following it. Participants who had seen the FDDG suggested that the guidelines provide a healthy system of eating specific food groups such as vegetables or cereals.

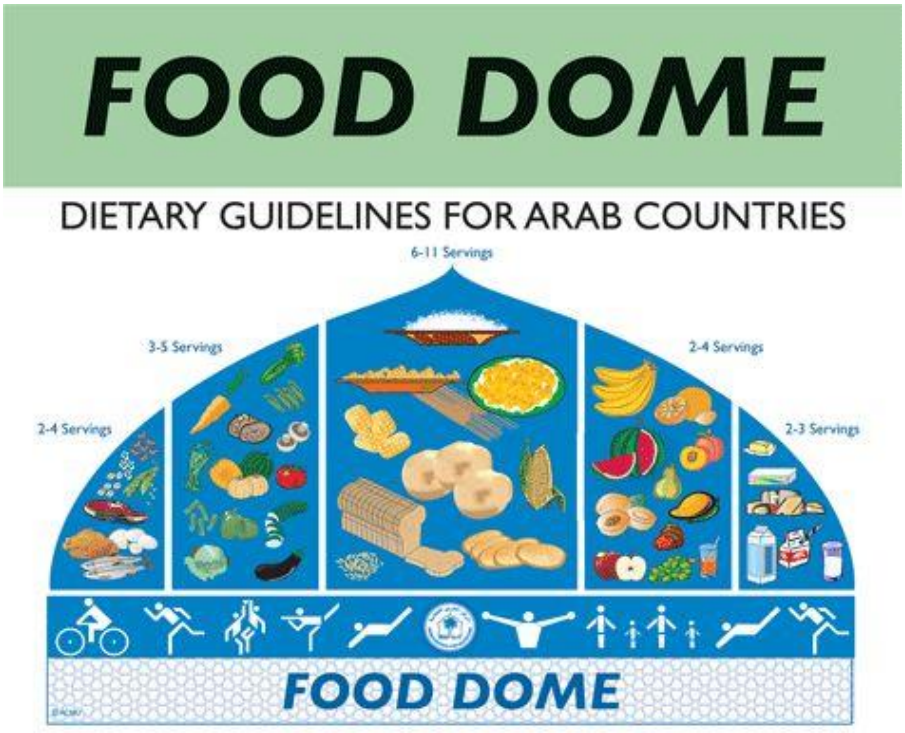
> *"I thinking heard about the food dome. It's like a system a healthy system to eat a specific number of vegetables of cereal." (P.6, 18-20y., male, single)*

> *"I have seen this before." (P.10, 21-23y., male, single, diabetic)*

In sum, the knowledge discussion showed that while participants had either only heard or assumed what nutritional guidelines [Food Dome] meant, none followed dietary guidelines, except for one participant because of their health condition - Diabetes Miletus.

"Yeah, I am diabetic. I have some nutritional guide to follow." (P.10, 21-23y., male, single, diabetic)

Since only two participants stated that they had seen the Food Dome before, the researcher felt it appropriate to show the Food Dome to the participants, allowing them to explore it and share their thoughts. The researcher showed the image of the Food Dome[13] and explained the recommendations included within the image (Figure 2.9).



Food groups and suggested daily servings

Food Group	Servings	Serving sizes
Cereals and their products	6-11	1 slice, ¼ Arabic flat bread, 30g cornflakes, ½ cup cooked cereals (rice, wheat, oats, macaroni), 6 small crackers (use whole meal cereals)
Vegetables	3-5	1 cup raw leafy vegetables or cooked vegetables, ¾ cup vegetable juice
Fruit	2-4	1 medium piece of fruit (banana, apple, mango, pear), ½ cup fresh, frozen or canned fruit , ¾ cup fruit juice.
Milk and dairy products	2-3	1 cup of milk, laban or yoghurt, 45g of cheese, 1 tablespoon cream cheese , 1 ½ tablespoon labnah(use low fat dairy product).
Meat, chicken, fish, eggs, legumes and nuts	2-4	50-80g of meat, chicken or fish, one egg, 2 tablespoons of peanut butter, ½ cup legumes, ⅓ cup nuts, 2 tablespoons of seeds.
Physical activity	Daily	Medium activity like walking (30 minutes for adults and 60 minutes for children, most days).

Figure 2.9. Food Dome dietary guidelines (Musaiger, 2012).

[13] A few chapters ago the reader saw a picture of the Food Dome. However, it has been included in this section as well to give the reader an idea of the structure of the guidelines.

Participants were interested to learn more about who had developed the concept and whether it was a media advertisement.

> *"Is this a media or what is this?" (P.9, 24-25y., male, single)*
> *"First time I see it. I have to read it." (P.14, 18-20y., male, single)*
> *"Oh, for Arab countries? Who made it, oh initiated?" (P.15, 21-23y., male, single)*

Once the students had had the opportunity to get familiar with the FDDG, a discussion followed on their thoughts and attitudes towards the food groups and portion sizes it recommended. Findings on attitudes to the Food Dome are presented in the next two sub-sections.

5.9.3.2 Useful and comprehensive

Participants found the FDDG to be an interesting, useful and coordinated tool that is worthy as it includes a variety of foods, and considers daily PA. They also noted that these recommendations might improve mental health.

> *"It's interesting." (P.1, 18-20y., male, single)*

> *"This is helpful." (P.4, 21-23y., female, single)*

> *"For me it's it's a word* [referring to worthy] *that we like it's for variety of food." (P.5, 24-25y., female, married)*

> *"More coordinated." (P.6, 18-20y., male, single)*

> *"It also improves your mental health." (P.2, 21-23y., male, single)*

> *"It's concentrated on daily activity." (P.7, 21-23y., male, single)*

One diabetic participant mentioned that the Food Dome is right for him owing to his health condition that requires special diet.

> *"For me it's right." (P.10, 21-23y., male, single, diabetic)*

They also considered that the FDDG balances what the body needs in terms of nutrition. One participant stated that before giving feedback he should read it, since he saw the Food Dome for the first time.

> *"It makes the balance of what the body need." (P.11, 21-23y., female, single)*

Students were then asked to familiarise themselves with the recommendations to facilitate discussion around the food groups and portion sizes. They were also asked to reflect on what would be the hardest adjustments to make to their diets and daily lives. As a result, barriers and challenges to following the Food Dome led to the next sub-theme, discussed below.

5.9.3.3 Barriers and challenges to following the FDDG

In developing the focus group guide, the researcher also considered exploring participants' nutritional attitudes and behaviours as students. This enabled understanding more about their nutritional likes and dislikes in respect of food groups in general, and from Food Dome in particular.

During the focus group discussions, participants questioned the number of portions of cereals' servings. They emphasised that Arabs eat more sweets and meat than other foods. When asked if Arabs eat more meat than cereals, i.e., rice, participants noted that both foods are consumed almost the same amount, with a slight predominance of meat. Thus, participants recommended decreasing the number of serving sizes for cereals and increasing meat.

> *"Arabs usually eat carbohydrates, sweets.....if you look at the picture here it's the first plate. Rice. Yes. Six to 11 Yeah, six to 11 servings. Who is going to utilize it? I don't think so...We used to eat a lot of meat." (P.15, 21-23y., male, single)*

> *"...they should decrease cereals and more protein with meat." (P.16, 21-23y., male, single)*

Furthermore, looking into the recommendations of the FDDG, most participants indicated vegetables and fruits as their least consumed food groups in daily life, asserting that these food groups would be the hardest to add to the diet. Since most of the participants felt that fruits and vegetables are difficult to add to their diets, they were asked to explain why, and a number of probe questions were used to explore whether it was due to price, availability,

freshness, or culture. Participants highlighted that the main reason was the price of vegetables and fruits since most of them are imported and mainly sold in grocery stores, where prices are higher than at the farmers' market. In addition, the students pointed out that in Saudi culture, people are not used to eating much fruit, mainly because of the price and the inconvenience of storing fruits in the refrigerator. Therefore, there is a preference for convenient foods in both price and availability.

> *"If you go to grocery store, it's very expensive. Most of them is imported. But it's actually it's cheap of the reason if you meet farmers market like." (P.12, 24-25y., male, married)*

> *"Actually, in our culture, we're not used to eat much fruits, to get it for which it's included in the price. So we used to, to eat some kind of food, what we used to eat, so about fruits, it's not that much useful to get it and keep it in the fridge." (P.16, 21-23y., male, single)*

Some of the main barriers to adopting the FDDG were the culturally accustomed diet, price, and availability of specific food groups, which will be discussed in the next sections, when referring to students' lifestyle. While participants expressed a positive attitude towards a healthy lifestyle and the FDDG in general, they concluded that the way it is displayed, makes it hard to follow daily (e.g., food groups, serving sizes). This led to the questions on which aspects of the FDDG participants felt would benefit from improvements, discussed under the sub-theme 'Food Dome – feedback and promotion' section 5.9.4.

5.9.4 Food Dome – feedback and promotion

Since this phase of research aimed to explore the knowledge of and attitudes toward the Food Dome among students, it was important to learn more about their feedback in relation to Food Dome. This would allow recommendations to be proposed to target knowledge, attitudes, and behaviour to support improving nutritional and lifestyle choices. Participants shared their thoughts on how the FDDG could be improved and the factors that could motivate students to follow it. This section outlines the relevant two sub-themes.

5.9.4.1 Education and awareness

To propose recommendations to target knowledge, attitudes, and behaviour in relation to the FDDG, participants were asked to discuss the best way to provide students with details of it.

The majority agreed that education, including lectures, posters, and scientific evidence on the harms of unhealthy nutrition, may increase interest in the FDDG. In addition, participants asserted that presentations should discuss conditions associated with obesity, to enable students to better understand the guidelines. They also suggested showing an example of someone who lost weight by following the Food Dome.

> *"Awareness of the status that caused by the unhealthy food." (P.3, 24-25y., female, single)*

> *"I agree with that. Before and after pictures on someone who lost like 50." (P.8, 24-25y., male, single)*

> *"By presentation, doing presentation regarding the forms and the calories and obesity and diseases. This is what is the best way that students can receive, be receptive to understand this information." (P.9, 24-25y., male, single)*

Disagreement arose when some of the participants suggested showing a comparison between the Food Dome and the American Food Pyramid through a poster. In particular, they felt that poster may require someone to explain the differences between two guidelines, hence displaying both posters may not work.

> *"Maybe showing difference between the two American Pyramid and Food Dome." (P.2, 21-23y., male, single)*

> *"A comparison of both I don't think it will work because they need someone to explain to them between the American type and Arabian* [referring to Food Dome] *type. So, I don't think poster will be clear for them." (P.5, 24-25y., female, married)*

In addition, disagreement arose in relation to daily PA recommendations being a part of the FDDG, with participants arguing that PA does not relate to nutritional guidelines and this recommendation does not make sense. However, one participant disagreed, noting that PA recommendations should remain in their place since it relates to healthy lifestyle as such. These arguments showed that the term "food dome" was perceived by participants only as "food" and not as a "healthy lifestyle" recommendation.

> *"Remove that exercise sign. It's not related to food." (P.15, 21-23y., male, single)*

"In my humble opinion physical activity shouldn't be there." (P.11, 21-23y., female, single)

"I agree, they are talking about the food and they are talking about physical activities doesn't make sense." (P.14, 18-20y., male, single)

"I think it should stay there, like eat healthy and exercise." (P.9, 24-25y., male, single)

This part of the analysis suggests that in addition to positive attitudes in relation to FDDG, participants also felt a need to be educated and learn more about the recommendations, which may eventually impact their food choices. Therefore, they were asked to share their thoughts on the best way to improve the FDDG and how they would like to receive the information, in addition to education. This part of the discussion resulted in the next sub-theme 'suggested improvements and promotion,' presented in the next section.

5.9.4.2 Improvements and promotion

To learn the best ways to propose recommendations to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population, participants were asked to discuss the best way they would like to receive the information about the FDDG.

Recommendations included making the Food Dome more visually appealing by using more colours and pictures, decreasing the number of words and showing the calorie content of the different foods. They also noted that the FDDG should be interactive and be presented electronically in both Arabic and English.

"Like more visual, interactive, something versus like a dry picture. Both language Arabic and English can then translate." (P.5, 24-25y., female, married)

"I think for me if decrease the number of words and highlight the most important things on it. It will be more attractive and it will be easy for people to follow." (P.11, 21-23y., female, single)

They further recommended highlighting the most important things, which could make the FDDG more attractive and easier to follow, including the revision of portion sizes (i.e., reduce the amounts of vegetables and fruits and increase meat). In their arguments,

participants also stated that the design of the American Food Pyramid is much better compared to the Food Dome.

> *"Even the design of the pyramid that used to be used in the States is much better. Also my concern is the portion." (P.15, 21-23y., male, single)*

This part of focus group discussions was followed by questions about the main sources of information participants use to help them follow a healthy lifestyle or dietary recommendations, aimed to explore the best way students expect to be informed about the FDDG. Most of the participants mentioned either social networks or applications. The diabetic participant also recommended the hospital, which provided him with dietary guidelines.

> *"Social media." [background]*
>
> *"YouTube, Twitter, Instagram." [background]*
>
> *"Apps." [background]*
>
> *"Invite celebrities." [background]*
>
> *"I get this one from the hospital. And also I get it from the social media. Something it's I forgot about the health." (P.10, 21-23y., male, single, diabetic)*

The majority agreed that social media and applications could be the most useful approach in distributing information about the FDDG. Participants also suggested distributing the FDDG in universities, colleges, and cafeterias. This could encourage students to choose healthier food, especially if the university offers incentives (such as discounts) and access to gyms and healthy restaurants.

> *"Put Food Dome in universities, colleges, cafes." (P.5, 24-25y., female, married)*
>
> *"The university gives students offers to the gyms and healthy restaurants, like sales or something integrated." (P.3, 24-25y., female, single)*

Overall, participants made useful suggestions about promoting the Food Dome and raising awareness of the outcomes of eating unhealthy food, including the idea of inviting celebrities,

information being displayed widely, and in both languages, mostly digitally (i.e., social media, applications).

Findings relating to knowledge of and attitudes towards the FDDG among the target population showed that although most participants lacked knowledge, they perceived the FDDG positively and expressed an intention to learn and follow it, with the appropriate education and promotion. The discussion also explored the students' lifestyles, specifically their nutritional and PA preferences and behaviour, which allowed more insight to be gained into their attitudes, that could inform recommendations in the next stage of research. As a result, the third theme of 'students' lifestyle,' broken down into sub-themes is presented in the following section.

5.9.5 Students' lifestyle

Having explored the knowledge of and attitudes towards the FDDG, this section covers the second theme derived from FA relating to students' lifestyles and sub-themes, including responsibilities and commitments, food choice – availability and convenience, time as perceived constraint for PA.

5.9.5.1 Responsibilities and commitments

The discussion of students' lifestyles showed that they experienced substantial changes after becoming students due to class load, time constraints, and changes in responsibilities, leading to changes in their diet, physical inactivity, sedentary behaviour, and stress. In general, participants reported having a high degree of stress and multiple responsibilities after becoming a student, which ultimately impacted their nutritional and PA behaviour as presented in section 5.9.5.3. They further emphasised that one of the main outcomes is the constant lack of time and energy.

> *"Responsibilities is different ... it's dependent on stress." (P.4, 21-23y., female, single)*
>
> *"I have more energy before becoming a student." (P.8, 24-25y., male, single)*
>
> *"More study." (P.2, 21-23y., male, single)*

When asked how their daily routine had changed, in addition to classes and exams, students highlighted that one of the main changes were in respect of their dietary patterns. Before becoming a student, participants used to eat healthy homemade food, whereas afterwards

their dietary patterns were affected due to class load, distance from home, and time constraints. Participants started eating mostly outside in cafeterias or fast food restaurants.

> *"Before being a student, I was living with my family. So I eat mostly healthy food, because it's homemade. But after I came, becomes the student, my diet is not healthy it's disaster. Because almost I eat my meals from fast food restaurant." (P.3, 24-25y., female, single)*

> *"I eat worse after becoming student." (P.6, 18-20y., male, single)*

> *"...no time to go specially with the home is far away from the university. So into it outside more than the home." (P.14, 18-20y., male, single)*

Students reported cooking less due to time constraints, recognising the importance of eating at home, where a variety of good quality food is available at different hours. Commitments to classes, exams and time limits were the main perceived barriers by the participants to consume less healthy food or to cook, and instead eating more junk food.

> *"...actually I'm eating outside because I didn't have time to study and cook together." (P.16, 21-23y., male, single)*

> *"I eat junk food most of the time, but home is actually different. At home there are variety of food at different times, good quality food." (P.15, 21-23y., male, single)*

> *“Now, I don't have chance to cook. Actually, it turns out that college because Okay, I have many exams. Okay, many commitments.” (P.16, 21-23y., male, single)*

This discussion was followed by a series of questions about food choices made by the participants after they became students, where they highlighted that the factors influencing their food choices, were not necessarily related to their attitudes. As a result, a sub-theme of 'food choice - availability and convenience’ has emerged, discussed below.

5.9.5.2 Food choice – availability and convenience

This part of the discussion provided a more detailed image of what influences students' food choices and why there were arguments and disagreements regarding the FDDG. All participants expressed a positive attitude towards healthy food and the importance of balancing the body's energy needs with food. However, food choices largely depended on

time, budget, availability, taste, and ease of food preparation as discussed in section 5.9.3.3. Furthermore, a married female participant noted that her food choice mainly depends on her and her child's activities throughout the day, where she tried to choose the food that will provide enough energy for all day with the minimum intake of sugar. Another participant indicated that he was mostly looking for a healthy food. For the rest of the participants availability, taste, time and budget were decisive.

> *"It depends on my body needs okay I know that I'm making an effort today so I would have just my foot* [referring to my food] *accordingly and for my kid for example for my kid know that much sugar so they will not be hyper* [referring to hyper active] *but at the same time it will be healthy for any nutritious so he can focus and then they will have energy throughout the day." (P.5, 24-25y., female, married)*
>
> *"For me, most of the time I'm looking for the for the healthy food." (P.9, 24-25y., male, single)*
>
> *"Availability." (P.1, 18-20y., male, single)*
>
> *"What's available in refrigerator." (P.8, 24-25y., male, single)*
>
> *"The taste." (P.10, 21-23y., male, single, diabetic)*
>
> *"I think it's colourful. It's might attract me." (P.11, 21-23y., female, single)*
>
> *"Time and budget." (P.16, 21-23y., male, single)*

Findings from Phase I showed that most of the participants consumed breakfast less than three times a week. Therefore, during the focus group discussion questions about breakfast were included to explore participants attitudes in relation to breakfast and the reasons they skip it. Participants who skipped breakfast emphasised 'time' as a perceived constraint, preferring to drink coffee as an alternative:

> *"I can sometimes I work late before class and I don't have enough time to eat my breakfast. And I prefer skip with the to drink a cup of coffee." (P.1, 18-20y., male, single)*
>
> *"Always I skipped breakfast just drinks." (P.6, 18-20y., male, single)*

"I skip breakfast no breakfast." (P.11, 21-23y., female, single)

"My breakfast usually the hot during drink coffee or milk." (P.14, 18-20y., male, single)

Further discussion led to arguments among those who consumed breakfast regularly and those who skipped breakfast substituting it with coffee. Those who ate breakfast argued that coffee cannot be an alternative to breakfast, since this meal is the main and most important meal of the day, whereas those who skipped breakfast argued that they usually wake up full, so only coffee is needed for convenience.

"I wake up full but I need coffee for convenience to complete my day." (P.2, 21-23y., male, single)

"I disagree with previous participant. Coffee cannot complete a day." (P.7, 21-23y., male, single)

"For me it's really important to have some breakfast yeah because really it's for me it's the main meal for the day." (P.16, 21-23y., male, single)

Those participants for whom breakfast was an important meal and consumed it regularly, preferred cereals, sandwiches or fruits, with one asserting that he sometimes ate eggs, while another reported wanting to eat something before, they had coffee, and another highlighting that they were addicted to caffeine:

"For me sandwich, one type of vegetables, one type of fruit." (P.5, 24-25y., female, married)

"It's usually in the morning cereal or small sandwich." (P.8, 24-25y., male, single)

"But it's not necessary for the food fruits are enough." (P.12, 24-25y., male, married)

"So for me I like to use banana at the morning to banana okay, because I'm addicted to caffeine. Alright, it will feel my stomach before I take the coffee." (P.9, 24-25y., male, single)

"Sometimes I'm taking cereals with milk. Sometimes eggs." (P.15, 21-23y., male, single)

The discussion of attitudes and behaviour towards breakfast led to a discussion of cereal consumption patterns among the participants. Low cereal consumption was an emergent finding from Phase I and debated during the Food Dome discussion. Thus, those participants who consumed cereals preferred cooked cereals in small portions. Only one participant consumed three to four portions of cereals:

"Little little cereal" (P.3, 24-25y., female, single)

"Dimension. It depends. It depends on your height and weight." (P.8, 24-25y., male, single)

"Three to four servings." (P.7, 21-23y., male, single)

As discussed in section 5.9.3, most of the participants did not consider rice as a cereal. The uncertainty in relation to cereals and their products can be explained by the fact that participants perceived cereals only as "breakfast cereal" and not as a food group belonging to the grain family. When the products that belong to the cereal food group were translated into Arabic, students agreed that Saudis consume a lot of rice and grains. This indicates that the participants need more education and awareness about the components of a healthy diet in general and specific components about the FDDG, i.e., the names of the food groups and their constituents.

During Phase II, attitude questions were asked about the types of dairy products participants preferred. All participants expressed positive views in relation to milk and dairy products being consumed daily. When asked about specific dairy products preferences, the majority indicated cheese, milk, yoghurt, or labneh (i.e., Greek yoghurt).

"Every day yogurt with oats." (P.10, 21-23y., male, single, diabetic)

"Daily yogurt and cheese me and my family." (P.12, 24-25y., male, married)

“Milk, cheese, yoghurt.” [background]

In respect of the question, why do participants consume dairy products daily, they responded that this food group is rich in calcium, light, and healthy.

"The rich have calcium." (P.5, 24-25y., female, married)

"It's light and healthy." (P.15, 21-23y., male, single)

During the discussion of the FDDG (section 5.9.3), participants generally agreed that they were consuming fewer vegetables and fruits compared to other foods due to the price and inconvenience of refrigeration. This part of the discussion adds more depth on how vegetables are chosen by participants. They explained that they prefer vegetables that are easy to cut, wash, and cook. In addition, the choice of vegetables was based on the taste and the amount of carbohydrates.

"Me I prefer the vegetables which is easy in cutting. Cleaning washing is in cutting I don't like carrots. Carrots vs organic yellow longer procedure. No, I don't like it. Okay, yani.[14] And even if I like the test, I prefer the easy way." (P.5, 24-25y., female, married)

"Taste and amount amount of carbohydrate." (P.9, 24-25y., male, single)

When asked about the importance of vegetable colour and nutritional value, all participants stressed that colour and nutritional value did not matter, rather taste and smell.

"Taste and smell." (P.13, 21-23y., female, single)

"Colour doesn't matter." [background]

"Taste." [background]

"Agree." [background]

Findings from Phase I showed that students consumed fast food frequently, although, consumption frequency was not found to be associated with high BMI. Fast food consumption preferences were further explored during the focus groups, where participants reported perceiving fast food as harmful, unhealthy and dangerous. At the same time, fast food was reported popular by participants due to its affordability, accessibility, and the fact that it is cooked food, given their time shortage, class load, which leaves them with little time to cook. Participants noted that their fast food consumption increased after becoming students.

[14] Yani – 'yaa'nii' means that is to say, because, namely (Rekhta Dictionary, 2023)

"A lot of a lot of fast food." (P.2, 21-23y., male, single)

"For it's not good just what but I like." (P.15, 21-23y., male, single)

"Actually, it is heavy food for me, but it is easy way." (P.14, 18-20y., male, single)

"We know it's not healthy but sometimes we have too." (P.12, 24-25y., male, married)

"After the classes started we start eating the fast food." (P.16, 21-23y., male, single)

Interestingly, a married participant, who stated that before being married he used to eat much fast food reported that after marriage he consumed fast food only once a week. Another married participant concurred with this, stating that they only consumed fast food only on the weekends. This suggests that being married may positively impact dietary patterns. Nevertheless, this idea was expressed by only two participants, which cannot be considered a new finding, rather a hypothesis that requires further research with a larger study sample.

"When I became a student, at that time, I was single I was eating too much. But when I married once a week." (P.12, 24-25y., male, married)

"Every weekend." (P.5, 24-25y., female, married)

Thoughts were expressed that fast food intake should be moderated, e.g., only at the weekend or in a balanced way. In general, fast food was referred to as a dangerous and tempting food that should consumed only once a week and balanced with other food groups. Yet, of sixteen participants only two did not consume fast food at all.

"It's dangerous if it's only a weekend." (P.3, 24-25y., female, single)

"Fast food consumption. When you're eating fast food to balance we don't have to eat always." (P.4, 21-23y., female, single)

"It's not all the time. But a good to have some times it's all easy wales [referring to easy way]. *We know it's not tempting. But sometimes." (P.12, 24-25y., male, married)*

"It's bad for my health." (P.11, 21-23y., female, single)

*"I hate it. For me, I don't prefert [*referring to prefer*]. I don't it at all." (P.9, 24-25y., male, single)*

The discussion on participants' nutritional attitudes and behaviour highlighted that several factors influenced their preferences and choice of food – time, budget, availability, taste, ease of preparation, and smell. The decisive factors in choosing less healthy food, were time, distance from home, and class load. When asked if colour and nutritional value affected their food preferences and choices, they replied that taste and smell are important in most cases. While the students recognised the dangers of fast food, it was a cheap and easy alternative for them. These data support the assertion that a positive attitude towards healthy eating does not necessarily result in healthy choice unless they are provided with additional information (as requested by students in this research), knowledge, and promotion of healthy food choices, as well as time. In order to get a complete picture of the students' lifestyle, it was important to explore their PA and sedentary behaviour presented in the next sub-theme.

5.9.5.3 Time as perceived constraint for PA

When asked about their physical activity habits, participants expressed positive perceptions regarding PA and asserted that everyone should be physically active daily. They also noted that PA includes a healthy diet, as well as the arrangement (i.e., balancing) between meals and hours of PA.

> *"I think all of us have been to exercise every day." (P.15, 21-23y., male, single)*

> *"...if you do exercise, I think you can't eat anything, but you have to find time to exercise." (P.13, 21-23y., female, single)*

> *"Arrange your time between eating and exercise." (P.10, 21-23y., male, single, diabetic)*

Despite knowledge and positive attitudes towards PA, most tended to lead a largely sedentary lifestyle. One participant continued to train once or twice a week, while another stopped daily PA immediately after he became a student. Higher education, a new environment at the university/college, relocation from one region to another, and time constraints due to class load were all cited as factors for being less physically active.

> *"Once a week, twice a week active." (P.4, 21-23y., female, single)*

"...before I became students, I used to go to gym every day, and I was making my own meals nowadays I eat one meal a day. I didn't have much time to physical activities." (P.8, 24-25y., male, single)

"I just came from west side of Saudi Arabia to the east side of Saudi Arabia until now, I'm just busy with my family that I couldn't find any time to go to gym or to do any sports so I'm just eating and sleeping all the time. This is my schedule. It's a daily routine. It changed after becoming student here." (P.12, 24-25y., male, married)

Only one participant continued to work out daily after becoming student, despite class load, time limits, and responsibilities as a student. This was the same participant who mostly made healthy food choices and never consumed fast food as stated in section 5.9.5.2.

"Every day you work for me I'm, I used to go to the gym. Okay, especially after school. So I used to go to the gym for like one hour. Okay, yeah. So, yeah, I found myself that." (P.9, 24-25y., male, single)

Summarising the findings of this sub-theme the findings indicated that although students have a positive attitude towards PA, emphasising its role in a healthy lifestyle, most of the group was physically inactive. As with food choices, the main reasons for less PA and a more sedentary lifestyle were class load and time constraints. The female participants did not mention gender as a barrier to PA. This may potentially be because they were in a mixed gender environment, where they were less likely to engage in active discussions about gender-specific barriers. However, this is a hypothesis that requires further consideration.

It is important to note that the study was conducted during the COVID-19 pandemic, which meant that the students were required to comply with restrictions and participate in online learning. Questions on how COVID-19 affected their lifestyles and behaviour were included in this research as a separate contribution to the existing data on the effects of pandemic, presented below.

5.9.6 COVID-19 impact

Due to the COVID-19 pandemic, a nationwide lockdown across all provinces of the KSA was announced on March 12th, 2020 (MOH, 2020). As a result, all social and governmental gatherings and events were suspended. In addition, many services, including fitness centres, hospitality, leisure, and educational institutions, were forced to close for an unspecified

amount of time (MOH, 2020). This resulted in universities closing their campuses, asking students to return home, and moving to remote teaching and assessment methods (MOH, 2020). These changes impacted the lifestyles of the general population and students in particular, leading to changes in dietary patterns, PA, and sedentary behaviour. Therefore, in addition to the main aim of this research, the focus groups explored the impact of COVID-19 on the students' lifestyles.

During the focus group discussion, participants shared a number of distinct experiences they had during the COVID-19 lockdown. As such, some of the participants experienced a diet change, i.e., they ate more homemade meals, which resulted in considerable weight loss, up to 20 kilogrammes. They also started cooking daily at home, as the restaurants were closed. Some participants noted that the lockdown was a good opportunity to have more family time.

> *"Coronavirus? Yes Yeah, I actually lost a lot a lot weight during the pandemic. It changed my diet. I ate homemade dishes." (P.1, 18-20y., male, single)*
>
> *"Before the pandemic yani I eat always outside, but during the pandemic yani it's different, we cooked at home." (P.3, 24-25y., female, single)*
>
> *"During the pandemic we start to cooking every day at home." (P.4, 21-23y., female, single)*
>
> *"During pandemic I lost almost 20 kilogram because the restaurants were closed. I only get obligated with food in my house." (P.6, 18-20y., male, single)*
>
> *"I'm happy to put because the timing we stay at home increasing and meeting each other doing some activity with food like barbecue like to cooking together eating together that dynamic affecting our habits." (P.11, 21-23y., female, single)*

Thus, for these students, the pandemic led to healthy food choices, with students spending more time with family, and cooking and eating homemade meals, which resulted in weight loss, highlighting the potential role of restaurants and eating out in weight gain. In addition, these observations added weight to participants' statements about changes in dietary patterns after becoming student and consuming unhealthy food outside.

In terms of PA during the lockdown, some participants reasoned that the closed gyms led to less PA, while others continued their training at home:

"It's affects a lot. So for me…..the gym all the gyms closed so I found it I had a hard time to find a place you have to find a place to walk out." (P.9, 24-25y., male, single)

"I trained in a house." (P.14, 18-20y., male, single)

In sum, students reported eating more homemade food during the COVID-19 lockdown, which resulted in weight loss for some. Further, although gyms were closed those participants keen on regular PA continued to exercise despite closed gyms.

The next section summarises the main findings of the focus groups discussions, followed by the reflexive statement.

5.10 Summary of key findings from the focus group discussions

The objective of Phase II was:

- *To explore the knowledge of and attitudes towards the FDDG among the target population.*

Several key findings emerged, as follows:

- Participants had a general idea of the overall goal of nutritional guidelines but lacked knowledge about the FDDG.
- Participants found the FDDG to be an interesting, useful and coordinated tool and were willing to learn and be further educated about healthy nutrition through awareness of the FDDG.
- Some of the main challenges in adopting the FDDG recommendations were the culturally accustomed diet, price, and availability of specific food groups, i.e., vegetables and fruits.
- Disagreement arose in relation to daily PA recommendations being a part of the FDDG, with some participants arguing that PA does not relate to nutritional guidelines.
- Participants recommended making the FDDG more visually appealing by using more colours and pictures, decreasing the number of words and showing the calorie content of foods.

- Social media and applications were asserted as the most useful approach in distributing information about the Food Dome in addition to distributing the Food Dome in universities, colleges, and cafeterias.
- Participants reported experiencing substantial changes to their lifestyles after becoming students due to class load, time constraints, and responsibilities, leading to changes in their diet, physical inactivity, sedentary behaviour, and stress.
- Food choices largely depended on time, budget, availability, taste, and ease of food preparation, with an increase in fast food consumption reported since starting University.
- Participants who skipped breakfast emphasised 'time' as a perceived constraint, preferring to drink coffee as an alternative.
- Participants recognised the importance of grains and their products, however, only after the term 'cereal' was translated into Arabic and they understood which foods belonged to the group of grains.
- Positive views were articulated in relation to milk and dairy products being consumed daily, as participants identified this this food group as being rich in calcium, light, and healthy.
- Despite knowledge and positive attitudes towards PA, most reported tending to lead a sedentary lifestyle.
- Higher education, a new environment at university/college, relocation from one region to another, and time constraints due to class load were all cited as factors for being less physically active.
- During the COVID-19 lockdown, some participants reported experiencing a dietary change, i.e., eating more homemade meals, which resulted in considerable weight loss.
- Participants who were physically active before COVID-19, reported that they continued to practice regular PA during lockdown in their home environment.
- Female participants did not mention gender as a barrier to physical activity. Similar to male participants time constraints and class load were decisive factors.
- Differences in power dynamics were observed between males and females. Females were more reluctant and less dominants to talk and communicated mostly by gestures (i.e., nodding), agreeing or disagreeing with some thoughts, whereas males were more active and engaged.

These findings represent a unique contribution from Saudi students in respect of their knowledge, attitudes and food choices, along with their desire to learn more about FDDG. The finding from the focus groups (together with those from Phase I) were considered as the basis to answer the fourth objective of the current research, i.e., to provide short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population. However, before turning to the fourth objective, the findings from two phases of the research will be discussed in relation to the literature in Chapter 6.

The next section that will conclude Chapter 5 is a reflexive statement critically discusses the insights and observations made by the researcher during the study. The role of the researcher, his beliefs, the influence of these beliefs and behaviours on the research process will be presented.

5.11 Reflexive statement

Good qualitative research requires careful record keeping and being reflexive, which increases the credibility of research and professional development (Mruck & Breuer, 2003; Lacey & Luff, 2007). Reflexivity is a term used to describe the relationship between the researcher, study sample, collected data, and knowledge gained, offering more in-depth meanings to the phenomenon (i.e., the aim of research), thereby clarifying the approaches used to obtain certain interpretations (Ryan, 2005).

Sandelowski & Barroso (2002) explain,

> "Reflexivity is a hallmark of excellent qualitative research and it entails the ability and willingness of researchers to acknowledge and take account of the many ways they themselves influence research findings and thus what comes to be accepted as knowledge. Reflexivity implies the ability to reflect inward toward oneself as an inquirer; outward to the cultural, historical, linguistic, political, and other forces that shape everything about inquiry; and, in between researcher and participant to the social interaction they share" (p. 222).

Reflexivity recognises the role of the researcher as a participant in the process of building knowledge and not just an outside observer of the phenomenon (Anderson, 2008; Dowling, 2006). It is a process of self-criticism by the researcher to examine how one's own experience

may or may not have influence the research process (Dowling, 2006). This reflective statement aims to share any conscious or unconscious bias that might affect the research process, as well as knowledge gained in the flow of research (Flick, 2009; Holloway and Wheeler, 2010; Silverman, 2011).

My journey started seven years ago; after moving to Saudi Arabia to teach at Prince Mohammad bin Fahd University, I became particularly interested in Saudi history. Inspired by culture, traditional values, people, and the land, and I started capturing and documenting images, chronicles, and stories of the KSA.

Just as past explorers ventured into the forbidden deserts of Arabia and discovered the *Badu*[15] and their ways of life, I embarked on a twenty-four-month tour of the entire Kingdom (June, 2017). The journey started in the Southern Province, and circling the country through the Eastern, Central, North–Western and Western provinces became a real circumambulation (*tawaf*[16]) around the land, of over 150,000 kilometres. The journey has been a true learning school and experience in understanding Saudi '*adat*[17] and *taqlid*[18].

The journey involved taking a number of trips with my students across the regions of Saudi Arabia (Southern, Eastern, Central, North-Western, Western province), walking into the daily life of the people and living among them, which offered a higher layer of understanding than reading about them. As I listened to my students talking about their ancestors and traditions, I discovered a new Saudi Arabia, one that stood the tests of time and history. The results of my journey turned into a book entitled "*The Land of 'Adat*," a Westerner's vision of the Kingdom, where I zoomed on a rarely discussed aspect of the nation, namely its inner beauty.

Being mesmerised by the country and writing a book did not distance me from my background in research, i.e., public health. My experience in research deeply shaped in me the core values of public health "to protect and improve the health of people and their communities, which can be as small as a local neighbourhood or as large as an entire country

[15] Badu (Bedouin) – the ethnic, nomadic people of Arabia (Woodman, 2020).
[16] Tawaf - circumambulation around the Ka'bah (Woodman, 2020).
[17] 'Adat is derived from the Arabic word ʿādā́t, to mean tradition, or the habit of a family, tribe, or nation, that is passed on from generation to generation (Woodman, 2020).
[18] Taqlid or taqleed signifies the traditionalism of one person to the teaching of another. When the elder member of the family teaches the younger generation (Woodman, 2020).

or region of the world" (CDC, 'Public Health Connects Us All,' para. 1 2021). This experience served as an impetus for the further continuation of my research.

During my travels, I had the privilege of entering into traditional Saudi families, homes where I was treated to local cuisine rich in healthy and nutritious foods. In comparison, when I had dined with my students, at the university, I observed that from a rich menu they mostly choose unhealthy or fast food, and that some of them were overweight. I can unequivocally say that my students inspired me to start this research to understand more about nutrition in this diverse community and contribute to the Saudi youth and society in general.

Having grown up and been educated in the United States, where one in three adults (30.7%) are overweight and more than two in five adults (42.4%) are obese (including severely obese), I have witnessed and studied a number of behavioural patterns that may lead to overweight and obesity, as well as obesity related NCDs (National Institute of Diabetes and Digestive and Kidney Diseases, 2021). In addition, as a student I had the opportunity to observe the food choices of my peers in the United States, which led me to understand that there are a number of complex factors influencing student attitudes and food choices that are not necessarily related to their knowledge of nutritional values. In most cases, after entering higher educational institutions, students became independent and free to choose food, and they started to choose based on taste rather than health benefits. Additional factors influencing food choices were the environment, whether physical or social, and individual values.

My own attitudes and behaviour towards a healthy lifestyle, PA and healthy eating, have been influenced by my personal and professional life. Personally, I am committed to a healthy lifestyle, including daily exercise and healthy food choices, even with minimal budget and time. At the same time, I acknowledge that leading a healthy lifestyle, eating healthy food and going to the gym requires time, discipline, and resources that we do not always have, especially as students. At the same time, based on my own experience, I have developed approaches to finding inexpensive alternatives to a healthy lifestyle without extra costs. For example, walking for at least two hours a day (during cooler hours when in KSA) instead of going to the gym; if there were no alternative to fast food, eating small portions and drinking water regularly. I believe that this approach stems from my personal attitudes, which I cannot instil in anyone else but can suggest. From a professional point of view, my choice of public health education has deepened my knowledge and strengthened my attitudes towards a

healthy lifestyle, according to the core values of public health. I argue that to promote a healthy lifestyle or public health, one needs to lead a healthy lifestyle and be a living example. However, even this approach sometimes does not work, as I have observed during lunches with students. Thus, while they waited for me to make my first choice, almost always healthy food, they might choose something unhealthy or too fatty; a highlight of how our choices mainly stem from our attitudes and not always from knowledge or resources.

This is how I became interested in factors influencing Saudi students' food choices, and what might motivate them to reconsider their food choices. Observations and dietary contrasts within the home environment and outside (i.e., restaurants, cafes) prompted me to begin an initial study of what is known and missing in the literature on dietary patterns and lifestyle in the Gulf region and Saudi Arabia, particularly in respect of the factors that could either motivate or prevent students from choosing healthy foods or being physically active.

From the onset I recognised that my aim was to understand the nutritional knowledge, attitudes and behaviour of students that influence their food choice and weight. The quantitative phase provided numerical descriptions and estimates of the size and distribution of effects, and allowed tests for statistical significance, while the qualitative stage allowed me to study phenomena from the inside, to explore the meanings students assign to their experiences and how they understand the world around them. In choosing a qualitative methodology for this study, I considered that focus groups were suitable for examining the complexity of knowledge and attitudes towards food choice, diet, and PA, i.e., allowing participants to answer the question "why?". At the same time, I had less control over the data collected since participants talked to each other, asked questions and expressed doubts and opinions, while my role was to keep the participants' attention on the topic. This is why the questions were developed to start with "Can you tell me about..." or "What do you think..." Probing questions were introduced only when appropriate so as not to elicit specific responses that might be consistent with previous observations or meet my perceptions or beliefs. As stated, while the reliability and validity of quantitative research depends on the design of the instrument, in qualitative research, "the researcher is the instrument" (Patton, 2014, p. 14) Therefore, as *an instrument*, it was my responsibility to carefully develop the focus group guide, review previous evidence, and obtain ethical approval from the UoS (HSR1920-016) Ethics Committee. As a result, the findings of the two phases of the study, in particular the focus group discussions, have provided insights into the challenges Saudi

students face after they leave their home environment and enrol in higher education, which ultimately affect their lifestyle including food choices and PA.

A number of steps were taken into account to reduce potential bias throughout the study to be presented in this paragraph. Keeping records, diaries, and notes was the beginning of documenting all the communicative actions that took place in this intercultural study, which made it possible to explain the communication process and draw accurate and reliable conclusions. In addition, detailed record keeping has become a way to track what has been done along the way, suggesting ways to improve next steps and ensuring methods are reproducible. Furthermore, I considered using framework analysis, which provides a structured approach that would facilitate a systematic and comprehensive analysis to answer research questions while at the same time ensuring credibility, transferability, dependability, and confirmability of the collected data. Lastly, since I am a novice researcher in qualitative studies, two experienced researchers (i.e., my supervisors) were engaged to guide the data collection and interpretation stages. At all stages of my research, I present the findings by taking into account the methodology used, through written texts, tables, graphs based on the research aim and objectives, to diminish bias or personal interpretation. I hoped that the findings of this research would lead to the development of interventions to support young people in making healthier food choices, reducing their chances of becoming overweight, obese, and developing long-term obesity-related health conditions. However, due to the challenges of COVID-19, it has only been possible to put forward recommendations for future research to explore further.

Reflection is a metacognitive process that occurs before, during and after situations with the purpose of developing greater understanding of both the self and the situation so that future encounters with the situation are informed from previous encounters (Sandars, 2009). My experience of conducting this mixed methods research allowed me to immerse myself in the reality of Saudi students, different from what I observed over the years of teaching. This experience has helped me to better understand how students live, perceive and behave in their daily lives, not necessarily about food choices and PA, but including their social interactions and the day-to-day application of freedom and gender equality promoted throughout the Kingdom in recent years.

Under the guidance of my supervisors, this reflective statement was developed to share my experience, motivations behind the research, and insights I gained.

Chapter 6 - Discussion of Findings

6.1 Chapter overview

Chapter 6 discusses the findings of Phases 1 and II of the research. It begins by introducing the thesis, setting out the overall aim of the research, the objectives addressed. This is then followed by the discussion of the overall characteristics of the study samples, as well as power dynamics, in this mixed-gender research setting. This is followed by the discussion of the main findings in relation to the objectives and the literature. The chapter will conclude with a summary of the research phases, thereby addressing the fourth objective of this PhD research, i.e., providing short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population (Chapter 7).

6.2 Introduction to thesis

Food, whether eating out or at home, is connected to every aspect of life and, most importantly, health. The food consumed has the potential to keep people in good health or cause ill-health, increasing the burden on already depleted health systems (Ul Haq et al., 2018; Irwin et al., 2019; Alves & Precioso, 2020). Over the past decades, traditional dietary patterns in the MENA region, specifically Saudi Arabia, including dates, milk, vegetables, fruits, fish, and whole grains of wheat, have been replaced by a western-style diet with excess intake of high-calorie foods, high intake of fat and sugar, and low intake of fibre (Memish et al., 2013; Musaiger et al., 2017; Al-Qahtani et al., 2019; Althumiri, 2021). This transition has resulted in decreased PA levels, increasing diet-related health conditions, such as overweight, obesity, and obesity-related NCDs (Kearney et al., 2001; Musaiger et al., 2017; Zarrazquin et al., 2018).

The Arab Center for Nutrition developed the FDDG (2012), a set of recommendations designed to promote a healthy lifestyle and tackle obesity and obesity-related NCDs in the MENA region. While understanding nutritional knowledge, attitudes and behaviour of the community about proposed dietary guidelines are essential factors, no further research was conducted to explore whether the general public knows or follows the Food Dome, or to provide the feedback about its recommendations (Musaiger, 2012; Montagnese et al., 2019).

In the KSA, the rates of obesity vary, with the highest rates in the Eastern Province (29.4%) and central regions (20.5%) and the lowest in the southern regions (8.9%) (Al-Shehri et al., 2013; Alkahtani & Awad, 2016; Al-Qahtani et al., 2019; Althumiri, 2021). Studies conducted in the Eastern Province of KSA reported increasing changes in dietary patterns and unhealthy attitudes toward food choices in addition to low levels of PA (Al-Qahtani & Sundogji, 2016; Fatima & Ahmad, 2018; Al-Qahtani et al., 2019). While authors concur on the urgent need for nutrition education among this population, none of the studies previously conducted have investigated the common factors associated with rising levels of obesity and overweight, alongside knowledge, attitudes, and behaviour in relation to the FDDG.

This PhD research became the first to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the FDDG among 18-25-years-old university students in the Eastern Province of the KSA.

The objectives of the study were:

1. To identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA (Phase I – quantitative).
2. To investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region (Phase I – quantitative).
3. To explore the knowledge of and attitudes towards the FDDG among the target population (Phase II - focus groups).
4. To provide short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population.

6.3 Study sample characteristics

As part of this research, seventeen higher educational institutions of the Eastern Province of the KSA were invited to participate. Three gave initial agreement, and of these, two participated in the final data collection. The study sample for two phases of research included n = 426 participants in Phase I and n = 16 in Phase II. During Phase I, of n = 426, (males n = 293, females n = 133). It is well established that low female participation in research is a global issue (Al Subeh & Alzoubi, 2021; Sosinsky et al., 2022). However, in Saudi Arabia, male participants have previously been found to make up over 60% of the sample size in

health research (see for example Mahfouz et al., 2011; Ahmed et al., 2017; Algabbani et al., 2021). Consistent with previous research, this suggests that the underrepresentation of females in health-related research may lead to undesirable and biased outcomes for women's communities in the study population (Ahmed et al., 2017; Al Subeh & Alzoubi, 2021; Algabbani et al., 2021). Moreover, this difference in numbers also suggests that, despite the changes taking place in the country, females may not feel entirely comfortable and free to participate in various activities, including health research, which was confirmed during Phase II of this research.

During the focus group phase (Phase II), emerging observations related to the power dynamics between male and female participants. Of n = 16 participants, the majority were males, n = 11, alongside n = 5 females. It appeared that students either felt uncomfortable interacting with the researcher and the chaperone or participating in a mixed-gender discussion (see section 5.9.1). They were hesitant when speaking and elaborating on their daily habits, preferences, choices, and concerns regarding the questions asked. Instead, most of them tended to speak only when one of the participants would start to answer a question. These patterns were especially evident for the female participants, who were less active and preferred to communicate mostly through gestures or nodding. On the contrary, males were more active and sociable. As such, while males and females are very active in their daily lives and interactions with peers, in a shared environment (e.g., during the focus groups) with a researcher and chaperone, students of both genders were more reluctant to talk, specifically female participants. Considerable efforts by the researcher and chaperone mitigated this to some extent, however, it was evident that the Saudi students' cultural background and roots influenced how they think, feel, and interact with the world (Hofstede, 2001; Kuwari et al., 2021; Al-Amer et al., 2018).

The findings of this PhD research resonate with previous evidence in terms of the demographics and interaction of participants, highlighting how culture and tradition continue to be important determinants affecting the group dynamics, thereby contributing to the debate as to whether it is appropriate to carry out mixed-gender focus groups in countries that still have gender segregation (House, 2012; AlMofawez, 2016; Alsadaan et al., 2021; Alnasser, 2022). While some authors of earlier studies in the region have stated that even communicating with a researcher of the opposite gender can be burdensome for participants, others have suggested that innate politeness and shyness can prevent even same-gender

discussions or arguments during data collection (Hofstede, 2001; Kuwari et al., 2021; Al-Amer et al., 2018). On the other hand, given the findings of previous researchers, it would be misleading to assume that gender-segregated focus groups or face-to-face interviews could lead to a richer data. Hence, this PhD research concurs with previous authors findings and confirming the need for researchers to understand the cultural elements of a population in order to adapt during data collection, regardless of the methods chosen (i.e., face-to-face interviews or focus groups) (Thomas, 2008; Hawamdeh & Raigangar, 2014; Kuwari et al., 2021; Al-Amer et al., 2018). Moreover, continuous progress on the representation of females in health research, including identifying obstacles and barriers, is critical to ensure greater representativeness of the data (Ahmed et al., 2017; Al Subeh & Alzoubi, 2021; Algabbani et al., 2021).

The next section will discuss the findings of two phases of this research in relation to the objectives and literature to inform the fourth objective of this PhD research - providing short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population.

6.4 Discussion of findings from phases I and II

The first objective aimed to identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA. The findings of the first objective of this study showed that most of the nutritional PA, and sedentary behavioural factors in the questionnaire did not influence obesity amongst the participants. However, certain emerging patterns were identified that warrant discussion.

The question of whether or not to eat breakfast and its impact on health and weight has been the subject of controversy for decades (Betts et al., 2016; Ferrer-Cascales et al., 2018; Sievert et al., 2019). In this research, more than half of students (n =231 (54%)) consumed breakfast fewer than three times per week, and n = 62 (14.6%) did not consume it at all. Gender analysis showed that more male participants consumed breakfast, consistent with a study conducted among US students, where females were less likely to report daily breakfast consumption than males (Manore et al., 2017). This research found no significant relationships between breakfast consumption and any of the weight categories (even those who were obese n = 73) of the target population. These patterns were consistent with earlier research conducted among Saudi students (Alhakbany et al., 2018), which reported

insignificant differences in skipping breakfast and being overweight, obese, or normal. Similar patterns were reported by Al-Qahtani et al. (2019) in a study conducted among adolescents in the Eastern Province of KSA, where breakfast consumption was not found to be associated with BMI. The evidence in the literature is consistent with the results of the current research, in which neither skipping nor eating breakfast *per se* was associated with obesity or overweight in participants. These findings concur with previous studies which highlight that the relationship between breakfast intake and body weight are not yet well understood, although research linked breakfast consumption to improved overall nutrition, higher levels of PA, and overall quality of life (Manore et al., 2017; Ferrer-Cascales et al., 2018; Al-Hazzaa et al., 2020; Shatwan & Almoraie, 2022). During the focus group discussions, participants mentioned that they often skipped breakfast due to the lack of time because of the class load, consistent with previous studies (Teleman et al., 2015; Manios et al., 2015; Al-Hazzaa et al., 2020). For example, an Italian study by Teleman et al. (2015) found that about 40% of students did not meet the frequency of breakfast consumption recommendations, as per Italian National Research Institute on Food and Nutrition guidelines, due to lack of time (Teleman et al., 2015). Previous research in Saudi Arabia and worldwide has shown that in addition to lack of time, multiple factors can affect breakfast intake, including gender, family composition, and SES (Manios et al., 2015; Al-Hazzaa et al., 2020). Further research is recommended to explore students' breakfast quality and factors influencing their choice to consume or skip this meal, i.e., other socio-economic and lifestyle factors such as smoking, sleep, and PA (Harris, Carins & Rundle-Thiele, 2021; Ricotti et al., 2021; Giménez-Legarre et al., 2021).

It is suggested that a generous intake of fruits and vegetables may help with weight control, as they are rich in fibre and water, which provides a satiety effect (Al-Nakeeb et al., 2012; Al-Qahtani & Sundogji, 2016; Al-Qahtani et al., 2019). In this research, the analysis of fruit consumption frequency and its relation to weight found it to be statistically significantly associated with BMI categories of males (i.e., males who consumed fruits more than three times per week were more likely to be in the normal weight category) but had no significant association with the BMI of females (Table 4.14). In the obese group, frequent fruit consumption was significantly associated with obesity in males but not in females. Further findings showed no significant association between vegetable consumption and obesity among males and females. In the literature, Al Qahtani et al. (2019) reported that overweight and obese individuals had a significantly higher consumption of vegetables than normal-

weight subjects. Similarly, a study conducted among Omani students showed that frequent vegetable intake per week (i.e., more than three times per week) was associated with an increase in the odds of being overweight by 19%, and frequent fruit intake per week (i.e., more than three times per week) was associated with a decrease in the odds of being underweight and overweight by 24% and 17%, respectively (Al-Mahrouqi, 2019). Taking into consideration the findings on the association of fruit and vegetable consumption with BMI during Phase I, the attitudes, and preferences of students in choosing fruits and vegetables were explored in the focus group discussions. While students acknowledged the health benefits of fruits and vegetables, they reported that their choice of vegetables and fruits was mainly based on taste, price, and ease of preparation, as opposed to for health reasons. Participants had positive attitudes in relation to healthy eating, however also emphasised "affordability," as an additional important factor when choosing foods, discussed in relation to the literature in the following paragraph.

During focus groups, participants reported consuming fewer vegetables and fruits than other foods due to the price and inconvenience of refrigeration, although they all lived in their family home environment. Some students who bought fruits and vegetables from farmers' markets stated that the prices were not as high, although others argued that farmers' markets require travelling long distances to buy, which will need to be refrigerated for several days. Therefore, they preferred to buy cheap, tasty food that satiates quickly and do not require refrigerated storage. This reasoning was consistent with assertions from Dutch university students' (n = 689, from more than 40 universities across Germany) that healthy food is expensive and not affordable, among other factors (Hilger et al., 2017). Similarly, a study conducted among students in New Zealand reported that the aspects most frequently identified as a motivation for eating fruit and vegetables were taste and price, in addition to health outcomes and satiety (Hartman et al., 2013). Among the challenges of adherence to nutritional recommendations, Australian students cited the increased cost of fruits and vegetables in grocery stores, which was consistent with the reasoning of Turkish students, who stated that low availability and quality, combined with high prices for fruits and vegetables were the reasons for their low consumption (Ünüsan, 2004; Irwin et al., 2019). In contrast, despite their limited income and lack of time, Italian students (n = 457) were willing to dedicate time to buy less expensive but healthy food (Savelli, 2018). This suggests that along with attitudes towards the choice of fruits and vegetables, it seems important to educate university students about places to buy cheaper fruits and vegetables since increased

availability of attractive, healthy, and inexpensive fruits and vegetables may increase consumption (Ünüsan, 2004; Macdiarmid et al., 2013; Miller et al., 2012; Irwin et al., 2019). Furthermore, considering the socio-ecological model, providing students access to cheaper fruit and vegetables might be another solution (Hill et al., 2013).

Offering accessible and affordable fruits and vegetables on campus has been found in previous studies to remove perceived barriers for students in making healthier choices, since the food environment is an important factor in choosing healthy food, among other factors (French & Stables, 2004; Boeing et al., 2012; Sacks et al., 2015; van den Bogerd et al., 2020). For example, a study by Sacks et al. (2015), conducted in 2005, in the New York City Department of Health and Mental Hygiene initiative used the socio-ecological model to develop a multifaceted effort to increase fruit and vegetable access citywide, emphasising low-income neighbourhoods. The Department of Health and Mental Hygiene introduced Health Bucks as a farmers' market–based initiative to distribute $2 coupons to low-income consumers. As a result, the percentage of adult New Yorkers who reported not eating fruits and vegetables the previous day dropped slightly over ten years from 14.3% (2002) to 12.5% (2012). A more recent study among Dutch university students aimed to investigate the effects of free fruit and snack vegetables at a university on students' fruit intake, snack vegetable intake, and total vegetable intake (van den Bogerd et al., 2020). Students were offered free fruit and raw snack vegetables in a stand in the form of a miniature wooden house located in the central hall of the university's main building. The results showed that the intervention positively affected students' consumption of vegetable snacks but did not influence fruit consumption or overall vegetable consumption (van den Bogerd et al., 2020). However, the intervention resulted in an increase in the consumption of fruits and vegetables by students who had low intakes of these foods prior to the intervention. An earlier systematic review by French and Stables (2004) looking at environmental interventions to encourage fruit and vegetable consumption among young people found that multi-component interventions in schools were effective in increasing fruit consumption, with increases reported from 0.2 to 0.6 servings per day. However, the effect on vegetable intake was less effective, with an increase from 0 to 0.3 servings per day. The overall results of studies on environmental change interventions show the potential for a positive impact on young people's consumption of fruits and vegetables (French & Stables, 2004). As seen from these examples, the application of targeted interventions and socio-ecological model helped increase fruit and

vegetable consumption and shed light on areas that require additional research, policy, or focus.

Milk and dairy products are a source of lipids, proteins, vitamins and minerals, immunoglobulins, hormones, growth factors and other bioactive peptides (Platkin et al., 2015; Mozaffarian, 2019). Although there has been some controversy regarding the impact of milk and dairy products on weight, with some researchers stating they can promote weight loss and fat reduction, while others point out that they do not affect BMI (Platkin et al., 2015; Mozaffarian, 2019; Yücel, 2020). In this research, the analysis of milk and dairy product consumption showed that males and females who consumed this food group more than three times per week were significantly more likely to be in the normal weight category. At the same time, in the obese group (n = 73), participants who consumed milk and dairy products were also more likely to be obese than those who consumed this food group less than three times a week or did not consume at all (Table 4.14). In contrast, a study among Omani students showed that the consumption of milk and dairy products more than three times per week was higher among underweight girls (57%) than their peers across other BMI categories (Al-Mahrouqi, 2019). A more recent meta-analysis examining the associations between milk and dairy consumption frequency and BMI found no significant difference between milk or yoghurt and obesity levels or between total dairy and its products and obesity levels (Babio et al., 2022). Further evidence suggests that it is important to distinguish between dairy subtypes as their nutritional profiles differ; therefore, they may also be associated with obesity differently (Mozaffarian, 2019; Babio et al., 2022). The exploration of preferences for types of milk and dairy products was undertaken during Phase II.

During the focus group discussions, all participants expressed positive views in relation to milk and dairy products being consumed daily, asserting that this food group is rich in calcium and healthy. When asked about specific dairy product preferences, the majority indicated cheese, milk, yoghurt, or labneh (i.e., Greek yoghurt). This reasoning was consistent with a recent study among Turkish students who reported consuming milk and dairy products because they are a source of vitamins, proteins, nutrients and calcium (Güzeler et al., 2020). Similarly, Çetinkaya (2010) indicated that 46.0% of Kafka University (Turkey) students preferred to consume milk due to its nutritional properties, and 25.3% of them stated that they consume milk due to its being a source of vitamins, proteins, and calcium (cited in

Güzeler et al., 2020). While nutritional awareness is not always correlated with attitudes and behaviours, results from this study indicated that Saudi students consumed milk and dairy products because they knew about the beneficial components of this food group. Nevertheless, future studies are required to explore whether the choice of dairy products was associated with knowledge only, or whether affordability was also a factor.

The consumption of various types of fast food is progressively growing worldwide, both in developed and developing countries (Epuru & Al Shammary, 2014; Alissa et al., 2015; Al-Qahtani et al., 2019). In this study, although overall fast food consumption was high for the general sample, males were more likely to consume fast food more than three times a week than females, which was found to be statistically significant (Table 4.13). This pattern was consistent with studies among Italian and Romanian students (Teleman et al., 2015; Pop et al., 2021). Similarly, Alassaf et al. (2021), in their study among students from Central Saudi Arabia, reported that more than half of males (53.8%) reported eating fast food three or more times a week, while more than half of females (58.8%) reported consuming once or twice a week. However, this research found no statistically significant association between BMI categories (including those who were obese n = 73) and fast food consumption. Similarly, Yücel (2020) found no significant relationship between the BMI of Turkish students and their consumption of fast food and acidic-sugary beverages both for males and females, consistent with a study among Jordanian students and Finnish university students. Given the conflicting results of this study with previous evidence, i.e., there was no positive association between the consumption of fast food and obesity among 18-25-year-old university students in the Eastern Province of the KSA (including those who were obese n = 73), more research was needed to examine the specific fast food preferences of the target population. During the focus group discussions, fast food consumption participants perceived fast food as harmful, unhealthy, and dangerous. Nonetheless, despite this, students reported that it is popular with many due to its affordability, accessibility, social reasons (i.e., sharing meals with friends at cafes), and the fact that it is cooked food. Additional factors leading to fast food consumptions related to their lack of time because of class load, which leaves them with little time to cook when they are back in their family home after classes. Students reported that fast food consumption increased after they became students, being consumed at least twice a week. This finding was consistent with global data (Haines et al., 2010; Berge et al., 2014; Janssen et al., 2018) and led to the discussion in the focus group of the main barriers and challenges that Saudi students face while choosing food.

Participants in this research had positive attitudes toward healthy nutrition and reported consuming homemade food before becoming students. However, this pattern changed after entering higher education, predominantly due to “convenience.” Reflecting on convenience, King et al. (2007) stated that specific intra- and interpersonal inactive behaviours (e.g., self-discipline, and communication with others, respectively) referred to as convenience may be associated with overweight and obesity regardless of a physically active lifestyle. On the contrary, according to Adams and White (2015), convenience foods are overestimated as contributing factors to poor health. Other authors have also put forward the idea that convenience food is not necessarily harmful as long as it is healthy and at a reasonable price (LaCaille et al., 2011; Sogari et al., 2018; Nakano & Washizu, 2020). Saudi students in this research perceived "convenience" food as delicious, cheap, satiating quickly, and taking less time, whereas healthy options were perceived as expensive, and take more time and resources to buy and cook. A study among Portuguese students reported the lack of time to prepare healthy meals due to academic commitments as the main barrier to reaching healthy dietary habits (Alves & Precioso, 2020). Similarly, a study among 40 universities across Germany found that the main barriers to healthy eating were lack of time due to class load, lack of healthy food available in the university cafeteria, and high prices for healthy food (Hilger et al., 2017). A recent systematic review by Li et al. (2022) on how the university food environment influences students' eating behaviour found that the taste of food was the primary factor in students' food choices, followed by the availability (also called convenience) of food and the price of food. The authors further noted that when university students from Australia, Brazil, Norway, the UK, and the US perceive and choose foods and drinks, they sometimes erroneously perceive unhealthy foods and drinks as healthy options to save time and satiate (Li et al., 2022).

The literature identifies the food environment of universities as characterised by low availability of healthy food and higher cost compared to unhealthy food, where high prices for healthy food, fruits and vegetables prevented them from choosing healthier food (Sogari et al., 2018; Ziegler et al., 2021). This implies that while both Saudi and international students may have the intention of making healthy food choices, the university environment and amount of the time spent on campus may be triggers that push them away from making healthy food choices (King et al., 2007; Jokela et al., 2013; Li et al., 2022). Although this study found no evidence that those who ate fast food were more likely to be overweight or obese, the long-term negative health effects of fast food should not be underestimated or

overlooked given the rate of NCDs in Saudi Arabia (Al-Qahtani & Sundogji, 2016; Almutairi et al., 2018; Althumiri et al., 2021). This highlights the importance of Saudi students being able be able to get healthy food at an affordable price and receive information about healthy eating, regardless of the effect of food on their weight at this stage of their life. This is particularly important, as evidence shows that a healthy environment and more affordable healthy food can encourage the student community to make healthier food choices, thereby rethinking the concept of convenient choice (LaCaille et al., 2011; Sogari et al., 2018; Nakano & Washizu, 2020).

In addition to nutrition, the first objective of this research aimed to explore other behavioural factors (i.e., sedentary behaviours and PA patterns) influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA. This research found no significant association between a lack of PA, sedentary behaviours and obesity (including those who were obese n = 73). However, a number of emerging patterns found during two phases of research require discussion to inform future researchers. Walking was found to be the most frequently practiced PA by the majority of participants, n = 327 (77%), consistent with an earlier national study showing that among 26,000 households from 13 administrative districts in Saudi Arabia, walking was the most frequent PA, accounting for 56.05% (Al-Qahtani et al., 2021). Further findings of this research showed that the majority of participants practiced moderate-intensity daily walking, although there was no statistically significant association between walking and BMI categories, which concurred with previous researchers using the ATLS questionnaire (Hazzaa et al., 2011; Khalaf et al., 2013; Kilani, 2013; Al-Qahtani et al., 2019; Al-Mahrouqi, 2019). Nevertheless, a study among Omani university students by Al-Mahrouqi (2019) found a positive association between the BMI of participants n=306 (73%) and PA, i.e., participants who preferred moderate-intensity walking were more likely to be in the normal weight category. Further analysis of this research showed that the number of males of being physically active was higher compared to females (although not statistically significant as shown in Table 4.9 and Appendix 11), consistent with the evidence in the literature. One way to explain gender differences in PA in the Saudi setting and worldwide, as suggested by previous researchers, is to consider the participation of men and women in daily and leisure activities, with women tending to engage in fewer leisure activities and exercise less intensively than men, which is a global pattern (Guthold et al., 2018; McCarthy & Warne, 2022). In addition, women often experience restrictions on certain types of PA due to anxiety about stereotypes, insecurity about their image, or feelings

of being limited by cultural acceptability, as well as physical and social environments (Telford et al., 2016; Guthold et al., 2018; Addas, 2020; Al-Qahtani et al., 2021). This is especially true for Saudi society and its cultural norms, despite all the transformations that are taking place, including the use of parks for women, being limited to the time spent with children, husbands or parents, at the expense of PA, as shown in sections 1.2 and 2.7.1. Saudi women still often take the lead in childcare and housekeeping in addition to their education or work, which means they usually have less free time for PA (Al-Hazzaa, 2018; Addas, 2020; Al-Qahtani et al., 2021). Focus groups enabled the attitudes of students towards PA and what motivated or hindered them from engaging in PA to be explored further.

During the focus group discussions, all participants acknowledged the importance of PA and balancing it with healthy food choices, but only a few (males) reported keeping up their levels of PA (e.g., going to the gym after classes) after transitioning into higher education. Students mentioned a new environment, relocation from one region to another, and stress due to class load as perceived barriers. These factors are consistent with those reported by Belgian students (Deliens et al., 2014) whose physical and sedentary activities were similarly influenced by time, social and physical environment, residence, university lifestyle, exams, and academic pressure. The same reasoning was expressed by the British, US, and Canadian students (Keating et al., 2005; Monhollen, 2015; Lee & Kim, 2019; Matei & Ginsborg, 2020). These findings, along with the evidence of previous studies, suggest that students' PA levels are affected by a complex interaction of individual factors such as time, the physical environment, and cultural barriers (Deliens et al., 2014; Lee & Kim, 2019; Matei & Ginsborg, 2020). This may be one of the reasons why the students in this PhD research did not complete the time spent walking section of the questionnaire or other physical activities during Phase I, as their thoughts and routines could potentially be centred around education rather than maintaining a healthy lifestyle and keeping records. Further research would be required to explore this in more depth. Closing the gender gap in PA has been found to be associated with improving access to and investment in the built environment, i.e., the establishment of women-only gyms with affordable membership costs, which are evenly distributed throughout the country to support women's participation in PA alongside the educating the students about the importance of PA as a long-term outcome for their health, (Almutairi et al., 2018; Al-Hazzaa & AlMarzooqi, 2018; Aljehani, 2021). Additionally, while the institutions included in this study had separate gyms for women and men, time constraints were mentioned as a major barrier to PA. Thus, the active involvement of various

stakeholders such as public health professionals, trainers and educators in the planning of incentive programmes (e.g., collegiate competitions) in accordance with the curriculum could potentially stimulate and create an enabling environment for students' participation in PA (Al-Hazzaa, 2018; Vision 2030, 2022). In terms of gender differences and traditions, another approach could be to make women's athletic performance more visible by simply encouraging young Saudi girls to take up the sport they are passionate about from an early age, where the role of parents is significant (Al-Hazzaa, 2018; Vision 2030, 2022). Such multisectoral involvement and encouragement could potentially help change a number of long-standing attitudes, including one associated with gender segregation, which does not necessarily mean abandoning traditions or culture (Almutairi et al., 2018; Al-Hazzaa & AlMarzooqi, 2018; Aljehani, 2021).

The last behavioural factor explored as part of objective one was sedentary behaviours of 18-25-year-old university students in the Eastern Province of the KSA. The results showed that males who had more than two hours of screen time daily were more likely to fall into the normal weight category. In contrast, females who spent less than two hours of screen time per day were more likely to be in the normal weight category. Similarly, an earlier study by Kilani et al. (2013) showed that although their study subjects led mainly sedentary lifestyles, they maintained a normal BMI, which was echoed by Al-Hazzaa et al. (2012) who reported that total screen time was not associated with being overweight or obese. This concurs with the study by Kalirathinam et al. (2019) among Malaysian university students whereby screen time was not found to be significantly associated with any overweight or obesity of the participants. However, a study among Australian students found that longer sedentary hours were associated with a higher risk for overweight and obesity (Al-Qahtani, 2019). During the focus groups students asserted that sedentary behaviours were associated with class load and education, without specific gender differences. Over the past decade, sedentary lifestyle trends have been shown worldwide to differ between genders across the life course, with education being an important social determinant influencing this behaviour, regardless gender (Gebremariam et al., 2015; Stierlin et al., 2015; Muñoz-Galiano et al., 2022). However, as shown in the literature review (see sections 2.5.6 and 2.7.1), there are additional factors that contribute to Saudi women being less physically active than men, including cultural and social norms (Määttä et al., 2019; Muñoz-Galiano et al., 2020; Al-Qahtani et al., 2021).Thus, while this PhD research provided insights into students' daily lives in terms of factors influencing their sedentary behaviours, more detailed studies could enrich data on whether

marital status, having children or other SES factors affect sedentary lifestyles as reported by previous authors and discussed in section 2.7.

Objective one summary, based on the quantitative and qualitative findings, showed that while most of the nutritional, PA, and sedentary behavioural factors did not influence obesity, the long-term weight and health outcomes of the current choices made by Saudi students should not be underestimated. This is especially important given the rising rates of overweight, obesity, and obesity-related NCDs among the Kingdom's adult and ageing population. Therefore, multisectoral collaboration with the participation of students is required to educate them about the importance of healthy food choices and PA, provide them with a motivating environment, and refine on-campus menus, including food prices and healthier options. The recommendations outlined in this part of the discussion will be reiterated in Chapter 7 to guide future research, policy, and practice.

The second and third objectives of this research aimed to investigate and explore knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region through the Food Dome questionnaire and focus groups. The quantitative findings on the knowledge of FDDG found that n = 47 (11%) out of n = 426 (100%) participants reported that they knew or followed FDDG. There was no significant difference between the knowledge of FDDG, the age and gender of the participants. Moreover, no significant difference was found between the knowledge of the FDDG and the BMI categories of participants (including those in the obese category). Furthermore, less than half the participants chose the correct answers on knowledge of the weekly consumption frequency in each food group. Qualitative findings revealed that while participants had a general idea of the overall goal of nutritional guidelines, they lacked specific knowledge about the FDDG. Those students with a general idea about the overall goal of nutritional guidelines, the importance of healthy nutrition and regular PA appeared to be those who tried to make healthier choices daily. Participants found the FDDG to be an interesting, useful and coordinated tool, although there were a number of misinterpretations of the messages within the guidelines, discussed in the next paragraphs. Evidence from the literature provides conflicting data as to whether increased knowledge of nutritional guidelines may be positively associated with healthier food choices among students internationally (Kolodinsky et al., 2007; Liao et al., 2019, Alves & Precioso, 2020). In Portuguese students, better knowledge of dietary guidelines and healthy nutrition were found to be associated with

positive attitudes in relation to healthy food and nutritional choices (Alves & Precioso, 2020). Subsequent parts of the Food Dome questionnaire examined knowledge, attitudes, and behaviours, the findings of which are discussed below, supplement with the findings from the focus groups.

One of the emerging findings from the Food Dome questionnaire was low cereal consumption, with only n = 86 (20.2%) participants reporting that they consumed cereals and their products more than five times per week. This finding was consistent with a study among Australian students, where only 16% of students consumed the recommended sizes of cereals and their products (Irwin et al., 2019). However, when looking at the literature, the low cereal consumption found in this study seemed unusual. For example, studies from Lebanon and Syria found grains (bread and cereals) to be the highest contributor to students' daily energy, estimated at 32.7% and 18.4–22%, respectively (Nasreddine et al., 2010). Similarly, an earlier study by Mahfouz et al. (2012) in the KSA showed that grains were the most frequently consumed food groups among students, with more than 50.5% reporting consuming rice at least once daily. In Romania, more than half of the students (52.61%) ate cereals daily (Pop et al., 2021), while Otemuyiwa and Adewusi (2012) reported that 60% of the Southwestern Nigerian students consumed the recommended minimum number of cereal servings. These conflicting patterns necessitated further exploration in the focus groups, where it emerged that Saudi students did recognise the importance of cereals and their products, however, this was only after the term "cereal" was translated into Arabic and they understood which foods belonged to the cereal group. Similarly, the literature indicates that cereals are often only considered breakfast cereals, not as a separate food group that includes whole grains (Foster et al., 2020; Dall'Asta et al., 2022). Participants also indicated that they were eating more cereals and their products than originally stated in the questionnaire, thereby explaining the seeming ‘low consumption’ patterns reported. Participants who consumed cereals reported preferring cooked cereals in small portions and disagreed with the serving sizes recommended by FDDG (i.e., 6-11 servings throughout the day), asserting that this would be too much cereal, despite it being recommended by the American Food Pyramid, the British Eatwell Plate, the Japanese Spinning Top nutrition guide, the Dutch food-based dietary guidelines, and Norwegian dietary guidelines, among others (FAO, 2022). Therefore, given the fact that Saudi students were not aware of what cereals were, it is recommended that future research and FBDGs include an explanation of grains and what is included in this food group, so that the recommendations can be correctly interpreted

(FAO/WHO, 1998; Barbosa et al., 2016; Springmann et al., 2020). This is of particular importance, given that FBDGs aim to inform the public about healthy eating and to set the direction for programmes and policies and key messages should be concise and clear, provide broader information (FAO/WHO, 1998; Dwyer, 2001).

When developing the FDDG, Musaiger (2012) considered that the region's daily intake of iron, calcium and vitamins D and C was below the recommended daily allowances (RDA). Hence, the FDDG recommends consuming sufficient quantities of food rich in iron and food that promotes iron absorption, such as foods rich in vitamin C. The Food Dome questionnaire looked into the knowledge and preferences of vegetables, iron-rich products, meat and fish and whether they met the recommendations of the FDDG. Findings indicated that none of the target population knew the colour of vegetables recommended to the Arab population, i.e., dark green and orange vegetables rich in fibre, iron, magnesium, potassium and calcium, and vitamin C, among other nutrients, that are often deficient among the populations in the MENA region (Musaiger, 2012). Despite the lack of knowledge, the choice of vegetables was consistent with the FDDG; most participants chose lettuce, broccoli and carrots, consistent with international research that ranks lettuce and carrots as the most preferred vegetables for healthy snacks among students (Cullen et al., 2005; Khalid et al., 2011; Holligan et al., 2019).

Further analysis of the FDDG food groups showed that meat, chicken, fish, eggs, legumes and nuts were consumed regularly, with the choice of meat (i.e., chicken, fish, lean meat) being consistent with FDDG (i.e., chicken and fish). Comparing this with findings from international studies has shown that weekly fish consumption was high among Chinese students, while in Poland, 46% of university students said they either never eat fish or eat it occasionally (Kowalcze et al., 2016). In Romania, students most commonly consumed poultry (90.30%) and fish (87.20%) (Pop et al., 2021). While this study’s finding was consistent with the recommendations of FDDG and was confirmed during the focus group discussions, more research is required to explore whether Saudi students eat chicken and fish based on their knowledge, or whether this is due to price, availability, or is a habituated pattern.

After the development and implementation of the Food Dome, further promotion of guidelines among the general public of the MENA region was recommended by Musaiger (2012). Hence, during Phase I, participants were asked whether they would like to learn more about Food Dome. Findings showed that less than one-third of participants were interested in

this. To explore the preferred way of being educated about the Food Dome, the last question of the Phase I questionnaire was open-ended. The summary analysis showed that social media and mobile applications were among the most often indicated sources of information preferred by students, followed by education. During the focus group discussions, students suggested that a Food Dome mobile app could potentially be a useful and low-cost intervention to improve their nutrition and PA, supported by educational programmes and projects within higher education institutions. In their discussion on how they envision the Food Dome app, participants recommended highlighting the most important components of the Food Dome, making it more attractive with fewer words, simple yet, appealing. These results were consistent with similar studies that consumers in various settings prefer apps because they enable health information collection, self-monitoring, healthy eating and weight management, and real-time feedback (West et al., 2017; Villinger et al., 2019; Ghelani et al., 2020). Saudi students were willing and eager to be educated to learn more about FDDG and rethink their behaviour in light of this. However, some of the main challenges students reported in adopting the FDDG recommendations were the culturally accustomed diet, price, and availability of specific food groups, i.e., vegetables and fruits. These arguments were consistent with a study by Macdiarmid et al. (2013) examining barriers to healthy eating among the UK population. The author found that the main barriers were social and cultural rather than a lack of skills or knowledge about healthy nutrition. As concluded by Macdiarmid et al. (2013) and confirmed by other researchers from Australia, Pakistan, and Italy, the food choices of students are often based on the availability of resources, facilities for cooking, taste and culture of food, physical environment, and perhaps most importantly, time, class pressure, and food prices (Deliens et al., 2015; Munt et al., 2017; Kabir et al., 2018; Irwin et al., 2019). While some researchers from Australia, Canada and the UK have reported that knowledge and positive attitudes are not necessarily associated with food choices or PA, other studies from Belgium and Portugal have shown that increasing knowledge and how information is delivered can increase the likelihood of healthy choices. In this research, Saudi students lacked knowledge, but those who agreed to participate in the focus groups reported being willing to learn and change their habits.

Through their valuable contribution, participants in this research suggested the ways they would like to be educated about FDDG and a healthy lifestyle in general, including social medial applications, presentations, and promotional programmes. They further suggested improvements for the FDDG that might motivate them to follow them. Hence, the FDDG

requires clarification or additional documentation to convey key messages and terms in a consumer-oriented guide. In addition, future versions of the FDDG are expected to contain sufficient information (i.e., terms and details on serving sizes) so that healthcare professionals and other technical personnel involved in the use of the FDDG as part of the research, educational programmes, or in the policy context can clearly understand how each message was developed (UNICEF, 2020). Findings of the current research supported by evidence in the literature show that digital engagement of current and future generations are on the rise as mobile apps are a potentially useful tool for shaping and tracking consumer diets (Coughlin et al., 2015; Gilliland et al., 2015; Villinger et al., 2019). Thus, Saudi students preferred an app relating to FDDG that could increase their motivation, desire, and ability to improve nutrition and behavioural choices. However, diet and nutrition applications must not obscure the role of nutritionists and health care providers. They are expected to contribute to developing a comprehensive plan for developing and launching the Food Dome app in a culturally sensitive way with English and Arabic versions (Minkler, 2009; Choi et al., 2021).

The summary of objectives two and third of this PhD research highlights the complex relationship between nutritional knowledge (e.g., FDDG), food choices, the food environment and weight. Therefore, concluding that better knowledge about healthy eating will lead to improved eating behaviour and lower BMI would be imprecise (Strawson et al., 2013; Macdiarmid et al., 2013). Consistent with previous studies, food choices in this PhD research were not necessarily related to a lack of knowledge or attitudes; participants mentioned other meaningful explanations, discussed in earlier paragraphs of this section. However, Saudi students were willing to be educated and rethink their behaviour.

Lastly, since this research was conducted during the COVID-19 pandemic, a number of unique findings about nutritional choices and PA during a pandemic emerged. The pandemic affected the daily habits and lifestyles of the participants in this research, who returned to their family home environment 24/7. Two male participants highlighted that staying home and the "obligatory" consumption of homemade food resulted in weight loss of up to twenty kilogrammes – potentially supporting the assertion that the food environment in university is unhealthy. The qualitative aspect of this PhD research indicated that those participants (n= 2) who were physically active before the COVID-19 restrictions, found ways to exercise at home despite closed gyms or inconvenience. Moreover, although only two students reported weight loss during the pandemic, this was attributed to the impact of staying at home and

eating homemade food compared to university food. This finding is different to a range of quantitative studies looking into the impact of COVID-19 on people's nutrition and PA. Thus, the synthesis of evidence from previous cross-sectional studies in different regions of Saudi Arabia looking at how nutritional behaviours changed during the COVID-19 pandemic concluded that while some healthy habits increased (e.g., eating homemade food), the amount of food consumed also increased, often accompanied by unhealthy snacks, leading to weight gain (Bakhsh et al., 2021; Alhusseini & Alqahtani, 2020; Mana et al., 2022). These findings were consistent with studies reported in Canada, Australia, West Asia, North Africa, and Europe, which showed that calorie intake increased due to frequent snacking during lockdown (Ammar et al., 2020; Gallo et al., 2020; Bertrand et al., 2021). Unhealthy diets, lack of PA, and sedentary lifestyles were common among university students before the pandemic and worsened during the lockdown (Ammar et al., 2020; Romero-Blanco et al., 2020; Bertrand et al., 2021; Al-Qahtani et al., 2021). Declines in PA during the pandemic were reported by students in the UK, Italy, Spain, Australia and US, among other countries (Gallo et al., 2020; Meyer et al., 2020; Romero-Blanco et al., 2020; Wickersham et al., 2021). What has been less explored are the patterns of PA from the time of the lockdown onwards, including subsequent periods when the restrictions remained in place (Angosto et al., 2020; Wickersham et al., 2021). In addition, it is important to consider that the participants' views may differ from those of the larger student group.

6.5 Summary of the discussion and the unique contribution of this PhD research

This research is the first to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the FDDG among 18-25-year-old university students in the Eastern Province of the KSA. To achieve the aim of the research, a number of unique contributions to the evidence base have been made.

Firstly, the methodology used during this PhD research, i.e., a mixed-methods, and mixed-gender, are novel data collection approaches in the Eastern Province of Saudi Arabia and the KSA. To achieve the objective 1, this was the first study that administered the ATLS questionnaire among the students of the Eastern Province of the KSA; and the Food Dome questionnaire was developed, translated into classic Arabic and validated (Cronbach Alpha value of 0.985), which can be used in future quantitative studies in the MENA region. To achieve objective 2, mixed-gender focus groups were carried out. By using a variety of

instruments and mixed-methods, it has been possible to generate unique insight into students' knowledge, attitudes, behaviour and views on food, food choices, PA and the FDDG.

Looking at the make-up of the sample, it is important to note that throughout the study females were underrepresented, indicating that they may not have felt entirely comfortable and free to participate in the study, despite the changes taking place in the KSA. This became more evident during the focus groups, where female participants were less active and preferred to communicate mostly through gestures or nodding, while males were more active and sociable. The larger percentage of male respondents, may potentially have skewed the findings of this PhD research.

The first objective aimed to identify nutrition and behavioural factors influencing rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA using the ATLS questionnaire. The findings showed that most of the nutritional, PA, and sedentary behavioural factors did not influence obesity amongst the participants, although there were emerging patterns that warrant further research and exploration. For example, no significant relationships between breakfast consumption and any of the weight categories (including those who were obese n = 73) of the target population were found, adding to the evidence-base where there is lack of consensus on this. The analysis of fruit consumption frequency and its relation to weight found it to be statistically significantly associated with the weight categories of males, but not females. Despite global data on the negative impact of fast food on body weight, in this research, while fast food consumption was generally high for the entire sample, there were no statistically significant associations with any of the weight categories of the sample (including those who were obese n = 73), which warrant further research and exploration. During the focus groups, while students held positive attitudes towards healthy nutrition, and acknowledged the health benefits of fruits and vegetables, they reported that their choice of food, including fast food, vegetables and fruits, was mainly based on taste, price, and ease of preparation, as opposed to for health reasons. Whereas, previously they ate homemade food with their families, their eating patterns changed after entering higher education, primarily due to the new environment, lack of time, convenience and affordability of food, which reportedly led to more fast food consumption, less physical activity and a more sedentary lifestyle. Nevertheless, using the ATLS questionnaire, this research found no significant association between a lack of PA, sedentary behaviours and weight categories (including those who were obese n = 73), which warrant further research

and exploration. Participants generally failed to report the number of minutes they engaged in a particular PA, which was a major limitation in further analysis of the data, particularly for females, i.e., when looking for associations between food consumption patterns and MET.

The second and third objectives of this research aimed to investigate and explore knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region for the first time. These objectives were addressed using the Food Dome questionnaire (specifically developed for this study) and focus groups. The analysis of Food Dome questionnaire findings showed that neither age, gender, or BMI were significantly associated with knowledge and behaviour in relation to the FDDG. However, most of the study sample lacked knowledge about aspects of the FDDG, with fewer than half correctly identifying the recommended weekly consumption frequency in each of the food groups, or the sources of minerals and vitamins. None of the target population knew the colour of vegetables recommended to the Arab population, however, despite the lack of knowledge, the choice of vegetables was generally consistent with the FDDG; most participants chose lettuce, broccoli and carrots. Focus group findings revealed that while participants had a general idea of the overall goal of nutritional guidelines, they lacked specific knowledge about the FDDG. One of the novel findings from the Food Dome questionnaire was low cereal consumption. However, during the focus groups, it emerged that Saudi students did actually recognise the importance of cereals and their products and did consume them daily. The reason for the low cereal consumption finding in the questionnaire became apparent only after the term "cereal" was explained and it was clear which foods belonged to the cereal group. This insight highlighted the importance of future research, and guidelines explaining what terms mean, particularly where they might be ambiguous, e.g., grains (including wheat, oats and rice). In terms of wanting to know more about the FDDG, while Phase I showed that less than a third of participants were interested in them, this was not the case during the focus groups once the graphic of the FDDG had been shared. This seemed to stimulate their interest, and they reported being willing to explore and rethink their diet and PA behaviour using these guidelines, potentially through educational programmes and mobile apps. Their suggestions also included improving the availability of healthy food (i.e., prices), special offers and more availability of healthy restaurants and gyms at the higher educational institutions. The insight gained through both research phases highlighted how engaging the target audience (i.e., students) in an active way during the focus groups enabled a better understanding of the findings of different elements in the questionnaire (e.g., FDDG), and generated dialogue on

the best ways to teach and promote FDDG among Saudi students. Although as previously highlighted males were more vocal during the focus groups than females.

As the study was conducted during the COVID-19 pandemic, additional data on dietary and PA changes discussed in the focus groups, have added to the evidence based on the impact of the pandemic on nutrition. For two students, the "obligatory" consumption of homemade food resulted in weight loss of up to twenty kilogrammes, attributed to the impact of staying at home and eating homemade food compared with university food - potentially supporting the assertion that the university food environment in KSA is unhealthy.

Overall, the unique contribution of this PhD study is the depth of insight into Saudi students' knowledge, attitudes and behaviour in respect of food, food choice, PA and the FDDG, which was previously unknown. This knowledge, enables short-term and long-term recommendations to be proposed for future research and practice to support improving the nutritional and behavioural choices of the target population, which is imperative, given the rates of overweight and obesity in this group, and its relationship to NCDs. The recommendations presented in Chapter 7 add a unique contribution to the literature and can be incorporated into a future intervention and evaluated to understand what works and what does not in a Saudi context.

Chapter 7 – Recommendations and Conclusions

7.1 Chapter overview

Chapter 7 addresses the last objective of this research by providing short and long-term recommendations for future research, policies, and practice to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population. The chapter will start with a brief overview of the study and added value to existing knowledge, followed by short and long-term recommendations for research, policy and practice. This chapter concludes with the strengths and limitations of the research and concluding remarks.

7.2 Overview of thesis and added value

Nutrition and health are inseparable, as good health cannot be achieved without good nutritional status, and with poor nutrition, good health will remain elusive. Therefore, nutritional knowledge is an important factor in choosing a healthy diet, which can influence and improve overall health and well-being throughout life (Worsley, 2002; Musaiger & Al-Hazzaa, 2012; Spronk et al., 2014).

This research is the first in the MENA region to have explored the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the Food Dome among 18-25-years-old university students in the Eastern Province of the KSA. To achieve the aim of the research and capture a holistic understanding a mixed-method approach was used by the application of quantitative and qualitative methods (Steckler et al., 1992; Bryman, 2006; Pasek, 2012).

During Phase I, the ALTS and Food Dome questionnaire was administered among the target population. This was the first study to administer the ATLS questionnaire in the Eastern Province of Saudi Arabia, which has previously mostly been used in the GCC states and central regions of the Kingdom. Moreover, to address the second objective of this research a new Food Dome questionnaire was developed and validated. Similar to ATLS, the Food Dome questionnaire was pilot tested, validated and translated into classic Arabic. The result is a validated tool that can be used both in English and Arabic in the MENA region (see section 4.2.3.2).

During Phase II, focus group discussions were conducted where the target population contributed to the research overall aim and its objectives. Thus, this study became the first qualitative assessment of knowledge and attitudes of Saudi students in relation to FDDG, healthy nutrition and PA in general. The focus group guide allowed the insights of the Saudi students, their knowledge, attitudes and behaviour in relation to FDDG and their lifestyles as students to be explored. Furthermore, the focus groups allowed exploration of the characteristics of Saudi students and resulted in emerging patterns that future researchers could consider (see section 5.9.1).

The quantitative phase allowed dietary choices, PA, sedentary behaviour, knowledge and behaviours in relation to the FDDG of the target population to be explored. Phase II enabled a deeper understanding of knowledge and attitudes in relation to FDDG and provided insight into participants' daily habits, allowing personal stories to be heard, thereby gaining more information about what could influence and improve the dietary patterns of the target population. Thus, exploring nutritional knowledge, attitudes and behaviours in relation to the FDDG could potentially be a model for future studies where the target population can play an active role in facilitating future interventions.

The key findings from the first two phases of this research showed that although most participants were of normal weight, they lacked knowledge of the FDDG and had fragmented knowledge of healthy behaviours (i.e., nutrition and PA). At the same time, the focus groups revealed that students were interested and willing to explore and rethink their nutrition and PA behaviours, asserting that they would welcome finding out more about the FDDG. Based on the findings of two phases of research, the evidence presented in literature review, and discussion of findings in relation to the literature, the following sections will present the intervention components, as well as recommendations for future research, policy and practice.

7.3 Recommendations for future research, policy and practice

Nutrition policies, FBDGs and interventions take the form of targeted actions aimed at bringing about significant and sustainable changes in diet, PA, and sedentary lifestyle. The FDDG has been developed to encourage healthy food choices and reduce rates of overweight, obesity, malnutrition and diet-related NCDs. However, there is a gap in knowledge about whether or how they were promoted among the general public. Moreover, the choice of unhealthy food in the MENA region, especially among students continues to grow. This PhD

research found that while most study participants lacked knowledge of FDDG, they were motivated and willing to explore it and rethink their dietary and PA behaviours. The important contribution of Saudi students to this research cannot be underestimated, enabling short and long-term recommendations to be proposed based on the perspectives of the target population, as well as evidence in literature.

7.3.1 Short-term recommendations for research, policy and practice

- Explore factors that may increase the participation and involvement of females in health research.
- Determine why students often did not include PA minutes when completing the ATLS questionnaire.
- Explore the effects of gender, screen times and BMI.
- Explore the association between skipping breakfast and low consumption of fruits, vegetables, as well as frequent consumption of fast food.
- Explore the knowledge of students about nutrients that can be obtained from certain fruits and vegetables.
- Explore how healthy food can be made more accessible for students through a range of approaches (including reduced pricing/signposting students to more economical ways of accessing fruit and vegetable) underpinned by the SEM model.
- Disseminate FDDG to support improved knowledge, dietary patterns and PA of the target population.

7.3.2 Long-term recommendations for research, policy and practice

- Explore how education through policy implementation can increase the overall nutrition knowledge of students about FDDG.
- It is recommended that nutrition education programmes are developed in a participatory way, based on research with and the participation of the target population (e.g., students).
- Explore how FDDG marketing (potentially through a Food Dome app) can help consumers (e.g., students) achieve healthy behaviour.
- Create and promote healthy environments within universities, potentially incorporating the FDDG.
- Explore how to create an enabling environment for female participation in PA.

- Ensure recommendations/guidelines for Arabs explain food groups/products, particularly grains so that they can be correctly interpreted.

The FDDG are only one solution to national levels of overweight and obesity in Saudi Arabia. There is no single solution for influencing people's behaviour, but rather multisectoral action is required, including interactions between research, policy and practice, as well as continuous follow-up and evaluation (Musaiger, 2012; Hill et al., 2013; Mubita et al., 2017; Vision 2030, 2022). A community-based approach to student nutrition education programmes based on the FDDG could potentially lead to beneficial change. Engaging the target audience (i.e., students from different regions of Saudi Arabia) has the potential to start a dialogue on the best ways to teach and promote FDDG among Saudi students and eventually the general public. This can be achieved through proper planning, clear goal setting, communication methods, the target population participation, and proper follow-up.

7.4 Strengths and limitations of this research

This research aimed to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the Food Dome among 18-25-years-old university students in the Eastern Province of the KSA. The aim was met by systematically addressing the objectives of the study. Key strengths and limitations of the study are outlined below.

7.4.1 Strengths of this research

- This research is unique in that it is the first study to explore knowledge, attitudes, and behaviour in relation to FDDG since it was implemented in 2012.
- This was the first study that administered the ATLS questionnaire among the students of the Eastern Province of the KSA.
- The Food Dome questionnaire, which can be used in future quantitative studies in the MENA region, has been developed, translated into classic Arabic and validated (Cronbach Alpha value of 0.985).
- The exploratory sequential mixed-methods methodology provided rich and reliable data about knowledge, attitudes and behaviour in relation to FDDG among Saudi students.
- This research is the first (to the author's knowledge) in Saudi Arabia to explore the reasons for food choices of Saudi students and their behaviour, adding to the body of knowledge in this area.

- This research has involved the development of focus group guidelines that can be used in future qualitative studies in the MENA region.
- Focus groups allowed the voices, insights, and expectations of participants about FDDG to be heard, recorded and reported.
- Because the study was conducted during the COVID-19 pandemic, additional data on dietary and PA changes among Saudi students have enriched the global data on the impact of the pandemic.
- The rich data presented in this thesis provide a solid basis for raising new questions in the future, as rates of obesity continue to increase at the same pace as obesity-related NCDs.
- Upon being published, this research can make a unique contribution to the Saudi Vision 2030 by informing the lifestyle of Saudi youth and the gaps that require special attention from the Saudi government, including nutrition education projects, the availability of food for certain groups in the community, and the role of educators in motivating the youth.

7.4.2 Limitations of this research

- As this research was the first looking into knowledge, attitudes and behaviour in relation to FDDG, it was infeasible to compare the findings with similar studies conducted in the MENA region.
- Due COVID-19 to the pandemic the quantitative phase of the study was divided into several data collection dates to minimize the spread of the virus, which, however, created a number of inconveniences and was time consuming.
- BMI was the only suitable measure for specifying weight groups due to cultural specificities and social distancing caused by the pandemic. However, due to the limitations of these measures, caution is advised when using BMI as the sole measure of obesity in small observational studies.
- The greater number of males compared to females may potentially have skewed the findings.
- Participants mostly did not report the number of minutes they engaged in a particular PA, which was a major limitation in further analysis of research specifically for females.
- During the focus group discussions, it appeared that male and female members of this group felt uncomfortable being in the same room, even in the presence of a researcher

and a female chaperone. Future research in this setting should consider whether participants feel comfortable participating in mixed-gender discussions.

- Due to the impact of COVID-19 only a small number of focus groups was conducted
- The use of the term "cereals" in the Food Dome questionnaire in accordance with the FDDG created a limitation in Phase I, which was clarified in Phase II. Future research should consider the terminology of even simple words in English when conducting research in a diverse environment.
- At the outset of this PhD, it was anticipated that there would be sufficient time to develop an intervention to improve nutrition among Saudi students in KSA. However, due to delays and challenges caused by COVID-19, instead, it became necessary to propose intervention components based on phases I and II of the research together with the evidence from the literature.
- Three of the seventeen institutions gave initial agreement to participate, and the students of two institutions actually participated in the final data collection. Future studies should consider the recruitment of more participants that will provide better knowledge and present the bigger picture.

7.5 Conclusions

This PhD research has become the first to explore knowledge, attitudes, and behaviours in relation to the FDDG in one of the most obese parts of the GCC, namely the Eastern Province of the KSA. The mixed-methods research found that food choices and PA behaviours of Saudi students were not necessarily related to knowledge or attitudes. Instead, they experienced substantial changes after becoming students due to class load, time constraints, and changes to the food environment, which were reported to have led to changes in their diet, PA, and sedentary behaviour. Saudi students were interested and willing to explore and rethink about their diet and PA behaviour, asserting they were eager to learn more about the FDDG through educational programmes, mobile apps, and environmental changes. The suggestions also included improving the availability of healthy food and access to the gyms (i.e., prices). Based on the two phases of research, short-term and long-term recommendations were proposed to target knowledge, attitudes, and behaviour to support improving the nutritional and behavioural choices of the target population. These recommendations add a unique contribution to the literature and can be incorporated into a future intervention and evaluated to understand what works and what does not in a Saudi context.

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Appendences

Appendix 1. Policies and programmes for obesity prevention and management in GCC.

#	Guidelines & Author(s)	Suitability - Why has the guideline been reviewed for possible consideration?	Review & Critique - Why has the guideline been rejected?	Review from other researchers about the guidelines
1	Omani Healthy Plate (FAO, 2009)	The Omani Healthy Plate is a visual representation of the food guide, which encourages the consumption of various foods from each of the six food groups every day in proportions that are consistent with the food guide. According to their nutritional and beneficial content, the types of food were classified into groups, considering the amounts that will satisfy the dietary needs of the population. These guidelines were intended for the entire Omani population over the age of 2, with an emphasis on adequate nutrition and physical activity to prevent obesity.	Although Omani Healthy Plate is considered a comprehensive and inclusive approach to prevent and reduce the high rates of overweight and obesity, no further studies have been conducted to assess general public knowledge and attitudes in relation to Omani Healthy Plate.	Several researchers included Omani Healthy Plate guidelines as the of their studies: 1. Alasfoor et al., 2013. Taskforce for the development and implementation of the Omani Food Based Dietary Guidelines. Food Based Dietary Guidelines: Technical background and description. 2. Mabry et al., 2014. A national strategy for promoting physical activity in Oman: A call for action. However, in these studies, the Omani Healthy Plate was viewed as part of a literature review. No attempt was made to assess its practical relevance to the population of Oman or other Gulf countries.
2	Arab Food Dome (Arab Center for Nutrition & Musaiger, 2012)	Arab Food Dome was developed to be used to prevent overweight, obesity, under-nutrition, and micro-nutrient deficiencies in the Arab population. The Arab Center for Nutrition offered a unique dietary guideline, the Arab Food Dome, designed for Arab countries with food groups specific to the MENA region, considering biological factors, genetics, cultural, environmental, and demographic data. FDDG reported all steps for the developing FBDGs. They described the review of MENA region nutrition problems and lifestyle patterns associated with diet-related diseases. These guidelines are available both in the local language (Arabic) and in English.	Although Musaiger (2012) recommended additional studies among the target population to assess the understanding of the recommendations presented by this Food Dome, no further research has been done to assess the knowledge and attitudes of the general public in relation to FDDG.	Food Dome was included in several scientific reviews as appropriate guidelines for the MENA region. In addition, FDDG served as the basis for the development of national nutritional guidelines in other Gulf countries: 1. Coats et al., 2019. Food-based dietary guidelines of Arabic-speaking countries: a culturally congruent profile. 2. Aboul Enein et al., 2016. Dietary transition and obesity in selected Arabic-speaking countries: a review of the current evidence. 3. Supreme Council of Health of Qatar, 2015. The Qatar Dietary Guidelines. 4. Ministry of Health of Saudi Arabia, 2012. The Healthy Food Palm. Ministry of Health….in a similar way to the other guidelines. Montagnese et al., 2019. Food-based dietary guidelines around the world: eastern Mediterranean and Middle Eastern countries. No further research has been undertaken since 2012 to assess the Arab people knowledge and attitudes in relation to the Food Dome.

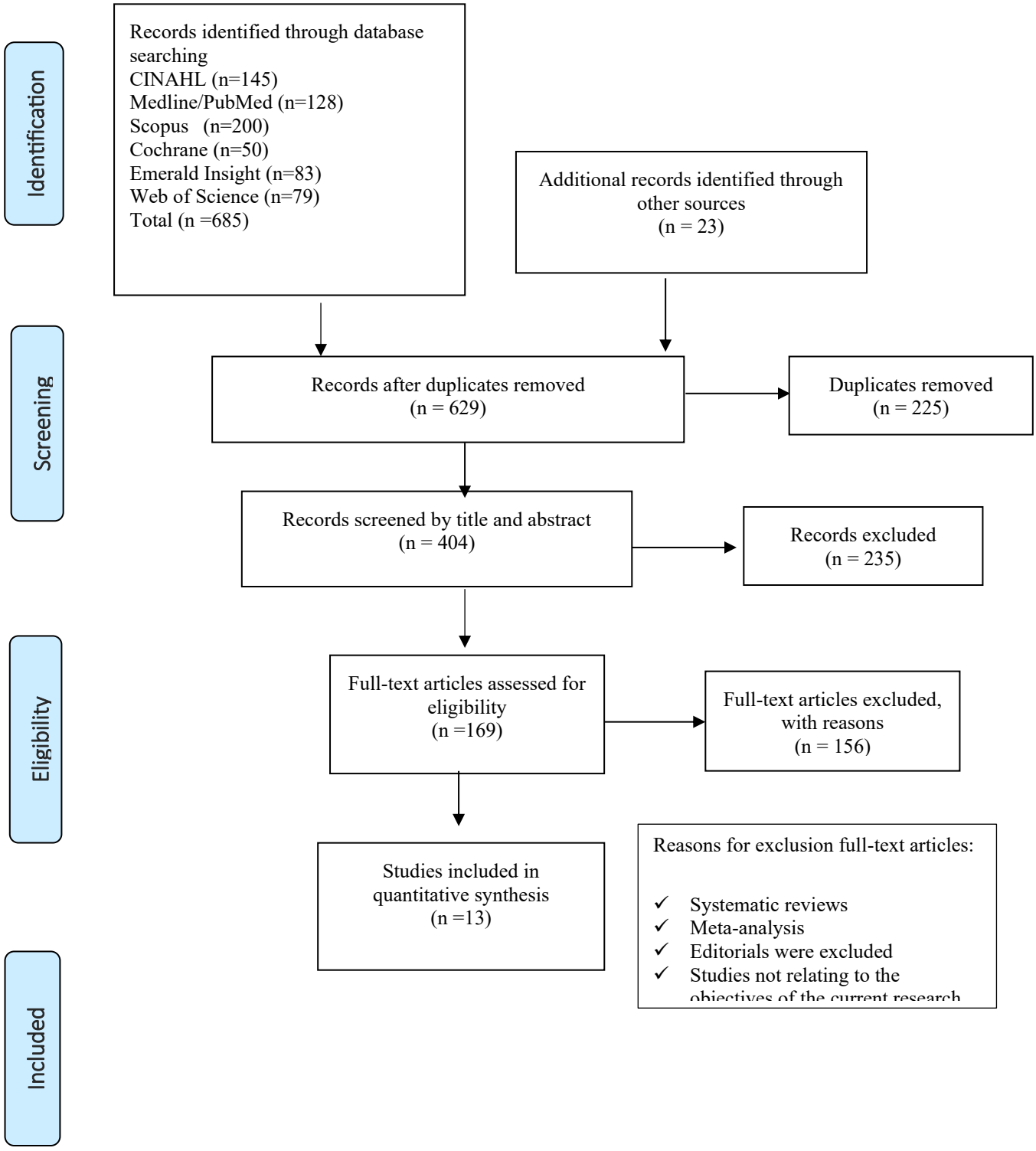
3	Nutrition Clinics Management & Prevention of Obesity (Gharib, Al Amer, & Al-Salehi, 2012)	Nutrition Clinics Management & Prevention of Obesity in Bahrain offered early and comprehensive long-term care to obese patients based on high quality updated services to decrease its prevalence and the associated morbidity and mortality factors. The priority was the improvement in general health and a reduction in health risk factors. Weight management programmes were offered, including dietary changes, general exercise, and behaviour modification. The project recommended that physicians should evaluate the care of patients at regular intervals and maintain a surveillance system.	Although this initiative is a comprehensive and inclusive approach to prevent and reduce the high rates of overweight and obesity, in the current PhD research frameworks, this would be infeasible. The rationale behind this statement is that such an initiative requires considerable funding for equipment, recruitment of specialised physicians and trainers, location, and time for the adaptation and implementation of the project.	Nutrition clinics have helped to encourage Bahrainis to make the essential nutrition and behaviour changes to decrease the risk of overweight and obesity. WHO (2014) reported that, according to clinics, about three-quarters of patients in a 5-year programme had significant weight loss? The number of Bahrainis who took part in this initiative was not reported. Therefore, the scale of these positive results is unknown. Aside from the MOH and WHO reports, there were no studies reporting details of these clinics, patients' experience, and their critique or satisfaction from this initiative.
4	Healthy Food Palm (MOH, 2012)	The Healthy Food Palm was designed to educate Saudis on what to eat and how much to eat (quality and quantity of food items). Food Palm presented daily servings of different food groups practice of physical activities, which prevent diet-related, such as obesity, diabetes mellitus, hypertension, nutritional anaemia, and vitamin deficiencies. In addition, Food Palm aimed to educate Saudis to use food enriched with nutrients essential to the body, such as proteins, vitamins, minerals, and fibres, and to avoid unhealthy food items such as fast food, soft drinks, food items rich with salt, sugar and saturated fat and modification of dietary habits.	The development of the Food Palm for Saudis (2012) was based on Food Dome, investigated and implemented for the entire MENA region by the Arab Centre of Nutrition. In addition, the guidelines were developed in English only and not translated into the local (Arabic) language. Food Palm was launched via the YouTube channel by the MOH, but there is a gap in further research regarding the distribution and promotion of Food Palm among Saudis.	Since the development and publication of the Food Palm dietary guidelines by MOH of KSA (2012), there was no further investigation whether Saudis knew, followed, and how they perceived the guidelines. These guidelines were not included in other scientific studies either as a part of literature or investigative research purposes.
5	Qatar Dietary Guidelines (Supreme Council of Health of Qatar, 2014)	Qatar Dietary Guidelines is a shell-shaped plate containing food groups to be consumed daily and foods to limit or avoid. The "plate" design gives guidance on the proportion of different foods to eat. Qatar Dietary Guidelines focus on the quality of food choices, with advice on quantity as well (i.e., portions of fruit and vegetables per day; legumes daily; fish twice a week). Making a diversity of high-quality food choices is a cornerstone to healthy eating. The guidelines emphasise plant-based foods (vegetables, fruit, whole grain cereals, legumes, nuts and seeds), as decades of research have shown the health benefits of eating plant-based diets.	Launched in 2014, Qatar Dietary Guidelines were based on FDDG. However, similarly to Healthy Food Palm, Qatar Dietary Guidelines were not further promoted. There is no data on whether these guidelines were adopted or rejected by the population in the long term. Despite the commitment of the Task Force on Dietary Guidelines and the Supreme Council of Health to educate the public on the relevance and importance of healthy living, there is no study on public attitudes about Qatar Dietary Guidelines since its implementation.	Since the implementation of Qatar Dietary Guidelines, some studies reviewed and evaluated them: 1. Al Thani, M. et al. (2018). Adherence to the Qatar dietary guidelines: a cross-sectional study of the gaps, determinants and association with cardiometabolic risk amongst adults. 2. Lang, T., & Mason, P. (2018). Sustainable diet policy development: implications of multi-criteria and other approaches, 2008-2017. 3. Seed B. (2015). Sustainability in the Qatar national dietary guidelines, among the first to incorporate sustainability principles. The researchers reported that Qatar Dietary guidelines are multi-criteria sustainable recommendations developed with strong input from nutrition scientists. No attempt was made to assess its practical relevance to the population of Qatar.

6	Kuwait national programme for healthy living: first 5-year plan (Behbehani, 2014)	The Kuwait National Programme for Healthy Living was an initiative to promote a healthy lifestyle. The goal of the National Programme for Healthy Living was to overcome obesity and diet-related NCDs, including diabetes, hypertension and coronary heart diseases. The initiative aimed to empower the population of Kuwait to make healthy choices and adopt a healthy lifestyle to sustain good health and social well-being and enable individuals to lead productive and satisfying life.	Kuwait National Programme for Healthy Living was developed and implemented with the participation of governmental organisations, scientists, and nutritionists. New research, surveys, evaluations and reviews are required to estimate the outcomes of such an initiative. Although Kuwait National Programme for Healthy Living initiative is a comprehensive and inclusive approach to prevent and reduce the high rates of overweight and obesity, this would be infeasible in the current PhD research frameworks. The rationale behind this statement is that such an initiative requires considerable funding for equipment, recruitment of specialised physicians and trainers, location, and time for the adaptation and implementation of the project.	There is no data or literature on whether the recommendations were considered in national (Kuwait) or international research and the results of this initiative. However, there was no further evidence or information on the results of this programme.
7	Saudi Guidelines for the Prevention and Management of Obesity (Al-Shehri et al., 2016)	The Scottish Intercollegiate Guidelines Network (SIGN) served as a basis for the Saudi Guidelines for the Prevention and Management of Obesity. The main goal of the guidelines is to offer health care professionals tools to help in the prevention and control of overweight and obesity. The guidelines were structured both for preventive and curative aspects of overweight and obesity and could be implemented at primary, secondary, and tertiary care levels in Saudi Arabia.	Saudi Guidelines for the Prevention and Management of Obesity have been applied among patients at primary, secondary, and tertiary care levels in Saudi Arabia. Thus, as with the Nutrition Clinics Management & Prevention of Obesity in Bahrain, this project requires extensive funding and constant follow-up by the physicians and nutritionists. Therefore, this would be infeasible in the current PhD research frameworks. The rationale behind this statement is that such an initiative requires considerable funding for equipment, recruitment of specialised physicians and trainers, location, and time for the adaptation and implementation of the project.	There is a gap in data on whether these guidelines were used by the Saudi health system and the results. The National Obesity Control Programme reviewed and confirmed the guidelines' value with the assistance of the Obesity Control Programme Scientific Committee.

8	United Arab Emirates Dietary Guidelines (MOHAP, 2019)	The Ministry of Health and Prevention developed the Guidelines based on the National Health Survey 2018 and were revised by the National Committee. The United Arab Emirates Dietary Guidelines are meant to be used by healthcare professionals and individuals; shared with International, Arab, and Gulf governmental and non-governmental organisations; be included in the school curriculum and projects, programmes, campaigns, competitions, and festivals related to health awareness.	Despite a comprehensive approach to developing the United Arab Emirates Dietary Guidelines and aiming to support and strengthen a healthy lifestyle through a healthy diet and physical activity for all, these guidelines are available only on the FAO web page. This can be explained by the fact that, compared to other FBDGs, these guidelines are relatively new (2019), and the distribution and promotion process is still ongoing. Nevertheless, the United Arab Emirates Dietary Guidelines were launched when the aim and objectives of the current PhD have been already decided and confirmed. However, the United Arab Emirates Dietary Guidelines have been incorporated into the final version of this PhD study to provide readers with a complete picture of FBDGs at GCC and research gaps.	The United Arab Emirates Dietary Guidelines initiative was intended to be promoted through workshops, healthcare personnel training, and individual school programmes for parents, children, and educators. There are no reports or studies published details of this project or evidence of evaluation of impact.

Appendix 2. The questionnaire choice for Phase I of this research guided by PRISMA.

Questionnaire identification, screening, and inclusion, guided by PRISMA (Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009).



Appendix 3. Choosing the appropriate data collection questionnaire for Phase I.

#	Author(s) & study title	Data collection tool Questionnaire used/adopted/ developed	Inclusion criteria #1 Questionnaires with items/sections on behaviour influencing the rates of obesity (e.g., dietary habits, PA, sedentary lifestyle), nutritional knowledge and behaviour	Inclusion criteria #2 18-25-year-old students/participants	Comparison Other studies using the same questionnaire & Request for the questionnaire
1	Al Bshabshe et al., 2018. *Weight status and related factors in medical students of King Khalid University, Saudi Arabia.*	Cross-sectional study A self-administered questionnaire.	Dietary & physical activity behaviours/habits	University students with mean age 22.05 ± 1.8	Further investigation was conducted to understand whether the used or adopted the internationally validated questionnaire or developed a new tool for their study. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response. Due to the lack of information on the used questionnaire and nonresponse from the authors, there is a gap in knowledge as to whether the particular questionnaire was used by others.

2	Al-Hazzaa, H.M., Musaiger, A.O. and ATLS Research Group, 2011. *Arab Teens Lifestyle Study (ATLS): objectives, design, methodology and implications*	Arab Teens Lifestyle Study Questionnaire A cross-sectional study A self-administered questionnaire	Physical activity behaviour/habits Sedentary activity and sleeping hours Dietary behaviour/habits	Secondary year students aged 14-19-year-old	The ATLS project was the first initiative aimed to study the lifestyle of Arab students, physical activity, a sedentary lifestyle, and eating habits. It was adopted or used by other researchers among different age groups and settings: 1. Al-Hazzaa, Al-Sobayel, & Musaiger, 2011. Convergent validity of the Arab Teens Lifestyle Study (ATLS) physical activity questionnaire. 2. Khalaf, A. et al., 2013. Female university students' physical activity levels and associated factors-a cross-sectional study in southwestern Saudi Arabia. 3. Kilani, 2013. Assessment of Life Style, Physical Activity, Nutrition Status, Sleep Duration, and BMI among Schools' Adolescents in Oman (14-18): A Research Proposal. – However, no further results were reported in relation to the study development and results. 4. Tayyem, et al., 2014. Association of Lifestyle Factors with Obesity Indices among Adolescents in Amman, Jordan. 5. Hamrani, et al., 2015. Physical activity and dietary habits among Moroccan adolescents. 6. Albawardi, Jradi, Almalki, & Al-Hazzaa, 2017. Level of sedentary behavior and its associated factors among Saudi women working in office-based jobs in Saudi Arabia. 7. Alhakbany, et al., 2018. Lifestyle Habits in Relation to Overweight and Obesity among Saudi Women Attending Health Science Colleges. 8. Osman, & Abumanga, 2019. The relationship between physical activity status and dietary habits with the risk of cardiovascular diseases. 9. Ismail, Al-Qahtani, Alghareeb, & Alramadan, 2019. Determinant of overweight and obesity among females' adolescents in the Eastern Province of Saudi Arabia, Cross-Sectional Study. 10. Al-Mahrouqi, 2019. Assessing the lifestyle (physical activity levels, sedentary behaviour and eating habits) of Omani adolescent girls: a mixed-methods study (Doctoral dissertation, Queen Margaret University, Edinburgh). Request for the use of the ATLS as part of the current PhD research was sent to Prof. Hazzaa Al-Hazzaa and permission was obtained.

3	Almutairi, K.M. et al., 2018. *Health promoting lifestyle of university students in Saudi Arabia: a cross-sectional assessment.*	Health Promotion Lifestyle Profile II (HPLP-II) Questionnaire A cross-sectional study A self-administered questionnaire	Health responsibility Physical activity behaviour/habits Dietary behaviour/habits	University students aged 20-31-year-old	The HPLP-II has shown high internal consistency and test-retest reliability (Walker and Hill-Polerecky, 2019) and has been used or adopted by several researchers: 1. Wei, et al., 2012. Assessment of health-promoting lifestyle profile in Japanese university students. 2. Al-Kandari, & Vidal, 2007. Correlation of the health-promoting lifestyle, enrollment level, and academic performance of College of Nursing students in Kuwait. 3. Nassar, & Shaheen, 2014. Health-promoting behaviours of university nursing students in Jordan. 4. Lim, et al., 2016. Validation of Health Promoting Lifestyle Profile-II: A Confirmatory Study with a Malaysian Undergraduate Students Sample. – The questionnaire was adopted for Malaysian with the permission of the authors. 5. Al-Qahtani 2019. Comparison of health-promoting lifestyle behaviours between female students majoring in healthcare and non-healthcare fields in KSA. 6. Nacar, et al., 2014. Health promoting lifestyle behaviour in medical students: a multicentre study from Turkey. 7. Lee, & Loke, 2005. Health-promoting behaviors and psychosocial well-being of university students in Hong Kong. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study, whether it was adapted and validated for Saudi setting. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response.
4	Baig, M. et al., 2015. *Prevalence of obesity and hypertension among University students' and their knowledge and attitude towards risk factors of Cardiovascular Disease (CVD) in Jeddah, Saudi Arabia.*	A cross-sectional study A self-administered questionnaire	Physical activity behaviour/habits Dietary behaviour/habits	University students with mean age 22.40±3.90	Further investigation was conducted to understand whether the used or adopted the internationally validated questionnaire or developed a new tool for their study. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response. Due to the lack of information on the used questionnaire and

					nonresponse from the authors, there is a gap in knowledge as to whether the particular questionnaire was used by others.
5	Craig et al., 2003. *International physical activity questionnaire: 12-country reliability and validity. Medicine & science in sports & exercise.*	International Physical Activity Questionnaire (IPAQ) A cross-national study A self-administered questionnaire	Physical activity behaviour/habits	Adults aged 18–65-year-old	The IPAQ has been used in the frameworks of several in: 1. Al-Hazzaa, 2007. Health-enhancing physical activity among Saudi adults using the International Physical Activity Questionnaire (IPAQ). 2. Saglam, et al., 2010. International physical activity questionnaire: reliability and validity of the Turkish version. 3. Van Holle, et al., 2015. Assessment of physical activity in older Belgian adults: validity and reliability of an adopted interview version of the long International Physical Activity Questionnaire (IPAQ-L). 4. Helou, et al., 2018. Validity and reliability of an adopted Arabic version of the long international physical activity questionnaire. 5. Alahmed, & Lobelo, 2018. Physical activity promotion in Saudi Arabia: A critical role for clinicians and the health care system. The IPAQ (2005) is available on the Internet and can be used without the permission of the authors, an e-letter to Craig et al. (2003) was not sent.
6	King Abdulaziz City for Science and Technology (KACST) (1995). *The Evaluation of the Nutritional Status of the People of Saudi Arabia.*	Study design: unknown A self-administered questionnaire	Eating behaviour/habits Frequency of food consumption Groups and types of food	Saudi adults aged 18-year-old and older	Further investigation was conducted to understand whether the used or adopted the internationally validated questionnaire or developed a new tool for their study. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response. Due to the lack of information on the used questionnaire and nonresponse from the authors, there is a gap in knowledge as to whether the particular questionnaire was used by others.

7	Kliemann, N., Beeken, R.J., Wardle, J. and Johnson, F., 2016. *Development and validation of the self-regulation of eating behaviour questionnaire for adults.*	Self-regulation of Eating Behaviours Questionnaire (SREBQ) A cross-sectional study. A self-administered questionnaire	Eating behaviours/habits	Saudi adults aged 18-year-old and older	This questionnaire considers self-regulation as purposeful health behaviour, controlling thoughts, and feelings. The SREBQ questions have been used or adopted by other researchers: 1. Kliemann, 2017. The impact of eating self-regulatory skills on weight control and dietary behaviours in adults (Doctoral dissertation, UCL). 2. Kliemann et al. 2018. Starting university with high eating self-regulatory skills protects students against unhealthy dietary intake and substantial weight gain over 6 months. 3. Ghazi, et al., 2018. Research Article Non-Communicable Diseases and its Association with Body Composition and Nutrition among General Population in Subnag Jaya, Selangor: Community-Based Study. 4. Lombardo et al., 2020. Eating self-efficacy: validation of a new brief scale. 5. Ferhatoglu, Kartal, Filiz, & Kebudi, 2020. The Positive Effects of a Calorie-Restricting High-Protein Diet Combined with Intragastric Botulinum Toxin Type A Application Among Morbidly Obese Patients: A Prospective, Observational Analysis of Eighty-Seven Grade 2 Obese Patients. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study, whether it was adapted and validated for Saudi setting. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response.

8	Kliemann, N., Wardle, J., Johnson, F. and Croker, H., 2016. *Reliability and validity of a revised version of the General Nutrition Knowledge Questionnaire.*	The General Nutrition Knowledge Questionnaire (GNKQ) Study design: unknown A self-administered questionnaire	Dietary recommendations Food groups Healthy food choices Diet, Disease, and Weight management	Saudi adults aged 18-year-old and older	The GNKQ was developed and validated in the 1990s by Parmenter and Wardle. This instrument was adopted and approved for use in other populations (e.g. Australia, Germany, Turkey, Protugal) as well: 1. Spendlove, Heaney, Gifford, Prvan, Denyer, & O'Connor, 2012. Evaluation of general nutrition knowledge in elite Australian athletes. 2. Alsaffar, A.A., 2012. Validation of a general nutrition knowledge questionnaire in a Turkish student sample. 3. Ferro-Lebres, Moreira, & Ribeiro, 2014. Adaptation, update and validation of the general nutrition questionnaire in a Portuguese adolescent sample. 4. De Souza, Kratzenstein, Hain, Mayer, & Carlsohn, 2015. General Nutrition Knowledge Questionnaire-Modified and Validated for Use in German Adolescent Athletes. 5. Bukenya et al., 2017. Validity and reliability of general nutrition knowledge questionnaire for adults in Uganda. 11. Matsumoto, Tanaka, & Ikemoto, 2017. Validity and reliability of a general nutrition knowledge questionnaire for Japanese adults. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study, whether it was adapted and validated for Saudi setting. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response.
9	Mansour, A.E., et al., 2020. *Lifestyle diseases and associated risk behaviours among medical students in Saudi Arabia.*	A cross-sectional study A self-administered questionnaire	Physical activity behaviour/habits Dietary behaviour/habits	University students aged 18-24-year-old	Further investigation was conducted to understand whether the used or adopted the internationally validated questionnaire or developed a new tool for their study. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response. Due to the lack of information on the used questionnaire and nonresponse from the authors, there is a gap in knowledge as to whether the particular questionnaire was used by others.

10	Marías, Y.F. and Glasauer, P., 2014. *Guidelines for assessing nutrition-related knowledge, attitudes and practices. Food and Agriculture Organization of the United Nations.*	Guidelines for Assessing Nutrition-Related Knowledge, Attitudes, and Practices (KAP)	Modules for the development of questionnaires assessing general public knowledge, attitudes and practice of FBDGs of a given setting	Adults aged 18-year-old and older	Several studies have been developed based on the KAP manual: 1. Koome, M.M., 2016. Household's Knowledge, Attitude and Food Handling Practices, Consumption of Traditional Fermented Milk and Risk Factors for Adult Overweight and Obesity in Isiolo Central Sub County. 2. Lotton, et al., 2018. Characterization of Nutrition Knowledge Attitudes and Practices Among Agricultural Extension Agents and their Beneficiaries in Rural Honduras. 3. Manzour, Assalya, & Faramawy, A.A.E., 2019. Maternal Knowledge and Practice Regarding Children's Nutrition and Impact on Growth of their Children in Sixth of October City, Cairo. 4. Rodríguez et al., 2019. Knowledge, Attitudes and Food Practices in Caregivers and Nutritional Status in Infants from Ventaquemada, Boyacá, Colombia. KAP (FAO, 2014) is available on the Internet and can be used without the permission of the authors.
11	Memish, Z.A. et al., 2014. Peer reviewed: obesity and associated factors—Kingdom of Saudi Arabia, 2013.	Saudi Health Interview Survey (SHIS) A cross-sectional study A self-administered questionnaire	Physical activity behaviour/habits Dietary behaviour/habits	Saudis aged 15-year-old and older	Several studies have been conducted to establish specific health conditions of the Saudi population based on the SHIS: 1. El Bcheraoui, et al., 2014. Status of the diabetes epidemic in the Kingdom of Saudi Arabia, 2013. 2. Tuffaha, et al., 2015. Deficiencies under plenty of sun: Vitamin D status among adults in the kingdom of Saudi Arabia, 2013. 3. Moradi-Lakeh, et al., 2015. Tobacco consumption in the Kingdom of Saudi Arabia, 2013: findings from a national survey. 4. Mokdad, et al., 2015. Cost of diabetes in the Kingdom of Saudi Arabia, 2014. 5. El Bcheraoui, et al., 2015. Access and barriers to healthcare in the Kingdom of Saudi Arabia, 2013: findings from a national multistage survey 6. Moradi-Lakeh, et al., 2017. Diet in Saudi Arabia: findings from a nationally representative survey. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study, whether it was validated and used by other researchers since 2013. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide

					more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response.
12	Rasheed, P. 1999. Overweight status: body image and weight control beliefs and practices among female college students.	Study design: unknown A self-administered questionnaire	Knowledge and attitude towards eating behaviour Erratic eating behaviours Beliefs about and practice of physical activity	University students aged 17-25-year-old	Further investigation was conducted to understand whether the used or adopted the internationally validated questionnaire or developed a new tool for their study. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response. Due to the lack of information on the used questionnaire and nonresponse from the authors, there is a gap in knowledge as to whether the particular questionnaire was used by other researchers.
13	Saeed, E. et al., 2017. Obesity and associated risk factors among students of health colleges of King Saud University, Saudi Arabia: a cross-sectional study.	A cross-sectional study A self-administered questionnaire	Possible risk factors associated with obesity Dietary and physical activity behaviours associated with obesity.	University students aged 18-24-year-old	Further investigation was conducted to understand whether the used or adopted the internationally validated questionnaire or developed a new tool for their study. A formal detailed e-letter was sent to the authors to learn more about the questionnaire used in this study. However, during the period of 20 days the authors of the study did not respond to emails with the request to provide more information on the process of development and adaptation of the questionnaire. A follow-up e-mail was sent, however, there was no response. Due to the lack of information on the used questionnaire and nonresponse from the authors, there is a gap in knowledge as to whether the particular questionnaire was used by other researchers.

Appendix 4. Summary of the evaluative factors for considering or rejecting questionnaires that either entirely or partially address the objectives of this study.

No.	Previously validated Measure/questionnaire	Why was the questionnaire considered? (What it measured/population/how administered)	Why was the questionnaire rejected? Critique and suitability for the study in this thesis.
1	**General Nutrition Knowledge Questionnaire (GNKQ)** (Parmenter & Wardle, 1999)	The GNKQ is one of the most commonly used and adopted and validated questionnaires both globally and in the MENA region. The 88-item survey tool is reported as a measure of nutrition knowledge that is consistent, reliable, valid, and sensitive to the recent changes in the culture of nutrition (Yahia et al., 2006; Said, Gubbels & Kremers, 2019). The GNKQ comprises four independent sections, each assessing a different aspects of nutrition knowledge: dietary recommendations; food groups; healthy food choices; diet, disease, and weight management, and an additional section with socio-demographic questions. All knowledge sections have been found to have good internal consistency and test-retest reliability (Kliemann, Wardle, Johnson, & Croker, 2016).	Despite being a validated tool for studies aimed at assessing the nutritional knowledge of participants, GNKQ is time-consuming and lengthy, which might affect and feasibility of the current study. Although some questions of the GNKQ may address the inclusion criteria of the current research and the survey has been used and adopted in several countries of MENA region, this instrument will lose its validity if to use only several questions of the 88-items questionnaire. The GNKQ is not suitable for the second objective of the current study as well, as the questionnaire will lose its validity if to change entire question and variables based on the Food Dome nutritional guidelines.
2	**Self-regulation of Eating Behaviours Questionnaire (**Kliemann, Beeken, Wardle, & Johnson, 2016a**)**	SREBQ is a five-item questionnaire focused on eating behaviours that support individuals to handle their diet in an obesogenic environment, and maintain a healthy weight and diet (Kliemann et al., 2016a; Kliemann, 2017; Ghazi et al., 2018). It is a self-administered scale that assesses the ability of a person to change his/her eating behaviour and food choices. The validation process confirmed that the SREBQ is a useful tool for the assessment of the effectiveness of dietary and weight control interventions (Kliemann et al., 2016; Kliemann, 2017; Ghazi et al., 2018).	The authors of SREBQ suggested that environmental changes in both nutritional structure and physical activity contribute to a positive energy balance in many populations, thus influencing on their healthy lifestyle (Kliemann et al., 2016). However, SREBQ's focus is narrowed to the goal of people to follow a healthy diet or reduce the consumption of junk food, without focusing on the importance of the physical activity. In addition, SREBQ is a short 5-item questionnaire that will create limitations to address the first objective of the current research entirely. One of the main reasons is the limited numbers of the questions and the fact that even if to change the questions, the original SREBQ will lose its validity. Therefore, the SREBQ would not meet the objectives of the current research.
3	**Saudi Health Interview Survey** (Memish et al., 2014)	The Saudi Health Interview Survey (SHIS), was developed to determine obesity prevalence, behavioural, lifestyle, and health-related factors influencing on the growing rates of obese population in the KSA (Memish et al., 2013). The SHIS included questions on diet and nutritional behaviours as well as questions on the levels of physical activity. The questionnaire was developed for the Saudis aged 15 years and older. Based on this evidence, the SHIS questionnaire might entirely address the first objective of the current research (i.e., identify nutrition and behavioural factors influencing the rates of obesity among 18-25-year-old university students in the Eastern Province of the KSA).	Although the SHIS meets inclusion criteria of the current research. However, the SHIS has included a lab-based biomedical examination, which can be considered as a limitation for this PhD research, since there is no access to biomedical examination data of participants. To assess the levels of physical activity, Memish et al. (2013) used the IPAQ, which was validated in the frameworks of their study. Nevertheless, the authors did not indicate the process of validation of the entire SHIS questionnaire. Several researchers have reviewed and evaluated the outcomes of the SHIS, these studies are mainly literature reviews and discussions based on the initial SHIS study and did not assess SHIS questionnaire. The SHIS is not suitable for the second objective of the current study.

4	**Arab Teens Lifestyle Study Questionnaire** (Al-Hazzaa, & Musaiger, 2011)	The ATLS project was aimed at assessing behavioural variables influencing on obesity rates in a large sample of high-school students from some urbanised countres of the MENA region (Al-Hazzaa & Musaiger 2011). The ATLS questionnaire included the following sections: 1) Anthropometric measurements (body weight, height, and waist circumference (WC); 2) Physical activity behaviour and level; 3) Sedentary activity and sleeping hours 4) Dietary habits questionnaire - ten specific questions designed to collect information on the frequency of certain dietary habits of students (Al-Hazzaa & Musaiger, 2011). Before distribution of the ATLS questionnaire, it was validated in all countries participating in this project (Saudi Arabia, Bahrain, United Arab Emirates, Kuwait, Jordan, Iraq, Oman, Tunisia, and Morocco) (Al-Hazzaa & Musaiger, 2011). The ALTS has been used or adopted by other researchers, among different age groups and populations.	The main consideration in respect of the ATLS questionnaire for the current study was the age group limitation of the original questionnaire (i.e., 14-19 years high-school students). However, evidence shows that since the implementation of the ATLS, the questionnaire has been adopted or used in different age groups varying from the original 14-25 years (Al Khalaf et al., 2013; Alhakbany et al., 2018; Osman, & Abumanga, 2019) Although the age can be considered a significant limitation for the further revision of the ALTS, still this evidence shows that the ATLS can be successfully implemented among participants age 14-25 years. However, the ATLS is not suitable for the second objective of the current study (i.e., to analyse the knowledge and attitudes in relation to the Food Dome, dietary guidelines).
5	**The Guidelines for Assessing Nutrition-Related Knowledge, Attitudes, and Practices (KAP manual)** (FAO, 2014).	The Guidelines for Assessing Nutrition-Related Knowledge, Attitudes, and Practices (KAP manual) is a practical guideline developed by the Food and Agriculture Organisation of the United Nations (FAO) for conducting high-quality surveys aimed to assess key indicators: knowledge, attitudes and practices in relation to local nutritional issues and find any gaps. (WHO, 2008; Médecins du Monde, 2011; FAO, 2014). The handbook delivers useful guidance for devising and conducting a KAP survey as well as information on the further analysis of the survey results (FAO, 2014). Taking into consideration the second objective of the current research (i.e., to investigate knowledge, attitudes, and behaviour in relation to the FDDG, designed specifically for the MENA region) and the absence of the specific survey for the Food Dome guidelines. Although the initial aim of the search was to find suitable questionnaires, rather than looking for guidelines to develop a new block of questions, however, as shown in the previous section neither of discussed questionnaires addresses the second objective of the current research. This is why this study will use the KAP manual by FAO, as well as evidence on developing a valid questionnaire, references for the developing a new block to address the second objective.	One of the main reasons for rejecting the current guidelines as a reference for developing a new block for the current research was the limited number of questions assessing knowledge and attitudes in relation to Food-based dietary guidelines (Module 12, FAO, 2014). However, despite the limited quantity of the questions, KAP manual provides descriptive and informative details on how the additional questions should be designed, and which particular points should be assessed (i.e., knowledge of the local food-based dietary guidelines; different food groups, examples of foods from each food group; perceived importance of dietary guidelines; intake and frequency of consuming foods from a specific food group).

Appendix 5. ATLS questionnaire use permission for Phase I.

Gmail

Permission to Use "The Arab Teens Lifestyle Study"
1 message

Hazzaa Al-Hazzaa <halhazzaa@hotmail.com> Wed, Jun 15, 2020 at 5:32 PM

To: alexwoodman.ucla@gmail.com

Dear Alexander Woodman,
Thank you for the email. You are given full permission to use the ATLS questionnaire. Kindly find attached the revised ATLS questionnaire in Arabic and English as well as the computational instructions. Please to keep the psychometric property of the questionnaire as intact, I would suggest having all other added questions come after the ATLS questionnaire.

Good luck and BR.

Hazzaa

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https://scholar.google.com/citations?user=DJpXW6wAAAAJ&hl=en&oi=sra

Appendix 6. Arab Teens Lifestyle Study and Food Dome questionnaire.

PART ONE: Socio-demographic Questions الجزء الأول :الأسئلة الاجتماعية والديموغرافية		
1. What is your gender?		**حدد جنسك**
Male	☐	ذكر
Female	☐	أنثى
2. What is your age?		**كم عمرك؟**
18-20	☐	18-20
21-23	☐	21-23
24-25	☐	24-25
3. What is your current weight approximately? **كم يبلغ وزنك بالكيلوجرام؟**		
Kilograms		كيلوغرام
4. What is your current height approximately? **كم يبلغ طولك بالسنتيمترات؟**		
Centimetres		سم
5. What is your marital status?		**حدد حالتك الإجتماعية**
Single	☐	أعزب
Married	☐	متزوج
Divorced	☐	مطلق
Widowed	☐	أرمل
Other	☐	أخرى
6. Do you have any children?		**هل لديك أطفال؟**
No	☐	لا
1	☐	1
2	☐	2
3	☐	3
More than 3	☐	أكثر من 3
7. What is your nationality?		**حدد جنسيتك**
Saudi		سعودي
Non-Saudi		غير سعودي
PART TWO: *Physical Activity/Inactivity* النشاط البدني / الخمول		
8. How many <u>days</u> per week do you regularly walk? **كم يوم في الأسبوع تمارس بانتظام رياضة المشي؟**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
9. If you regularly walk, what is the pace of your walk? **في حالة ممارستك المشي بانتظام، ما هي طبيعته في الغالب؟**		
Slow	☐	بطيء
Moderate	☐	معتدل
Fast	☐	سريع
10. If you regularly walk, how many minutes do you walk each day? **في حالة ممارستك المشي بانتظام، كم تستغرق من الوقت في كل يوم؟**		
Number of minutes		عدد الدقائق
11. How many times per DAY you use the stairs in school, home, or elsewhere? (one floor of stair counts as 1 time) **كم مرة في اليوم تقوم بصعود الدرج سواء في المدرسة أو في المنزل أو معا؟(دور واحد يساوي مرة واحدة، ودوران يساويان مرتان، أما صعود دور واحد مرتين في اليوم فيساوي مرتان، وهكذا)**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان

3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
12. How many <u>days</u> per week do you regularly jog or run? **كم يوم في الأسبوع تمارس بانتظام رياضة الهرولة أو الجري أو كلاهما سواء على الأرض أو السير**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
13. If you regularly jog or run, how many minutes do you do each day? **في حالة ممارستك الهرولة أو الجري بانتظام، كم تستغرق من الوقت في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**
14. How many <u>days</u> per week do you regularly cycle (either on an outdoor or a stationary cycle)? **كم يوم في الأسبوع تقوم بانتظام بركوب الدراجة العادية أو الدراجة الثابتة المنزلية أو كلاهما؟**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
15. If you use an outdoor or a stationary cycle regularly, how many minutes do you cycle each day? **في حالة استخدامك الدراجة العادية أو الدراجة الثابتة المنزلية بانتظام، كم تستغرق من الوقت في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**
16. How many <u>days</u> per week do you regularly swim? **كم يوم في الأسبوع تمارس السباحة بانتظام؟**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
17. If you regularly swim, how many minutes do you swim each day? **في حالة ممارستك السباحة بانتظام كم تستغرق من الوقت الفعلي في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**
18. How many times per week do you regularly engage in moderate intensity sports (e.g., volleyball, table tennis, bowling, badminton, aerobic dance or other similar activities)? **كم يوم في الأسبوع تمارس بانتظام أنشطة رياضية معتدلة الشدة وغير مجهدة بدنياً غير الأنشطة السابق ذكرها (مثل كرة الطائرة ، تنس الطاولة، البولينج، الريشة الطائرة، وما شابه ذلك)**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
19. If you regularly play moderate intensity sports, how many minutes do you play each time? **في حالة ممارستك تلك الرياضات معتدلة الشدة بانتظام، كم تستغرق من الوقت فعلياً في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**

20. How many times per week do you regularly engage in high intensity sports (e.g., soccer, rugby, hockey, netball, basketball, handball, athletics, tennis, squash, rope jump, cross fit)? **كم يوم في الأسبوع تمارس بانتظام أنشطة رياضية عالية الشدة ومجهدة بدنياً غير الأنشطة السابق ذكرها (مثل كرة السلة، كرة اليد، كرة القدم، التنس الأرضي، السكواش، نط الحبل، كروس فت)**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
21. If you regularly play high intensity sports, how many minutes do you play each time? **في حالة ممارستك تلك الرياضات عالية الشدة بانتظام، كم تستغرق من الوقت فعليا في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**
22. How many times per week do you participate in self-defence sports (e.g., kick-boxing, judo, karate, taekwondo, etc.)? **كم يوم في الأسبوع تمارس بانتظام رياضات الدفاع عن النفس (مثل الجودو، الكاراتيه، التايكواندو) ؟**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
23. If you participate in self-defence sports regularly, how many minutes do you do each time? **في حالة ممارستك لرياضات الدفاع عن النفس بانتظام، كم تستغرق من الوقت فعلياً في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**
24. How many times per week do you regularly do strength training (weight training or body building or calisthenics exercise)? **كم يوم في الأسبوع تمارس بانتظام التمارين السويدية أو تدريبات الأثقال(من أجل تقوية العضلات)؟**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
25. If you regularly do strength training (weight training, body building or calisthenics exercise), how many minutes do you do it each time? **في حالة ممارستك التمارين السويدية أو تدريبات الأثقال بانتظام، كم من الوقت تستغرق فعلياً في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**
26. How many times per week do you engage in household work (e.g., gardening, vacuuming, washing, car cleaning)? **كم يوم في الأسبوع تقوم بانتظام بممارسة أعمال بدنية منزلية (مثل العمل في الحديقة المنزلية من قص الأشجار وتنسيقها، حرث الأرض، أو كنس المنزل، غسل المنزل، غسل الملابس ، غسل السيارة، الخ) ؟**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
27. If you do household work, how many minutes does it take per day? **في حالة قيامك بانتظام بممارسة أعمال بدنية منزلية، كم من الوقت تستغرق في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**

28. How many times per week do you do traditional dancing (whether alone or with your friends)? (*This question is specifically for girls, and boys can go directly to item 30*). **بالنسبة للسيدات، كم يوم في الأسبوع تقومين بانتظام بممارسة الرقص (سواء مع صديقاتك أ و وحدك في المنز ل)؟**		
None	☐	لا يوجد
One day	☐	يوم واحد
2 days	☐	يومان
3 days	☐	3 ايام
4 days	☐	4 ايام
5 days	☐	5 ايام
6 days	☐	6 ايام
7 days (daily)	☐	7 أيام (يومياً)
29. If you do dancing, how many minutes do you do such activities each time? **بالنسبة للسيدات، في حالة قيامك بانتظام بممارسة الرقص، كم من الوقت تستغرقين في كل يوم؟**		
Number of minutes		**دقيقة في كل يوم**
30. Where do you normally do your physical activities or sports? **عند ممارستك النشاط البدني (أو الرياضي)، أين يكون غالباً مكان الممارسة ؟**		
Home	☐	في المنزل
Park or public area	☐	في الشارع أو الساحات أو الحدائق العامة
School	☐	في المدرسة
Sports or recreation center	☐	في مركز صحي أو ترويحي أو نادي الرياضي
Other, please give details	☐	أماكن أخرى (فضلا أذكرها):
31. With whom do you normally do your physical activities or sports? **مع من تمارس النشاط البدني (أو الرياضي) في المعتاد ؟**		
Alone	☐	لا أحد
School peers	☐	مع زملاء الدراسة
Parents	☐	مع الوالدين
Other relatives	☐	مع الأقارب
Friends	☐	مع الأصدقاء
Other, please give details	☐	مع آخرين (فضلا أذكر من هم):
32. When do you usually do your physical activities or sports? **متى عادة تمارس النشاط البدني (أو الرياضي)؟**		
Morning	☐	صباحاً
Afternoon	☐	بعد الظهر
Noon time	☐	وقت العصر
After evening meal	☐	بعد وجبة العشاء
Evening	☐	مساء
No specific time	☐	لا يوجد وقت محد د للممارسة
33. If you <u>participate</u> in physical activities or sports regularly, what are the main reasons for that? *<u>Please answer either item 33 (if you are active) or item 34 (if not active</u>*). **في حالة ممارستك النشاط البدني بانتظام، ما هي أهم الأسباب وراء ذلك؟(لمن لا يمارس النشاط البدني بانتظام الرجاء الإجابة على السؤال رقم 34)**		
Health	☐	صحة
Social	☐	اجتماعي
Competition	☐	منافسة
To lose weight	☐	لتخفيف الوزن
Recreation	☐	الترفيهية
Others, please give details	☐	آخرون ، يرجى إعطاء التفاصيل
34. If you <u>don't</u> participate in physical activities or sports regularly, what are the main reasons for that? **في حالة عدم ممارستك النشاط البدني بانتظام، ما هي أهم الأسباب وراء ذلك؟**		
No time	☐	لا وقت
No suitable facilities	☐	لا توجد مرافق مناسبة
Afraid of criticism	☐	يخاف من النقد
Not important	☐	غير مهم
Health reasons	☐	أسباب صحية

Other, please give details	☐	أخرى ، يرجى إعطاء التفاصيل

PART THREE: *Sedentary Behaviours*
الجزء الثاني :السلوكيات المستقرة

35. On average, how long do you watch TV per day on weekdays?
في المتوسط، ما هي المدة التي تقضيها في مشاهدة التلفزيون يوميًا في أيام الأسبوع؟

I do not watch TV	☐	انا لا اشاهد التلفاز
½ hour	☐	½ ساعة
1 hour	☐	1ساعة
2 hours	☐	ساعتين
3 hours	☐	3ساعات
4 hours	☐	4ساعات
5 hours	☐	5ساعات
More than 5 hours	☐	أكثر من 5 ساعات
If it's more than 5 hours, how many?	☐	إذا كانت أكثر من 5 ساعات ، فكم عددها؟

36. On average, how long <u>per day</u> do you watch TV and/or DVD/Video during <u>weekends</u>?
في المتوسط، ما هي المدة التي تشاهد فيها التلفزيون يوميًا خلال عطلات نهاية الأسبوع؟

I do not watch TV	☐	انا لا اشاهد التلفاز
½ hour	☐	½ ساعة
1 hour	☐	1ساعة
2 hours	☐	ساعتين
3 hours	☐	3ساعات
4 hours	☐	4ساعات
5 hours	☐	5ساعات
More than 5 hours	☐	أكثر من 5 ساعات
If it's more than 5 hours, how many?	☐	إذا كانت أكثر من 5 ساعات ، فكم عددها؟

37. On average, how long per day do you spend on the computer and/or social media (for leisure) during weekdays?
في المتوسط، ما هي المدة التي تقضيها يوميًا على الكمبيوتر و / أو وسائل التواصل الاجتماعي (لقضاء وقت الفراغ) خلال أيام الأسبوع؟

I do not use Internet	☐	أنا لا أستخدم الإنترنت
½ hour	☐	½ ساعة
1 hour	☐	1ساعة
2 hours	☐	ساعتين
3 hours	☐	3ساعات
4 hours	☐	4ساعات
5 hours	☐	5ساعات
More than 5 hours	☐	أكثر من 5 ساعات
If it's more than 5 hours, how many?	☐	إذا كانت أكثر من 5 ساعات ، كم عددها

38. On average, how long per day do you spend on the computer and/or social media (for leisure) during weekends?
في المتوسط، ما هي المدة التي تقضيها يوميًا على الكمبيوتر و / أو وسائل التواصل الاجتماعي (لقضاء وقت الفراغ) خلال عطلات نهاية الأسبوع؟

I do not use Internet	☐	أنا لا أستخدم الإنترنت
½ hour	☐	½ ساعة
1 hour	☐	1ساعة
2 hours	☐	ساعاتين
3 hours	☐	3ساعات
4 hours	☐	4ساعات
5 hours	☐	5ساعات
More than 5 hours	☐	أكثر من 5 ساعات
If it's more than 5 hours, how many?	☐	إذا كانت أكثر من 5 ساعات ، كم عددها

39. On average, how many hours <u>per day</u> do you sleep during week days? **في المتوسط، كم ساعة تنام في اليوم خلال أيام الأسبوع؟**		
3 hours	☐	3ساعات
4 hours	☐	4ساعات
5 hours	☐	5ساعات
6 hours	☐	6ساعات
7 hours	☐	7ساعات
8 hours	☐	8ساعات
9 hours	☐	9ساعات
10 hours or more	☐	10ساعات أو أكثر
40. On average, how many hours per day do you sleep during weekends? **في المتوسط، كم ساعة تنام في اليوم خلال عطلات نهاية الأسبوع؟**		
3 hours	☐	3ساعات
4 hours	☐	4ساعات
5 hours	☐	5ساعات
6 hours	☐	6ساعات
7 hours	☐	7ساعات
8 hours	☐	8ساعات
9 hours	☐	9ساعات
10 hours or more	☐	10ساعات أو أكثر
PART FOUR: Dietary Habits **الجزء الرابع :العادات الغذائية**		
41. How many times (days) per week do you have your breakfast? **كم مرة (أيام) تتناول فيها وجبة الإفطار في الأسبوع؟**		
I don't have breakfast	☐	لا أتناول الفطور
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات
42. How many times per week do you drink sugary drinks /soft drinks (e.g., Coke, Pepsi, 7up, Sports drink)? **كم مرة في الأسبوع تشرب مشروبات سكرية / مشروبات غازية (كوكاكولا ، بيبسي ، سفن أب ، مشروب رياضي)؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات
43. How many times per week do you eat vegetables (fresh or cooked)? **كم مرة في الأسبوع تأكل الخضار (الطازجة أو المطبوخة)؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات
44. How many times per week do you eat fresh fruit? **كم مرة في الأسبوع تأكل فواكه طازجة؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين

3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات
45. How many times per week do you have dairy products (e.g., milk, yogurt, cheese)? **كم مرة في الأسبوع تتناول منتجات ألبان (لبن ، زبادي ، جبن)؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات
46. How many times per week do you eat fast food (e.g., burgers, sausage, pizza, or Arabic shawarma, inside or outside your home? **كم مرة في الأسبوع تأكل وجبات سريعة (برغر ، سجق ، بيتزا ، أو شاورما عربية) داخل أو خارج منزلك؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات
47. How many times <u>per week</u> do you eat French fries and/or potato chips? **كم مرة في الأسبوع تأكل البطاطس المقلية و / أو رقائق البطاطس؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات
48. How many times <u>per week</u> do you eat cakes, biscuits, doughnut, or similar food? **كم مرة في الأسبوع تأكل الكعك أو البسكويت أو أي طعام مشابه؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات
49. How many times <u>per week</u> do you eat sweets and/or chocolates? **كم مرة في الأسبوع تأكل حلوى و / أو شوكولاتة؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات

50. How many times <u>per week</u> do you drink energy drinks (e.g., Red Bull, Power Horse)? **كم مرة في الأسبوع تشرب مشروبات الطاقة (ريد بول ، باور هورس)؟**		
None	☐	لا شيء
Once	☐	مرة واحدة
Twice	☐	مرتين
3 times	☐	ثلاث مرات
4 times	☐	4مرات
5 times	☐	5مرات
6 times	☐	6مرات
7 times	☐	7مرات

PART FIVE: FOOD DOME
الجزء الخامس: الهرم الغذائي

51. Do you follow the recommendations by Food Dome dietary guidelines designed specifically for the MENA region? (tick one box) **هل تتبع إرشادات الهرم الغذائي المصمم خصيصاً للوسط العربي؟ (اختيار واحد)**		
Yes, I follow Food Dome guidelines	☐	نعم, أنا أتبع إرشادات الهرم الغذائي
No, I do not follow Food Dome guidelines	☐	لا, أنا لا أتبع إرشادات الهرم الغذائي
No, I have not ever heard about such guidelines	☐	لا, أنا لم أسمع قط عن إرشادات الهرم الغذائي
No, I do not know, but I would like to follow specific dietary guidelines	☐	لا, أنا لا أعلم بتلك الإرشادات, و لكن أود أن أتبع بعض الإرشادات الغذائية

52. Experts classify foods into groups. Please, choose five food groups recommended specifically for the MENA region. (tick on box per answer)
صنَّف المختصون الغذاء إلى مجموعات. اختر خمس مجموعات غذائية موصى بها في الوسط العربي (حدد لكل مجموعة)

	Yes **أوافق**	**No** **لا أوافق**	**Not Sure** **غير متأكد**	
Cereals and their products	☐	☐	☐	الحبوب و منتجاتها
Vegetables	☐	☐	☐	الخضراوات
Fruit	☐	☐	☐	الفواكه
Milk and dairy products	☐	☐	☐	الحليب و منتجات الأجبان
Meat, chicken, fish, eggs, legumes and nuts	☐	☐	☐	اللحوم و الدواجن و الأسماك و البيض والبقوليات و المكسرات
Vegetables and legumes/beans	☐	☐	☐	الخضراوات و البقوليات
Fruits and vegetables	☐	☐	☐	الفواكه و الخضراوات

53. How many times per week do experts recommend Arab people to eat the following foods? (tick one box per food) ما هو عدد المرات الموصى بها تناول الأغذية التالية في الأسبوع للشعب العربي؟ (حدد لكل مجموعة)

	Once **مرة واحدة**	**3-4 times** **4-3 مرات**	**5 times** **5 مرات**	**Daily** **يومياً**	**Not Sure** **غير متأكد**	
Cereals and their products	☐	☐	☐	☐	☐	الحبوب و منتجاتها
Vegetables	☐	☐	☐	☐	☐	الخضراوات
Fruits	☐	☐	☐	☐	☐	الفواكه
Milk and dairy products	☐	☐	☐	☐	☐	الحليب و منتجات الأجبان
Meat, chicken, fish, eggs, legumes and nuts	☐	☐	☐	☐	☐	اللحوم و الدواجن و الأسماك و البيض والبقوليات و المكسرات

54. How many servings of the following foods do you eat as a minimum on a daily basis? (tick one box per food)
كم حصة تتناول من الأغذية التالية كحدٍ أدنى كل يوم؟ (حدد لكل مجموعة)

	2-3serv. **3-2 حصص**	**2-4serv.** **4-2 حصص**	**3-5serv.** **5-3 حصص**	**6-11serv.** **11-6 حصة**	**Not Sure** **غير متأكد**	
Cereals and their products	☐	☐	☐	☐	☐	الحبوب و منتجاتها
Vegetables	☐	☐	☐	☐	☐	الخضراوات
Fruit	☐	☐	☐	☐	☐	الفواكه
Milk and dairy products	☐	☐	☐	☐	☐	الحليب و منتجات الأجبان
Meat, chicken, fish, eggs, legumes and nuts	☐	☐	☐	☐	☐	اللحوم و الدواجن و الأسماك و البيض والبقوليات و المكسرات

55. What size is the recommended portion of the following foods that health experts recommend Arab people? (tick one box per food)*
ما هو حجم الحصة الموصى بها للشعب العربي من مجموعات الأغذية التالية؟ (حدد لكل فقرة)

	⅓ cup* ⅓كوب	½ cup* ½كوب	1cup* كوب واحد	1.5 cup* 1.5 كوب	Not sure غير متأكد	
Fresh fruits	☐	☐	☐	☐	☐	الفواكه الطازجة
Fresh vegetables	☐	☐	☐	☐	☐	الخضراوات الطازجة
Legumes	☐	☐	☐	☐	☐	البقوليات
Milk (laban or yoghurt)	☐	☐	☐	☐	☐	الحليب (اللبن و الزبادي)
Nuts	☐	☐	☐	☐	☐	المكسرات
*1 cup = 250g						*كوب = 250 غرام

56. According to the Food Dome what size is a recommended portion of cereals and their products? (tick one box per food)
وفقاً للهرم الغذائي ما هو الحجم الموصى به للحصة الواحدة من منتجات الحبوب التالية؟ (حدد لكل فقرة)

	Yes أوافق	No لا أوافق	Not Sure غير متأكد	
30g cornflakes	☐	☐	☐	30 غرام من رقائق الذرة
¼ Arabic flat bread	☐	☐	☐	ربع رغيف عربي
6 small crackers	☐	☐	☐	6 قطع من البسكويت
½ Arabic flat bread	☐	☐	☐	نصف رغيف عربي
½ cup cooked cereals (e. g. rice, wheat oats, macaroni)	☐	☐	☐	نصف كوب من الحبوب المطبوخة (مثل الرز, شوفان القمح,المعكرونة)
100g cornflakes	☐	☐	☐	100 غرام من رقائق الذرة

57. Do you think these foods are typically rich source of iron? (tick one box per food)
هل تعتقد أن الأغذية التالية غنية بمحتوى الحديد؟ (حدد لكل فقرة)

	Rich in Iron غني بالحديد	Low in Iron فقير بالحديد	Not Sure غير متأكد	
Poultry (e.g., chicken)	☐	☐	☐	الدواجن
Spinach	☐	☐	☐	السبانخ
Broccoli	☐	☐	☐	البروكلي
Beans	☐	☐	☐	الفاصوليا
Nuts	☐	☐	☐	المكسرات
Grains (e.g., whole wheat, fortified cereals)	☐	☐	☐	البقوليات (مثل الشوفان و الحبوب المدعمة)
Dried fruits	☐	☐	☐	الفواكه المجففة

58. What colour vegetables are recommended for Arabs to eat more often? (tick one box per food)
من بين ألوان الخضراوات, ما هو اللون اللذي يوصى العرب بتناوله بكثرة أكثر من غيره؟ (حدد لكل فقرة)

	Yes أوافق	No لا أوافق	Not Sure غير متأكد	
Red (tomatoes, beets)	☐	☐	☐	الأحمر (الطماطم و الشمندر)
Blue/ Purple (eggplant)	☐	☐	☐	الأزرق/البنفسجي (الباذنجان)
Dark Green (Spinach, Broccoli)	☐	☐	☐	الأخضر الغامق (السبانخ و البروكلي)
Orange (e.g., carrot)	☐	☐	☐	البرتقالي (الجزر)

59. What types of meat are recommended to Arabs? (tick one box per food)
ما هي أنواع اللحوم الموصى بها للعرب؟ (حدد لكل فقرة)

	Yes أوافق	No لا أوافق	Not Sure غير متأكد	
Fish	☐	☐	☐	السمك
Chicken	☐	☐	☐	الدجاج
Lean meat	☐	☐	☐	اللحم الطري
Red meat (e.g., Lamb)	☐	☐	☐	اللحم الأحمر (مثل الضأن)

60. According to Food Dome, what do you think is the one serving size of meat, chicken, fish? (tick one box)
وفقاً للهرم الغذائي، ما هو الحجم الموصى به للحصة الواحدة من اللحوم أو الدجاج أو السمك؟ (اختيار واحد)

50-80g	☐	80-50 غرام
100-120g	☐	120-100 غرام
200g	☐	200 غرام
Not sure	☐	غير متأكد

61. According to Food Dome, the amount of energy from fat should not exceed.... (tick one box)
وفقاً للهرم الغذائي، نسبة الطاقة المأخوذة من الدهون يجب ألّا تتجاوز... (اختيار واحد)

30% of daily calories	☐	30% من السعرات الحرارية اليومية
10% of daily calories	☐	10% من السعرات الحرارية اليومية
50% of daily calories	☐	50% من السعرات الحرارية اليومية
Not sure	☐	غير متأكد

62. How many times a week do you consume following foods?
كم عدد المرات التي تتناول فيها الأغذية التالية أسبوعياً؟ (حدد لكل مجموعة)

	Once مرة واحدة	3-4times 4-3 مرات	5 times 5 مرات	Daily يومياً	Not Sure غير متأكد	
Cereals and their products	☐	☐	☐	☐	☐	الحبوب ومنتجاتها
Vegetables	☐	☐	☐	☐	☐	الخضراوات
Fruit	☐	☐	☐	☐	☐	الفواكه
Milk and dairy products	☐	☐	☐	☐	☐	الحليب ومنتجات الأجبان
Meat, chicken, fish, eggs, legumes and nuts	☐	☐	☐	☐	☐	اللحوم والدواجن والأسماك والبيض والبقوليات والمكسرات

63. Which of the following vegetables do you consume at least 5 times per week? (tick one box per food)
هل تتناول أي من أنواع الخضراوات التالية على الأقل 5 مرات أسبوعياً؟ (حدد لكل نوع)

	Yes نعم	No لا	
Spinach	☐	☐	السبانخ
Broccoli	☐	☐	البروكلي
Lettuce	☐	☐	الخس
Carrot	☐	☐	الجزر
Pumpkin	☐	☐	اليقطين
Yellow bell pepper	☐	☐	الفلفل الأصفر

64. Which of the following products do you consume regularly (i.e., daily)? (tick one box per food)
من بين المنتجات التالية، ما هي المنتجات التي تتناولها بانتظام (يومياً مثلاً)؟ (حدد لكل فقرة)

	Yes أوافق	No لا أوافق	Not Sure غير متأكد	
30g cornflakes	☐	☐	☐	30 غرام من رقائق الذرة
¼ Arabic flat bread	☐	☐	☐	ربع رغيف عربي
6 small crackers	☐	☐	☐	6 قطع من البسكويت
½ Arabic flat bread	☐	☐	☐	نصف رغيف عربي
½ cup cooked cereals (e.g., rice, wheat oats, macaroni)	☐	☐	☐	نصف كوب من الحبوب المطبوخ (مثل الرز، شوفان القمح، المعكرونة)
100g cornflakes	☐	☐	☐	100 غرام من رقائق الذرة

65. Thinking about the choice of meat/fish. Which of the following meet do you prefer? (tick one box per food)
أي أنواع اللحوم التالية تفضل؟ (حدد لكل فقرة)

	Yes نعم	No لا	
Fish	☐	☐	السمك
Chicken	☐	☐	الدجاج
Lean meat	☐	☐	اللحم الطري
Red meat (e.g., Lamb)	☐	☐	اللحم الأحمر (مثل الضأن)
I don't eat meat	☐	☐	أنا لا آكل اللحوم

66. What support would you like to receive, to learn more about the Food Dome dietary guidelines for Arab people?
ما هي وسائل التعلم التي تفضلها في حال أردت أن تتعلم المزيد عن إرشادات الهرم الغذائي للشعب العربي؟

Please specify: الرجاء

التوضيح:

Appendix 7. University of Salford ethical approval for Phase I.

University of Salford MANCHESTER

Research, Enterprise and Engagement
Ethical Approval Panel

Doctoral & Research Support
Research and Knowledge Exchange,
Room 827, Maxwell Building,
University of Salford,
Manchester
M5 4WT

T +44(0)161 295 2280

www.salford.ac.uk

17 December 2019

Dear Alex,

RE: ETHICS APPLICATION–HSR1920-016 – To investigate and understand knowledge, understanding and attitudes towards dietary guidelines for Arab countries among adolescents in the Eastern Province of the Kingdom of Saudi Arabia (KSA).

Based on the information that you have provided, I am pleased to inform you that application HSR1920-016 has been approved.

If there are any changes to the project and/or its methodology, then please inform the Panel as soon as possible by contacting Health-ResearchEthics@salford.ac.uk

Yours sincerely,

Professor Andrew Clark
Chair of the Research Ethics Panel

University of Salford MANCHESTER

Amendment Notification Form

Title of Project:		
An Investigative Study on University Students' Knowledge and Attitudes towards the Food Dome in the Eastern Province of the Kingdom of Saudi Arabia		
Name of Lead Applicant:	**School:**	
Alexander Woodman	Health & Society	
Are you the original Principal Investigator (PI) for this study?		Yes
If you have selected 'NO', please explain why you are applying for the amendment:		
Date original approval obtained:	**Reference No:**	**Externally funded project?**
17/12/2019	**HSR1920-016**	No

Please outline the proposed changes to the project. *NB. If the changes require any amendments to the PIS, Consent Form(s) or recruitment material, then please submit these with this form highlighting where the changes have been made:*

The ethics for the first phase of the study was obtained on December 17, 2019. However, given the objectives of the current PhD study, it became necessary to revise the previously confirmed title and questionnaire. Previously confirmed questionnaire was a combination of several surveys: The General Nutrition Knowledge Questionnaire (GNKQ), the Self-regulation of Eating Behaviour Questionnaire (SREBQ), the Guidelines for assessing nutrition-related knowledge, the attitudes and practices (KAP manual), Salford Community Food Workers Report (SCFW), the Adolescent Food Habits Checklist (AFHC), the International Physical Activity Questionnaire (IPAQ), Arab Food Dome.

The PGR, with the recommendations by the Supervisor(s) conducted a systematic search for a questionnaire to identify previously validated and adopted international questionnaires used in the Kingdom of Saudi Arabia, or those designed specifically for the Kingdom of Saudi Arabia (KSA) or Middle East and North Africa (MENA) region that would address the objectives of Phase 1 of the study. The results of the systematic search indicated that the Arab Teens Lifestyle Study (ATLS) questionnaire was a suitable validated instrument that will address the first objective of the current study. The ATLS questionnaire assesses the lifestyle habits influencing obesity rates in the Arab region, including physical activity patterns, sedentary and eating behaviours (i.e., frequent fast food consumption, eating occasions away from home, large portion sizes, high consumption of beverages high in sugar, and breakfast omission).

For the current study, all parts of the ATLS questionnaire will be used as they are the validated version with minor modifications in some terms due to the age of the target population (e.g., "school" will be changed to "university") as well as in anthropometric measurements (i.e., gender, age, race and ethnicity, marital status, and parental status). This modification aims to describe the study sample at an accurate level, which will allow the sample to be described so that readers can better understand the similarities and differences between studies. In addition, by doing this, other researchers are more likely to replicate the original results. Official permission to use the ATLS questionnaire as a research instrument for this phase of the study was obtained from the author of the questionnaire Professor Hazzaa Al-Hazzaa. Hazzaa Al-Hazzaa provided details of the ATLS questionnaire, as well as computational instructions, recommending that the psychometric property of the questionnaire be kept intact.

Appendix 8. Participant information sheet and consent form English & Arabic.

PARTICIPANT INFORMATION SHEET 27/07/2020

Title of study: *An Investigative Study on University Students' Knowledge and Attitudes towards the Food Dome in the Eastern Province of the Kingdom of Saudi Arabia*

Name of Researcher: Alexander Woodman

1. Invitation paragraph

You are being invited to take part in a research study that aims to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the Food Dome among 18-25-years-old university students in the Eastern Province of the KSA.

Before you decide whether or not to participate, you should know why the research is being conducted and how you will be involved. Please, take a few minutes to read the following information carefully. If necessary, do not hesitate to consult with others about the study. The researcher is prepared to explain any of the details to you and, of course, answer any questions you may have regarding the study. Feel free to ask about anything that is unclear to you, or if you need more information. Take your time to decide if you will take part in this study or not. The researcher would greatly appreciate your participation.

2. What is the purpose of the study?

Due to changes in dietary patterns over the past few decades in the Gulf Cooperation Countries the survey and focus group are designed to explore your dietary behaviours, to evaluate your knowledge related to healthy weight, and to assess your attitudes, practices, and concerns regarding dietary guidelines. The information derived from the study is projected to improve nutritional behaviours in adolescents in the Eastern Province of the KSA.

3. Why have I been invited to take part?

You have been invited to take part because you are a student at a university in the Eastern Province of KSA, and it is hoped that by understanding your views on dietary guidelines and healthy weight, we can work with students to develop interventions to improve dietary knowledge, awareness and behaviour in adolescents.

4. **Do I have to take part?**

It is your decision whether to participate in this study or not. Take your time to make this decision (at least 24 hours). You are free to discuss and ask questions to the person, who have provided you with this study. If you want more clarification, contact the researcher Alexander Woodman (e-mail: A.Woodman1@edu.salford.ac.uk).
Please, note if you agree to take part in this study, you are still free to withdraw at any time, without providing a reason. This will not affect your regular classes or lifestyle anyhow.

5. What will happen to me if I take part?

If you decide to take part in this study, the researcher will ask you to follow the link to the online survey. This contains a paragraph where you are asked to tick to consent to your participation. Following consent, you will have access to the online questionnaire, which you can complete at home. This questionnaire, for example, will ask your age, gender, and contain questions about nutritional guidelines and behaviour in respect of dietary intake and physical activity. The questions are structured to be answered using tick boxes and will only take about twenty minutes to complete. At the end of the questionnaire, you will be asked if you are interested in taking part in a focus group, which is a group discussion about the topic (separate focus groups will be held for males and females on your university premises). Once submitted the questionnaire will be automatically returned to the researcher. It is again your decision to take part, or not, in the focus group. If you agree, you will be sent a consent form and invited to attend the focus group. If you do choose to participate, you can change your mind at any time, if necessary. There are no reimbursements available for taking part in the focus groups, as this is a self-funded PhD.

The focus groups will be audio-recorded to help the researcher to accurately record what was said during the discussions. Your name will not be mentioned in the discussion, and the recording will only be available to the researcher. Once the study is completed, all records will be deleted. You will not be asked anything personal.

6. Expenses and payments?

There is no expense in completing the questionnaires, as the study will take place online. Similarly, there are no expenses for taking part in the focus groups, as these will be held at the university you are studying at.

7. What are the possible disadvantages and risks of taking part?

There are no disadvantages, risks, or potential harm that could happen by taking part in the study. At any time during the study, if you feel that a break is required, you are free to do so.

8. What are the possible benefits of taking part?

Even though you may find information that could improve your lifestyle and nutritional behaviours, your participation in this study will not directly affect you now. The obtained data will help the researcher to evaluate and develop an intervention to improve dietary behaviours for students like yourself at university.

9. What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researcher by email (A.Woodman1@edu.salford.ac.uk) who will do their best to answer your questions.

Following this, if you have any issues or complaints, you may contact the research supervisor Dr Margaret Coffey by email (m.coffey@salford.ac.uk) or by telephone (0161 295 2551).

However, if you remain dissatisfied and wish to complain formally, please forward your concerns to Professor Andrew Clark, Chair of the Health Research Ethical Approval Panel, University of Salford, Salford, M6 6PU. Tel: 0161 295 4109. Email: a.clark@salford.ac.uk.

10. Will my taking part in the study be kept confidential?

The research team will protect the data of all participants as it is considered confidential. All electronic data associated with the project will be password protected, accessible by the researchers involved in the project and backed-up at all times. Any physical paperwork will be held in locked cabinets, only accessible by the researchers. No data will be shared with any other agencies. You will be given a copy of the information sheet to keep.

The confidentiality of collected information may be broken only for reasons of safeguarding and/or illegal activities. This process will be controlled in accordance with the UoS Safeguarding Policy, Shari'a Law and GDPR legislation.

11. What will happen if I don't carry on with the study?

You can withdraw from the study at any time, and your daily life and classes that you are currently registered for will not be affected in any way. If you withdraw from the study, all the information and data collected from you, to date, will continue to be used, however, your name will be removed from all the study files.

12. What will happen to the results of the research study?

The findings of this study will be used as the part of the researcher's PhD thesis. Research papers will be written on the findings, which will be published in a peer-reviewed scientific journal. The identity of all participants will remain confidential.

13. Who is organising or sponsoring the research?

The research is being organised by the School of Health and Society, University of Salford, Manchester. The study is a self-funded project by the researcher.

14. Further information and contact details:

If you need further information about the study procedures, or to withdraw from the study, please contact the researcher: Alexander Woodman (e-mail: A.Woodman1@edu.salford.ac.uk).

PARTICIPANT CONSENT FORM

Title of study: *An Investigative Study on University Students' Knowledge and Attitudes towards the Food Dome in the Eastern Province of the Kingdom of Saudi Arabia*

Name of Researcher: Alexander Woodman

Please complete and sign this form **after** you have read and understood the study information sheet. Read the following statements and circle 'Yes' or 'No' in the box on the right-hand side.

I confirm that I have read and understand the study information sheet version ***[3]***, dated ***[27/07/2020]***, for the above study. Yes/No

1. I have had the opportunity to consider the information and to ask questions, which have been answered satisfactorily. Yes/No
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without my rights being affected. Yes/No
3. If I do decide to withdraw, I understand that the information I have given up to the point of withdrawal, will be used in the research. The timeframe for withdrawal is 1 month starting from the signature of the Consent Form. Yes/No
4. If I withdraw from the study, all the information and data collected from me to date of withdrawal will continue to be used in all phases of research. However, my name will be removed from all the study files. Yes/No
5. I agree to participate by taking part in a focus group that is audio recorded, and keeping the content of the focus group discussion confidential**.** Yes/No
6. I understand that my personal details will be kept confidential and will not be revealed to people outside the research team. Yes/No
7. I understand that my anonymised data will be used in the researcher's thesis, other academic publications, conferences/presentations, and further research. Yes/No
8. I understand that that confidentiality of collected information may be broken for reasons of safeguarding and/or illegal activities of two parties. This process will be controlled in accordance with the UoS Safeguarding Policy, Shari'a Law and GDPR legislation. Yes/No
9. I agree to take part in the study:

_____	_____	_____
Name of participant	**Date**	**Signature**
_____	_____	_____
Name of person taking consent	**Date**	**Signature**

صفحة إعلام المشارك
(27/7/2020)

عنوان البحث: دراسة استقصائية عن معرفة و سلوك الطلاب الجامعيين تجاه القبّة الغذائية في المنطقة الشرقية من المملكة العربية السعودية.

اسم الباحث: ألكساندر وودمان

1. دعوة المشاركة

نتشرف بدعوة حضراتكم للمشاركة بهذه الدراسة البحثية التي تهدف إلى التحقيق في مدى إدراك و التزام الطلاب الجامعيين في البلدان العربية بالعادات الغذائية الصحية. تتمحور الدراسة حول الطلاب الجامعيين بالمنطقة الشرقية من المملكة العربية السعودية.

قبل أن تقرروا المشاركة، يحق لكم معرفة الغرض من إقامة البحث و طبيعة مشاركتك به. نرجو منكم أن تتمعنوا بقراءة المعلومات التالية، و إن لزم الأمر، لا تترددوا بطلب رأي الآخرين بحيثيات البحث. بالإضافة إلى ذلك، يمكنكم التواصل مع الباحث بخصوص أي أسئلة أو استفسارات عن البحث. تكرموا بأخذ ما تحتاجون من الوقت لاتخاذ قراركم. يحق لكم التكرم بالسؤال عن أي تفاصيل و حيثيات تخص البحث قبل القبول بالمشاركة أو بعدها. سيقدر الباحث مشاركتكم جزيل التقدير.

2. ما الغرض من الدراسة؟

نظراً للتغيرات التي حلت بالأنماط الغذائية الخاصة بدول مجلس التعاون الخليجي في العقود الماضية، سوف تتمحور الدراسة حول السلوكيات الغذائية الخاصة بالعينة المشاركة بالبحث. خلال الدراسة، سيتم تقييم معرفتكم و مدى تقيّدكم بأنواع السلوكيات الغذائية و الوزن المثالي و التعليمات الغذائية الصحية. سيتم استخدام المعلومات المستخلصة من البحث لتحسين السلوكيات الغذائية الخاصة بالمراهقين بالمنطقة الشرقية من المملكة.

3. لماذا تم دعوتي للمشاركة؟

تم دعوتكم للمشاركة بهذا البحث لأنكم طلاب جامعيين في المنطقة الشرقية من المملكة العربية السعودية. و نأمل أن من خلال فهم منظور حضرتكم بخصوص الإرشادات الغذائية الصحية أنه يمكننا العمل مع الطلاب لتطوير سبل التدخل لشد انتباه الشباب إلى السلوكيات الغذائية الصحية و حثهم على اتباعها.

4.هل تجب عليّ المشاركة؟

قرار المشاركة في هذه الدراسة يقع بيدكم بالكامل. و يفضل أن تمعنوا التفكير قبل اتخاذ القرار (على الأقل فترة 24 ساعة). يحق لكم التواصل و سؤال المراسل الذي وصل لكم هذه الدعوة. في حالة وجود أي استفسارات، يمكنكم التواصل مع الباحث، ألكساندر وودمان، مباشرةً من خلال بريده الالكتروني:
A.Woodman1@edu.salford.ac.uk
و في حال قبولكم للمشاركة في البحث، يحق لكم التراجع في أي وقت و بدون الحاجة إلى أي أعذار، و ذلك لن يأثر على دراستكم أو حياتكم الخاصة بأي شكل.

5. ما هي حيثيات قبولي بالمشاركة؟

في حال قبولكم بالمشارة في البحث، سيرسل لكم الباحث رابط الاستبيان الالكتروني. هناك سيُطلب منكم أن تؤكدوا قبولكم بالمشاركة. بعد القبول، سيتم توجيهكم إلى أسئلة الاستبيان و التي يمكنكم أجابتهم في المنزل. هذه الأسئلة تشمل بعض الأسئلة العامة كالعمر و الجنس بالإضافة إلى أسئلة خاصة بالتغذية مثل معلوماتكم عن

الإرشادات الغذائية و سلوكياتكم الغذائية و أنشطتكم الرياضية. هذه الأسئلة مبنية بحيث أن كل ما عليكم فعله هو اختيار الإجابات التي تعبر عنكم و ذلك لن يأخذ من وقتكم أكثر من 20 دقيقة. في نهاية الاستبيان سيعرض عليكم الانضمام إلى مجموعة مركزة سيقام فيها الحديث عن الموضوع عن كثب (سيكون هناك مجموعة خاصة بالرجال و مجموعة خاصة بالنساء و ستقام الاجتماعات داخل حدود الجامعة). عند انتهائكم من الاستبيان، سيتم إرساله تلقائياً للباحث. قرار الانضمام للمجموعة المركزة أمر عائد لكم كلياً. وإن قررتم الانضمام سيتم التواصل معكم بغرض تأكيد القبول، و بذلك ستتلقون الدعوات اللازمة. إن قررتم المشاركة في المجموعة، يبقى لقم حق التراجع لأي سبب إن اضطررتم. المشاركة بالمجموعة لا تتطلب أي سداد مادي من أي نوع، فرسالة الدكتوراه هذه هي تحت تمويل الباحث.

سيتم تسجيل اجتماعات المجموعة المركزة صوتياً ليسهل على الباحث استخلاص المعلومات بأكثر دقة ممكنة. أسماء الحاضرين و هويّاتهم لن تكشف لأحد ما عدا الباحث الذي سيحتفظ بالتسجيلات. و بمجرد إنتهاء البحث، سيتم التخلص من التسجيلات. لن يخوض الباحث في أي معلومات شخصية خلال أي من الاجتماعات.

5. ما هي حيثيات قبولي بالمشاركة؟

إذا كان برغبتكم المشاركة باجتماعات المجوعة المركزة المقررة بتاريخ (يوم-شهر-سنة) أو (يوم-شهر-سنة)، نرجو منكم التواصل معنا عبر الوسائل التالية:
(specify phone numbers, emails, etc.)

ستقام الاجتماعات بأحد قاعات الدراسة بكلية الامير سلطان العسكرية للعلوم الصحية بالظهران. لن يسمح بحضور أحد بالقاعات باستثناء الباحث ومساعدته والمشاركين، وذلك للحفاظ على خصوصية وسرية معلومات المشاركين.

سيتم تجهيز القاعة قبل ميعاد الاجتماع بيوم واحد لضمان راحة المشاركين ونظافة بيئة الدراسة. للحفاظ على سلامتكم، سنقوم باتخاذ الإجراءات التالية للحد من انتشار فيروس كوفيد-19 في فترة الاجتماعات وخارجها:

أ- ستقام اجتماعات المجموعة في يومين مختلفين، وسيتم تعقيم القاعة وما فيها من معدات بين الاجتماعات.
ب- سيتم حصر عدد المشاركين بكل اجتماع الى 8 مشاركين.
ج- سيتم استخدام أجهزة قياس درجة حرارة الجسم قبل دخول المشاركين.
د- سيتم الحفاظ على التباعد الاجتماعي خلال الاجتماعات وسيتم ترتيب المقاعد للحفاظ على المسافات اللازمة.
ه- سيلتزم المشاركون والباحث بارتداء الكمامات الواقية واستخدام المعقمات خلال فترة الاجتماعات.

ستتضمن اجتماعات المجموعة المركزة مشاركين من كلا الجنسين، وبغرض الحفاظ على التقاليد الاجتماعية السعودية، سيقوم الباحث بدعوة مساعدة مؤهلة (وهي طالبة متطوعة بالبحث) لتتكفل بالتواصل مع المشاركات بالمجموعة.

في حال قبولكم بالمشارة في المجموعة المركزة، سنطلب منكم توقيع خطاب إفادة بالقبول قبل بداية الاجتماع. في حال قررتم المشاركة في المجموعة، يبقى لقم حق التراجع لأي سبب. المشاركة بهذه المجموعة لا تتضمن أي نوع من السداد المادي.

سيتم تسجيل اجتماعات المجموعة المركزة صوتياً ليسهل على الباحث استخلاص المعلومات بأكثر دقة ممكنة. أسماء الحاضرين وهوياتهم لن تكشف لأحد ما عدا الباحث الذي سيحتفظ بالتسجيلات. وبمجرد انتهاء البحث، سيتم التخلص من التسجيلات. لن يخوض الباحث في أي معلومات شخصية خلال أي من الاجتماعات.

6. النفقات و المدفوعات.
لا توجد أي نفقات من قبل المشاركين من أي نوع. سيتم الاستبيان على الانترنت، و ستقام الاجتماعت داخل حدود الجامعة الملتحق بها الطلاب.

7. ما هي المساوئ أو المخاطر الممكن أن أتعرض لها كمشارك؟
لا توجد أية مخاطر يمكن التعرض إليها من قبل المشاركين في البحث. إن احتجتم أن تستأذنوا عن الحضور أو المشاركة أو في حال أن أردتم قسطاً من الراحة، فلكم الأحقية بذلك.

8. ما هي الفوائد الممكنة من المشاركة؟
من الممكن أن تستفيدوا من المعلومات التي تشكل محور البحث من ناحية الأساليب الحياتية و النصائح الغذائية، و لكن ذلك لن يكون له تأثير مباشر عليكم كمشاركين. المعلومات المستخلصة من البحث ستساعد الباحث على تقييم و تطوير الحلول المناسبة لتحسين السلوكيات الغذائية بين الطلاب الجامعيين.

9. ماذا عليّ أن أفعل في حال حدوث مشكلة؟
إذا راودتكم أي ترددات أو استفسارات حول أي ناحية من هذا البحث، يمكنكم التواصل مع الباحث شخصياً عن طريق بريده الإلكتروني، و سيحاول الباحث الإجابة بأكمل وجه.
A.Woodman1@edu.salford.ac.uk

في حال وجود أي مشاكل أو شكوى بعد التواصل مع الباحث، بإمكانكم التواصل مع مشرفة البحوث د. مارغريت كوفاي. في حال استمرار الاستياء، بإمكانكم تقديم شكوى رسمية من خلال بروفيسور أندرو كلارك، رئيس الأخلاقية للبحوث الصحية جامعة سالفورد. اللجنة

Research Supervisor, Dr. Margret Coffey
(Tel: 0161 295 2551, Email: m.coffey@salford.ac.uk)
Professor Andrew Clark, Chair of the Health Research Ethical Approval Panel
(Tel: 0161 259 4109, Email: a.clark@salford.ac.uk)
Salford University

10. هل ستبقى مشاركتي بالبحث سرية؟
سيحتفظ فريق البحث بجميع المعلومات المسجلة خلال البحث و سيتم حمايتها بغرض الحفاظ على خصوصية المشاركين. ستبقى جميع البيانات الإلكترونية الخاصة بالمشروع تحت الحماية بالأرقام السرية و لن يتمكن لأحد خارج فريق البحث من الوصول إليها. سيتم الحفاظ على أي ملفات مادية في خزانة مغلقة تحت أيدي فريق البحث فحسب. لن تتم المشاركة بأي من بيانات البحث مع أي جهات أخرى. بالإضافة إلى ذلك، سنزودكم بنسخة من المعلومات المسجلة في حال احتجتموها.

سرية المعلومات المستقصاة قد تكون في عرضة للكشف فقط لدواعي أمنية أو في حال التعرض لأنشطة غير قانونية. عند الحاجة إليها، ستتم عملية الكشف بالتوافق مع سياسة الحماية الخاصة بجامعة سالفورد و قانون الشريعة و النظام الأوروبي العام لحماية البيانات.

11. ماذا سيحدث في حال انسحابي من البحث؟
بإمكانكم التراجع عن المشاركة في البحث في اي وقت، و بذلك لن تتأثر حياتك اليومية أو دراستك الجامعية بأي شكل. في حال تراجعكم عن المشاركة في البحث، سيتم استخدام المعلومات و البيانات التي تم جمعها منكم لإكمال الدراسة، و لكن سيتم حذف إسمكم من جميع ملفات البحث.

12. فيمَ ستستخدم النتائج المستخلصة من دراسات البحث؟
جميع النتائج المستخلصة من البحث ستكون جزءاً من رسالة الدكتوراه الخاصة بالباحث. أوراق البحث الناتجة عن تلك البيانات سيتم مراجعتها قبل النشر من قبل مكاتب الصحافة العلمية. ستبقى هوية جميع المشاركين تحت السرية التّامة.

13. ما هي الجهات الموجِهة و الراعية لهذا البحث؟
يتم توجيه البحث من قبل كلية الصحة و الاجتماع بجامعة سالفورد بمدينة مانشستر. الرعاية المادية للبحث عائدة كلياً على الباحث.

14. كيف أحصل على المزيد من المعلومات عند الحاجة؟
إن احتجتم لمعرفة أية تفاصيل لم يتم ذكرها في هذا الملف أو إن أردتم الانسحاب من المشاركة، يمكنكم التواصل مع الباحث، ألكساندر وودمان خلال بريده الإلكتروني:
A.Woodman1@edu.salford.ac.uk

استمارة قبول المشارك

عنوان البحث: دراسة استقصائية عن معرفة و سلوك الطلاب الجامعيين تجاه القبّة الغذائية في المنطقة الشرقية من المملكة العربية السعودية.

اسم الباحث: ألكساندر وودمان

الرجاء قراءة صفحة إعلام المشارك بتمعّن **قبل** إكمال و توقيع الاستمارة الموضحة أدناه. نرجو قراءة الأسئلة بتمعّن قبل الإجابة ب"نعم" أو "لا" في المربع المقابل للسؤال:

1. أُقر أنا القارئ بأنني قد قرأت و فهمت صفحة إعلام المشارك المرفقة أعلاه و هي النسخة **الثالثة** المصدرة بتاريخ **27 يوليو 2020**. نعم / لا

2. أُقر أنا القارئ بأن فرصة التفكير في المعلومات المرفقة قد أُتيحت لي، و أن جميع الأسئلة التي دارت في بالي تمت إجابتها بشكل مُرضي. نعم / لا

3. أتفهم أنا القارئ أن مشاركتي بالبحث هي عملية تطوعية و أنه يحق لي التراجع عنها بأي وقت بدون الحاجة إلى ذكر أسباب و أن ذلك لن يكون له تأثير على حياتي أو حقوقي أو دراستي. نعم / لا

4. أتفهم أنا القارئ أنه في حال تراجعي عن أكمال البحث، أسمح باستخدام المعلومات التي قدمتها للبحث في فترة مشاركتي. وأن فترة التراجع عن البحث تنتهي بعد **شهرٍ كامل** من توقيعي لاستمارة القبول. و أن جميع المعلومات و البيانات المجموعة مني حتى تاريخ تراجعي ستستخدم في بقية البحث. وأن في تلك الحالة سيتم حذف إسمي من جميع ملفات البحث. نعم / لا

5. أقر أنا القارئ بقبولي الإنضمام إلى المجموعة المركزة و أتفهم أن اجتماعات المجموعة سيتم تسجيلها صوتياً، و أن محتوى تلك الاجتماعات من موضوعاتها و أعضائها سيبقى تحت السرية التامة. نعم / لا

6. أتفهم أنا القارئ أن معلوماتي الشخصية كمشارك بهذا البحث ستبقى تحت السرية التامة و أنها لن تكشف لأحد خارج فريق البحث. ☐

7. أتفهم أنا القارئ أن المعلومات المبهمة التي سأشارك بها في البحث ستستخدم في رسالة الباحث العلمية، و أن نتائج ذلك البحث قد تستخدم في بعض المنشورات العلمية و المؤتمرات و البحوث الأخرى عُرضةً لذلك. ☐

8. أتفهم أنا القارئ أن سرية المعلومات المستقصاة مني قد تكون في عرضة للكشف فقط لدواعي أمنية أو في حال التعرض لأنشطة غير قانونية. عند الحاجة إليها، ستتم عملية الكشف بالتوافق مع سياسة الحماية الخاصة بجامعة سالفورد و قانون الشريعة و النظام الأوروبي العام لحماية البيانات. ☐

9. أوافق أنا القارئ على المشاركة في البحث: ☐

_____	_____	_____
إسم المشارك	التاريخ	التوقيع
_____	_____	_____
إسم مستقبل القبو	التاريخ	التوقيع

Appendix 9. Seca scale calibration.

seca 761
seca 750/760
seca 762

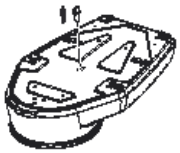
seca
Precision for health

	Open packaging here
	Packaging material can be disposed of through recycling programs

4. BEFORE YOU GET STARTED ...

4.1 Removing the locking pin

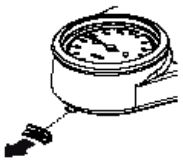
1. Turn the locking pin on the base of the housing a quarter-turn anticlockwise.



2. Take out the locking pin.

NOTE
Keep the locking pin for transporting the scale at a later date.

4.2 Removing the transport lock



► Remove the transport lock from the lower section of the housing.

NOTE:
►Put the transport lock in a safe place for subsequent transport of the scale.

►You can use the transport lock as a wall spacer (see section "Fitting the wall spacer").

4.3 Fitting the wall spacer

If you wish to position the scale close to a wall, we recommend using the transport lock (see section "Removing the transport lock") as a wall spacer. This stops the weighing platform from touching the wall and the measured result from being incorrect.

1. Position the transport lock as shown in the adjacent drawing.
2. Attach the transport lock to the lower section of the housing.

4.4 Aligning the scale

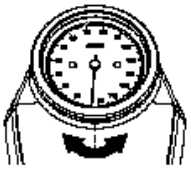
ATTENTION!
Incorrect measurement due to force shunts
Soft floor coverings such as carpets may cause weights to be measured incorrectly.
- ► Set the scale up so that only its feet are in contact with the floor.

- ► Place the scale on a firm, flat surface.

5. WEIGHING

CAUTION!
Bodily injury
Perform a function check before every use as described in the section "Function check" on page 36.

5.1 Adjusting the display



To obtain meaningful measured values you must check before every use that the pointer of the scale reads **"0"**.

1. Ensure that the scale has no load.
2. Check the current position of the pointer.
3. Move the adjusting wheel so that the pointer reads **"0"**.
   - Turn clockwise: Pointer moves counter-clockwise
   - Turn counter-clockwise: Pointer moves clockwise

5.2 Performing weighing

CAUTION!
Patients can be injured if they fall
People with restricted mobility may fall when trying to step on or off the scales.
- ► Support people with restricted mobility when they step on and off the scales.
- ► Only use this scale for patients who are able to stand on their own when being weighed.

1. Make sure that the pointer reads **"0"**.
2. Ask the patient to step onto the scale and keep still.
3. Read off the measured result.

   NOTE:
   If your scales only display measurement values in "lbs", you can use the conversion tool on page 40 to convert measurement values to kg values.
4. Ask the patient to step off the scale.

Appendix 10. Queries and comments of pilot study participants.

No_1[19]

1. How long did it take you to complete the questionnaire? **15 minutes**
2. What is your opinion of the length of the questionnaire? ☒About right ☐Too short ☐Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☒ Yes ☐ No If "YES" provide details I would like the variables for the food groups to be shorter in choice.
6. Did you have any difficulties completing the questionnaires? ☐ Yes ☒ No If "YES" provide details _____
7. What will be your general feedback about the questionnaire? It is a very well-designed survey. I only was confused with the variables of question 52.

[19] *Printed versions of these feedback papers were distributed among n = 10 participants of the Pilot Study. All written comments by participants were retyped without editing.*

No_2

1. How long did it take you to complete the questionnaire? **12 minutes**
2. What is your opinion of the length of the questionnaire? ☒About right ☐Too short ☐Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☐ Good ☒ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☐ Good ☒ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☒ Yes ☐ No If "YES" provide details ___Q.23 The Arabic spelling of some words is wrong, I have highlighted. Please correct.
6. Did you have any difficulties completing the questionnaires? ☐ Yes ☒ No If "YES" provide details _____
7. What will be your general feedback about the questionnaire? The survey was very interesting, but check Arabic spelling again. Some letters in Arabic got lost because of word file. Consider saving files in PDF.

No_3

1. How long did it take you to complete the questionnaire? **15 minutes**
2. What is your opinion of the length of the questionnaire? ☐About right ☐Too short ☒Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☒ Yes ☐ No If "YES" provide details _____It was a bit long_____
6. Did you have any difficulties completing the questionnaires? ☐ Yes ☒ No If "YES" provide details
7. What will be your general feedback about the questionnaire? It was interesting, but a bit long. But I know this is important topic.

No_4

1. How long did it take you to complete the questionnaire? **15 minutes**
2. What is your opinion of the length of the questionnaire? ☒About right ☐Too short ☐Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☐ Good ☒ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☐ Good ☒ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☒ Yes ☐ No If "YES" provide details _____
6. Did you have any difficulties completing the questionnaires? ☐ Yes ☒ No If "YES" provide details _____
7. What will be your general feedback about the questionnaire? Excellent questionnaire. It should reach the largest number of people. Because it's about nutritional benefits, sports activities, and knowledge about beneficial and harmful foods. Thanks those who make these efforts.

No_5

1. How long did it take you to complete the questionnaire? **14 minutes**
2. What is your opinion of the length of the questionnaire? ☒About right ☐Too short ☐Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☐ Yes ☒ No If "YES" provide details _____
6. Did you have any difficulties completing the questionnaires? ☐ Yes ☒ No If "YES" provide details
7. What will be your general feedback about the questionnaire? I think it is very important subject and the most Arabs don't give time to think about this. But I think if they get some information about it, they will get interest about it.

No_6

1. How long did it take you to complete the questionnaire? **15 minutes**
2. What is your opinion of the length of the questionnaire? ☐About right ☐Too short ☒Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☐ Yes ☒ No If "YES" provide details _____
6. Did you have any difficulties completing the questionnaires? ☐ Yes ☒ No If "YES" provide details _____
7. What will be your general feedback about the questionnaire? I liked the survey, it helped me to think what I eat and not.

No_7

1. How long did it take you to complete the questionnaire?

12 minutes

2. What is your opinion of the length of the questionnaire?

☒About right ☐Too short ☐Too Long

3. What is your opinion of the clarity of the questions?

☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent

4. What is your opinion of the structure and format of the questionnaire?

☐ Poor ☐ Satisfactory ☐ Good ☒ Very good ☐ Excellent

5. Does the questionnaire have any issues you consider to be important to be changed?

☐ Yes ☒ No

If "YES" provide details

_____

6. Did you have any difficulties completing the questionnaires?

☐ Yes ☒ No

If "YES" provide details

_____

7. What will be your general feedback about the questionnaire?

It is very important subject.

No_8

1. How long did it take you to complete the questionnaire? **15 minutes**
2. What is your opinion of the length of the questionnaire? ☒About right ☐Too short ☐Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☐ Yes ☒ No If "YES" provide details _____
6. Did you have any difficulties completing the questionnaires? ☐ Yes ☒ No If "YES" provide details _____
7. What will be your general feedback about the questionnaire? I like the survey, I think online application about Food Dome will help Arab people to follow a healthy lifestyle.

No_9

1. How long did it take you to complete the questionnaire? **15 minutes**
2. What is your opinion of the length of the questionnaire? ☐About right ☐Too short ☒Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☒ Yes ☐ No If "YES" provide details _____
6. Did you have any difficulties completing the questionnaires? ☒ Yes ☐ No If "YES" provide details _____
7. What will be your general feedback about the questionnaire? It was interesting to participate in this survey. I will think what I am eating now.

No_10

1. How long did it take you to complete the questionnaire? **15 minutes**
2. What is your opinion of the length of the questionnaire? ☒About right ☐Too short ☐Too Long
3. What is your opinion of the clarity of the questions? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
4. What is your opinion of the structure and format of the questionnaire? ☐ Poor ☐ Satisfactory ☒ Good ☐ Very good ☐ Excellent
5. Does the questionnaire have any issues you consider to be important to be changed? ☐ Yes ☒ No If "YES" provide details _____
6. Did you have any difficulties completing the questionnaires? ☐ Yes ☒ No If "YES" provide details _____
7. What will be your general feedback about the questionnaire? I liked the survey and now will learn more about Food Dome to have a healthy life.

Appendix 11. ATLS physical activity and screen time data & demographics.

Table 8.1 ATLS data of PA of n = 426 participants of respective totals.

Physical Activity	Number of Respondents for activity*	Respondents who provided number of minutes/times*	Respondents who did not answer number of minutes*
Walking	320 (100%)	44(14%)	276 (86%)
Using staircase	389(100%)	39(10%)	351 (90%)
Jogging/Running	242(100%)	34(14%)	208(86%)
Cycling	88(100%)	19(22%)	69(78%)
Swimming	104(100%)	20(19%)	84(81%)
Moderate Intensity Sports	126(100%)	126(100%)	0(0%)
Vigorous Intensity Sports	167(100%)	167(100%)	0(0%)
Self-defence sports	48(100%)	16(33%)	32(67%)
Strength training	123(100%)	27(22%)	96(78%)
Household work	261(100%)	37(14%)	224(86%)

Table 8.2. ATLS data of PA of n = 426 whole total of the study.

Physical Activity	Number of Respondents for Activity*	Respondents who provided number of minutes/times*	Respondents who did not answer number of minutes*
Walking	320 (75%)	44(10%)	276 (65%)
Using staircase	389(91.5%)	39(9.1%)	351 (82.4%)
Jogging/Running	242(57%)	34(8%)	208(49%)
Cycling	88(20.7%)	19(4.5%)	69(16.2%)
Swimming	104(24.4%)	20(4.7%)	84(19.7%)
Moderate Intensity Sports	126(30%)	126(30%)	300(70%)
Vigorous Intensity Sports	167(39%)	167(39%)	259 (61%)
Self-defence sports	48(11.3%)	16(3.8%)	32(7.5%)
Strength training	123(29%)	27(6%)	96(23%)
Household work	261(61.3%)	37(8.7%)	224(52.6%)

***Percentage** = respective cell value divided by respective total on particular physical activity

Table 8.3. Age, gender and BMI of participants who provided number of minutes of PA of n = 426 (100%).

Physical Activity	Minutes/times by age n (%)			Minutes/times by gender n (%)		Minutes/times by BMI n (%)				Total n (%)
	18-20-years	21-23-years	24-25-years	Male	Female	Underweight	Normal Weight	Overweight	Obese	
Walking	16 (36.4)	22 (50)	6 (13.6)	33 (75)	11 (25)	1 (2.3)	32 (72.7)	6 (13.6)	5 (11.4)	**44(10.3)**
Using staircase	17 (43.6)	17 (43.6)	5 (12.8)	29 (74.4)	10 (25.6)	1 (2.6)	28 (71.8)	7 (17.9)	3 (7.7)	**39(9.2)**
Jogging/ Running	13 (38.2)	17 (50)	4 (11.8)	26 (76.5)	8 (23.5)	1 (2.9)	25 (73.5)	6 (17.6)	2 (5.9)	**34(8)**
Cycling	4 (21.1)	11 (57.9)	4 (21.1)	15 (78.9)	4 (21.1)	1 (5.3)	11 (57.9)	5 (26.3)	2 (10.5)	**19(4.5)**
Swimming	2 (10)	14 (70)	4 (20)	16 (80)	4 (20)	1 (5.0)	12 (60)	4 (20)	3 (15)	**20(4.7)**
Moderate Intensity Sports	49 (38.9)	49 (38.9)	28 (22.2)	99 (80)	27 (21.4)	12 (9.5)	62 (49.2)	39 (31)	13 (10.3)	**126(30)**
Vigorous Intensity Sports	65 (38.9)	74 (44.3)	28 (16.8)	133 (79.6)	34 (20.4)	13 (7.8)	90 (53.9)	45 (26.9)	19 (11.4)	**167(39)**
Self-defence sports	2 (12.5)	11 (68.8)	3 (18.8)	13 (81.3)	3 (18.8)	1 (6.3)	10 (62.5)	4 (25)	1 (6.3)	**16(3.8)**
Strength training	6 (22.2)	15 (55.6)	6 (22.2)	18 (66.7)	9 (33.3)	0(0)	17 (63)	7 (25.9)	3 (11.1)	**27(6)**
Household work	11 (29.7)	20 (54.1)	6 (16.2)	29 (78.4)	8 (21.6)	1 (2.7)	27 (73)	6 (16.2)	3 (8.1)	**37(8.7)**

Table 8.4. METs of participants who provided number of PA minutes/times.

Physical Activity	MET Moderate n (%)		MET Vigorous	
	< 180 min/wk)	> 180 min/wk)	< 180 min/wk)	> 180 min/wk)
Walking	24 (88.9)	3 (11.1)	23 (82.1)	5 (17.9)
Using staircase	23 (88.5)	3 (11.5)	21 (80.8)	5 (19.2)
Jogging/Running	22 (88)	3 (12)	21 (80.8)	5 (19.2)
Cycling	11 (91.7)	1 (8.3)	9 (64.3)	5 (35.7)
Swimming	11 (78.6)	3 (21.4)	8 (61.5)	5 (38.5)
Moderate Intensity Sports	118 (93.7)	8 (6.3)	68 (91.9)	6 (8.1)
Vigorous Intensity Sports	71 (95.9)	3 (4.1)	157 (94)	10 (6)
Self-defence sports	10 (90.9)	1 (9.1)	9 (69.2)	4 (30.8)
Strength training	15 (83.3)	3 (16.7)	12 (70.6)	5 (29.4)
Household work	20 (87)	3 (13)	18 (78.3)	5 (21.7)

Table 8.5.The proportions of METs in relation to screen time.

	Males M(SD)			**Females M(SD)**		
	MET Moderate			**MET Vigorous**		
Variables	Inactive (<180 METs-min/wk)	Active (180+ METs-min/wk)	***t-test* *p*-value**	Inactive (<180 METs-min/wk)	Active (180+ METs-min/wk)	***t-test* *p*-value**
Screen time (d/wk)	1.47 (1.53)	2.75 (2.25)	*t = 2.19;* *p* = 0.03*	-	1.09 (1.49)	-

* Significant at 95%

Appendix 12. Focus group guide.

Alexander Woodman
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United Kingdom
[A.Woodman1@edu.salford.ac.uk]
02/08/2021

Firstly, I would like to express my gratitude to you for agreeing to take part in this focus group discussion. I truly appreciate your time and contribution for this study. My name is Alexander Woodman, I am the Post Graduate Researcher (PGR) at the University of Salford.

We will have discussion that will provide an insight about your attitudes, allowing you to express, criticise, and share experiences, opinions, observations, preferences and beliefs regarding your physical activity and eating behaviour, as well as the Food Dome dietary guidelines.

As mentioned in Participation Information Sheet, the focus group discussion is voluntary. I will take notes while you are talking. This is going to be done in order not to miss anything important and will give me the opportunity to go back and ask any unanswered questions. In addition, the discussion will be recorded and later transcribed for qualitative analysis purposes.
Before starting, I would like to mention some minor, but important details:

- There are no right or wrong answers to the questions
- I simply want to hear your opinion and experiences
- During the discussion you are free to leave the classroom
- Please, feel free to use the washroom if needed
- Your name or other personal details mentioned during the interview, will not be used in the study write-up
- The confidentiality of collected information may be broken only for reasons of safeguarding and/or illegal activities. However, this process will be controlled in accordance with the UoS Safeguarding Policy, Shari'a Law and GDPR legislation.
- All precautions by the Saudi Ministry of Health and World Health Organisation have been considered to reduce the possible spread of COVID-19
- Please, keep social/physical distancing, sitting at least 6 feet (about two arms' length/1.8 metres) from each other

- Please, wear masks and use hand sanitisers all the time
- I would like to hear everyone express his or her opinion. I might ask people who have not spoken up to comment.
- Please respect each other's opinions. I want to hear what each of you think and it is okay to have different opinions.
- I would like to inform that this discussion is confidential, and the information is only for the research purposes. I kindly ask not to use personal names when communicating with each other. Please, do not discuss any information that has been discussed during this session after the session has ended. However, because this is in a group setting, some participants might unknowingly and unintentionally share some of the information that we talked about. I cannot guarantee that they will not share your responses outside of the focus group.

- **Opening question(s)** – An opening question that is factual and establishes the participants' commonality.
  1. Can you tell me about your life as a student? [Probe: What about your living arrangements as a student?]
- **Introductory questions –** A series of introductory questions that introduce participants to the topic and initiate conversation.
  2. Can you tell me about any changes in your lifestyle since you became a student, particularly in terms of diet? [Probes: Do you cook for yourself? Do you eat out more? Do you eat with other students? What are the main influences on your food choices?]
  3. Have your physical activity behaviours changed since you became a student? [Probes: In what way? What about sedentary behaviour? Has the pandemic led to any changes in your physical activity or sedentary behaviour levels? In what way?]

- **Transition questions –** A series of questions move the discussion to the central topics.
  4. What do you think constitutes a healthy lifestyle? [Probes: Can you describe a 'healthy lifestyle' to me? Can you tell me where you get most of your lifestyle information/advice from?]
  5. Tell me about your breakfast habits? [Probes: Do you eat breakfast? What do you prefer to eat for breakfast? If you skip breakfast, why is that?

6. What are your thoughts on cereals? How often do you eat cereals? [Probes: What part do you think cereals should play in your diet? What kinds of cereals do you eat? How do you feel about raw cereals compared to cooked?]
7. What kinds of dairy products do you have/consume? [Probe: Why do you chose these dairy products?]
8. What do you take into consideration when choosing vegetables? [Probe: Is it colour, taste, smell, nutritional benefits, country of origin?]
9. What is your preference for fruits? [Probe: Do you choose by considering colour, taste, smell, nutritional benefits, country of origin?]
10. What are your thoughts on fast food consumption? [Probes: What kind of fast food do you prefer? Has your fast food consumption changed since becoming a student? In what way?]

- **Key questions –** Two to five key questions in relation to study aims and objectives.

11. What do you know about nutritional guidelines? [Probes: Are there any that you know of that relate specifically to Arab people? What about the Food Dome dietary guideline?]
12. Please take a look at Food Dome. What do you think of the different food groups recommended in the Food Dome? [Probe: What about the portion sizes?]
13. Which foods or food groups would be the most difficult to add to your diet?
14. What do you think would motivate/excite students to follow the Food Dome dietary guidelines? [Probe: What kinds of information would you think they would like to get/find useful]?
15. What would be the best way to give students information about the Food Dome? [Probe: an app, poster, social media commercial, booklet, brochure].

- **Ending question -** An ending question to encourage participants to state their final position on key topics and reflect on the entire discussion.

16. Summing up, having considered the lifestyle of students and the guidelines available is there anything further that you think could be done to improve your lifestyle as students? [Probe: Any feedback, ideas, observations, and comments would anyone like to add in relation to the current research and Food Dome dietary guidelines?]

Thank you for your participation. We highly appreciate your honesty. This was an extremely important stage for the research development. Do you have any questions relating to the discussion and its further usage? Thank you very much.

Appendix 13. University of Salford ethical approval for Phase II.

University of Salford MANCHESTER

Amendment Notification Form

Title of Project:		
An Investigative Study on University Students' Knowledge and Attitudes towards the Food Dome in the Eastern Province of the Kingdom of Saudi Arabia		
Name of Lead Applicant:	**School:**	
Alexander Woodman	Health & Society	
Are you the original Principal Investigator (PI) for this study?		Yes
If you have selected 'NO', please explain why you are applying for the amendment:		
Date original approval obtained:	**Reference No:**	**Externally funded project?**
17/12/2019	**HSR1920-016**	No

Please outline the proposed changes to the project. *NB. If the changes require any amendments to the PIS, Consent Form(s) or recruitment material, then please submit these with this form highlighting where the changes have been made:*

The PGR obtained University of Salford Ethics Committee approval to start the PhD research on December 17, 2019, which was revised on August 03, 2020, considering changes in the aim and objectives, as well as the study instrument for Phase I (i.e., questionnaire). As of June 2021, the PGR has completed Phase I (quantitative). To begin Phase II (i.e., qualitative - focus group discussions), the PGR has amended the Ethics Application Form to include the focus group procedure and topic guide.

Focus group discussions will be undertaken to explore the knowledge of and attitudes towards the Food Dome among the target population and explore the findings from Phase I in more depth (i.e., physical activity, sedentary and nutritional behaviours). As part of nutritional research, focus groups are appropriate to explore the complexities of knowledge and attitudes of food choices, diet and other nutrition-related behaviours. Focus group allows participants to explain, critique, and share their experiences, opinions, and attitudes in relation to their nutritional choices.

The group composition of the current research will be determined by the characteristics of the study population and the aim (i.e., to explore the relationship between weight, nutritional behaviours, knowledge and attitudes in relation to the Food Dome among 18-25-years-old university students in the Eastern Province of the KSA). The study population will typically be homogeneous with respect to SES (i.e., 18-25-years-old university students in the Eastern Province of the KSA), but with sufficient variation in experience to allow for contrasting opinions. That is, participants who know and follow Food Dome dietary guidelines and participants who do not know or are interested in learning more about the Food Dome. The sample size of the focus groups will be approximately 16 students (eight in each group) participants, which is an optimal number, not too small, neither too large to obtain a useful data. Similar to Phase I, the focus group discussions will include both male and female participants. Therefore, in respect with the Saudi setting and culture, the PGR will invite a qualified chaperone (i.e., a female student enrolled in research) to communicate with the female participants.

The focus group guide for the current research has been carefully designed to explore participants attitudes, opinions or experiences and seek to gain a variety of responses in relation to study aim and objectives. Developing a culturally sensitive discussion guide is paramount in respect to local culture and adhering to ethical standards, thereby, avoiding controversial and provocative themes. Thus, the

focus group guide was developed, taking into consideration the cultural norms of the Saudi population, e.g., no questions about prohibited foods/drinks and those considered haram (i.e., prohibited) were included (i.e., alcoholic beverage or pork) (Appendix 8).

Focus group discussions are not completely confidential or anonymous because the material is shared with other group members during the discussion. However, ethical considerations for focus group discussions are the same as for most other social research methods. Participants will be fully informed about the aim and objectives of the study and how collected data will be used. Informed consent will be obtained from the participants before the discussion. Participants will be encouraged to maintain the confidentiality of what they hear during the meeting (Appendix 5).

Once the location of the group discussion is decided, the PGR will arrive early to arrange the seating, equipment and to welcome participants. Before starting the focus group discussion, precautionary measures will be taken into account to reduce the risk of possible spread of COVID-19 among participants (i.e., there will be one-day break between each session when the classroom and furniture will be cleaned and ventilated; non-contact temperature devices will used as part of the initial entry check to identify people who may have a fever; social/physical distancing, staying at least 6 feet (about two arms' length/1.8 meters) from one another will be kept; participants and the PGR will wear masks and use hand sanitisers. In order to maintain the privacy and confidentiality of the participants, no one else will be allowed into the room.

Analysis of the focus group data is essential for understanding individual contributions as well as the bigger picture. Analysis ranges from descriptions to interpretations and recommendations. To achieve this, the framework analysis (FA) method will be used. FA will provide a systematic and flexible structure for data management and analysis of the current research, allowing the development and maintenance of transparent records. The analytical stages of this method enable other researchers to review how the final interpretation has been developed. The analysis will be accomplished in 5 key stages: (1) Familiarisation; (2) Identifying a thematic framework; (3) Indexing; (4) Charting; (5) Mapping and interpretation.

The distinct stages of the FA method will facilitate transparency of the data analysis process, and enhance rigour. The analysis process and the results of key findings, as well as how the research findings support the theory and explanations will be documented. Patterns and relationships will be identified, alongside developing plausible explanations based on them, and ensuring that findings are open to further discussion, development, and critique.

The research will be constructed on two fundamental principles: informed consent and anonymity. The information sheet sent to each of the participants will inform them that any data collected about the subjects will be kept anonymous. Furthermore, they have a right to withdraw from the study at any time. Additionally, a consent form will be signed by all participants of focus group discussions.

Please say whether the proposed changes present any new ethical issues or changes to ethical issues that were identified in the original ethics review, and provide details of how these will be addressed:

The proposed changes will not present new ethical changes. All participants will be identified by their ID number on any database where information will be saved. All data associated with the research will be password-protected, accessible only to the researchers involved in the project. Data will be backed-up at all times. No data will be shared with a third party. All hard copies of consent forms, small-scale evaluation data, and questionnaires will be stored in the appropriate area.

Amendment Approved:	**YES**	***Date of Approval:***	**25/08/2021**

Chair's Signature:

Once completed you should submit this form and any additional documentation to ethics@salford.ac.uk

Version 4.0 – August 2021

Appendix 14. Local COVID-19 risk assessment form for research projects.

Task/Activity/Environment: Covid-19-specific assessment for research project		**Location/s, please list:** Prince Sultan Military College of Health Sciences, Dhahran, Saudi Arabia		**Date of Assessment:** **September, 2021**	**Completed by:** Alexander Woodman Post Graduate Researcher School of Health and Society
Please identify the following for your research project and list the specific risk controls you will implement and enforce for your area:					
Identify Hazards which could cause harm		**Identify risks:**		**What risk controls will be in place to eliminate or control the risks?**	
No.	**Hazard**	**No.**	**Risk**	**No.**	**Risk control**
1	List the touch points common to staff – this should include any shared equipment, machinery, resources, etc.	1	Failure to keep these clean could result in cross contamination leading to significant illness or death.	1	List the processes within your area for cleaning and sanitising any shared equipment. If equipment, machinery, resources cannot be cleaned and sanitised, what other methods will be used to prevent contamination, e.g., quarantine, etc. The focus group discussions will take place at Prince Sultan Military College of Health Sciences (PSMCHS). Environmental surfaces (e.g., furniture such as door and window handles, tables, chairs) will be cleaned and sanitised before and after each focus group discussion, following the recommendations by World Health Organisation (WHO, 2020), "Cleaning and disinfection of environmental surfaces in the context of COVID-19." Surfaces will be cleaned with a detergent to remove organic matter first, followed by disinfection, by using sanitisers (WHO, 2020). How will you make sure that everyone in the space knows what must happen? The participants of the current research will sign an informed consent before the focus group discussion and will be provided with Participant Information Sheet, where all precautionary measures to reduce the risk of possible spread of COVID-19 will be listed. Before each focus group discussion, participants will be reminded about the measurers to mitigate the possible spread, and will be asked to respect and follow recommendations. How will you monitor and enforce the requirements? - Data collection will take place at Prince Sultan Military College of Health Sciences, where an average classroom is 78 square meters. - Data collection will take place in two separate days for the classroom and furniture to be cleaned and ventilated; - The number of participants will not exceed eight, plus the PGR and a qualified chaperone (i.e., a female student enrolled in research) to communicate with the female participants; - Non-contact temperature devices will be used as part of the initial entry check to identify people who may have a fever; - Participants and the PGR will keep social/physical distancing, sitting at least six feet (about two arms' length) from one another; - During the discussion, participants and the PGR will wear face masks and use hand sanitisers.

2	Nature of the work that involves close proximity to others (e.g. taking blood samples from individuals)	**2**	Inability to maintain 2m social distancing owing to the nature of the activity could result in cross contamination leading to significant illness or death.	2	What protective equipment will be provided to protect the person administering the procedure? **N/A** How will the work areas be sanitised after each individual procedure? **N/A** How will you make sure that everyone working in the area knows what must happen? **N/A** How will you monitor and enforce the requirements? **N/A**
3	List any shared facilities such as kitchens/brew spaces	**3**	Failure to keep these clean could result in cross contamination leading to significant illness or death. Inability to maintain social distancing owing to size of facility could result in significant illness or death.	3	How will you limit the number of people using the facility at any one time. Think about posting notices on the doors stating the maximum number of users permissible. According to Saudi Ministry of Health recommendations dating June 21st, 2020, the maximum number of people in one location should not exceed 50 (MOH, 2020). Thus, the number of participants of each focus group discussion will be eight. The door will be open when the participants enter and will not be touched. Chairs will be placed six feet apart with hand sanitisers. Participants will be asked to wear a face mask and to use hand sanitiser whenever they come into contact with any surface. As soon as all participants arrive, the temperature is measured, the door is closed [by the PGR] and the ventilation is switched on. During the discussion, which will last 1–1.5 hours, no physical contact (i.e., shaking hands) with each other will be allowed. How will you make sure that everyone in the space knows this must happen? The participants of the current research will sign an informed consent before the focus group discussion and will be provided with Participant Information Sheet, where all precautionary measures to reduce the risk of possible spread of COVID-19 will be listed. Participants will be encouraged to follow the measurers. How will you monitor and enforce the space restrictions? In order to reduce the risk of the spread of COVID-19, as well as to maintain the privacy and confidentiality of the participants, no one else will be allowed into the classroom, expect participants and the PGR.

4	What is the size of space being shared (i.e. size of office, lab, workshop, etc.)	**4**	Inability to maintain social distancing owing to size of the room and the number of people that are required to carry out essential work could result in cross contamination leading to significant illness or death.	4	How will you control the use of the space room to ensure that too many people cannot use it at any one time, e.g. redesign the layout of the room; remove desks or computer equipment; position lab equipment so that staff can work at the required 2m apart; or restrict the number of people using the space; etc. - Data collection will take place at Prince Sultan Military College of Health Sciences, where an average classroom is 78 square meters. - Data collection will take place in two separate days for the classroom and furniture to be cleaned and ventilated; - The number of participants will not exceed eight and the PGR; - Non-contact temperature devices will be used as part of the initial entry check to identify people who may have a fever; - Participants and the PGR will keep social/physical distancing, sitting at least six feet (about two arms' length) from one another; - During the discussion, participants and the PGR will wear face masks and use hand sanitisers.
5	Please add any other specific hazards and risks relevant to control of Covid-19 in your area	**5**	Risk control		- The PGR will keep (securely) contact details of all participants who engage face-to-face in case a member of the research team develops COVID-19 symptoms within 21 days of contact and need relay this. - Research team will follow any local COVID-19 risk assessment operations in KSA.

Have you identified particular equality issues in your risk assessment that are not covered in the individual workplace risk assessments?

Yes – complete an Equality Impact Assessment or

No – Proceed without ☒

Appendix 15. Participant invitation letter.

Study: *An Investigative Study on University Students' Knowledge and Attitudes towards the Food Dome in the Eastern Province of the Kingdom of Saudi Arabia.*

With this letter, Alexander Woodman, PGR at the School of Health and Society, University of Salford, would like to invite you to take part in a focus group on DD/MM/YYYY and/or DD/MM/YY.

Since you have participated in Phase I of the current study, I would highly appreciate your input in Phase II (i.e., explore the knowledge of and attitudes towards the Food Dome among the target population). This focus group discussion will provide an insight about your attitudes, allowing you to explain, criticise, and share experiences, opinions, observations, preferences and beliefs regarding your physical activity and eating behaviour, and the Food Dome dietary guidelines.

The focus group should last no longer than 1.5 hours.

Based on the results of the two phases, intervention components will be developed to target students' behaviour, knowledge and attitudes and support improving the nutritional and lifestyle choices. There is no any pressure for you either to take part or not. It is your decision to withdraw from the study at any point. This will not affect your daily life or any classes that you are currently registered for.

Attached you will find detailed information about the study and precautions to be undertaken to avoid any risks of COVID-19.

Please, read this information carefully, and feel free to contact me if you have any questions - A.Woodman1@edu.salford.ac.uk.

Sincerely,
Alexander Woodman
Post Graduate Researcher

خطاب دعوة المشاركين

يتشرف الباحث، ألكساندر وودمان، بدعوتكم للمشاركة بمجوعة البحث المركزة المقررة بتاريخ (يوم-شهر-سنة) أو (يوم-شهر-سنة).

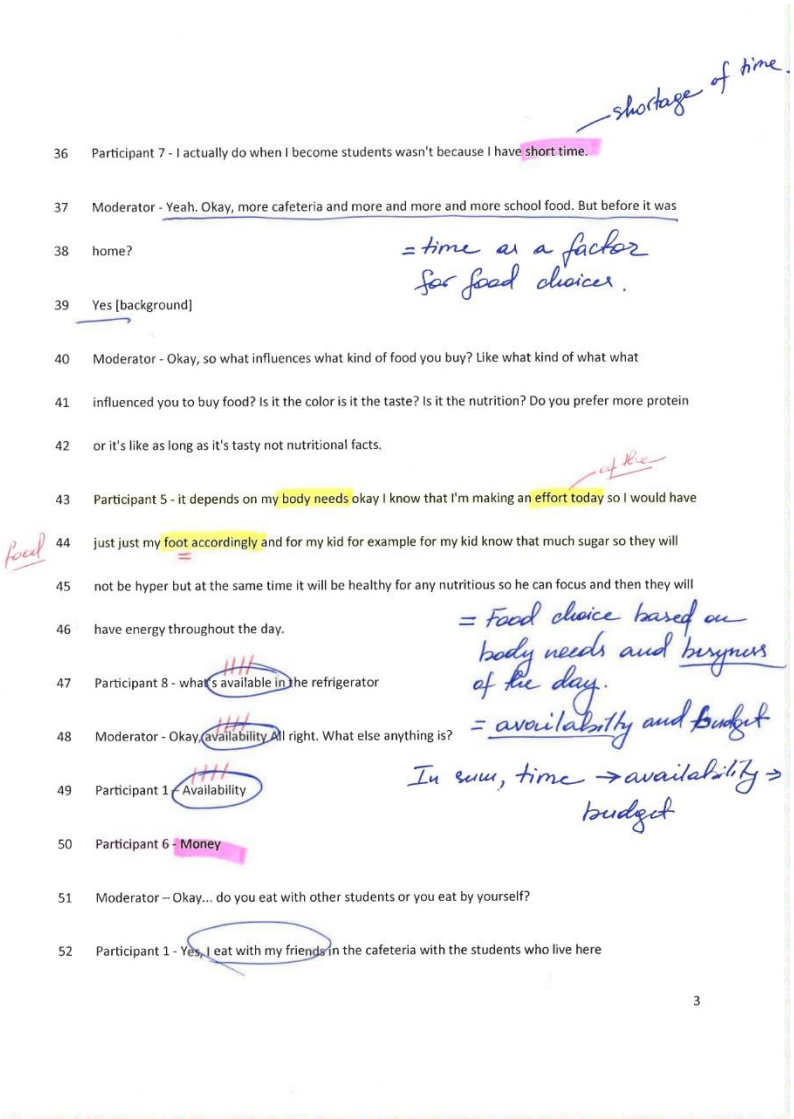
تبعًا لمشاركة حضرتكم في المرحلة الأولى من البحث، نرجو أن تتفضلوا بإبداء آراءكم في المرحلة الثانية (والتي تتمحور حول الموقف والمعرفة العامة تجاه القبة الغذائية). خلال اجتماعات المجموعة، سيخوض النقاش بمنظور المشاركين تجاه القبة الغذائية. وذلك سيسمح لهم بالمشاركة بخبراتهم وآرائهم حول سلوكياتهم الغذائية ونشاطهم الجسدي ومراجعة أو انتقاد أولوياتهم ومعتقداتهم الصحية في ظل القبة الغذائية.

مدة اجتماعات المجموعة لن تتجاوز 90 دقيقة.

بناءً على نتائج البحث بمرحلتيه، يأمل الباحث بإنشاء سبل تدخّل صحية لمساعدة الطلاب في تطوير سلوكيات غذائية إيجابية وزيادة وعيهم الغذائي. تلقيكم لهذه الدعوة لا يجبركم على المشاركة، فقرار المشاركة يرجع لكم فقط. في حال قبولكم بالمشاركة في المجموعة، يبقى لقم حق التراجع لأي سبب، وذلك لن يؤثر على دراستكم أو حياتكم الخاصة بأي شكل سواء قررتم الحضور أو التراجع.

للمزيد من المعلومات، الرجاء قراءة الملف المرفق بعناية، وفي حال راودتكم أي اسئلة حول البحث أو المجموعة المركزة، يمكنكم التواصل مع الباحث شخصياً عن طريق بريده الإلكتروني.

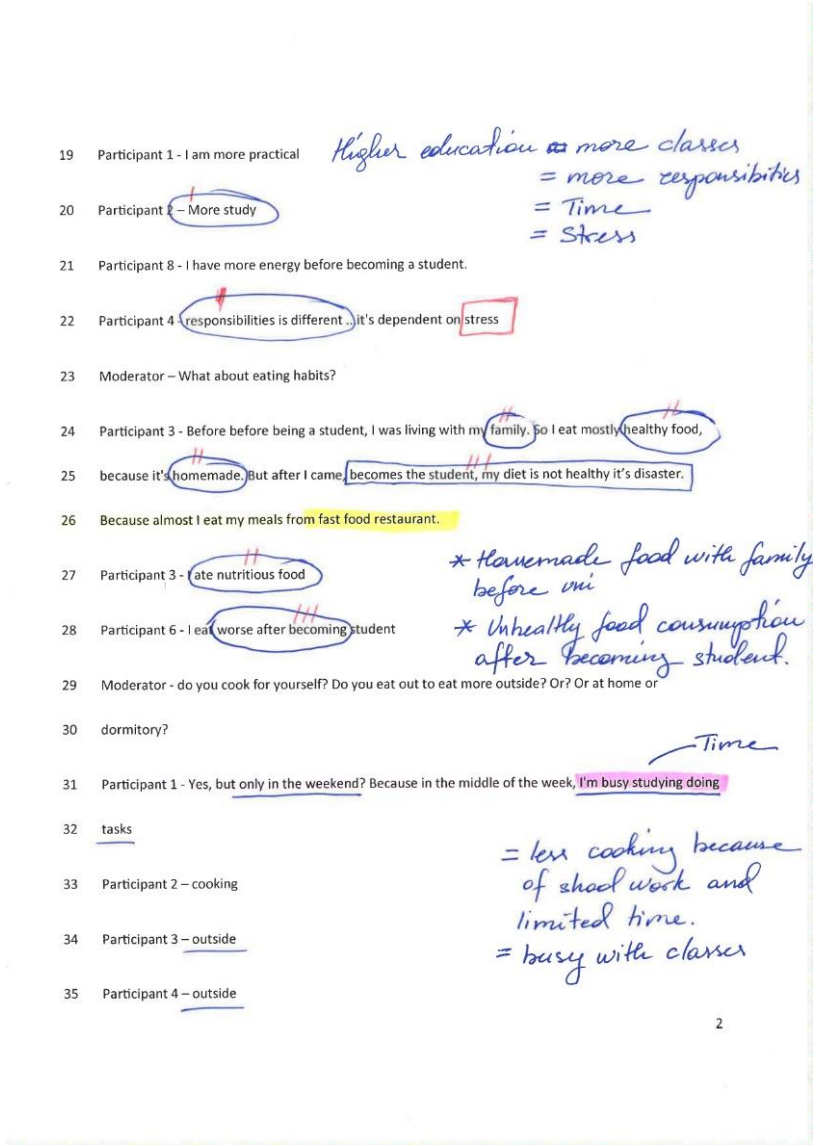
Appendix 16. Framework analysis familiarisation process extracts.



Participant 7 - I actually do when I become students wasn't because I have short time.
Moderator - Yeah. Okay, more cafeteria and more and more and more school food. But before it was
home?
Yes [background]
Moderator - Okay, so what influences what kind of food you buy? Like what kind of what what
influenced you to buy food? Is it the color is it the taste? Is it the nutrition? Do you prefer more protein
or it's like as long as it's tasty not nutritional facts.
Participant 5 - it depends on my body needs okay I know that I'm making an effort today so I would have
just just my foot accordingly and for my kid for example for my kid know that much sugar so they will
not be hyper but at the same time it will be healthy for any nutritious so he can focus and then they will
have energy throughout the day.
Participant 8 - what's available in the refrigerator
Moderator - Okay availability All right. What else anything is?
Participant 1 - Availability
Participant 6 - Money
Moderator – Okay... do you eat with other students or you eat by yourself?
Participant 1 - Yes, I eat with my friends in the cafeteria with the students who live here

shortage of time.
= time as a factor for food choices.
= Food choice based on body needs and busyness of the day.
= availability and budget
In sum, time → availability → budget

3



Participant 1 - I am more practical
Participant 2 – More study
Participant 8 - I have more energy before becoming a student.
Participant 4 - responsibilities is different .. it's dependent on stress
Moderator – What about eating habits?
Participant 3 - Before before being a student, I was living with my family. So I eat mostly healthy food,
because it's homemade. But after I came becomes the student, my diet is not healthy it's disaster.
Because almost I eat my meals from fast food restaurant.
Participant 3 - I ate nutritious food
Participant 6 - I eat worse after becoming student
Moderator - do you cook for yourself? Do you eat out to eat more outside? Or? Or at home or
dormitory?
Participant 1 - Yes, but only in the weekend? Because in the middle of the week, I'm busy studying doing
tasks
Participant 2 – cooking
Participant 3 – outside
Participant 4 – outside

Higher education → more classes
= more responsibilities
= Time
= Stress
* Homemade food with family before uni
* Unhealthy food consumption after becoming student.
Time
= less cooking because of school work and limited time.
= busy with classes

2

Participant 5 – Not

Moderator - What about nutrition effects and the color?

Taste [background]

Color doesn't matter [background]

Moderator - Okay. What about fast food? Do you eat fast food?

Yes, yes, yes [background]

Moderator - What are your thoughts on fast food consumption when you're eating fast food?

Participant 5 - Every weekend,

Participant 1 - Once a week

Participant 2 - A lot of a lot of fast food.

Participant 3 – its dangerous if it's only a weekend

Participant 4 - Fast food consumption. When you're eating fast food to balance we don't have to eat always

Moderator - Okay. What kind of fast food do you prefer?

Pizza, burger [background]

* choice of vegetables = taste, easy cooking and preparation.
* color and nutritouse values don't effect the choice.

* consumption of fast food at least once a week.
* need a balance not to eat all the time.
* hesitation to express either positive or negative thoughts/opinions

* they all liked fast food.

preferred choice of fast food.

Question – about the food dome.
Feedback – Food Dome.
As a prompt / group be more active.

Silence [background]

Moderator - Okay. What do you think would motivate or excite students to follow the food dome dietary guidelines? What kind of information would you think you the students would like to see or find useful to use this?

Participant 1 – social media

Participant 4 - applications

Participant 5 – lectures

Participant 7 – possters

Moderator – okay, any other suggestions?

Participant 2 - Maybe showing difference between the two american pyramid and food dome

Participant 5 - a comparison of both I don't think it will work because they need someone to explain to them between the the american type and riparian type. So, I don't think poster will be clear for them.

Participant 8 - awareness of the status that caused by the unhealthy food?

Participant 8 - I agree with that before. before and after pictures on someone who lost like 50.

Participant 1 - Yes Another student.

Participant 6 – social media

* motivation to follow F.D.
* social media and apps
* scientific evidance/lectures
* experice of others who followed F.D.
* Disagreement with F.D. vs. Food Pyramid
* Incentives offered by uni to follow F.D.
* Awareness about harms of unhealthy food.

Moderator - Thank you. Can you tell me about any changes in your lifestyle since you became a student? In terms of like diet in terms of food guys? Do you cook for yourself or do eat outside more with other fellow students?

Participant 16 - me actually I'm eating outside because I didn't have time to study and cook together.

Participant 14 - I agree with it's no time to go specially with the home is far away from the university. So into it outside more than the home

Silence [background]

* attachment to home/family
* distance as an obstical/constraint to eat at home

Moderator – Anyone else? And what else?

Participant 11 - Before I eat with family. Now I eat individually, maybe with my colleagues or something like that, in restaurants.

* no time to cook
* home is far from uni
* more cafeteria

Participant 12 - Maybe I cooking or restaurants. More cafeteria

Participant 15 - actually, it's not the same with my parents, saying that they might call the port is different than the quality we actually just put a sign on it for a different type of good quality food. I eat junk food most of the time, but home is actually different. At home there are variety of food at different times, good quality food.

* negative association with outside food

Participant 13 - For me a found like, I find the hardest time to find like, a good food, especially about cooking shoes. So as you know, for myself, I'm picky eater. Some sometimes they need like a split,

* the quality of food is different at home vs. cafe.
= home made food vs. outside food

* No chance to cook due to classwork
* hard to find good quality food

especially food, like I do, like like to go to the restaurant and eat the junk food. So or so. Yeah, most of the time, I'm preparing my food by myself.

* work load as an obstical/constraint to cook

Participant 16 - No, I don't have chance to cook. Actually, it turns out that college because Okay, I have many exams. Okay, many commitments.

Moderator - Alright. So when you're choosing the food, what does influence you to choose food? Then anyone can just throw announcer when you're choosing the food when you go like a cafeteria, or when you go to market.

Participant 12 - for me it depend timing if it's afternoon for o'clock I prefer to be our traditional dish which is rice. And at night, I prefer little snacks. That will help me to sleep.

Silence [background]

* food choice depends on (mostly)
  - color
  - time
  - taste
  - budget

Moderator - Thank you Anyone else? Any anything influencing your food habits?

Participant 10 - the taste

Participant 16 – time and budget

Note: only one participant chose healthy food.

Participant 9 - for me, most of the time I'm looking for the for the healthy food

Participant 11 - I think it's colorful. It's might attract me.

Look, color, taste [background]

Moderator - Okay, the look and taste? What about how active are you physically?

= Despite the fact, that time is an obstacle, food choice is based on taste rather than nutritious values
– budget

* being student as a factor for eating more fast food
* marital status as a factor for eating less fast food. (one participant)

152 Participant 14 - Yes of course.

153 Participant 16 - After the classes started we start eating the fast food

154 Participant 12 - When I became a student, at that time, I was single I was eating too much. But when I

155 married once a week

156 Participant 9 - For me, I don't prefert. I don't it at all.

healthy lifestyle

157 Moderator – Alright. Have you ever heard about nutritional guidelines?

158 Silence [background]

- confused looks
- no answer
- more encouragment

159 Moderator - nutritional guidelines? Have you ever heard anything about nutritional guidelines? Do you

160 know anything about nutritional guidelines? Have you seen the one in the US the food pyramid? Do you

161 know anything about it?

162 Participant 10 - Yeah, I am diabetic. I have some nutritional guide to follow

* more assumption less awareness
* lack of knowledge
* health condition as a factor to follow the nutritional guidelines

163 Participant 9 - Yes, It's meat, fruit, protein

164 Participant 15 - rules to make your diet healthier.

165 Participant 16 - Okay, some kind of guidelines that make your diet healthier.

166 Moderator - What do you think about those guidelines?

167 Participant 11 - It's good for you

* positive attitudes towards e.g. despite the lack of knowledge

168 Participant 15 - Good

169 Participant 13 - Healthy

170 Participant 12 - If you want to eat healthy you need nutritional guidelines

171 Moderator - Okay, have you ever heard about nutritional guidelines called Food Dome? A dietary

172 guidelines for Arab countries.

* interest towards Food Dome
* heard vs. known or followed Food Dome.
* interest to learn more about the Food Dome

173 Participant 9 - Is this a media or what is this?

174 Participant 11 - First time

175 Participant 15 - O, for Arab countries? Who made it, oh initiated?

* willingness to learn more before giving a feedback.

176 Participant 14 – Nope

177 Moderator – Anyone else? Have you seen this before [showing the Food Dome]

178 Participant 13 - Yes

179 Participant 12 - It's guideline for food

180 Participant 10 - I have seen this before

seen but not followed

181 Moderator - Very good. Okay, the Food Dome was created by Professor Musaiger. And it's specifically

182 tailored for Arab countries. What do you think about it?

183 Participant 14 - First time I see it. I have to read it.

Appendix 17. Framework analysis thematic framework.

Preliminary Outline *A-priori* Themes	**Quotations from the Raw Text**	**Notes from familiarisation to outline sub-themes**
Physical Activity & Sedentary Behaviour	More sedentary	Less PA due to classes, time limit, and new environment
	Sedentary [background]	Classwork/load as a factor for being more sedentary
	Once a week, twice a week active	
	Before I became students, I used to go to gym every day, and I was making my own meals nowadays I eat one meal a day. I didn't have much time to physical activities.	
	I just came from west sides of Saudi Arabia to the east side of Saudi Arabia until now, I'm just busy with my family that I couldn't find any time to go to gym or to do any sports so I'm just eating and sleeping all the time. This is my schedule. It's a daily routine. It changed after becoming student here.	New environment as an obstacle to be physically active
	Every day you work for me I'm, I used to go to the gym. Okay, especially after school. So I used to go to the gym for like one hour. Okay, yeah. So, yeah, I found myself that.	Positive attitudes and importance of PA
	I think all of us have been to exercise every day.	Some participants were physically active, while others more sedentary
	For me, to be honest with you all the pushups at all	
	if you do exercise, I think you can't eat anything, but you have to find time to exercise.	Balance between eating and PA
	Arrange your time between eating and exercise	
	Food choice	
	It depends on my body needs okay I know that I'm making an effort today so I would have just just my foot accordingly and for my kid for example for my kid know that much sugar so they will not be hyper but at the same time it will be healthy for any nutritious so he can focus and then they will have energy throughout the day.	
	What's available in refrigerator	
	Availibility	Time as a factor for food choices
	Money	Body needs, business of the day, energy required for mother and her child
	The taste	
	Time and budget	Time, budget, availibility, look, and taste as factors for food choice
	for me, most of the time I'm looking for the for the healthy food	Healthy food
	I think it's colorful. It's might attract me.	Color
	Moderator - Do you have breakfast?	

Nutritional Attitudes & Behaviour	Yes	Regular consumption of breakfast by some
	to me no	Skipping breakfast by others
	me too no	
	Sometimes	Time shortage as a main reason for skipping the breakfast
	every day	
	I always skipped breakfast	Coffee instead of breakfast and to bgin the day
	I work late before class and I don't have enough time to eat my breaksfast. And I prefer to skip with the to drink a cup of coffee	
	I wake up full but I need coffee for convenience to complete my day	Sandwich, fruits, and cereals as breakfast
	I disagree. Coffee cannot complete a day.	
	I prefer for breakfast sandwich one type of vegetable one type of fruit	
	Cereals	
	I skip breakfast no breakfast	
	No breakfast	
	must be taken breakfast. I cannot stop the day without the breakfast even though I kind of skipped breakfast I can't	Breakfast as an important and main meal of the day
	My breakfast usually the hot during drink coffee or milk	
	for me it's it's really important to have some breakfast yeah because really it's for me it's the main meal for the day	
	But it's not necessary for the food fruits are enough	
	so for me I like to use banana at the morning to banana okay, because I'm addicted to caffeine. Alright, it will feel my stomach before I take the coffee	
	Sometimes I'm taking cereals with milk. Sometimes eggs	
	Cereals	
	I like cereals	Cereals with milk
	Sometimes [background]	Preference of cooked cereals
	Cereals with milk	
	Little cereals [background]	Lack of knowledge on the recommended srving sizes
	Three to four servings	
	Cooked cereal	Positive attitudes towards cereals

Nutritional Attitudes & Behaviour	**Milk and dairy products**	
	Cheese, milk, yoghurt, Greek yoghurt	Regular consumption of dairy products
	Rich in calcium	Knowledge of usefulness of dairy products
	Daily	Positive attitudes towards dairy products
	the daily yogurt	
	Every day yogurt with oats	Daily consumption of yoghurts
	daily yogurt and cheese me and my family	
	It's light and healthy	Light and healthy
	Vegetables	
	Me I prefer the vegetables which is easy in cutting. Cleaning washing is in cutting I don't like carrots. Carrots vs organic yellow longer procedure. No, I don't like it. Okay, yani. And even if I like the test, I prefer the easy way.	Preference of vegetables based on easy preparation, cooking, cleaning
	Taste [background]	Taste and smell
	Color doesn't matter	Color and nutritious values do not affect the choice
	Taste and amount amount of carbohydrate.	
	Taste and smell	
	Easy way to cooke	
	Color doesn't matter	
	Fast Food	
	Every weekend	Consumption of fast food at least once a week
	Once a week	Need a balance not all the time
	A lot of a lot of fast food	
	its dangerous if it's only a weekend	Negative attitudes towards fast food
	Fast food consumption. When you're eating fast food to balance we don't have to eat always	Understanding that rare and balanced consumption is needed
	I hate it. For me, I don't prefert. I don’t it at all	
	For it’s not good just what but I like	
	Actually, it is heavy food for me, but it is easy way	Heavy food but easy way/quick food
	It’s bad for my health	
	it's not all the time. But a good to have some times it's all easy Wales. We know it's not tempting. But sometimes.	
	We know it's not healthy but sometimes we have too	

	After the classes started we start eating the fast food	Being students asa factor for eating more fast food
	When I became a student, at that time, I was single I was eating too much. But when I married once a week	Marital status as a factor for eating less fast food
Healthy lifestyle	Enough sleep. Healthy food and water	Healthy Food
	Sleep	PA
	Mental health	Good sleep
	you have to fix your meals with the vegetables that comes not only fries, it has to be with vegetables	Mental health
	Sleep very well sleep early go to a gym	
	most avoid especially like for eating junk food so and oily food yeah it's less of those things	fix meals including more vegetables and less fried food = less junk and fried food
	Healthy food and fitness	
	for me I think we have to have a balance not only food even your walk even when you are studying given the relationship with the teachers is a part of the healthy lifestyle okay I think	Healthy lifestyle as a balance between eating, PA, communication with others, and classes
	Source of information about healthy lifestyle	
	I get this one from the hospital. And also I get it from the social media	Health condition to follow healthy lifestyle - 1 diabetic participant Hospital as a source of information
	Applications [background]	
	Twitter, Instagram, YouTube [background]	Social media as a source of information about healthy lifesytle
	Knowledge of dietary guidelines in general	
	That some some food. I need to get some portions of some type of food more than another. Like, for me, I don't consume much carbs. I take protein that is more protein that is I'm calling to the gym. more vegetables, less fruits.	General idea about nutritional guidelines
	rules to make your diet healthier. Okay, some kind of guidelines that make your diet healthier.	Lack of knowledge
	Some kind of guidelines that make your diet healthier	
	Yes, I think I heard one for Saudi Arabia and another one in United Arab Emirates	More assumptions less awareness
	I think there is one intermidiet between Bahrain and Saudi Arabia	
	Yeah, I am diabetic. I have some nutritional guide to follow	Health condition as a factor to follow healthy lifestyle/nutritional guidelines
	Yes, It’s meat, fruit, protein	
	rules to make your diet healthier	
	If you want to eat healthy you need nutritional guidelines	

Knowledge, Attitudes & Behaviour about Food Dome	**Knowledge**	
	Food what? No	More assumptions less awareness about FD
	No, no no [background]	Lack of knowledge about FD.
	Yeah, I thinkg heard about the food dome. it's like a system a healthy system to to eat a specific number of vegetables of cereal.	One participant heard about FD
	Is this a media or what is this?	Interest towards FD and interest to learn more
	First time	
	for Arab countries? Who made it, oh initiated?	
	I have seen this before	heard, seen vs known or followed FD
	Attitudes	
	It's interesting	
	this is helpful	Some remarks on usefulness and helpfulness
	for me it's it's a word that we like it's for variety of food	
	More coordinated	
	It also improves your mental health.	Remarks on mental health and daily activity
	It's concentrated on daily activity	
	First time I see it. I have to read it.	Willingness to learn more about FD before giving a feedback
	For me it's right	
	It makes the balance of what the body need	
	It's like it's for variety of food where should increase vegetables	
Moderator	**some people are saying that vegetables is expensive and really difficult to keep in Saudi Arabia or foods because you know the weather is very hot you're putting in your refrigerator after two days it goes bad What about that?**	
	but it's actually it's cheap of the reason if you meet farmers market like	
	If you go to grocery store, it's very expensive. Most of them is imported	Vegetables are expensive of not bought in farmers' market
Moderator	**What would be the hardest to add to diet**	
Behaviour	meat and chicken	
	Carbohydrates	Participants were not sure would be hard to add to their diet
	Vegetables	
	Fruits	
	daily activity	

	Arabs usually eat carbohydrates, sweets. Yeah Then extreme but most of most of them they like to, like they like to eat like, if you look at the picture here it's the first plate. Rice. Yes. Six to 11 Yeah, six to 11 servings. who is going to utilize it? You mean yes. I don't think so. Okay, then I would have said Well, most of the time Alright, I didn't want to it's very divided here into a different type of food. Okay, but I think they didn't focus I didn't see what is the meat the meat product is is is the first one to service servings. We used to eat a lot of meat. All right, I said rice but as you can see here the mention fruits and a large portion about fruits it's not true.	Disagreement with portions of food groups Arabs prefer sweets over other products Cereals are too much
	Yes they should decrease cereals and more protein with meat	Meat followed by rice as the main product in Arab diet
	Fruits	Culture as a factor for particular food choices
	Actually, in our culture, we're not used to eat much fruits, to get it for which it's included in the price. So we used to, to hit some kind of food, what we used to eat, so about foods, it's not that much. useful to to get it and keep it in the fridge.	Disagreement with he portion sizes of fruits
		Less cereals more meat
The best way to give students information about the Food Dome	social media, applications	Social media and apps
	lectures, posters, science	Scientific evidence and lectures
	Maybe showing difference between the two american pyramid and food dome	
	someone to explain to them between the the american type and riparian type. So, I don't think poster will be clear for them.	
	awareness of the status that caused by the unhealthy food	Awareness about harms of unhealthy diet
	before and after pictures on someone who lost like 50	Experience of others who followed FD
	the university gives students offers to the gyms and healthy restaurants, like sales or something integrated	Incentives by uni to students to follow FD
	Put Food Dome in universities, colleges, cafes	Distibution of FD at Unis, cafes, etc.
	More teaching about those important things	
	by presentation, doing presentation regarding the forms and the calories and obesity and diesaes This is what is the best way that students can receive, be receptive to to understand this information	Presenations and education about obesity and other diseases due to unhealthy eating
	website links who wants to be to get information about it.	
	Apps	
	Encourage encourage him to eat healthy food is	
	Show the students healthy and unhealthy food	

Feedback for Food Dome	It's a little bit hard to follow daily	Useful and comprehensive but hard to follow
	that's very useful	FD isa balance between body needs and food needs
	It's comprehensive	More visually appealing
	like more visual, interactive, something versus like a dry picture. Both language Arabic and English can then translate.	Less words
	more color, choices, electronic	Arabic/English
	show calories	More colors
	It is too wordy	More choices of foods and display calories
	I agree I think for me if decrease the number of words and highlight the most important things on it. It will be more attractive and it will be easy for people to follow.	Disagreement with the FD vs Food Pyramid
	More colors, more picture	More colors
	Remove that exercise sign. It's not related to food	Disagreement on keeping or remoning PA - **how does it relate to healthy lifestyle?**
	In my humble opinion physical activity shouldn't be there	
	I agree, they are talking about the food and they are talking about physical activities doesn't make sense.	
	Even the design of the pyramid that used to be used in the States is much better. Also my n concern is the portion	Revise portion sizes of cereals, meat, fruits and vegetables
Students' Lifestyle	**Daily life**	
	I am more practical	
	More study	
	I have more energy before becoming a student	
	responsibilities is different ...it's dependent on stress	Difficulty in adapting as a student
	Living Outside, with family, at home [background]	Living with families
	Nutrition	
	Before before being a student, I was living with my family. So I eat mostly healthy food, because it's homemade. But after I came, becomes the student, my diet is not healthy it's disaster. Because almost I eat my meals from fast food restaurant.	More classes
	I ate nutritious food	More responsibilities
	I eat worse after becoming student	More stress
	Yes, cooking only in the weekend. In the middle of the week, I am busy studying, doing tasks	Less time
	Cooking	Less energy
	Outside	Negative associations with outside food

	Outside	Homemade food with family before Uni
	I actually do when I become students wasn't because I have short time.	Unhealthy food consumption after becoming student
	no time to go specially with the home is far away from the university. So into it outside more than the home	Distance as a obstacle/constraint to eat at home because home is far from uni
	actually I'm eating outside because I didn't have time to study and cook together.	Less cooking because of classwork and time limits
	Before I eat with family. Now I eat individually, maybe with my colleagues or something like that, in restaurants.	No time and chance to cook due to classwork/load - an obstacle
	Maybe I cooking or restaurants. More cafeteria	More cafeteria
	I eat junk food most of the time, but home is actually different. At home there are variety of food at different times, good quality food.	The quality of food is different at home vs cafeteria
	most of the time, I'm preparing my food by myself.	hard to find good quality food
	No, I don't have chance to cook. Actually, it turns out that college because Okay, I have many exams. Okay, many commitments.	
COVID-19 influence on the daily life	Coronavirus? Yes Yeah, I actually lost a lot a lot weight during the pandemic. It changed my diet. I ate hommeda dishes	Change in diet towards homemade food
	it's still the same no different in what way.	Obligated to eat at home
	during the pandemic we start to cooking every day at home	Wieght loss
	Before the pandemic yani I eat always outside, but during the pandemic yani it’s different, we cooked at home	Family time and more cooking
	During pandemic I lost almost 20 kilogram because the restaurants were closed. I only get obligated with food in my house	Less physically active
	I'm happy to put because the timing we stay at home increasing and meeting each other doing some activity with food like barbecue like to cooking together eating together that dynamic affecting our habits	Staying at home during pandemic = eat healthy
	pandemic affected our habits	Home environment as a factor for eating healthy and weight loss
	It's affects a lot. So for me…..the gym all the gyms closed so I found it I had a hard time to find a place you have to find a place to walk out	Closed gyms
	I trained in a house	Some trained at home

Appendix 18. Framework analysis thematic charting of focus group discussions.

Initial Themes	Quotations from the Raw Text	
Healthy Lifestyle	'Enough sleep.' *#1* 'Healthy food and water' *#2*	#1 = sleep #2 = healthy food = water, more vegetables, avoid junk food, variety of food, homemade food #3 = mental health #4 = PA = gym, fitness, #47 #5 = balance = #1 + #2 + #3 + #4 + relationship with others; balance of what the body need [Food Dome]
	'Sleep' *#1*	
	'Mental health' *#3*	
	you have to 'fix your meals with the vegetables that comes not only fries,' *#2* it has to be with vegetables	
	Sleep very well sleep early 'go to a gym' *#4*	
	most 'avoid especially like for eating junk food so and oily food' *#2* yeah it's less of those things	
	'Healthy food' *#2* and fitness *#4*	
	for me I think we have 'to have a balance' *#5* not only food even your walk even when you are studying given the relationship with the teachers is a part of the healthy lifestyle okay I think	
	Source of information about healthy lifestyle	
	I get this one from the 'hospital' *#6*. And also I get it from the 'social media' *#7*	#6 = healthy guidelines from hospit #7 = social media and apps as source of information
	'Applications' [background] *#7*	
	'Twitter, Instagram, YouTube' [background] *#7*	
	Knowledge of dietary guidelines & FD	
	'That some some food. I need to get some portions of some type of food more than another. Like, for me, I don't consume much carbs. I take protein that is more protein that is I'm calling to the gym. more vegetables, less fruits.' *#2*	#8 = rules, guidelines, healthy food, healthier diet #9 = heard about some guidelines, thinl there is one for Bahrain and KSA, no, food what?, healthy system to eat, media?, for Arabs?, seen this before, first time, have to read #10 = diabetic following guidelines from hospital, for me it's right [Food Dome]
	'rules' *#8* to make your 'diet healthier.' *#2* Okay, 'some kind of guidelines that make your diet healthier.' *#8*	
	'Some kind of guidelines that make your diet healthier' *#8*	
	Yes, I think I 'heard' *#9* one for Saudi Arabia and another one in United Arab Emirates	
	I 'think there is one intermidiet' *#9* between Bahrain and Saudi Arabia	
	Yeah, I 'am ***diabetic***. I have some nutritional guide to follow' *#10*	
	Yes, 'It's meat, fruit, protein' *#8 = #2*	
	rules to make your diet healthier *#8*	

1a = #1 + #2 + #3 + #4
Balanced life between healthy food, PA, mental health and relationship with others

2a = #6 + #7
Digital platform & health facilities as source - apps, social media, hospital

3a = #8 + #9
Assumptions vs knowledge rules, guidelines to eat healthy, heard, seen, first time
4a Health condition [diabetic] to follow specific diet

Knowledge, Attitudes & Behaviour about Food Dome	If you want to 'eat healthy' *#2* you 'need nutritional guidelines' *#8*	
	Knowledge	
	'Food what? No' *#9*	
	'No, no no' [background] *#9*	
	Yeah, I' thinkg heard about the food dome. it's like a system a healthy system to to eat' *#9* a specific number of vegetables of cereal.	
	'Is this a media' *#9* or what is this?	
	'First time' *#9*	
	'for Arab countries' *#9*? Who made it, oh initiated?	
	I have 'seen this before' *#9*	
	Attitudes	
	It's 'interesting' *#11*	#11 = interesting, helpful, coordinated, useful, comprehensive #12 = cheap, expensive, price [fruits and vegetables], money #13 Barriers = meat and chicken, vegetables, fruits, #4, fruits and vegetables, [not] useful to keep in fridge, hard to follow daily, remove PA
	this is 'helpful' *#11*	
	for me it's it's 'a word that we like it's for variety of food' *#2*	
	More 'coordinated' *#11*	
	It also improves your 'mental health.' *#3*	
	It's 'concentrated on daily activity' *#4*	
	'First time' I see it. I 'have to read it.' *#9*	
	For me 'it's right' *#10*	
	It makes the 'balance of what the body need' *#5*	
	It's like it's for 'variety of food where should increase vegetables' *#2*	
Moderator	some people are saying that vegetables is expensive and really difficult to keep in Saudi Arabia or foods because you know the weather is very hot you're putting in your refrigerator after two days it goes bad What about that?	
	but it's actually it's 'cheap' *#12* of the reason if you meet farmers market like	
	If you go to grocery store, it's very 'expensive.' *#12* Most of them is imported	
	Behaviour and What would be the 'hardest' *#13* to add to diet	
	'meat and chicken' *#13*	
	'Carbohydrates' *#13*	
	'Vegetables' *#13 + #12*	
	'Fruits' *#13 + #12*	

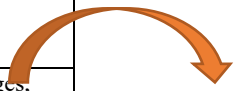
5a = #11
Useful and comprehensive
interesting, helpful, coordinated, useful, comprehensive
6a = #12 + #13
Barriers and challenges products price, food groups, keeping in fridge, portions, PA

	daily activity *#13 + #4*	#14 Behaviour = carbohydrates, sweets, meat, protein, rice, serving sizes, large portion of fruits not true = #13, decrease cereals #15 = #13 + #14 – Arabs usually used to eat some kind of food, culture, not useful keeping in fridge
	'Arabs ***usually*** eat ' *#15* carbohydrates, sweets' *#14*. Yeah Then extreme but most of most of them they like to, like they like to eat like, if you look at the picture here it's the first plate. 'Rice.' *#14* Yes. Six to '11 Yeah, six to 11 servings. who is going to utilize it? You mean yes. I don't think so.' *#14 #21* Okay, then I would have said Well, most of the time Alright, I didn't want to it's very divided here into a different type of food. Okay, but I think they didn't focus I didn't see what is the meat the meat product is is is the first one to service servings. We 'used to eat a lot of meat.' *#14* All right, I said rice but as you can see here the mention 'fruits and a large portion about fruits it's not true.' *#14*	
	Yes they should 'decrease cereals' *#14 + #13 + #21* and 'more protein with meat' *#21*	
	'Fruits' *#13*	
	'Actually, in our culture,' *#15* we're 'not used to eat much fruits, to get it for which it's included in the price.' *#12* So we 'used to, to hit some kind of food, what we used to eat,' so about foods, it's 'not that much. useful to to get it and keep it in the fridge.' *#15 + #13*	
The best way to give students information about the Food Dome	social media, applications *#7*	#16 lectures, posters, science, awareness about unhealthy food, presentations, unhealthy food #17 American Pyramid vs Food Dome #18 experience of others – before and after #19 offers, incentives from universities for gyms and healthy restaurants, encouragement #20 public distribution of Food Dome #21 more visual, interactive, two languages, colors, more choices, show calories, less words, remove PA
	lectures, posters, science *#16*	
	Maybe showing 'difference' between the two 'american pyramid and food dome' *#17*	
	someone to 'explain to them between the the american type and riparian type' *#17*. So, I don't think poster will be clear for them.	
	'awareness' *#16* of the status that caused by the unhealthy food	
	'before and after pictures on someone who lost like 50' *#18*	
	the university gives students 'offers to the gyms and healthy restaurants, like sales' *#19* or something integrated	
	'Put' *#20* Food Dome in 'universities, colleges, cafes' *#20*	
	More 'teaching' *#16* about those important things	
	by 'presentation, doing presentation regarding the forms and the calories and obesity and diesaes' *#16* This is what is the best way that students can receive, be receptive to to understand this information	
	'website links' *#7* who wants to be to get information about it.	
	Apps *#7*	
	'Encourage' *#19 (#16)* encourage him to eat healthy food is	

7a = #12 + #13 + #14 + #15 ***Culturally accustomed diet*** "Arabs usually eat" = preferences and 'used to' vs daily nutritional patterns vs recommended, availability, price

8a = #16 + #17 + #18 + #19 + #20 ***Education & digital promotion*** lectures, evidence, comparison, experience of others + incentive programmes for students + public distribution + digital platform

	‘Show the students healthy and unhealthy food’ *#16*	
	It’s a little bit ‘hard to follow daily’ *#13*	
	that's very ‘useful’ *#11*	
	It's ‘comprehensive’ *#11*	
Feedback for Food Dome	like more ‘visual, interactive,’ *#21* something versus like a dry picture. ‘Both language Arabic and English’ *#21* can then translate.	#21 visual, interactive, two languages, more color, electronic, more choices, show calories, decrease number of words, highlight most important things, serving sizes, remove PA
	‘more color, choices, electronic’ *#21*	
	‘show calories’ *#21*	
	It is ‘too wordy’ *#21*	
	I agree I think for me if ‘decrease the number of words’ *#21* and ‘highlight the most important things on it.’ *#21* It will be ‘more attractive and it will be easy’ *#21* for people to follow.	
	‘More colors, more picture’ *#21*	#4 + #13 + #21
	‘Remove that exercise sign. It’s not related to food’	
	In my humble opinion ‘physical activity shouldn’t be there’	
	I agree, they are talking about the food and they are talking about ‘physical activities doesn't make sense. ‘	
	Even the ‘design of the pyramid that used to be used in the States is much better.’ *#17* Also my n concern is the ‘portion’ *#13 #21*	
Physical Activity & Sedentary Behaviour	‘More sedentary’ *#4*	#4 = PA = gym, fitness, #47, #5, #22, #25
	‘Sedentary’ [background]	
	‘Once a week, twice a week active’ *#4*	#22 – daily
	‘Before I became students, I used to go to gym every day,’ and I was making my own meals nowadays I eat one meal a day. I ‘didn't have much ‘time’ *#25* to physical activities.’	
	I just ‘came from west sides of Saudi Arabia to the east side of Saudi Arabia’ *#4* until now, I'm just busy with my family that I ‘couldn't find any time to go to gym’ *#25* or to do any sports so I'm just eating and sleeping all the time. This is my schedule. It's a daily routine. It changed after becoming student here.	
	‘Every day’ *#22* you work for me I'm, I used to go to the gym. Okay, especially after school. So I used to go to the gym for like one hour. Okay, yeah. So, yeah, I found myself that.	
	I think all of us ‘have been to exercise every day.’ *#22*	



9a = #13 + #14 + #16 + #17 + #21
Visually attractive and interactive number of words, colorful, e.g., American Pyramid, more choices, more colors, portion sizes, digital representation, remove PA, revision based on culturally accustomed diet

10a = #4 + #22 + #25 + #39 + #47
PA & sedentary behaviour time limits, regular habits of workout, new environment, class load

	For me, to be honest with you all the pushups at all *#4*	
	if you 'do exercise, I think you can't eat anything, but you have to find time to exercise.' *#4, #5*	
	'Arrange your time between eating and exercise' *#5*	
Food Choice and preferences	**Food choice** *#23*	
	it depends on my 'body needs' *#23* okay I know that I'm making an **effort** today so I would have just just my foot accordingly and for my kid for example for my kid know that much sugar so they will not be hyper but at the same time it will be 'healthy for any nutritious' *#2* so he can focus and then they will 'have energy' *#23* throughout the day.	#23 food choice = body needs, energy #2, #24, #12, #25, colorful, sandwich, vegetables, fruits, milk, eggs, cooked cereals with milk, cheese, milk, yoghurt daily, taste, easy cooking, vegetables' color doesn't matter, smell, #31 #24 availability, easy way #25 time shortage after becoming student, don't have time to cook
	What's 'available' *#24* in refrigerator	
	'Availibility' *#24*	
	'Money' *#12*	
	'the taste' *#23*	
	'Time' *#25* and 'budget' *#12*	
	for me, most of the time I'm looking for the for the 'healthy food' *#2*	
	I think it's 'colorful. It's might attract me.' *#25*	
	Do you have breakfast? *#26*	
	Yes	#26 breakfast = no, yes, sometimes, skipped, cup of coffee, main meal of the day #23 = sandwich, vegetables, fruits, milk, eggs, cooked cereals with milk #27 coffee is not a breakfast
	to me no	
	me too no	
	Sometimes	
	every day	
	I always skipped breakfast	
	I work late before class and I 'don't have enough time' *#25* to eat my breaksfast. And I 'prefer to skip with the to drink a cup of coffee' *#26*	
	I wake up full but I 'need coffee for convenience to complete my day' *#26*	
	I 'disagree. Coffee cannot complete a day.' *#27*	
	I 'prefer for breakfast sandwich one type of vegetable one type of fruit' *#26 + #23*	
	'Cereals' *#26 + #23*	
	I skip breakfast no breakfast *#26*	

11a = #23 + #24 + #25 + #26 + #27 + #28 + #30 + #31
Food choice = availability & convenience taste matters, price matters, time matters, body needs matter, colour doesn't matter, health matters but not signify the choice = milk and dairy daily, breakfast is important, but depends on time [mostly]

	No breakfast *#26*	
	must be taken breakfast. I ‘cannot stop the day without the breakfast’ *#26* even though I kind of skipped breakfast I can't	
	My breakfast usually the hot during ‘drink coffee or milk’ *#26*	
	for me it's it's really important to have some breakfast yeah because really it's for me it's the ‘main meal for the day‘*#26*	
	But it's not necessary for the food ‘fruits are enough’ *#26 + #23*	
	so for me I like to use ‘banana at the morning to banana okay, because I'm addicted to caffeine.’ *#26 + #23* Alright, it will feel my stomach before I take the coffee	
	Sometimes I'm taking ‘cereals with milk.’ *#26 + #23* Sometimes ‘eggs’ *#26 + #23*	
	Cereals	
	I ‘like cereals’ *#28*	#28 = cereals preference, sometimes, little, 3-4 servings, cooked cereals, #23
	‘Sometimes’ *#28* [background]	
	‘Cereals with milk’ *#28 + #23*	
	‘Little cereals’ *#28* + *#23* [background]	
	‘Three to four servings’ *#28*	
	‘Cooked cereal’ *#23 + #28*	
	Milk and dairy products	
	‘Cheese, milk, yoghurt, Greek yoghurt’ *#29*	#29 milk and dairy = cheese, milk, yoghurt daily, light and healthy, rich in calcium = #2
	‘Rich in calcium’ *#29+2*	
	‘Daily’ *#29*	
	the ‘daily yogurt’ *#29*	
	‘Every day yogurt with oats’ *#29*	
	‘daily yogurt and cheese’ *#29* me and my family	
	It's ‘light and healthy’ *#29 + #2*	
	Vegetables	
	Me I prefer the vegetables which is ‘easy’ *#30* in cutting. Cleaning washing is in cutting I don't like carrots. Carrots vs organic yellow longer procedure. No, I don't like it. Okay, yani. And even if I like the test, I prefer the easy way.	#30 easy cooking vegetables, #23
	Taste [background] *#23*	

	Color doesn't matter *#23*		
	Taste and amount amount of carbohydrate. *#23*		
	Taste and smell *#23*		
	Easy way to cooke *#30*		
	Color doesn't matter *#23*		
	Fast Food *#31 = #23*		
	'Every weekend' *#32*	#31 = #32 – every weekend/once a week, #33 – a lot of fast food, #34 – dangerous, heavy, bad for health, #5 – balance, more fast food after becoming students #35 – don't eat at all #36 – not good vs like it #37 after becoming student more fast food #38 single vs married in eating less fast food	*12a* = #32 + #34 + #35 + #36 + #37 + #38 ***Fast food =awareness vs convenience*** time, price, taste, quick, easy BUT dangerous and unhealthy
	Once a week *#32*		
	'A lot of a lot of fast food' *#33*		
	its 'dangerous' *#34* if it's only a weekend *#32*		
	Fast food consumption. When you're eating fast food to 'balance we don't have to eat always' *#5*		
	I 'hate it. For me, I don't prefert. I don't it at all' *#35*		
	For it's 'not good just what but I like' *#36*		
	Actually, it is 'heavy food for me, but it is easy way' *#34, #24, #25*		
	It's 'bad for my health' *#34*		
	it's 'not all the time. But a good to have some times it's all easy Wales. We know it's not tempting. But sometimes' *#34, #24, #25, #36*		
	We 'know it's not healthy but sometimes we have too' *#34, #36*		
	'After the classes started we start eating the fast food' *#37*		
	When I became a student, at that time, I was 'single' *#38* I was eating too much. But when I 'married' *#38* 'once a week' *#32*		
Students' lifestyle *#39*	**Daily life**		
	I am 'more practical' *#39*	#39 = student life – more practical, study more, less energy, stress, responsibilities, commitments #40 – living and eating with family before being student = #2, homemade food, quality food #41 – after becoming student = #39 + #37 + #31	*13a* = #37 + #39 + #40 + #41 + #42 + #43 ***Students' lifestyle = responsibilities and commitments*** time constraints, more responsibilities, more stress, eating outside vs homemade food, more fast food, less PA
	'More study' *#39*		
	I have 'more energy before becoming a student' *#39*		
	'responsibilities is different' *#39* ...it's dependent on 'stress' *#39*		
	Living Outside, with family, at home [background] *#39*		
	Nutrition		
	'Before being a student, I was living with my family.' *#40* So I 'eat mostly healthy food,' *#2* because it's 'homemade.' *#2* But 'after I came, becomes the student, my		

	diet is not healthy it's disaster.' *#41* Because 'almost I eat my meals from fast food restaurant.' *#42, #15*	#42 = outside eating vs cooking = #15 #43 – cooking myself
	I'm 'eating outside' *#31* because I 'didn't have time to study and cook together.' *#15*	
	'Before I eat with family.' *#40* Now I eat individually, maybe with my colleagues or something like that, 'in restaurants.' *#42, #15*	
	Maybe I cooking or restaurants. 'More cafeteria' *#42, #15*	
	I 'eat junk food most of the time,' *#31* but home is actually different. 'At home there are variety of food at different times, good quality food.' *#40*	
	'most of the time, I'm preparing my food by myself.' *#43*	
	No, I 'don't have chance to cook.' Actually, it turns out that college because Okay, I 'have many exams. Okay, many commitments.' *#39, #25*	
	'Coronavirus?' *#44* Yes Yeah, I actually 'lost a lot a lot weight during the pandemic.' It changed my diet. I 'ate hommeda dishes' *#2*	#44 – COVID-19 = #44 + #2 #45 – weight loss #46 hard to do PA = #4 #47 = home training
	it's still the same no different in what way.	
	during the pandemic we start to 'cooking every day at home' *#43*	
	'Before the pandemic yani I eat always outside' *#31*, but 'during the pandemic yani it's different, we cooked at home' *#43*	
	During pandemic 'I lost almost 20 kilogram' *#45* because the restaurants were closed. I only get obligated with food in my house	
COVID-19 influence on the daily life	I'm happy to put because the timing we stay at home increasing and meeting each other doing some activity with food like barbecue like to cooking together eating together that dynamic affecting our habits	
	pandemic affected our habits	
	It's affects a lot. So for me…..the gym all the gyms closed so I found it' I had a hard time to find a place you have to find a place to walk out' *#46*	
	I 'trained in a house' *#47*	

14a = #44 + #45 + #46 + #47
COVID-19 = homemade food and weight loss healthy food, weight loss, closed gyms vs home workouts