The Impact of Academic Stress on the Dietary Behaviour of Female Undergraduates in Kingdom of Saudi Arabia

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Abstract

There is a paucity of research into the effect of stress on the dietary behaviour of undergraduate students in non-western societies, particularly middle-eastern countries. This is in spite of the seeming importance of culture and ethnicity as potential moderating factors of the stress- diet relationship. Consequently, there is limited knowledge and understanding of the factors that influence the stress-diet relationship in these societies. The aim of this study was to investigate the effect of academic stress on the dietary behaviour of female undergraduate students in King Abdul-Aziz University in Saudi Arabia and how it is influenced by the lifestyle choices and coping strategies adopted by students.

A longitudinal survey of a convenient sample of undergraduate students was carried out using several instruments. These included a self-completed questionnaire (to collect data on socio-demographics, lifestyle choices), Perceived Stress Scale (PSS14), Brief COPE instrument, and 24hour recall interviews. Data were collected when no examinations were scheduled (T1), and again during examinations (T2). The participants were drawn from the female undergraduate student population in six different faculties at the university with a median age of 21.6 years. 491 participants were recruited to the study (T1), of whom 322 completed the follow-up study (T2) during the examination period.

The results showed that students reported significantly higher levels of stress during examinations ($p<0.001$) and that age and smoking were the two

discriminating factors of students' perception of stress. The analysis of food data revealed that there wasn't a significant difference in the nutrient intake of students during (T1) and (T2). Nonetheless, results showed that during examinations the frequency of food intake was significantly lower ($t(320) = 6.195$; $p=0.001$), as with fast food intake ($t(320) = -3.439$; $p=0.001$). Whereas the intake of healthy food by students who reported significantly higher levels of stress decreased significantly. The study results also indicated that students reported significantly higher emotion focused coping scores ($t (321) = 4.559$; $p <0.001$) during examinations.

The findings from this study corroborate existing evidence linking changes in eating behaviour with the increased use of emotional coping strategies.

The research equally identified concerns about body image and weight gain as other possible moderators of changes in the frequency of food intake by students during examinations. The key indicators of these concerns include students stated desire to lose weight, actively taking actions to lose weight, skipping meals and self-reported ideal BMIs less than their current BMI.

Future work would be usefully directed towards investigating further the paradox between observed increase in emotional coping and reduced frequency in food intake. The influence the food environment (both availability and cultural values) and its impact on dietary behaviour during high stress periods should be explored further.

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Dedication

To My Mom, Malak Mohammad Adeeb Obaid.

May Allah make her abode in paradise.

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1 Introduction and Literature Review

1.1 Research Background

High levels of stress is increasingly associated with social and health problems in society. It is commonly described as a physiological and/or psychological response to real and perceived threats to an individual's sense of physical, emotional or social equilibrium. The growing levels of reported stress has been linked with the complexity and fast paced evolution of every aspect of modern society, including work place environments, sport, business, finance and education. The phenomenon of stress and the environments that produce them has therefore been the subject of much research and investigation, with a significant amount of these studies focused on understanding the source, effect and management of stress emanating from academic environments.

The academic life of undergraduate and postgraduate students in universities is often regarded as challenging and difficult (Elias et al., 2011, Misra and McKean, 2000, Shaikh et al., 2004). The stress that students experience in an academic setting can be described as an individual student's assessment of academic demands and the effectiveness or ineffectiveness of their response (Fabián et al., 2013, Kearns and Gardiner, 2007). University students often experience stress as a result of being confronted with demanding pressures linked to their academic studies as well as their social, personal and financial situation, which is perceived to be overwhelming and

beyond their capacity to manage (Ongori and Agolla, 2009, Sreeramareddy et al., 2007).

There has consequently been a significant number of research studies to understand and explain the effect of academic stress on students. The literature on academic stress reports that there is significant evidence to demonstrate that excessive stress can be damaging to a student's academic performance as well as adversely impact on their mental and physical health (Goff, 2011, Richardson et al., 2012, Solberg and Viliarreal, 1997). Studies by Rayle and Chung (2007), Robotham and Julian (2006) and Bennett (2003), have reported that dropout rates and loss of interest in academic study by undergraduates is closely associated with high levels of stress. Research has shown that common mental health problems associated with academic stress include depression and anxiety, whilst physical ailments like high blood pressure and metabolic disturbance have been observed in university students with excessive stress (Richardson et al.,2012). It has also been reported that students under high stress exhibit anti-social behaviours such as alcohol and drug abuse (Flynn, 2000, Wichianson et al., 2009).

It has also been hypothesised that stress has a direct effect on an individual's dietary pattern and behaviour and some research has been conducted to identify associations between stress and eating behaviour. The evidence from some studies suggests that the dietary habits are directly influenced by excessive stress, which in some cases may result in an increase or decrease in the frequency and quantity of food intake and/or irregular

eating pattern such as night eating syndrome (NES) (Elfhag and Rössner, 2005, Macht et al., 2005, Wichianson et al., 2009). It has been argued that the nutritional intake of a person can also be distorted by stress, leading to increased intake in certain types of food types, for example fatty and sugary foods that are over represented in comfort and fast foods (Adam and Epel, 2007, Gibson, 2006). It has equally been suggested that cultural values and social norms influence how people experience, respond and cope with stress (Chun et al., 2006, Constantine et al., 2004).

The findings from several studies of stress-diet relationship within academic environments have shown that the experience of students is uneven. A number of empirical studies (Misra and Castillo, 2004; Sheu and Sedlacek, 2004 and Kim et al., 1997) have concluded that the level of academic stress experienced and the coping mechanisms employed differ across student populations from different cultural backgrounds. There is therefore a need to examine academic stress in societies with different socio-cultural backgrounds, in order to understand whether there is a cultural slant to how academic stress is experienced, the nature of its effects and stress coping.

It is evident from the literature that academic stress has the potential to have a significant effect on the physical and socio-economic performance of students of higher institutions and by extension, society as a whole. The effect of academic stress on undergraduates cannot be overstated as it adversely affects their performance, daily efficiency and health (Misra and Mckean,

2000; Chemers et al., 2001; Vaez and Laflamme, 2008). It is therefore expected that emerging research into this area of study will broaden knowledge and understanding of the sources, nature and impact of academic stress. Furthermore, research results can help identify vulnerabilities and coping mechanisms within specific student communities as well as support the development of measures and practices to mitigate academic stress in universities (Vaez and Laflamme, 2008).

1.2 Stress

1.2.1 Defining Stress

The term stress has been traditionally defined as a "mere nonspecific response of the body to any demand" (Selye, 1936, in Dutta et al., 2006:4). The definition underlines stress as a physiological concept, which was the prevalent theory surrounding the nature of stress. The body's response to stress was wholly regarded as physical and triggered by the release of stress hormones such as adrenaline (epinephrine and norepinephrine) and cortisol. These hormones facilitate the increase in blood flow, heart rate and the activity of the immune, respiratory, digestive and nervous systems (Andreassi, 2013, Chrousos, 2009). However, Grinker and Speigel in Dutta et al., (2006:4) expanded on this definition to include a psychological framework for studying stress as a "mental reaction which arises when there is a perceived imbalance between the demands placed on a person on one hand and their abilities on the other hand". This theorises that the body does not only have a physical

reaction to stress but stress could also produce a cognitive, emotional and behavioural response. This categorisation of stress as a psychological construct provides a theoretical basis for understanding stress as being perceived and experienced differently by individuals. Thus, stress arises when an individual perceives he/she is inherently incapable of meeting a given demand(s) and/or environmental pressures associated with different life experiences (Baker and Karasek, 2000, Koolhaas et al., 2011; Schwarzer and Schulz, 2012). According to Schwarzer and Schulz, (2012) the nature of a response to physiological stress is dependent on the individual's detection of the stressor and assessment of its potential positive/negative effects and their ability to employ an appropriate coping response.

In this study, stress will be regarded as a physical, cognitive, emotional and behavioural response to perceived threats to an individual's sense of physical, emotional or social equilibrium, i.e. the person believes a given situation(s) is beyond his/her ability to cope or poses a danger to their well-being. The thrust of this definition is that stress and attendant responses are triggered by an individual's perceptions of the demands on or threats to their welfare and not by stressful experiences themselves. It is underpinned by the Cognitive Activation Theory of Stress (CATS) proposed by Ursin and Eriksen (2004), which identifies cognitive processes, followed by neurophysiological activation and arousal as integral to understanding stress. The CATS model suggests that stress is characterised by four elements namely, stress stimuli, experience of stress, nonspecific physiological stress response and the

experience of the stress response. Consequently, it is argued that the scope and intensity of physiological responses are modified by an individual's assessment of potential positive/negative effects of a stressor and their capacity to cope with any perceived threats (Ursin and Eriksen, 2004).

Research studies have clearly established that whilst there are differences in the way stress is experienced, stress is universally associated with life events and excessive changes, demands and associated threats brought about by these events. The Life Event Theory of stress theory postulated by Holmes and Rahe contends that stress is caused by life experiences that require more resources than is available to an individual (Riese et al., 2014). The categorisation of life events in relation to stress ranges according to severity. There are major severity events which can be acute and/or chronic in nature such as the death of a partner or loss of a limb or eyesight etc. There are also events with moderate severity, such as pregnancy, moving home or one's children leaving the family home. Finally, there are minor severity events like vacations, changes in eating or sleeping habits, or family gathering, which can also increase stress levels (Riese et al., 2014). The intensity of stress levels according to some researchers (Jeronimus et al., 2013; Riese et al., 2014) is directly related to that of the events creating it and at times, negative events that could potentially cause stress are balanced out by positive happenings which, on the other hand, relax the individual.

Life events can be categorised into 4 main groups (Ogden, 2007), namely:

- Salient Events: commonly associated with key aspects of an individual's life such as work, family and friends.
- Overload Events: when a new stressor is added to previous ones, and it triggers an increase in the stress on the individual.
- Ambiguous Events: these are events whose definition, relevance or role in the individual' life are unclear and as a consequence, they produce stress.
- Uncontrollable Events: stressors caused by events which are out of the individual's control.

In general, any event or circumstance that causes or has the potential to cause stress is called a stressor. A stressor is defined as any happening, occasion, request, need or condition which vary independently, is brought about by either external or internal influences and causes tension and stress in an individual (Cousins et al., 2004). Research carried out in 22 organisations in the UK including the University of Surrey, identified six factors, which act as stressors in work environments, namely demands, control, relationships, change, role and support. All these factors can act in isolation or in-combination to induce stress and produce a physical and/or emotional response in an individual (Cousins et al., 2004). The body's response to these stressors can often be physiological, mental, behavioural psychological (Sawyer et al., 2013; Gianaros et al., 2015).

1.2.2 The Effects of Stress

Stress affects people in different ways based on their subjective responses to stressors. As a consequence some individuals are more vulnerable to certain stressors than others. The effect of stress on an individual can be broadly categorised in physiological and psychological symptoms which can have adverse consequences for physical and mental health of the individual.

The physiological effects of stress are often triggered by severe chronic stress which is characterized by ongoing exposure and increasing intensity of the stressor. Chronic stress of this nature can lead to the prolonged activation of the Hypothalamic-pituitary-adrenal (HPA) system and the attendant release of ACTH and cortisol hormones and the Sympathetic-adrenal-medullary (SAM) system associated with the production of adrenaline hormones, epinephrine and norepinephrine. These stress systems upregulate the flow of energy to the brain, heart and muscles, whilst down regulating anabolic processes responsible for the defence, rejuvenation and repair of vital body organs (Theorell, 2000). Chronic stress therefore can lead to changes in the homeostatic balance in SAM and HPA systems over time (Nicolaïdis, 2002), characterized by a disruption in the physiological balance between catabolic and anabolic processes. According to McCarty and Pacak (2000), in such circumstances the body is unable to achieve compensatory recovery and is therefore more exposed to physical illness. The physical symptoms of this type of stress include aches and pains, physical exhaustion, diarrhoea or

constipation, nausea, dizziness, chest pain, rapid heartbeat, loss of sex drive and frequent colds (Itulua-Abumere, 2013). Furthermore, research studies have reported evidence of a direct relationship between chronic stress and a higher risk of cardiovascular disease and a repressed immune system (Kemeny, 2003). Similarly, diseases such as hypertension and coronary heart disease (CHD) have been disproportionately represented amongst people that live very stressful lives at work, home and in the community (Arrington, 2008). However, it is worthy underlining that the physiological activation mentioned above are not specific to stress and indeed can also be triggered by positive emotional states and non-stressful activities (McCarty and Pacak, 2000). Consequently, the symptoms identified are not wholly specific to stress and can be triggered by other physical and environmental factors such as bacterial contamination and disease.

The suppression of the body's immune system and anabolic processes brought about by chronic stress can also lead to psychological changes in the cognitive, behavioural and emotional baseline of individuals and may have an adverse effect on their mental health (Grossi et al., 2003, Itulua-Abumere, 2013). Cognitive symptoms induced by chronic and intense stress can include memory loss; poor concentration; difficulty making decisions; mental exhaustion and restlessness (Itulua-Abumere, 2013, McEwen and Sapolsky, 1995). These symptoms can impact on an individual's performance at work or in education and can increase the risk of human errors and mishaps (Thiffault and Bergeron, 2003). Behavioural changes induced by stress are often related

to lack of capacity to cope, evidenced by persistent procrastination and avoidance of tasks, nervousness, self-isolation and insomnia (Arrington, 2008, Itulua-Abumere, 2013). It can also be associated with maladaptive coping strategies, such as alcohol, tobacco and narcotics abuse and changes in eating habits (Itulua-Abumere, 2013, Webb et al., 2012). Stress can also result in adverse emotional consequences for an individual, particularly in the absence of resources to cope. These psychological effects may include depression, anxiety, post traumatic disorder and suicidal tendencies (Bhattacharjee, 2013, Schlotz et al., 2011, Webb et al., 2012).

The physical and mental effects of stress are not mutually exclusive but will in real life act in concert with each other, with physical ailments acting as triggers to psychological disorders and vice versa.

1.2.3 Types of Stress

There are a number of ways by which stress has been characterized. The most common characterisation of stress is based on the intensity and scope of the stress experienced by an individual, on the basis of which stress can be broadly classified as acute or chronic. Acute stress can be described as the body's direct and consistent behavioural and physiological response to stress (Chrousos, 1998). Behavioural responses include heightened alertness, enhanced cognition, concentration and attention, the reduction of appetite, digestion and sexual functions. Whilst physical responses are primarily focussed on the rerouting of energy to vital organs and are characterised by

increased blood circulation to the heart, immune system, respiratory system, digestive processes and the nervous system (Andreassi, 2013, Chrousos, 1998). Acute stress will often persist for short periods of time and is generally regarded as not having significant adverse consequences. Usually, the body copes well with acute stress, which may even be useful in flight or fight circumstances requiring a reflex response. Harden (1999) asserts that acute stress can easily affect people as a result of an excess of needs, expectations and pressure. At low levels, stress is easily handled and useful. It is also easily recognizable by some symptoms like mood changes, headaches, and body pain. Harden (1999) takes the view that stress can give an exhilarating and sometimes positive effect at its onset but when it continues for too long it can have adverse effect. According to some researchers (O'Sullivan, 2011; Berk et al., 2014; Kupriyanov et al., 2014), this type of stress is called eustress and it can be considered to be positive because it stimulates higher levels of activity and perseverance in people. The causes of eustress are usually anxiety-laden, but do not last for long, as in the case of an exam or a test, where stress can contribute to increased concentration and performance (O'Sullivan, 2011). Conversely, if stress persist for a longer period of time without adequate rest or recovery, it may lead to pressure overloading and can become a cause of physical and psychological problems (O'Sullivan, 2011; Kupriyanov et al., 2014).

Chronic stress can best be described as a physiological imbalance between catabolic and anabolic processes that is sufficiently large, such that

the body is unable to achieve compensatory recovery (Schneiderman et al., 2005). There are four probable situations that are likely to lead to chronic stress. These are repeated exposure to stress, failure to adapt to repeated exposure to a specific stressor, inability to control or turn off the body's response to stress when the stressor is removed and events that hampers the body's ability to regulate its' response to stress (McEwen and Seeman, 1999). According to Boonstra (2013), chronic stress can arise as a results of recurrent, stress-inducing conditions in one's life. Chronic stress is a serious health condition, which usually causes suffering and agitation, which can at time result in acute moments of distress (Charney and Manji, 2004). Similarly, stressful experience that persist over a long period of time should be considered chronic stress, particularly when they are initiated by severe and adverse external stressors that persevere over a lengthy period of time (Boonstra, 2013). When chronic stress exceeds our capability to cope, this can lead to psychological problems, such as depression and anxiety, or physical ailments like weakness and exhaustion (Nevid et al., 2010).

Middlebrooks and Audage (2008) described a moderate stage of stress, between acute and chronic as tolerable stress. Tolerable stress is of moderate intensity and usually lasts for a relatively short time and because of this, it is usually easier to handle and can be in fact turned into positive stress. However, for this to happen, tolerable stress needs to be effectively managed otherwise it easily evolves into chronic stress (Middlebrooks and Audage, 2008).

Stressors can also be classified based on the duration of exposure or the length of their impact, into short-term or ongoing. This division, however, should not be considered too rigidly, as certain stressors (like the loss of a family member) may be considered as short term, but can result in a chronic level of stress. Ongoing stressors, on the other hand, are long-term factors affecting the individual's state of mind. They may arise as a result of physical health and disease, and they may also relate to financial issues, work, or personal issues involving children, family, partner or friends (Cerda et al., 2013; Forbes et al., 2015).

In a naturally occurring setting there would normally be multiple stressors which act together and at the same time on an individual (Pacak and McCarty, 2000). It has been well established that stress is produced as a result of the interaction between an individual with different stressors in a given setting, location or event. Thus stressors can be classified in relation to the environments and events which produce them. Based on this categorisation stress can be broadly characterised into four groups namely, work-related stressors, academic stressors, family/parental stressors and events-related stressors. Work related stressors are those that are associated with the work environment such as demands of workloads and deadlines, lack of control over job functions and tasks, interpersonal conflicts with colleagues, lack of clarity of job roles and organisational changes (Cousins et al., 2004). Family/parental stressors are those that arise within the context of a family unit and would usually encompass marital dissatisfaction, home chaos,

parental depressive symptoms, and job role dissatisfaction (Musil et al., 2009). Events related stressors are associated with life changing events an individual experiences, which can have short or long term consequences. These stressors range from dire events such as the death of a loved one, loss of a job, illness, divorce, pregnancy and childbirth to seemingly mundane daily hassles such as traffic jams, car breakdown, time pressures etc. (Almeida and Horn, 2004, Almeida et al., 2005). Whilst academic stressors is regarded as that which exist within a formal educational context. The focus of this study is to explore in detail academic stress, its causes, effects and coping.

1.2.4 Measuring Stress

Stress can be measured using quantitative methods, usually in a laboratory setting by applying simulated acute stress to a subject sample, in order to assess or measure their response. Researchers would normally ask the sample to complete stressful tasks, such as an intellectual tests or giving a speech to an audience, watching a horror movie or being exposed to a displeasing event such as a loud noise or very bright light. This model enables researchers to measure the differences in stress response according to demographic parameters such as age and gender; study the relationship between acute and chronic stress; the effect of the personality traits on stress response etc. In controlled experiments stressors can be manipulated to measure psychological and physical changes in a given subject and the response can be explained almost exclusively, relative to the individual. The

impact of the presence or absence of social support on stress response can also be assessed by manipulation. However, responses to stress in an artificial environment such as a laboratory may not reflect fully that which is experienced in a natural setting (Depledge et al., 2011; Beil and Hanes, 2013), a factor which needs to be kept in mind when analysing results. Stress related to test anxiety can be measured using two measuring scales: the Test Anxiety Inventory and the Revised Test Anxiety Scale. Fear of failure is obvious in both scales and it is used to determine students' learning styles, as well as to develop questionnaire strategies (Cassady and Johnson, 2002).

In a controlled environment, stress can also be quantified by measuring the subject sample's physiological response to a given stressor. Scientific tools such as polygraphs are used to assess physiological changes related to stress i.e. heart and respiration rate, blood pressure and skin response (sweat). Blood, urine, or saliva samples can also be tested in a laboratory using appropriate assays. Saliva samples are particularly useful because they are the simplest way to test the presence and level of cortisol, a substance produced when the individual is under stress (Andreou et al., 2011, Lee, 2012). This quantitative method of measuring stress is particular useful because it is objective, controlled and quantifiable, as well as based on physiological responses which cannot be simulated by most people (Amadie, 2012). Another method of studying stress is by focusing on naturally occurring stress, i.e. where stress occurs as a result of daily life. Response to specific events is measured as observed actions and behaviour before and after

exams, during interview or during stressful activities. Furthermore, researchers can also examine the effects of on-going stressors such as work stress, day to day issues, poverty, and marital problems (Amadie, 2011). People's true reaction to both acute and chronic stress can therefore be examined in situ, however, it is difficult to measure other uncontrollable factors.

In the specific case of academic stress, some factors can be seen as a measure of stress, such as rate of absence, illness, dropout and academic performance of students. These measures are considered to be reasonable, albeit rough, indicators of stress. Moreover, data collected from group discussion, surveys, and any other source can be abstracted and analysed to identify the sources of stress, as well as the conditions responsible for the stress itself (Andreou et al., 2011, Lee, 2012, Thoits, 2013).

Self-report is another important measure to examine the effect of stressors related to the environment (Britner et al., 2003; Morey and Segerstrom, 2014). Some measures focus on life events: questions are asked about events such as death of a partner, career changes or moving into a new university. Others would focus on more general questions like how often the participant felt anxious because of an unexpected situation or how often participants felt nervous or stressed. Daily hassles can be measured, in order to assess the influence of ongoing minor stressors on the sample. Self-report measures are the most widely used method for measuring stress. This type of measure focuses on the individual's cognitive response to stress, not the

body's response. However, this particular model does not seem to take into account how each individual reacts differently to stressors and as a consequence should be used with care (Britner et al., 2003; Morey and Segerstrom, 2014).

Psychometric tools such as Perceived Stress Scale -14 (PSS-14) are often used to quantify reported stress in terms of Likert type scoring scale with higher marks associated to higher levels of stress (Andreou et al., 2011, Lee, 2012). According to Mendoza-Denton and Page-Gould (2013), physiological and self-report measures of stress should be used in research where practicable as they complement each other to assess the gamut of stress response.

1.2.5 Academic Stress

The academic life of students in universities is frequently considered to be challenging and difficult (Makrides et al., 1998, Robotham, 2008) and students have a propensity to have high levels of stress which can have adverse effect on their physical and mental health (Fabián et al., 2013). It is the opinion of some researchers (Dutta et al., 2006, Kadison, 2004, Palmer and Puri, 2006) that university students have a high risk of experiencing stress due to the intense and competitive selection process that obtains in modern universities, in addition to, the increased learning and research demands placed on them.

Academic stress is described as stress that is typical of an educational setting and is experienced as naturally occurring events (Fabián et al., 2013). It can comprise of many stressors that are perceived as negative and can have an adverse effect on students' academic performance (Amirkhan, 1998, Covington, 2007) as well as emotional mental and physical wellbeing (Kadison, 2004, Sominsky and Spencer, 2014). In an academic context, it is very likely that whilst some students are sensitive to certain stressors, others are not, as a result of their personalities and behaviour.

The stress that students experience in an academic setting can be described as an individual student's assessment of academic demands and the effectiveness or ineffectiveness of their response (Fabián et al., 2013, Pulido-Martos et al., 2012). University students often experience stress as a result of being confronted with demanding pressures linked to their academic studies as well as their social, personal and financial situation, which are perceived to be overwhelming and beyond their capacity to manage (Ongori and Agolla, 2009, Sreeramareddy et al., 2007). The stressors and possible effects of academic stress on students are discussed in detail in succeeding paragraphs.

1.2.6 Sources of Academic Stress

As discussed in previous paragraphs, students' interaction with the higher education academic environment can result in stressful episodes for some individuals, with different degrees of sensitivity, impact, intensity and duration (Ross et al., 1999). There are several sources of academic stress that

are associated with internal and/or environmental factors, some of which can have a positive or adverse effect (Ross et al., 1999). Research has shown that common stressors related to academic pressure include mid-semester and final examinations, submission of dissertations, research papers, project reports and other assignments which assess their academic performance (Zajacova et al., 2005). Other stressors include social pressures whilst at university, such as fallouts from romantic and non-romantic relationships, poor health, family and financial difficulties (Hashim, 2007). Physical and mental health problems can also influence students' lives, achievements, and create high stress levels (Sreeramareddy et al., 2007). These academic factors can be broadly categorised into transition, home sickness, financial issues, personal relationships and academic demands such as workload, peer competition, examination, presentations and group work (Fabián et al., 2013).

1.2.6.1 Managing Change and Transition:

Settling into a new physical and social environment can be a source of stress to students' particularly first year students new to the university or students transiting into a new course of study or even year of study (Kadison, 2004, Pritchard et al., 2007, Schutte and Malouff, 2002). According to Pancer et al. (2000) stress is triggered by the loss of familiarity of surroundings and social support provided by friends and family. The first weeks and months of an academic year are particularly stressful for students as they adapt to life away from home and familiar surroundings, establish or sustain a high level of

academic performance and adjust to new social spaces and life experiences (Martin and Marsh, 2008, Pancer et al., 2000, Ross et al., 1999).

The demand associated with adaptation and transition to university life or a different faculty or module is a stressor that triggers considerable stress in many students as they experience increasing demand and a lack of control over the new environment (Robotham and Julian, 2006). The university environment will present new rules and procedures, and the student needs to adapt to these as well as new places, faces, and routines. Managing this change whilst cut off from familiar source of social support, is likely to lead to some students experiencing increased levels of depression and inattentiveness within the first few weeks of the first term (Robotham and Julian, 2006). Homesickness is another source of stress for many students, which is associated with moving to unfamiliar surroundings, trying to make new friends, not having support of family and friends (Robotham and Julian, 2006). The level and intensity of stress associated with home sickness can be low and mild for some students and high and chronic for others leading to anxiety, depression and an inability to cope with academic demands. The effect of homesickness can often lessen over time but in some cases students can experience it over the course of their academic life (Robotham and Julian, 2006).

1.2.6.2 Academic Demands and Expectations:

There are a lot of expectations on university students to excel academically. Good grades are often associated with capability and competence in future careers and as such improves an individual's sense of self-worth. Thus the fear and anxiety of getting low grades or failing and actually receiving below than expected grade is an important source of stress for most students in the university. It is therefore not surprising that anxiety over tests and examination and course load are two primary components stressors linked to academic performance. According to Misra and McKean (2000) managing stress is one of the key challenges students face in their quest for academic success, as increasing levels of stress are often inversely proportional to academic performance.

Stress associated with examinations is often triggered by grade competition, anxiety, fear and emotionality (Pfeiffer, 2001). It has been found that moderate amounts of stress can help motivate students and sometimes increase academic performance. The fear of failing can also help to motivate students to prepare and perform well. Conversely, excess and persistent stress can impede preparation, concentration and performance during examinations. According to Fabián et al. (2013) academic stress is often driven by high performance standards and competition that pervades the higher education system. This may lead to anxiety, self-doubt and over-compensation during examinations. Students may also experience post-exam stress as a result of reflections on their performance and how they fared

compared to their colleagues. Low self-confidence and a poor perception of performance can be a reason why depression occurs after the test. According to Parsons (2008) other symptoms of examination stress include no show in exams, procrastination, excessive worrying, fast and inaccurate work, slow, cautious and over accurate work, delayed submissions, as well as feelings of helplessness and depression after failure.

The amount of coursework, which a student is required to complete during an academic session can be a stressor to students in the university. This is often exacerbated by students taking on a disproportionate number of academic modules. A high course load which may include classes, assignments, readings, paper submission and presentations can often result in some students being stressed. According to Hudd et al. (2000), the scope and complexity of course workloads in the university means that students often have to go through periods when there is pressure to submit projects, essays, laboratory reports etc. (usually just before examinations commences), which can result in some students experiencing high levels of stress. Struthers et al. (2000) is of the opinion that highly performing students experience more stress during this period due to the pressure of maintaining their high academic position.

1.2.6.3 Financial Issues:

An important source of stress to students in the university is the management of their finances. For some students life in university is the first

time they have had to manage a financial budget and the responsibility can be a source of stress especially when funds are limited. The lack of money to cover basic needs (i.e. food, clothing etc.) or to engage in social activities can be a source of stress to students (Pfeiffer, 2001; Robotham and Julian, 2006; Putwain, 2007). Furthermore, there are many students who have to work while at the university to either supplement their finances and/or to pay their tuition and other expenses. This can in itself be a source of stress or can act to overload an already stressful situation. Anxiety over financial issues and academic performance can be a source of much stress to some undergraduate students. Working whilst studying may mean that students have less time to study, attend classes and complete assignments, which can have an adverse effect on their academic performance leading to stress (Trockel et al., 2000).

1.2.6.4 Relationships and Family commitments:

Managing social relationships can be another source of stress for undergraduate students. Greenberg et al. (2003) asserts that students experience stress as a result of the loss or changing of friendships and the forming of new ones. The process of cultivating new friendships and settling into a new social network at the same time can be very stressful for students, particularly first year students. The time, energy and effort required to develop trust and confidence in strangers whilst needing but lacking the social support in a new environment can be stressor to some students. Pressures exerted by family relationships can also be another stressor (Misra et al.,

2003). Another source of stress to student is the expectations of nuclear and extended family for them to perform well academically, especially for students who are the first to attend university in their families or poorly performing students (Pfeiffer, 2001; Putwain, 2007). Likewise, some older students may have other nuclear family obligations that impact on their academics such as childcare and/or marital issues. For students who are away from their partners and children whilst at the university, feelings of loneliness and longing can lead to depression and a source of stress (Pfeiffer, 2001; Putwain, 2007). For other students, challenges with childcare arrangement, marital conflict and poor relations with other family members can act as a stressor.

The effect of the stressors discussed above vary according to year of study, course of study, age of student, and their personal circumstances (Zajacova et al., 2005). It is therefore likely that whilst some students are sensitive to certain stressors, others are not. The effect of these stressors is not uniform or objectively experienced, but changes according to the respondent's character, coping ability and availability of support (Reason et al., 2007, Zajacova et al., 2005).

1.3 Managing, Coping and Preventing Stress

Stress coping is defined as any approach towards addressing the imbalance brought about by stress, and includes any methods an individual uses to interact with stressor(s) in order to rebalance external and internal needs and return the body to a homeostatic state (Palmer and Rodger, 2009).

According to Folkman (2013) coping involves an analysis of the interaction between the individual and the stressors and includes attempts at controlling both the external stressor and internal response to it. Coping includes resolving or removing the stressor, altering perceptions about the stressor or understanding how to tolerate/accept the stressor with minimal side-effects (Palmer and Rodger, 2009). Coping can also be described as the individual's attempt to alter thoughts and performances in order to handle the external and internal needs created by a stressful event (Sominsky and Spencer, 2014). In effect, it involves changes in cognition and behaviour with the explicit aim of reducing stress and mitigating against its emotional and physical impacts.

1.4 Coping Strategies

Coping strategies are related to the range of cognitive strategies that an individual employs to eliminate or minimize the adverse effect of stress and usually comprise of physical, psychological and behavioural techniques of stress management. Stress coping strategies can be classified into two types, namely, approach and avoidance strategies (Carver and Connor-Smith, 2010). Approach coping focuses on the stressful event, and involves direct actions and thoughts towards managing the effects of the stressor. Approach coping can be considered “task-oriented” and geared towards changing the needs and mindset of the individual in order to manage a stressful event or situation (Sominsky and Spencer, 2014). According to some researchers (Folkman, 2008; Lazarus, 1991) the actions associated with this strategy can be classified into problem- focused and emotion focused actions, based on their

application on different aspects of the stress produced. According to Krohne (2001), problem focused coping technique comprise of practical actions taken to change the realities that produce stress by removing or mitigating the underlying causes of stress. Problem focused coping action will often involve taking control, information seeking, and appraisal of options (Folkman, 2008; Lazarus and Folkman, 1985). Conversely, emotional focused coping has been described as thoughts and actions that are employed by an individual to manage and lessen stressful negative emotions linked to a threatening situation that is perceived to be unavoidable and out of their control (Bargh and Williams, 2007, Follman, 2008). Carver and Connor-Smith (2010) defines emotion focused coping techniques as relating to deliberate mental decisions and actions taken towards preventing/mitigating against stress or reappraisal of the psychological effects of stress (Carver and Connor-Smith, 2010, Krohne, 2001). Brannon and Feist (2009) describe it as "oriented toward managing the emotions that accompany the perception of stress". The seminal work by Folkman and Lazarus (1988), proposed five mechanism by which emotion focused coping is applied, these include disclaiming, escape-avoidance, accepting responsibility or blame, exercising self-control, and positive reappraisal.

Avoidance coping strategy on the other hand is the intentional disregard of a stress in order to diminish the relevance of a stressful event in an attempt to diminish the effect of stress. It is associated with an individual's propensity to evade or diminish the effect of a stressful event by abstaining from thinking

or feeling about an ongoing stressful experience (Sominsky and Spencer, 2014). Emotional avoidance is considered to be a defensive form of coping, and usually involves psychological and behavioural overpass, avoidance, and deviation from a stressful situation. It is a form of redirection or isolation, which distracts the physical and emotional system of an individual from a stressful event towards more enjoyable and stress free activities (Sominsky and Spencer, 2014). Avoidance coping approach is closely related to the "wish-fulfilment fantasy" coping method, which involves turning ones interest and thoughts entirely towards utopian and farfetched desires that give the individual a pleasurable respite from real and urgent stressful events. It offers an imaginary but temporary escape but does not offer any real help with dealing with stressful situations (Nevid et al., 2010). Examples of avoidance coping are postponement and inhibition of emotion and/or actions, which are an intentional and intended to provide a means of interruption or escape from stressful cognitive and emotional situations. Avoidance copying is often observed in seriously ill people, who often fail to comply with their medical therapies because it is exacting and stressful, and consequently experience decline in their health. In the case of cancer, patient avoidance copying often involves refusal to talk or think about the illness, thus avoiding to address directly their ill health and its implications. There is evidence from research which suggest that stress avoidance can often result in more adverse psychological symptoms (e.g. panic attacks and anxiety), particularly with stressors such as illness (Augustine et al., 2011, Litman and Lunsford, 2009,

Sominsky and Spencer, 2014). According to Juth et al., (2015), although approach coping is often considered the healthier and more successful form of coping, the impact and success of coping types depends on the stressor itself, and some form of coping may be more apt to deal with short or long term stress than others. For example, in the case of acute stressors such as a visit to the dentist, avoidance coping is a powerful stress management option, whereas, as mentioned above, it is not a healthy response for long-term stressors such as debilitative illness. Individuals usually show only one form of coping in relation to one particular event, although they may not rely on the same form of coping when dealing with different stressors (Nevid et al., 2010).

1.5 Stress management methods

The methods employed in the management of stress influences how individuals perceive stress and their underlining belief in their ability to overcome it (Augustine et al., 2011). It has been theorized that behavioural techniques adopted by an individual can modify the scope and strength of their personal effectiveness in stress management (Krohne, 2001). The coping methods adopted by an individual is often based on the personal (e.g. self-efficacy) and external resources (e.g. social support) available to them. An example of personal resource drawn on for coping with stress is self-efficacy. It is hypothesized that expectations of personal efficacy determine whether coping behaviour will be initiated, how much effort will be expended, and persistence in the face of adverse experiences (Benight and Bandura, 2004;

Bandura and Locke, 2003). Self-efficacy is an indicator of an individual's ability to overcome the challenges faced, apply specific actions proficiently and make positive changes to their life (Benight and Bandura, 2004). There is therefore a direct relationship between high levels of self-efficacy and perception of stress. For example, exam stress may increase or decline based on students' confidence in their ability to perform well in the exam. According to Nevid et al. (2010), a high level of self-efficacy to cope with stressful situations correlates with the release of low level of stress hormones epinephrine and norepinephrine.

An example of an external resource an individual can call on to manage stress is social support. It comprises of an individual's social and affective relations, and the ways they can help the individual to avoid or manage stress (Cohen, 2004). Generally, social support refers to convenience, help, care, self-esteem gained from other individuals. Social support can take several different forms including instrumental, informational, appraisal, and emotional support (Malecki and Demaray, 2003, Cohen, 2004; Schwarzer and Knoll, 2007). Emotional support relates to expressions of love and trust that help promote an individual's self-confidence; Informational support, entails advice and guidance offered by other people; appraisal support consists of evaluative feedback received from other people; and instrumental support, which include tangible physical assistance (Cohen, 2004).

With respect to managing stress within higher education setting, support received from the faculty could be considered as a kind of social

support (Pfeiffer, 2001). It involves the social interaction between students and faculty staff, the latter focused on helping the former to overcome doubts and insecurities relating to the bureaucratic aspects of academic life. Additionally, academic advisors can help students facing in-class problems and other units in the faculty may also endorse stress management training and publicize their presence on campus. Social support is important in the lives of undergraduate students as it helps them to review and change their opinions about stressful and potentially stressful events and situations (Putwain, 2007). It can also have a positive influence by counteracting loneliness and homesickness, which are often associated with depression. However, when psychological symptoms of depression and anxiety occur, counselling services within universities play an essential role within any successful social support network to mitigate and manage academic and social stress in the university environment (Putwain, 2007).

1.6 Stress, Nutrition and Human Health

It has been established earlier on in this literature review that stress (particularly chronic and intense stress) can have an adverse effect either directly or indirectly on the physical and mental health of an individual. Diseases that are commonly associated with stress include cardiovascular disease, high blood pressure and intestinal ulcers, which are associated with the loss of homeostatic balance in the body's biological stress response system and the resultant suppression of the immune system (Andreou et al., 2011, Kemeny, 2003, Lee, 2012). It is however difficult to prove a causal link

as these ailments are not specific to stress. Besides, there are cognitive, behavioural and emotional maladies (e.g. mental exhaustion, insomnia, alcohol/drug abuse, changes in eating pattern) induce by stressed that can trigger and/or exacerbate physical and mental illnesses (Salmon, 2001; Steptoe and Kivmaki, 2012). Given that higher education institutions can be regarded as potentially very stressful by some students it can be inferred that these health risks are present in an academic setting.

In a study by Allgöwer et al. (2001), the relationship between personal health and stress in 5,529 university students from 16 countries was investigated. The results showed that a third of students exhibited signs of depression and anxiety as a result of academic stress. Allgöwer and his colleagues concluded that chronic levels of perceived stress can adversely affect the physical and mental health as well as social life of students. A similar study by Andrews and Wilding (2004) also revealed that academic stress is associated with significant levels of depression amongst undergraduate students in UK universities. Gupchup and Burrego, (2004) also investigated the impact of stress on matured postgraduate students and reported results that showed a direct correlation between academic stress and the mental health. A psychological effect of stress has therefore been the subject of much study in the educational environments, with the effect of stress on the eating behaviour of student populations, vis-à-vis nutrition and on their health and wellbeing receiving increasing attention (Zellner et al., 2006).

Nutrition is an important part of student life, as it can be detrimental or beneficial to both mental capacity and performance in exams, as well as help manage physical stress. Therefore, maintaining a good balanced nutrition is an important part of succeeding in university, as it can help concentration, energy level, strength and overall health (Allgöwer et al. 2001).

A healthy diet comprising of balanced portions of macro and micro nutrients usually revolving around fresh, non-processed foods such as fruits, vegetables and lean proteins is vital for maintaining optimal physical and cognitive functions. Academic examinations are a particularly stressful period for students and have been associated with an increase in poor dietary behaviour as many students tend to skip meals or increase their intake of high calorie fast foods in an attempt to save money and time (Mikolajczyk et al., 2009). However, these changes in dietary behaviour have been linked with adverse effects. Micheletti et al. (2001) argues that taking exams on an empty stomach significantly reduces the level of performance as optimal brain functioning cannot be achieved. Deliens et al. (2014) reported that eating behaviour that encompasses sugary, high energy, empty calorie diet (i.e. fast food, chocolates, biscuits, sweets and other confectionaries) often results in loss of concentration and focus due to energy slump. Sugary foods raise the level of glucose in the blood very quickly but are unable to maintain such high levels for any reasonable amount of time. Similarly, carbonated soft drinks which contain high amounts of sugar and/or caffeine often causes hyperactivity and insomnia associated with low levels of concentration and

mental acuity (Rath, 2012). Good nutrition is therefore important for maximizing learning and examination performance potential (Erikson, 2006).

It is clear from the literature that poor nutrition can have an adverse effect on physical and mental health, contribute negatively to a student's academic performance and increase levels of stress in the students, which is expressed as anxiety and fear of failure during examination periods.

There is evidence to indicate that changes in eating pattern in terms of the type of food, increased or decreased food intake can be brought about by stress. It has been suggested that eating disorders such as anorexia and bulimia are triggered by a stressful event experienced by susceptible persons during a sensitive period of life (adolescence and early adulthood) (Fryer et al., 1997; Costarelli and Patsai, 2012). Changes in dietary pattern are used as coping mechanisms to manage stress linked to anxiety over failure, insecurity over body image, poor self-esteem or multiple changes happening in a short span of time (Briefel, 2001). However, this is a destructive coping strategy and similar to the use tobacco, consumption of large volumes of alcohol and the abuse of illegal drugs or prescription medications, all of which may bring short-term relief but at a high cost to physical and mental health (Jyoti et al., 2005).

Our relationship with food is complex. Eating is an emotional, cultural and social activity, which is conditioned and reinforced over our lifetimes. Food can be used as a source of stress reduction for anxiety, loneliness and boredom and the foods eaten during stressful moments are more likely to be

high in fat, sugar and salt (Dalen et al., 2010). The unbalanced relationship with food and eating which is experienced with food addiction, anorexia and bulimia is influenced by an individual's emotions and stress may therefore be a contributory factor (Fryer et al., 1997; Costarelli and Patsai, 2012).

Other maladaptive coping mechanism adopted by undergraduates to manage academic stress is the excessive use of drugs and alcohol. Studies by Burt and Burt (2012), and Oaten and Cheng (2005) indicate that undergraduate students increase their intake of caffeine during exam period. In a study by Zunhammer et al. (2014) that examined the relationship between exam stress and poor sleep quality and drug consumption in a sample of undergraduate, they reported a statistically significant increase in perceived stress and caffeine intake during examination time.

However, mindful eating provides a positive approach towards food and beverage intake that enables an individual to positively intervene and manage stress. Mindful eating is an awareness of the thoughts, feelings, and social customs associated with food and eating, and an awareness of the automatic behaviours around eating (Dalen et al., 2010). It is an adaptive approach that has been shown by several studies to reduce stress and uncontrolled emotional eating as well as improve physical and mental wellbeing of an individual (Daubenmier et al., 2011). The results of studies carried out by Davidson et al., (2003) and Grossman et al., (2004) suggests that mindful eating was an effective coping technique for reducing stress and improving emotional wellbeing. Similar studies by Hepworth (2011), Tapper et al., (2009)

and Dalen et al., (2010) also indicated that mindful eating has a positive effect on controlling disordered eating and symptoms of emotional eating.

In conclusion, the nutritional ethics and food habits of university students are difficult to ascertain and it will difficult to compile an exact nutritional response to stress on the student body in any given university (Wolpert and Wheeler, 2008). This is due to the fact that students often adopt both healthy and unhealthy eating habits and because of relational nature of stress. It is likely that students may fall into a vicious circle of bad eating in particular periods of the year (when having exams), but fundamentally eating healthily the rest of the time.

1.7 Diet and Physical Health

Nutrition comprising of balanced diet of essential nutrients is one of the most significant environmental factors required for establishing and maintaining optimal health and is a vital part of disease prevention (Verkaik-Kloosterman et al., 2012). Foods improve physical and mental functions, aid the prevention and/or therapy of several non-infectious diseases (Graham and Rosser, 2000). The aim of a balanced diet is to provide an individual with the right amount of energy and nutrients essential for optimal health. The beneficial effects of a balanced diet comprising of appropriate proportions of macro and micro nutrients has been established by extensive research. These studies have examined the essential nutritional requirements of macronutrients, micronutrients and phytonutrients that makeup a balance

diet, as well as the effect of insufficient or excessive nutrition on the physical and mental health of individuals (Lupien et al., 2005).

Macronutrients are carbohydrates, protein and fats/oils. Foods rich in carbohydrate and fibre are an important source of energy and are essential for maintaining regular bodily functions. Protein is essential for growth and development in children and young people as well as vital for sustaining tissues, organs and systems in adults. Low dietary intake of protein can therefore compromise health by increasing the risk of disease and possibly inflammation (Kalantar-Zadeh and Kopple, 2001). Whilst the intake of very high levels of protein could contribute towards the disruption of bone and calcium homeostasis, renal disorders, and increases the risk of cancer, liver and coronary artery diseases (Delimaris, 2013, Manninen, 2004). Macronutrients of fats/oils are a rich source of cellular energy and promote mental and cardiovascular health via a balanced ratio of omega6: omega3 fatty acids (Maillard et al., 2002, Simopoulos, 1997). However, high intake of foods rich in saturated and trans fatty acids can engender the onset of cardiovascular diseases, obesity, type 2 diabetes mellitus, and other chronic degenerative diseases (Polacow and Lancha Junior, 2007, Simopoulos, 2001).

Micronutrients comprising of a range of vitamins, minerals and trace elements play a vital role in cell metabolism and support a multiplicity of tissue functions as well as potentially acting to promote disease prevention and treatment (Maughan, 1999, Shenkin, 2006). Similarly, there is an emerging body of scientific evidence that suggests that phytonutrients (in the

form of Carotenoids; Ellagic acid; Flavonoids; Resveratrol; Glucosinolates and Phytoestrogens) present in plant based material such as herbs, spices, fruits and vegetables are believed to play a role in preventing, reducing the risk and ameliorating the effect of diseases such as cancer and cardiovascular disease (Barber, 2001, Drewnowski and Gomez-Carneros, 2000). However, higher than adequate levels of intake of micronutrients and phytonutrients can have an adverse toxic effect on tissues and organs in the human body (Renwick et al., 2004, Verkaik-Kloosterman et al., 2012). Although the link between diet and cancer has not been fully established (Bingham and Riboli, 2004), there is a growing body of scientific evidence which suggest that diet influences the pathology and therapy of chronic diseases like cancer. Researchers Maillard et al. (2002), and Tavani et al. (2005) in their study of breast cancer etiology reported that omega–3 polyunsaturated fatty acids have a direct influence on the risk of breast cancer. According to Tavani et al. (2003), the risk of breast cancer increases with higher ratios of omega–6/omega–3. Other researchers Leaf et al. (2005), and Marangoni et al. (2004) have also reported that omega–3 fatty acids decreases ventricular arrhythmia by stabilizing contractile cells in the heart, thereby acting to prevent coronary heart disease.

Inflammation is regarded as a key process in the development of many chronic diseases, including cancers, atherosclerosis related diseases and pneumonia (Okuyama et al., 2005). One of the key triggers of inflammation in tissues and organs in the body is high intake of omega–6 (linoleic acid) and the up-regulation of the arachidonic acid (AA, omega–6) cascade. Okuyama et al.,

(2005) argues that the ratio of omega-6/Omega-3 fatty acid is regarded as playing a key role in the promoting inflammation.

Western diets are high in meat and processed meat, dairy products, low in fruit and vegetables, grains and nuts, and have been shown to be directly correlated with high risk of chronic diseases (Liu, 2013). In contrast, a balanced diet high in mono-unsaturated fat (e.g. olive oils), fish, fruit and vegetables, legumes, grains and cereals; and modest portions of diary consumption is typical of the Mediterranean region and considered to be directly associated with low risk chronic diseases. The Mediterranean diet is a rich source of nutrients and bioactive complexes and phytochemicals containing a range of vitamins, minerals and trace elements such as vitamin C, Vitamin B-6, potassium, magnesium and dietary fibres De Lorgeril and Salen, 2006). It has been suggested that the health benefits of fruit and veg are attributed to the interaction between bioactive compounds and other nutrients in whole foods (Liu 2013).

In a study by De Lorgeril and Salen (2006) a customized Mediterranean diet with a ratio of 4:1 of linoleic to alphalinolenic acid was shown to reduce the risk of coronary heart disease mortality by 70%. This corroborates the results of other studies, which show that the risk for coronary heart disease mortality is directly proportional to the ratio linoleic to alphalinolenic acid (Simopoulos, 2008). It can therefore be inferred that changes in diet that lead to deficiencies or overload of these nutrients are likely to increase the risk of inflammation and associated chronic diseases.

1.8 Diet and Mental Health

There is a large body of primary and secondary research evidence that suggests that a balanced diet of essential macro and micro nutrients is essential for preventing, maintaining and restoring physical health (Casper, 2005). There is equally a school of thought supported by scientific evidence, which posits that a balanced diet is also essential for brain function and consequently mental health, cognition and behaviour (Bellisle, 2004, Fernstrom, 2000, Hibbeln et al., 2006, Stevenson, 2006). Studies conducted over the past 20 years have showed that there are early signs of stress, which are associated with mental health. These symptoms include mood disturbance, headache, sleep disturbance, lack of concentration, short temper, or instability in the family and friend relationships.

The relationship between nutrition and brain functions has been the focus of much research and studies have partially demonstrated that diet exerts an influence on the performance of the brain (Fernstrom, 2000). It has been argued by Lieberman (2003) that the brain is not an independent functioning organ that is unaffected by other metabolic processes in the body, but it is instead significantly dependent on nutritional processes for it to function effectively. Research into the effect of diet on brain function suggests that deficiency of essential nutrients and/or excessive quantities of certain macronutrients and micronutrients is likely to have adverse consequences for brain function. Several substances, including amino acids and choline, are needed for optimal brain function. According to Bourre (2006) some of these

substances need to be introduced into the body through food, which can also enhance the production of molecules essential for the brain's well-being. Food consumption is vital to produce the right amount of amino acids and choline, which are two precursor molecules needed for normal cerebral functions (Zeisel, 2006). It is therefore reasonable to assume that diet can directly influence the brain. Research discussed by Wood (2001) demonstrates how nutrition can affect our cognitive functions, and several studies on school-aged children point to a direct correlation between poor nutrition and declining academic performance. According to Erikson (2006), there are several research studies which show that nutrition is important in the production of key neurotransmitters such as acetylcholine, dopamine and serotonin. Researchers Gómez-Pinilla (2008), and Wolpert and Wheeler (2008) are of the opinion that cognition is influenced by nutrition and that related factors such as diet, exercise, and sleep have the potential to alter brain health and mental function. They argue that it stands to reason that intentional changes in diet could be used to enhance cognitive abilities. Erikson (2006) identified five key dietary components important to brain development and function, these include proteins, carbohydrates, fatty acids, vitamins and minerals.

Proteins consist of amino acids essential for the proper functioning of many of the body's organs including the brain (Erikson, 2006, Rao et al., 2008). They are found in foods such as meat, eggs, fish, milk, cheese, beans, peas, and grains and are used to make most of the body's tissues and

elements, including neurotransmitters. In the brain the neurotransmitters dopamine and serotonin are made from the amino acids tyrosine and tryptophan respectively. Rao et al. (2008) are of the opinion that the consumption of foods high in protein and as a consequence high in associated amino acids 3 can have an adverse impact on brain function and mental health. A low protein diet can result in low concentrations of tyrosine and tryptophan amino acids and the dopamine and serotonin neurotransmitters that they produce. A lack of protein may cause an individual to be lethargic, withdrawn, and passive, and can potentially interfere with their emotional and social interactions. Conversely, accumulation of other amino acids such as phenylalanine can result in brain damage and mental retardation (Erikson, 2006, Rao et al., 2008).

Carbohydrates are regarded as the second most important food group essential to the body and the brain. They are polysaccharides commonly found in grains, fruits, and vegetables, which when broken down produces glucose from where the brain gets its energy (Bellisle, 2004, Erikson, 2006, Rao et al., 2008). A diet rich in carbohydrates facilitates the release of insulin to cells, which in turn triggers the release of tryptophan into brain and associated build-up of serotonin levels in the brain (Rao et al., 2008). As earlier mentioned, serotonin is created within the brain through the absorption and conversion of tryptophan, and is responsible for regulating mood and emotional wellbeing. The absorption of tryptophan in the brain is enhanced by carbohydrates and it has therefore been suggested that a low

carbohydrate diet may have an adverse effect on brain chemistry, resulting in mood swings, depression and energy level. It has been suggested that foods with a low glycemic index (GI) (e.g. fruits, vegetables, whole grains etc.) deliver long lasting positive outcomes for brain performance compared to foods (e.g. sweets) with high GI foods (Rao et al., 2008). These and other literature suggest that relative proportions of protein and carbohydrate contained in a meal can influence neurotransmitters such as serotonin, which is thought to be responsible for maintaining mood balance, memory and social behaviour (Blundell et al., 2003, Stevenson, 2006). According to Rogers (2001) meals with a high protein content contribute towards heightened brain alertness, whilst foods rich in carbohydrate have the capacity to alleviate depression linked to 'carbohydrate-craving obesity' and premenstrual syndrome. It has also been suggested that individuals will often 'self-medicate' with high carbohydrate foods to relieve their depression (Singh, 2014; Young, 2007; Rogers, 2001). However, there is a different school of thought that takes the view that the difference in protein and carbohydrate intake achieved from a balanced diet are not enough to significantly distort brain serotonergic function or trigger behavioural changes (Rogers, 2010).

Vitamins and minerals are other sets of important substances essential for the functioning of the brain (Erikson, 2006): vitamins A, C, E, and the B vitamins complex are the most relevant for optimal cerebral activity. Among minerals, manganese and magnesium are particularly useful, while sodium, potassium and calcium play a role in message transmission and the thinking

process. As previously mentioned, micronutrients are crucial to chemical messengers within the brain, which act as neurotransmitters to transport messages between neurons. An overview of relevant literature on the effects of nutrients on certain aspects of brain functions was carried out by Bourre (2006). The review underlined the importance of a number vitamins and nutrients as vital for human cognitive performance. Thus, vitamins such as thiamine (B1), riboflavin (B2) and niacin (B3) were reported as having a role in enhancing abstract thought and biochemical status and vitamin C in improving visual-spatial performance. Bourre (2006) cites the work of La Rue et al., which reported research results that show vitamins B12, B6, A, and E as contributory factors in increased visuo-spatial memory and abstraction test scores. Nutrient minerals like iron, zinc, iodine, magnesium, and selenium were also identified as playing a number of different roles in brain function (Bourre, 2006). Iron has been recognized as an important nutrient for brain energy production and cerebral functions such as cognitive performance. Greig et al. (2013) review of eight studies into the iron nutrient and its effect on concentration revealed that participants with normal to high levels of iron reported higher cognitive scores than participants with lowered levels of iron, whose cognition scores improved after iron treatment. Wood (2001) also emphasized the importance of zinc for the brain, in particular in relation with memory, citing experiments testing verbal memory that found that the ability to remember everyday words slowed significantly in subjects who followed a low-zinc diet for three weeks compared to those who did not.

Another important group of nutrient for brain function are fatty acids. Erikson (2006) points out that fatty acids makes up more than 60% of the brain and acts as a chemical messenger that helps to moderate human mood. Omega-3 fatty acids are regarded as the most important for the optimum performance of the brain, so much so that a lack of these fats can lead to depression, poor memory, low IQ, learning disabilities, dyslexia, and ADD (Erikson, 2006). A study by Maes et al., cited by Casper (2005) demonstrated that rising incidence of patients with major depression is associated with reducing levels of omega–3 polyunsaturated fatty acids and higher ratios of omega–6/omega–3 of patients with depression, is directly proportional to the degree of depression.

A diet rich in Omega-3 fatty acid will consist mainly of fish and sea foods, and to a smaller extent meat and eggs (Meyer et al., 2003). Gómez-Pinilla (2008) suggested that diets high in trans-fats and saturated fats adversely affect cognition and underline the relevance of a healthy diet for brain performance. Fast food and most junk foods are rich in trans and saturated fats, thus high and repeated consumption of junk food may affect brain synapses as well as many molecules that aid learning and memory. It can therefore be argued that a diet low in trans-fats and saturated fats and high in Omega-3 fatty acids can strengthen synapses and provide cognitive benefits (Wolpert and Wheeler, 2008). Gómez-Pinilla (2008) also states that Omega-3 fatty acids such as those found in salmon, kiwi fruit, and walnuts, are essential for normal brain function and support improvements to memory

and learning. He argues that Omega-3 fatty acids has a direct influence on synaptic plasticity and promotes the production of molecules in the synapses that support learning and memory. Omega-3 fatty acids insufficiency can therefore lead to increased risk of attention-deficit disorder and dyslexia (Gómez-Pinilla, 2008). Likewise, Peet and Stokes (2005) suggests that a diet with foods rich in omega–3 fatty acid, low saturated fat and low sugar, is likely to be beneficial in the prevention and treatment of schizophrenia.

According to Wolpert and Wheeler (2008) studies have shown that children who increased their intake of Omega-3 fatty acids performed better in reading and spelling, and had fewer behavioural problems. A study by Wolfe et al., (2000) into the relationship between nutritional supplements, brain function and learning, reported that nutritional supplements and superfoods have very little positive effect on brain function of students. Whereas, healthy nutritional habits learned early in life help promote normal physiological and neurological growth and development, which is translated into students' achieving optimal learning (Wolfe et al., 2000).

Studies by a number of researchers (Dixon et al., 2001, Rose and Oliveira, 1997, Tarasuk and Beaton, 1999), show that there is a direct relationship between food deprivation and low energy and nutrient intakes. Similarly, a study by Dixon et al. (2001) reported that the diets of people who regularly have less to eat are frequently typified by low intakes of critical nutrients, which could compromise their health and expose them to higher risk of some chronic diseases.

In summary the evidence in the literature indicates that the composition and proportional amounts of macro and micro nutrient in diets can have a direct and an indirect effects on the mental health of an individual.

1.9 Theory of stress and food intake

The seminal work by Greeno and Wing (1994) proposed two models to explain the relationship between stress and eating, namely the general effect and the individual difference models. The general effect model hypotheses that the effect of stress on food intake is indiscriminate and will generally cause changes in eating behaviour, whilst individual difference model, predicts that stress will only causes changes in eating behaviour in vulnerable individuals (Nguyen-Rodriguez et al., 2008). The research on stress induced eating suggest that there are two key ways by which stress can influence an individual's food choice, namely, it can result in an increase or decrease in food intake. The effect of stress on appetite can be moderated by the body's physiological and psychological response to stress. According to some researchers (Hainer et al., 2006, Torres and Nowson, 2007), corticotropin-releasing hormones such as norepinephrine and cortisol associated with the body's physical stress response can influence appetite and as a consequence food choice and intake. The hormone norepinephrine which is released in the adrenal medulla of the brain often in response to stress is believed to play a crucial role in the hypothalamic paraventricular nucleus of the brain in supressing appetite and promoting satiety (Halford, 2001, Wellman, 2000). On the other hand, the release of cortisol by the adrenal glands, which is

triggered by acute stress, has also been identified as being responsible aggravating appetite (Takeda et al., 2004).

It has also been proposed that emotional response to stress, such as anxiety, anger, joy, depression, and sadness can act as influencers of dietary practices in terms of increasing or reducing food intake (Canetti et al., 2002, Scott et al., 2011). There has equally been a number of research studies (Dallman, 2010, Nguyen-Rodriguez et al., 2008, Rutters et al., 2009, Spoor et al., 2007) that have produced evidence to suggest that increase in food intake, normally referred to as comfort or reward eating, is a form of coping adopted by individuals to manage stressful situations.

This phenomena can be explained by the theory of allostatic regulation, which explains weight gain or loss arising from stress as a form of adaptive mechanism adopted by individuals. McEwen (2007) and Sterling (2004) hypothesize that chronic exposure to psychosocial stressors (allostatic load) over a long period of time can lead to physiological or behavioural changes in order to achieve allostatisis or homeostasis in the body system. Thus, changes in dietary behaviour and body weight can be regarded as an allostatic regulation, which allows students to adapt to academic stress. McEwen (1998, 2007) of the opinion that some people on exposure to a chronic stress are unable to adapt and as a result their response to stress is repeatedly debilitating, whilst others are able to adapt and adjust their response over time. These responses are distinct and represent extreme patterns of

adaptation that belong to a continuous spectrum ranging from weak to strong adaptive responses (Hill et al., 2010).

1.9.1 Meal Patterns and Format

There is a broad consensus in the literature that good mental and physical health and wellbeing is largely dependent on an individual having a regular lifelong diet that is nutritionally robust and balanced. Conversely, a poor diet is a key risk factor that can cause and/or exacerbate poor physical and mental health (WHO, 2009). However, it has been suggested that perceived stress may adversely impact the health of an individual by disrupting their dietary patterns in terms of stress mediated increase or decrease in food intake (Torres and Nowson 2007).

As earlier mentioned in this review, several studies have suggested that perceived stress is related to low levels of fruit, vegetable and protein intake and high levels of carbohydrates, sugary and salty foods/snacks. However, there is little understanding of how food intake is moderated by academic stress within the higher education context (Laugero et al., 2010). In other to better understand the relationship between perceived stress, food intake and health of undergraduates, there is a need to examine the diet of individuals in terms of meal patterns (i.e. meal frequency, skipping, timing etc.) and format (i.e. meal content, sequence, nutrient profile etc.), as well as their implications on the health of an individual (Jacobs and Steffen, 2003; Mesas et al., 2013 Leech et al., 2015). This approach provides a good means of closely

examining the impact of perceived stress on dietary behaviour of undergraduates as a comparison of meal patterns and format before and during academic examinations can help identify changes in food intake and associations with examinations as an academic stressor.

1.10 Relationship between Stress and Dietary Behaviour: A review of the evidence

The evidence in the literature indicates that the composition and proportional amounts of macro and micro nutrient in diets as well as meal patterns can have a temporary or long-term effect, as well as beneficial or adverse effects on the physical and mental health of an individual. Given the importance of nutrition to health and wellbeing, any factor that influences the character of food choice and dietary habits is a cause of concern. The literature on food choice and dietary behaviour indicates that there are several factors that help shape the dietary practices of individuals in society; these include self-esteem/body dissatisfaction, gender, age, ethnicity and socio-economic status (Pollard et al., 2002, Seepersad, 2012). There are a number of research studies (Polivy and Herman, 2002; Johnson et al., 2004; Neumark-Sztainer et al., 2006), which indicate that low self-esteem and dissatisfaction with body image are useful predictors of disordered eating and low food intake. It follows that people with high self-esteem and body image satisfaction are likely to exhibit different eating behaviours. A large number of research studies have shown that the food preference, eating behaviour and dietary patterns are associated with gender (Beardsworth et al., 2002;

Wardle et al., 2004; Clarke et al., 2009). The results of a number of studies suggested that the choice of specific food types, composition, frequency and size of meals differs between females and males (Arganini et al., 2012). According to a number of researchers (Beardsworth et al., 2002; Fulkerson et al., 2004; Pollard et al., 2002; Sobal, 2005;Prättälä et al., 2007), women are more likely to have fruit and vegetables in their diet than men. Equally, women prefer fish, diary and high fibre food products, whereas men are more associated with a diet rich in red meat, carbohydrates, low in fat and high in alcoholic beverage intake. Men are also more likely to have larger portions of food and eat more frequently than women (Sobal, 2005; Berbesque, 2009).

The role of age as a predictor of dietary behaviour is unclear as some studies have indicated that dieting and low food intake are prevalent amongst younger adolescents (O'Dea and Abraham, 1999, Stice et al., 2000). On the contrary other studies (Comer, 2013, Heatherton et al., 1997) suggest that it is more common amongst older adolescents. Race and ethnicity is also regarded as a possible predictor of eating behaviour. There is a lot of evidence which suggest that people of African descent exhibit a dietary behaviour different from other ethnic groups and characterized by high intake of food and nutrients (Wildes et al., 2001; Roberts et al., 2006). Similarly, there is a lot of evidence that points towards a strong relationship between nutritional content of diets and the socio-economic class of individuals (Darmon and Drewnowski, 2008). These studies (De Irala-Estevez et al., 2000, Giskes et al., 2002, Giskes et al., 2004, Ricciuto and Tarasuk, 2007) show that nutrient rich

diets are associated with persons of higher socioeconomic status, whilst diets that are characterized by high energy and nutrient poor foods are often preferred by persons experiencing socioeconomic hardships.

There are also environmental factors, such as food advertisements, increased variety in food choice, social eating patterns etc. that can influence eating behaviour (Webber, 2003, Weinsier et al., 1998). Stress has increasingly been identified as one of the key environmental factors that can influence eating patterns in humans (Macht et al., 2005, Oliver and Wardle, 1999, Torres and Nowson, 2007). However, the nature of its influence remains disputed and at best regarded as bi-directional as some studies have shown that stress causes an increase in food intake, particularly saturated in fats and sugars (Wardle et al., 2000, Zellner et al., 2006), whilst other research studies have reported that stress triggers dietary restraint and consequent reduction in food intake (Wardle et al., 2000; Habhab et al., 2009)

1.11 Controlled and Naturalistic Human Studies

The role played by the body's response to stress in terms of changing eating behaviour has been the focus of several animal and human studies. There is a significant amount of empirical evidence of the relationship between stress and dietary habits in animal studies. The evidence emerging from studies using rat models to examine the effect of stress on food intake are varied, with results ranging from increase, decrease and no change in food intake by rats under stress. Torres and Nowson (2007) in a review of rat model studies, concluded that the chronic or acute application of severe

stress (e.g. physical immobilization) or moderate stress (e.g. movement restriction and protracted loud noise) resulted in a reduction in food intake in rats. The review also indicated that application of lower levels of stress (such as mild tail pinch, repeated handling) had no effect on appetite or result in increased food intake. A rat model study by Rowland and Antelman, cited in Torres and Nowson (2007) reported that rats increased their food intake and exhibited a heightened preference for sugary foods in response to low levels of stress. These results are similar with that of Diane et al. (2008) who reported that rats respond to moderate levels of stress by increasing their consumption of foods rich in fats. Torres and Nowson (2007) conclude that the relationship between stress and food intake is moderated by the severity of the stressor and the food choices, hence the discrepancies in the results obtained by these studies.

Nonetheless, these findings cannot be directly transferred to human populations due to methodological disparities and obvious differences in physiology and psychology between humans and animals (Lang et al., 2000). Consequently, analogous research has focused on laboratory based interventions aimed at assessing the effect of induced stress on dietary patterns sampled human populations across several demographic categories.

A review of the few human studies on the effects of laboratory-induced stress on food intake indicates that consumption is not significantly impacted following acute stress (Torres and Nowson, 2007). In a study by Oliver et al. (2000) acute stress was induced in a sample group of participants by asking

them to prepare a 4 minute speech which will be filmed after a meal. The results showed that there was no change in food intake or choice between the study group and a control group of participants. Similar results were reported by Epel et al. (2001) who induced stress in a study group of 59 women by asking them to solve puzzles and serial subtractions of prime numbers as well as prepare and deliver a videotaped speech within 45 minutes. The results showed that there was no difference in participants' food intake and choice during the stressful period and during a period of no stress when they were not required to complete any tasks.

In similar studies conducted by Habhab et al. (2009) and Zellner et al. (2006), researchers examined the impact of induced stress on the eating behaviour of female university students. In these studies, stress was induced by asking participants to complete an extremely complicated task (e.g. Sudoku puzzle anagrams) or within a limited time period. The study design required half the sample of participants to complete the difficult tasks, whilst the other half were given an easier version of the task to complete in the allocated time. According to Habhab et al. (2009), stress was exacerbated by positioning both groups of participants next to each other to create a competitive egocentric environment. As part of the study design, four categories of food items with varying fat, salt and sugar content (e.g. chocolate coated peanuts, crisps, dry roasted peanuts, honey-flavoured crackers, pretzels, and red grapes), were placed in front of each participant. The results of the studies revealed that participants in the high stress group ate considerably higher amounts of sweet

and high fat items compared to the control group (Habhab et al., 2009, Zellner et al., 2006). It could therefore be argued that during episodes of induced stress, individuals will tend to consume more foods high in fat and sugar.

However, some researchers (Cohen et al., 1997, Costarelli and Patsai, 2012, Torres and Nowson, 2007) argue that while the design of most laboratory type studies include controls in the form of blood pressure, heart rate or mood changes monitoring, induced stress under controlled conditions are representative of every day stressors, which are typically associated with chronic stress and adverse impact on food intake and choice. Therefore, methods that measure perceived stress levels and food intake using self-report questionnaires and food diaries respectively are better suited to examine the effect of everyday stress on eating behaviours.

1.12 Stress-Dietary Behaviour of Undergraduate Students

Naturally occurring stressful situations, such as stress experienced within an educational setting, provide an experimental context in which stress-induced eating behaviour can be studied have been the focus of some research (Costarelli and Patsai, 2012, Liu et al., 2007). Teenagers and young adults have been identified as particularly susceptible to extremely stressful episodes brought about by academic and social hassles. A study by Michaud et al., (2006) examined the effect of stress (i.e. a major school examination) on the eating behaviour of 225 high-school students. The research results showed that students increased their food intake during examination period suggesting that stressful events can cause changes in the eating habits of

students. In a similar study, Kim et al. (2013) examined stress-induced eating patterns of Korean high school students and results showed that students with perceived high stress levels, consumed larger quantities of food compared to students with lower levels of stress. Additionally, the study showed that students with high levels of stress had higher intake of sugary foods than the students with lower stress levels. This was due to the increased consumption of snacks such as chocolates, sweets and flavoured milk (Kim et al., 2013).

The effect of stress on dietary behaviours of undergraduates has also been the focus of some research, given that university education is considered to be a very stressful experience. In a study by Oliver and Wardle (1999), the effects of stress on the eating behaviour and food intake of 212 first year undergraduate students from University College London was examined. Using self-reports obtained from administering a brief questionnaire, the study revealed that the majority of students reported eating more snacks (e.g. cakes, biscuits, sweets, chocolate) and less meal type foods (fruit and vegetables, meat and fish) when stressed. Oliver and Wardle (1999) suggest that the dieting status of participants is a predictor of the effect of stress on eating behaviour as dieters in the study were more likely to report increased food intake when stressed, whilst non-dieters reported eating less when stressed.

A similar cross sectional study by Serlachius et al. (2007) conducted at the same university and with 268 students from the same target group (i.e.

first year undergraduates) examined the effect of chronic stress on weight gained by students over the course of their first year at the university. The research results showed that 55% of study participants reported weight gain, whilst 12 % of students reported weight loss in response to chronic academic stress over the course of the academic year. Serlachius et al. (2007) are therefore of the view that both the risk of weight gain and weight loss in students is associated with academic stress, with women more likely to report high levels of perceived stress.

The role of gender as a predictor of the nature of stress-dietary behaviour relationship in an academic setting has been underlined by other research studies. Mikolajczyk et al. (2009) examined the relationship between stress and food consumption and choice in 2,103 first year undergraduate students in universities across Germany, Poland and Bulgaria as part of a Cross National Student Health Survey. The results showed that there was a statistical significant relationship between reported high levels of perceived stress with increased intake of unhealthy foods (e.g. sweets, biscuits, snacks and fast food) and reduced intake of healthy foods (e.g. fruit and vegetables) amongst female students but not among male students (Mikolajczyk et al., 2009). It could therefore be inferred that female undergraduate students are more prone to changing their dietary behaviour in response to stress.

There is also further evidence that buttress the proposition that stress influences food choice. Liu et al. (2007) carried out a cross-sectional study involving a population of 2,579 undergraduate students drawn from

universities in seven cities across china. The study used self-reports of perceived stress, depression and the frequency of food intake of five types of food categories of varying carbohydrate and energy content: ready-to-eat foods, fresh fruits, snack food items, sweets, and fast-food. The research findings showed that perceived stress was associated with poor dietary intake as participants reported that the higher the perceived stress levels, the less intake of fresh fruits and higher intake of ready-to-eat foods and snack food items.

A recent study by Wansink et al. (2013) examined food choices of undergraduate students on Cornell University's campus in the USA. Food snacks on the cafeteria's menu were categorised into healthy snacks and unhealthy snacks and data on snack choices was collated from three cafeterias on campus over the course of an academic year. The results showed that there was an increase in the consumption of unhealthy snacks as each semester progressed. Noteworthy, in the final two weeks of semesters, healthy food purchases reduced by 4% whilst unhealthy food purchases increased by 8% with both changes being statistically significant. Wansink et al. (2013) concluded that this change observed during the last two weeks of each semester was associated with examinations and term paper deadlines. Ahmed et al. (2014) examined the relationship between stress and food choice in a cross-sectional study of 407 (164 males and 243 females) undergraduate students in a Kuwaiti University. The results showed that

female students were more likely to eat unhealthy foods (fast foods, snacks and beverages) than stressed male students and unstressed female students.

These studies suggest that undergraduate students respond to stress by increasing their intake of food and snacks, especially unhealthy foods rich in sugar and fat. It could therefore be argued that academic stress induced by examinations and deadlines can cause an increase in unhealthy food consumption by students. This hypothesis is supported by the results reported in other studies that focused on different naturalistic settings (O'Connor et al., 2008). In these longitudinal studies, participants used daily diaries to provide information about food intake and stressors encountered. Research findings showed that those respondents who reported high levels of stress also stated that they ate either more or less when stressed (Oliver and Wardle, 1999; Brownell, 1994). Those who experienced at least one stressful episode reported consuming more snacks between meals and less main meals and vegetables on stressful days. Results also suggest that increased snacking was associated with work-related hassles such as meeting a target/deadline, on the other hand decreased reduced intake of snacks was associated with physical stressors such as illness or threat of attack by a dog (O'Connor et al., 2008).

However, the effect of stress on diet is however inconclusive as there are other studies that suggest that academic stress during examinations does not lead to changes in dietary behaviour. Studies by O'Donnell et al. (1987), and Pollard et al. (1995) compared changes in eating behaviour of university

students living in Dublin and London respectively. Self-reports of stress and eating behaviour by students sitting for examinations were compared with that of a control group. The results revealed that whilst there was significant evidence of stress prior to taking examinations, there was no significant effect of examination related stress on food and nutrient intake (O'Donnell et al., 1987, Pollard et al., 1995). Likewise, in a study by Macht et al. (2005), which examined the relationship between stress and the eating behaviour of 122 German students and compared their reported perceived stress and eating one month and a few days before an examination with a control group, with no planned examinations. The results showed that although students reported varying levels of stress and eating to cope, there was no significant difference in the food intake or choice between the study and control groups of students.

1.13 A Middle-Eastern Perspective

Traditionally, Middle Eastern diet is naturally healthy as it is largely based on foods such as fresh vegetables, fruit and fish. The Middle Eastern diet is similar to that of the Mediterranean regions where healthy and wholesome foods had historically been at the core of their diet. In the past few decades, the Saudi Arabian society has experienced significant changes in its dietary habits, resulting in an increase in the incidence of overweight and obesity across the population (Al-Daghri et al., 2014b, Majeed, 2015). The influence of western diets of fast food and high calorie foods has had an adverse effect on its population particularly the younger section of its society,

a trend reflected in the exponential increase in obesity (Al-Rethaiaa et al., 2010).

Recent studies showed that Saudi school students' consumption of animal based products has significantly increased, while their intake of fruit and vegetable has declined (Amin et al., 2008, Mahfouz et al., 2008). The same pattern of change has also been observed in university undergraduate students. According to Al-Rethaiaa et al. (2010) 30% of female students in Saudi universities are either overweight or obese. Similarly, Al Qauhiz (2010) reported that in Saudi universities the levels of overweight and obesity recently reached 54% and 17.4% respectively. The high incidence of overweight and obesity have been shown to be associated with poor dietary habits, high consumption of fast and high calorie foods and low intake of healthier foods. A study by Sheikh-Ismail et al. (2009) examined the dietary habits of female students in the faculty of applied medical science in Jazan University, Saudi Arabia. The study results showed that a large proportion of female students (73.3 %) tend to skip meals and 28% of them tend to skip breakfast. Whilst the majority of the student body (75%) was aware of the influence of good nutrition on health and academic performance, nearly half of them did not apply such knowledge to their everyday dealings with food. It was reported that 98% of the sample consume fast food on a regular basis, and 63% did not undertake any form of exercise, mostly due to a lack of facilities in or around campus. In another study by Majeed (2015) that investigated the relationship between stress, dietary habits and exercise in

215 female undergraduate students from Dammam University, Saudi Arabia, results indicated that students favoured home cooked food but were prone to eat more food and candy when stressed. Whilst this study suggests that the reported academic stressors and dietary behaviour are similar to that of other undergraduates around the world, there is no indication that coping strategies adopted are similar. It has been suggested by Elzubeir et al. (2010) that people from middle-eastern countries are culturally disposed to turning to religion and/or social support when coping with stress rather than actively cope with stress personally or by consulting a therapist.

In summary, the review of relevant literature suggests that there is extant evidence which shows that the eating behaviour of undergraduates can be influenced by academic stress. However, the nature and character of the stress – diet relationship is still a subject of debate due to contradicting evidence. A number of researchers (Liu et al., 2007, Ng and Jeffery, 2003, O'Connor et al., 2008, Oliver and Wardle, 1999) have reported that stress triggers the increased intake of food, with a particularly preference for high energy sugary and fatty foods. Conversely, a number of studies (O'Connor et al., 2008, Wardle et al., 2000; Oliver and Wardle, 1999, Stone and Brownell, 1994) have reported results which show that stress can lead to a reduction in food intake. Other researchers, such as Epel et al. (2001), and Oliver et al. (2000) have reported that stress has no effect on food intake.

On balance, there is a relatively larger body of evidence that support the hypothesis that academic stress leads to increased food intake. This change in

dietary behaviour can result in excessive weight gain and obesity, as well as associated increase in the risk of degenerative diseases such as coronary heart disease, cardiovascular diseases and type 2 diabetes mellitus. As a consequence there is a need for better understanding of the relationship between academic stress and eating behaviour in furthering the development of new and effective preventive and therapeutic strategies.

1.14 Rationale for Further Research

The effects of academic stress on student populations are diverse as they are heterogeneous. There is substantive evidence in the literature that indicate that changes in the dietary pattern of undergraduate students is associated with academic stress (Fabián et al., 2013) either as a direct response to a stressor or as a side effect of food-mediated coping. However, there are gaps in the literature with respect to how external factors (such as academic year/course of study and socio-cultural influences) and internal factors (such as life style choices and coping strategies) influence the stress-diet relationship amongst undergraduates. Consequently, current evidence on the subject is limited, and understanding of the stress-diet relationship remain sketchy particularly in non-western higher institutions and societies with significantly different cultural and social contexts.

In order to improve understanding of why the effect of stress on the dietary behaviour is expressed differently by different groups of undergraduates, the variables that are likely to influence the stress-diet relationship need to be considered in more detail. Factors that may play a role

in determining if and how distress is related to food intake in an academic setting include distress severity and type, eating styles, and gender (Greeno and Wing, 1994, Torres and Nowson, 2007). The potential moderating effects of eating styles and gender on the stress – diet relationship has been an area of particular research interest as stress may not always translate to changes in diet composition and/or food intake, particularly in the presence of academic examinations. However, the majority of these studies were carried out in Western countries that have similar cultures and social influences. Given that culture and ethnicity are potential moderating factors of the stress- diet relationship, the results found in these studies may not be representative of university students globally. This is due to differences in environment, food and culture, structure of university education and access to stress management related health services. It is therefore important to analyse the evidence base for stress and food choice for university students living in non-western countries, such as the Middle East, for example. A number of studies have researched the subject of stress amongst undergraduate students in non-western universities.

Sedky (2012) examined the sources of stress among dental students enrolled at Pharos University in Alexandria in Egypt, and explore the role of gender, level of undergraduate study and residence with parents on perceived stressors. The study revealed that female students experienced greater stress than males and identified workload, performance pressure, and self-efficacy beliefs as key stressors. In another study, Abdulghani (2008) explored the

prevalence of stress among 600 undergraduate medical students at College of Medicine, King Saud University and reported that there was a high level of stress amongst medical students and this is linked to academic year, grades, regularity and physical problems. In a similar study, Al-Sowygh (2013) investigate the sources of stress among a sample of 556 undergraduate dental students King Saud University, Saudi Arabia, their perceived levels of stress and effective coping strategies. The results of the study indicated that students reported high levels of stress in relation to academic stressors and used axioms like "active coping", "planning", "religion", and "acceptance" to describe strategies for coping with stress. However, changes in diet or food intake were not mentioned as a coping mechanism.

Similar studies (Amr et al., 2008, El-Gilany et al., 2008) on academic stress from a middle-eastern context have focused on medical students based on the assumption that there are more exposed to high stress levels. El-Gilany et al. (2008) compared the character of academic stressors encountered by medical students in universities in Egypt and Saudi Arabia. The study result indicated that stressors (congested classrooms; inconsiderate and insensitive instructors; fear of the future; limited time for recreational activities) experienced by medical students in both countries were similar. Likewise, Amr et al. (2008) examined the influence of gender on perceived stress using a sample of medical students in a university in Egypt. The study results indicated that the type and intensity of stressors experienced by medical students is not influenced by gender. These results differ from that of Zhang

et al. (2012) which examined a similar question amongst college students in the USA and reported that male students generally present moderate level of academic stress, whereas female students have statistically significant more intense symptoms of academic stress than male students.

However, a review of the literature indicates that the vast majority of research on academic stress in a middle- eastern context have focused on the type and severity of academic stressors and to a lesser extent on the coping strategies adopted by undergraduate students. There remains a significant paucity of research into the effect of stress on the diet and food intake of undergraduate student and far less knowledge of the factors which influence its outcome.

1.14.1 Research Question

In order to address these gaps in the literature, this study will focus on examining the effect of academic stress on the dietary behaviour of undergraduates in the Kingdom of Saudi Arabia, by answering the following question;

"What is the effect of academic stress on the dietary behaviour of female undergraduate students in King Abdul-Aziz University in Saudi Arabia and how it is moderated by the lifestyle choices and coping mechanisms adopted by students?

1.14.2 Research Aim and Objectives

In order to answer the research question, the research will comprise of two studies, a baseline study to examine the research question during periods of relatively low academic stress i.e. no examinations scheduled; and a follow-up study to compare reported baseline results with that reported during a relatively high stress episode i.e. examination period.

1.14.3 Study 1 Objectives

The following are the principal objectives of the baseline study;

1. To examine the healthy lifestyle choices of the sample of female students during non-examination period (low stress conditions).
2. To investigate the perceived level of stress reported across the demography of the sample of female students during non-examination period (low stress conditions).

1.14.4 Study 2 Objectives

The following are the principal objectives of the follow-up study;

1. To investigate the perceived level of stress reported across the demography of a sample of female students during examination period (high stress conditions).
2. To examine the healthy lifestyle choices of the sample of female students during examination period (high stress conditions).

1.15 Conceptual framework

The theories of stress and coping espoused in the literature review was used as a basis to develop a conceptual framework for this research. The framework is intended to facilitate understanding and explanation of the relationship between examination stress, coping and changes in the dietary behavior of undergraduate students in Saudi Arabia. The transactional theory of stress and coping provides the primary basis for which changes in the eating behaviour of undergraduate students is hypothesized as a function of stressors within the university environment. The key environmental stressor under consideration in this framework is the stress brought about by academic examinations (Figure 1).

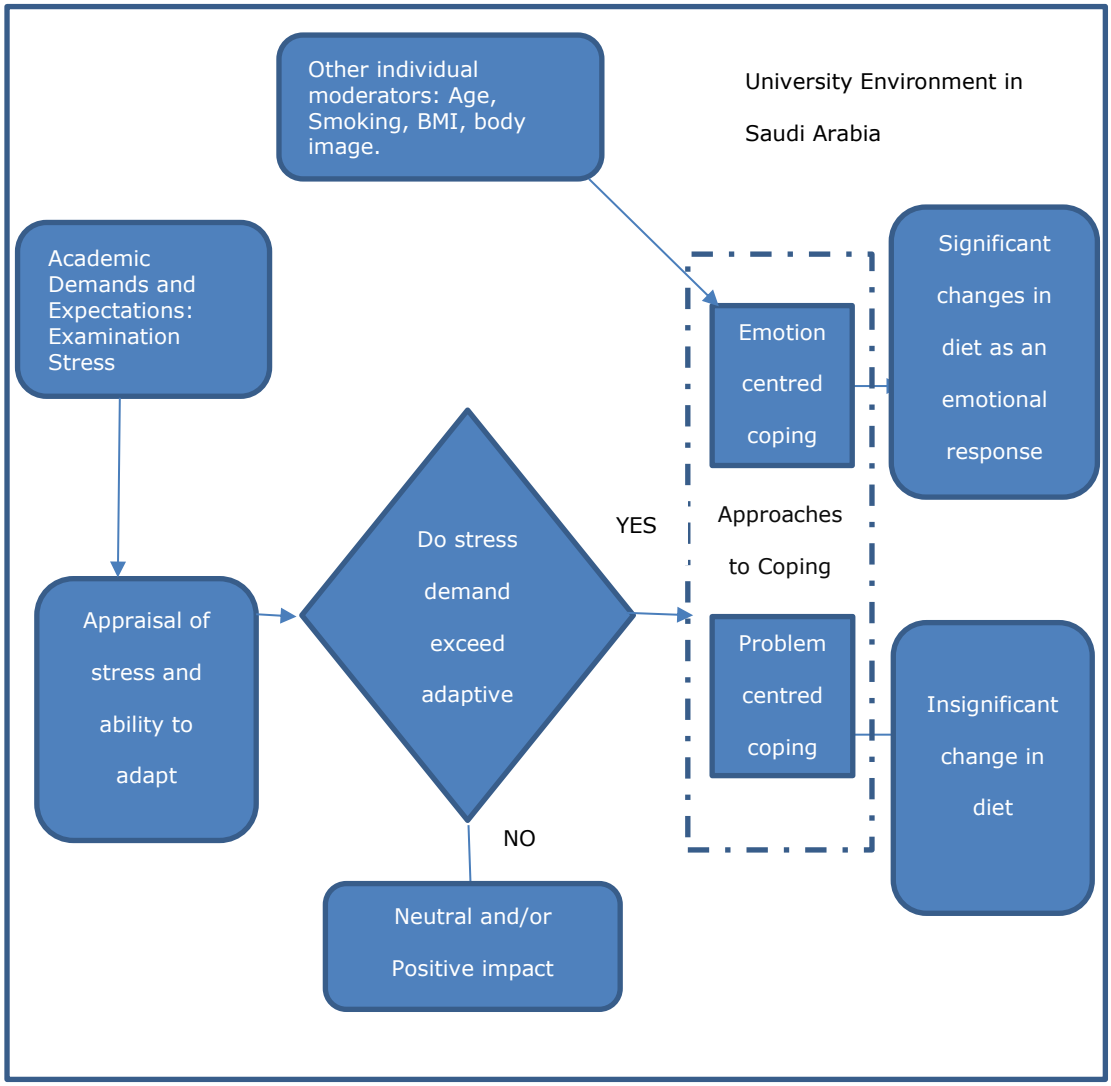


Figure 1 A Conceptual Framework linking examination stress to changes in diet (Adapted from Lazarus and FolkMan's Transactional Model of Stress and Coping)

Academic examinations: undergraduates are exposed to a range of stressors in the university environment, with academic examinations being arguably the most significant and most visible stressor amongst students. It is conceptualised that the onset of examinations triggers test anxiety, aggressive

grade competition and the fear of failure that solely or in combination lead to examination stress for some undergraduates (Pfeiffer, 2001).

Appraisal of adaptive capabilities: The existence of examinations as a stressor in the university environment does not ordinarily translate to stressful episodes for all students. It is conceptualized that students will evaluate the potential significance and magnitude of impact of the stressor on their lives and make a decision on their ability to adapt to the impact in terms of whether it will be nonthreatening or stressful.

Coping: when the results of an appraisal concludes that an examination is stressful, it is theorized that students will adopt coping strategies to either eliminate, mitigate and /or control both external stressor and internal response to it (Palmer and Rodger, 2009). It is proposed in this model that students' coping responses could be categorised into two sub classes, namely problem focused coping strategies dedicated to managing or changing the stressful situation, and emotion focused coping strategies that modulate emotional responses (including feelings and thoughts) to examination stress.

Changes in dietary behaviour: the use of emotion focused coping strategies by students is considered to be a useful indicator that statistically significant changes in dietary behaviour is likely to occur. These changes will relate particularly to frequency of food intake, portion size and food type, with long term implications for their health. Whereas the use of problem focused coping strategies will often lead to the engagement of external controls to

manage stressful situations that will not result in emotive decisions that lead to significant change in their diet.

Other personal moderators: the conceptual framework also underlines the interaction between coping strategies and personal factors that directly or indirectly influence undergraduates' dietary behavior. In this study, the age, smoking status and BMI of students as well as their perception of their body image was considered the most crucial personal factor that is likely to exacerbate students' emotional response to academic stress.

The following chapters will set out the research methodology and design that underpinned this research, a presentation of the study results and discussion relative to the research question and the wider literature and proposals for future research.

2 Methodology and pilot study

2.1 Methodological Procedures

This chapter sets out in detail the methodological procedures employed in this study and will be broken down into three major sections. The first section will discuss the research design; outline the research method; describe the study population and their selection; outline the research instruments; and the procedures for data collection and analysis. The subsequent section will discuss the reliability and validity of the methodological procedures and ethical considerations of the research. The closing section will discuss the method and results of a pilot study designed to test the Arabic versions of the research instruments for readability, understand ability, and cultural relevance as well as to determine the feasibility of the entire research strategy.

2.1.1 **Research design**

The research design is intended to facilitate the generation of answers to the research question about the effect of academic stress on the dietary behaviour of students during examinations. It is an action plan that outlines a systematic approach to carrying out a research. The design includes the selection of an appropriate study population; design of techniques for data collection, analysis and interpretation; and the researcher conduct that upholds the integrity of the research (Creswell, 2013).

The strategy adopted in this research comprise of a longitudinal survey using multiple measurement tools to collect and analyse data at two different time points. The methodological design of the study was largely informed by research questions and objectives but was also influenced by the particular constraints of the research setting, time and resources available to conduct the research. The details of the research design are outlined in the following paragraphs.

2.1.2 Longitudinal Survey

In order to investigate the effects of academic stress on the dietary behaviour of university students in Saudi Arabia, a longitudinal survey of a convenient sample of undergraduate students in King Abdul-Aziz University was considered to be the most appropriate research design. According to Harwell (2011) longitudinal survey entails the gathering of data on the same variables from the same population sample at more than one time points. Longitudinal studies have subsequently been used variously to investigate changes in the characteristics of a given population of students as a result of the effects of academic stress (Stice et al., 2000; Vaez and Laflamme, 2008; Wardle et al., 2011).

The design of this longitudinal study involved data collection at two different points in time. The first of these corresponds to a baseline study conducted during the start of the first and second semester of the 2011-2012 academic years at King Abdul-Aziz University. The survey was designed to use

a set of research instruments to capture background data relevant to establishing a starting point for comparing variables relevant to the research question. The second data collection point representing a follow-up study was carried out just before the first and second semester examination periods of the 2011-2012 academic year. This longitudinal survey targeted undergraduate students in all levels of study (except first and final year students, due to their susceptibility to very high levels of stress) and from all academic faculties at the university. Consequently, the study results will provide an archetypal snap-shot of the undergraduate student populations' perception of stress and its effect. The survey was designed to use research instruments that facilitated comparative analysis of reported stress levels, dietary intake and coping strategies. The data generated from these surveys will be processed and analysed singly and comparatively to obtain results that will help address the research question.

An important benefit of using a longitudinal design in research is that it facilitates the identification of patterns of behaviour and changes in variables relative to a given sample population (Fitzmaurice et al., 2012, Fraley and Hudson, 2014, Zapf et al., 1996). Longitudinal studies are also considered to be very useful in establishing causal relationships as well as associations between different events and variables over time. Since longitudinal studies facilitate the generation of a large body of data over a period of time, they have been associated with results that are considered to have high reliability, accuracy and validity (Fitzmaurice et al., 2012, Fraley and Hudson, 2014, Zapf

et al., 1996). Longitudinal studies can however be adversely impacted by drop outs of participant over the course of the study, which reduces the volume of useable data for analysis and inference. Similarly, the collection of data at specified time-points means that the results do not take into consideration the effect of events between the different time-points. Additionally, the results of longitudinal studies can be influenced by conditioned responses from participants who over time unwittingly change their responses to correspond with what they perceive to be the researcher's expectations.

2.1.3 Research Population Sample

The research was carried out in King Abdul-Aziz University, one of the leading universities in the Kingdom of Saudi Arabia with a student population of over 46,000 students[1]. The university was established in 1967 as the country's first private university and was later adopted as a government-led university in 1971. The institution currently has twenty-one academic faculties and colleges, which are split into two gender specific campuses for male and females in line with Islamic conventions. This research was restricted to the female campus of the university and participants were sampled from six academic faculties (Home Economics, Economics and Administration, Arts and Humanities, Applied Medical Sciences, Science and Medicine) with an approximate population of 15,250 female students.

[1] https://www.timeshighereducation.co.uk/world-university-rankings/king-abdulaziz-university?ranking-dataset=1072

The population sample excluded male participants given the administrative difficulties of securing permission from the university and socio-cultural challenges of a female researcher carrying out research in all male setting at the university. It also excluded first year and final year students from the study as they are considered to be susceptible to very high levels of stress (Alipuria, 2007, Ross et al., 1999) and may skew the research results.

2.1.4 Research Instruments

In this study, a number of research instruments were used to measure the variables of concern, which include participants 'perceived stress, coping strategies, food intake and several key demographic and lifestyle characteristics. These tools include a general questionnaire, perceived stress scale (PSS14), Brief COPE questionnaire and 24 Hour Food Intake Recall Method. The nature of these instruments is explained in detail in the following paragraphs.

2.1.4.1 General Questionnaire

A general questionnaire was designed to collate demographic and general data on participants in order to provide contextual information about their food intake and dietary behaviour, response to stress and perception of their body image. The questionnaire is a 34 item instrument comprising four broad sections (see Appendix A). The first section focused on collecting contact information (name, phone numbers and emails) and general

demographic data, (e.g. date of birth, course of study and level of study). The second section was concerned with respondents' anthropometric characteristics (e.g. height and weight) and their perception of body image (e.g. perception of ideal weight, actively trying to lose weight, involvement in physical exercise etc.).

In this study, ideal BMI was considered an indicator of the preferred BMI of participants based on their self-perceived ideal body weight. It was measured by asking participants to state what their preferred 'ideal' body weight against their current weight, and the resulting ideal BMI was calculated using the standard formula:

Ideal BMI = Ideal weight (Kg)/height squared (m^2)

The Ideal BMI was thus used in this study to explore participants' perception of their body image and to examine any links between dissatisfaction with their body image and dietary intake.

The questionnaire also included a section on participants' dietary behaviour and their intake of high energy sugary and fatty foods (e.g. sweets, chocolates, soft drinks etc.) as well as the use of stimulants such as coffee, high energy drinks and tobacco etc.

The final section of the questionnaire focused on participants reported dietary response to stress during exams as well as specific stress-related symptoms during exams or other stressful periods. The respondents were

asked to choose one or more of twenty one mental and physical symptoms they have experienced during periods of stress. Data was collected on stress symptoms as they may indicate the severity of a stressful episode as well as an indicator of the effectiveness of a coping strategy.

This questionnaire was translated into Arabic (Appendix E) and validated during a pilot study.

2.1.4.2 Perceived Stress Scale (PSS)

Self-report measures are the most widely used research instrument for measuring stress (Lee, 2012). The perceived stress scale (PSS-14) is a self-report measure that used in this research to assess levels of perceived stress. It is a 14 item instrument designed by Cohen in 1983 to assess the degree to which individuals perceive their life experience over the previous month to be stressful. Participants are expected to provide a response to each item using a 5 point response measure (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often and 4 = very often). PSS14 has a two part structure comprising of 7 positive items (questions 1, 2, 3, 8, 11, 12, and 14) and 7 negative items (questions 4, 5, 6, 7, 9, 10, and 1). The responses from the negative items are reversed scored when analysing the data, giving a score range of 0-56, with high scores interpreted as signifying a high level of perceived stress (Cohen et al., 1983). The PSS-14 is a validated tool that has been shown to have relatively high internal consistency of scale items (Cronbach's alpha 0.75 to 0.91) and high reliability, and as such it is very useful in measuring perceived

levels of stress (Andreou et al., 2011; Cole, 1999; Hewitt et al., 1992; Cohen et al., 1983). It has also proven to be a useful, easily understood and adaptable tool for studying stress in different countries and been translated from English into a number of different languages including Korean (Lee et al., 2015), Spanish (Remor, 2006), Portuguese (Reis et al., 2010), Chinese (Leung et al., 2010), and Japanese (Mimura and Griffiths, 2008). The PSS-14 has therefore been used to study stress in many non-western settings with a high degree of reliability and validity. There has however been no published validated Arabic version of the PSS-14 instrument. As a result the PSS-14 English version (Appendix B) will be translated and validated as part of this research.

2.1.4.3 Brief COPE Questionnaire

In this study, the coping strategies adopted by participants will be measured using the Brief Cope self-report questionnaire developed by Carver (1997). The instrument is a 28-item measure designed to assess a range of coping behaviours in response to stress, which can be broadly described as functional and dysfunctional (Appendix C). The instrument is broken down into 14 subscales of two items each using a 4 point graduating response scale ranging from 1 (I haven't been doing this at all) to 4 (I've been doing this a lot). The items of the brief Cope scale has been shown to have high internal consistency, reliability and validity (Benson, 2010, Carver, 1997, Tuncay et al., 2008, Yusoff et al., 2010).

An adapted Arabic version of the Brief Cope questionnaire was designed to measure a range of coping responses based on emotional and problem focused coping distinctions set out by Skinner et al., (2003). The ensuing instrument consisted of 28 items that have been categorised into two subscales that measure problem focused and emotional focused strategies. The items of the brief Cope questionnaire was re-organised into these two categories with items 2,7,10, 14, 23, and 25 signifying problem-based coping, whilst the remaining items were categorised as emotion-based coping. Continuous scores for each subscale are obtained by summing the scores of all the items within that subscale. Possible scores on the problem focused coping subscale range from 6 to 24, while those on the emotional coping subscale range from 20 to 80. This questionnaire was validated as part of a pilot study carried out during this research.

2.1.4.4 24 hour Food Intake Recall Interviews

The data on food intake, type, frequency and quantity was collected using 24 hour dietary recall interviews. The researcher conducted face-to-face interviews with participants during examination and non-examination periods on three non-consecutive days, (including one day in the weekend) during non-exams period, and one day during exams. In this study a meal is described within the context of an eating event which usually represents any occasion when food or drink is consumed either as a core meal (breakfast,

lunch or dinner) or a small incidental meal such as a snack or consumption of a beverage.

During each pre-arranged interview participants were asked to recollect details of their dietary intake (food, drinks and snacks) over the previous 24hours. Interviewees were prompted to recall incidents that were linked to food intake (e.g. breakfast), or activities (e.g. completing an assignment or finishing a lecture) in order to gather data on the type and frequency of food and drink consumed. The interview also used visual prompts to help respondents recall the portion sizes of food and drink. The 24hour dietary data collected during the interviews were subsequently checked for omission/errors with the support of a trained dietician and is then coded for analysis.

The 24 hour recall data (Appendix D) included a table of food items, amount consumed, description of the meal and constituent food ingredients, and the cooking methods used. The daily diary record had four main components, namely, breakfast, lunch, dinner, and snacks. The data was consequently analysed in order to facilitate a comparative analysis of type, amount and frequency of food eaten during examination and non-examination periods.

The type of food eaten before and after exams was also analysed from the 24 hour food intake data on the basis of whether they can be categorised as a healthy meal or a fast food meal. In this study healthy meals were regarded as meals that freshly cooked with a balanced proportion of key nutrients

including fruit and vegetable based meals. Fast foods were regarded as meals bought from a food outlet that were not freshly made and were ready to eat with no further preparation (e.g. biscuits, chocolates, crisps, ready meals). The food record will be used to compute and analyse the calories and nutrient constituents of the foods eaten using the computer programme Dietplan6. It was also intended to measure the frequency, quantity and type of foods consumed during the study period.

A 24 hour recall method was adopted in place of other dietary measurement tools (e.g. food frequency questionnaires or food diaries) because it posed relatively less demand on participants' time and mental acuity, and was a method widely used in diet-human health studies (Jackson et al., 2008; Davies and Deery, 2013). According to Jackson et al., (2008) this method is appropriate for measuring food and drink intake in a large sample and group mean intakes of different diet.

It has been argued that the main limitation of the 24 hour recall method is that it is often not a true representation of an individual's typical intake because of daily variations normally occur. However, additional questioning during interviews has helped to address this limitation and more that 1 day has been examined as part of this research.

2.1.5 Data Collection Procedures

The collection of data at King Abdul-Aziz University was undertaken for three separate studies. A pilot study to validate the research tools and assess

the feasibility of the research, a baseline study to gather relevant research data during less stressful periods of the academic calendar and a follow-up study during the semester examinations. An initial pilot study was carried out during the second semester of the May 2010/11 academic session. Twenty participants were randomly recruited by the researcher at different lecture halls of the university and were invited to take part in the pilot study, irrespective of their course or year of study. Pilot study participants were asked to complete the four- part questionnaire (General Questionnaire, PSS14 Questionnaire; Brief Cope Questionnaire and 24 Hour Food Intake Recall Interview) during a non-exam period in the month of October 2010 and immediately before the semester examination period in January 2011.

During the baseline and follow-up studies, twenty volunteers were recruited and trained to support the participant recruitment process. The studies were run using research instruments modified and validated during the pilot study. The study participants were drawn from six academic faculties (Home Economics, Economics and Administration, Arts and Humanities, Applied Medical Sciences, Science and Medicine) across four levels of study (years 2-5). Data collection commenced at different time points for the two main research studies. The baseline study was conducted during the start of the first and second semester, while the follow-up was carried out just before the start of examinations for both semesters of the 2011/12 academic session.

Participants were randomly recruited from six faculties in the university during lectures that were a prerequisite for all students in the faculty and as such would have a high turnout rate. The researcher invited the body of students to take part in the study before the start of the lecture and at the end of the lecture. The researcher and some student volunteers then stood at vantage points inside and outside lecture halls approaching and signing up prospective participants.

2.1.6 Research Reliability and Validity

The research design for this study took into consideration a number of factors that could have an adverse impact on the reliability of the research. The most important of these factors is the validity of the translated research measures used in data collection as well as the objectivity and representativeness of the data generated during the research (Sperber, 2004). The research instruments (PSS14 and Brief Cope) used in this study have been extensively validated for internal consistency of the items as well as for test-retest reliability and as such statistical analysis of reliability were considered to be unnecessary in this research. These instruments were translated into Arabic and were tested for their readability, understandability, and cultural relevance of the items during a pilot study (see section 2.1.7 for details).

Additionally, the research design included procedures for addressing concerns about biased, low and misleading responses in the study. These usually arise as a result of participants sharing a particular set of

characteristics that is related to the research questions (for example a participant sample made up of only obese students studying home economics). As part of the research strategy, a stratified random sampling method was adopted to avoid and/or reduce response bias, the incidence of low rates of response and unrepresentative research sample. In this study, the stratified random technique involved categorising the undergraduate student population at the university into two groups with specific characteristic features. The first groups were registered to a particular academic faculty and the other, a given year of academic study. These demographic variables were used as they were the primary indicators used by the university's registry to report the student population distribution and thus provided a means of ensuring that the study sample population was sufficiently representative of the student population. The research design therefore involved randomly recruiting participants from a convenient sample of students drawn from six academic faculties and different year of study at the university during academic lectures. The sampling method also entailed targeting groups of students in a randomised manner, and is considered to be an efficient means of ensuring that the representativeness of the research sample. In addition, this technique reduces the risk of a low rate of response to the study as participants with different demographic characteristics were recruited from more than one academic faculty at the university and as such the risk of a low response from all the diverse groups was low. It also ensured that response bias is reduced as the sample were not drawn from a homogenous population

(i.e. first year students studying medicine) but a heterogeneous population sample that are unlikely to have similar physiological and psychological characteristics. However, self-selective bias of individual participants cannot be said to be eliminated or reduced as a result of this technique.

2.2 Pilot Study

The testing of research measures was an important component of the research design for this study and was achieved via a pilot study prior to carrying out a full scale longitudinal study. The aim of pilot is to test the readability, understandability, and cultural relevance of the Arabic versions of the research instruments (the General Questionnaire; PSS14; and Brief COPE Questionnaire) and to determine the feasibility of the study on a larger scale. The use of cross-cultural translations of research instruments to gather data for a research study without validating the quality of the translation and the interpretation of the translated text in both cultures can have adversely impact on the reliability and validity of the research. The validation of translated research instruments ensures that the study measures the variables of concern; facilitates appropriate comparisons of data gathered and strengthens the results and conclusions of the study.

2.2.1 Translation of Measures to Arabic

The process of translating the content of the research instruments from English to Arabic was an essential aspect of the research. This is because poorly translated words and phrases in the Arabic version of the research

measures may mean erroneous responses are given and consequently invalidate the data gathered. The process of translating the research instruments into Arabic therefore took into consideration the impact of linguistic and cross cultural influences, which may change the meaning and interpretation of words translated (Sperber, 2004).The translation of the different measures was a forward-backward three-step process, which was intended to identify and address linguistic and cross-cultural inconsistencies during translation (Meadows et al., 1996).

The first step involved the forward translation of the original instrument from its source language (English) into the target language (Arabic) by the researcher who is a native Arabic speaker and four other bilingual individuals (two native English speaker and two native Arabic speaker). The use of multiple translators during the forward translation of the instruments was to incorporate cross cultural perspectives on the meaning and interpretation of items in the questionnaires.

The second step of the process involved the back translation of the initial Arabic translations to English by two professional bilingual translators (native Arabic speakers), who were 'blind' to the original English versions of the research instruments. These translators independently produced two back-translated versions of the instruments for comparison with the original English versions and with each other. The back translations were intended to act as an audit of the Arabic versions produced during the forward translation to ensure that the meaning of the text or the intended objectives of the

instrument items in the source language (English) was the same as that in the target language (Arabic).

The final step of the translation process involved the evaluation of the instructions, items and the response format of the two back-translations against the original English version by the researcher and two qualified translators (native English and Arabic speakers). The format, wording, and grammatical structure of the sentences of each items of the original instrument and the back translated versions were assessed for similarity in meaning and relevance. The reviewed of the two back translations for the PSS14 scale and the general questionnaire showed that the items were accurate with no errors, ambiguities or inconsistencies. However, the process identified a number of discrepancies in one of the back translation in items 2, 7, 8, 12, 18, 21 and 23 in Brief Cope questionnaire (Appendix C). Subsequently, alternative linguistic expressions in Arabic were used to clarify the meaning of these items and remove any ambiguities. Following the review, the back translated versions of the three measures were considered to be comparatively similar to the original versions, and thus the Arabic versions (forwarded translations) were of sufficient quality to be tested with potential study participants.

2.2.2 Testing the Measures

A convenient sample of 20 undergraduate students from the faculty of Home Economics at King Abdul-Aziz University in Jeddah, were invited to

participate in the pilot study. The Arabic version of all four research instruments were self-administered during the start of second semester and again before the start of examinations in the 2010-2011 academic year.

Participants were asked to provide answers to each item in the general questionnaire, PSS14 and Brief Cope scales as well as being interviewed about their food intake from a 24-hour recall standpoint. During the administration of the questionnaires, the researcher explored participants' comprehension of questions, clarity and meaning of scale items, and any ambiguities in terms of words and phrases used in questionnaire items.

2.2.3 Discussion of Pilot Study Results

Out of the twenty students who participated in the first phase of the pilot study, ten dropped out of the retest phase. The two male students recruited during the first phase of the pilot study dropped out at the retest phase. No explanation was given by participants who dropped out of the study. Additionally, it was noted that male students were very difficult to recruit given religious and socio-cultural conventions that limit contact between unmarried female and males in public. Given that the researcher is a single female, it was assumed that these difficulties will be exacerbated during a large scale study and as such the inclusion of male students as part of the study sample was not considered to be feasible.

During the testing of the Arabic version of the measures, it was noted that none of the respondents gave any verbal or non-verbal indication that

any of the words and phrases used in the PSS14 scales were unclear or requiring further explanation. Subsequently, it was assumed that respondents fully understood the questions asked and as they did not hesitate in providing answers. However, some respondents reported that items relating to the consumption of beverages in the general questionnaire (8, 10, 12, 14, 16, 18 and 20) were unclear as they did not refer to a timeline. This was rectified by adding the phrase “during exam” in Arabic to make it less ambiguous.

Furthermore, all participants responded in the negative to items 4 and 11 in the Brief Cope scale that refer to alcohol use and item 20 of the general questionnaire that refer to ‘beer’. Participants in the pilot study commented on their discomfort in having answering questions about taking alcohol, which was widely regarded as a religious taboo. Consequently, given this religious and cultural context, these questions on alcohol use were considered inappropriate and removed from the brief Cope scale.

The time interval between initial pilot of the questionnaires at the start of the semester and the retest prior to semester examinations was sufficiently far apart such that participants would not ordinarily recollect their former response to the items on the questionnaires, but the possibility of their responses to be influenced by other factors during the interval cannot be totally eliminated.

In summary, the Arabic translations of the instruments used in this research were linguistically comprehensible and culturally appropriate. The Arabic versions were therefore considered to be appropriate instruments for

a larger scale longitudinal study for assessing perceived stress, coping and recording food intake of an Arabic population of undergraduate students.

2.2.4 Ethical Considerations

In order to ensure the quality and integrity of this research a number of ethical issues were taken into consideration over the lifecycle of the research design. These include the conduct and norms relating to the way background data and information about this research was gathered and presented; and the recruitment, participation and use of data generated from the research participants (Harwell, 2011). In this research, a number of measures were employed to address these ethical issues, including the independent desk study of relevant background literature without third-party assistance and the use of appropriate citations and referencing to avoid plagiarism and misrepresentation. This study received approval from the Deanship of Graduate Studies at King Abdul-Aziz University. Informed and voluntary consent was a vital component of the research design. The researcher ensured that prior to students taking part in the study, the aim and objectives of the research was explained to them as well as the scope of their involvement and the use of any subsequent data arising from their participation.

Specific training and instructions was given to all volunteers (class representatives) who helped with the distribution of survey instruments to repeatedly state the voluntary nature of participation and avoid coercion

whilst recruiting potential participants. All participants were given a consent form to sign stating their acceptance to take part in the different studies and were informed of the option to withdraw from the study at any time. All responses were anonymous and no incentives were offered to participants to take part in any of the studies. The research design also placed considerable emphasis on protecting the confidentiality of participants by limiting the collection of personal data and anonymising the research data.

In order to maintain confidentiality of the personal identifiers (e.g. names and e-mails) collected from participants during the course of the study, these datasets will be stored in a protected file separate from the body of the research data. These will be deleted as soon as they are no longer required for logistic and administrative purposes. Additionally, generic identifiers such names will be replaced with alpha numeric codes to ensure that the research datasets are 'clean' and do not contain information that identifies any participants in the study.

3 Study One: Stress, Diet and Coping during Non-Examination Period

3.1 Study One Aim

The aim of this study was to examine female undergraduates' perception of stress, their reported coping strategies and their dietary habits during periods of low stress i.e. the start of the semester, with no examinations scheduled. The principle objectives are thus;

1. To investigate the perceived level of stress reported across the demography of the sample of female students during non-examination period (low stress conditions).
2. To examine the healthy lifestyle choices of the sample of female students during non-examination period (low stress conditions).

3.2 Study One Methods

3.2.1 Study Design

A longitudinal survey (but only cross-sectional data from the baseline is used in this analysis).

3.2.2 Sampling

A random sample of female undergraduate students at King Abdul-Aziz University in Jeddah, were invited to participate in the study during the start of the first and second semester of the 2011-2012 academic year. Participants were drawn from all six academic faculties at the University. King Abdul-Aziz

University is one of the oldest and highly ranked universities in Saudi Arabia with six academic faculties and a total population of 15,258 students.

3.2.3 Measures

As previously discussed in section 2.1.4, survey instruments were designed, modified or adopted to measure socio-demographic characteristics of the sample, perceived levels of stress and stress coping strategies. This instrument included a general questionnaire, PSS14 scale, and Brief Cope scale. Participants were also asked to take part in a 24 hour food intake recall interview, which was used to measure dietary behaviour.

3.2.4 Procedures

3.2.5 Data Collection

Prior to the distribution of questionnaires, a letter was sent to all departments in the female campus at King Abdul-Aziz University asking the department administrators to provide information regarding modules, such as: levels, room numbers, schedule of classes, class representatives in order to facilitate the administration of the survey. The researcher recruited twenty volunteers who were tasked with briefing the class representatives of each level of all academic department about the study. Class representatives acting as gatekeepers assisted in the distribution and collection of surveys. Participants were invited to take part in the study during requisite core module lectures, in order to maximize access to a large population of students across the various academic faculties at different levels of study. An information letter and

consent form was attached to all questionnaires distributed. The estimated recruitment rate from each faculty is shown in the table 1 below;

Faculty	Estimated No. of Students approached	No of Students Recruited	Estimated recruitment rate %
Medicine	750	22	2.9%
Applied Medical Science	1300	49	3.8%.
Science	1500	56	3.7%
Economic and Administration	1800	121	6.7%
Art and Humanities	2000	90	4.5%
Home Economics	1600	134	8.4%
Not indicated		19	
Total (n)	8950	491	5.5%

Table 1 Study Recruitment Rate

3.2.6 Data Analysis

The 24hr recall dietary data were analysed using the Dietplan6 programme and variables on energy, macro- and micro-nutrients, and number of eating occasions. The number of eating occasions was classified as healthy or unhealthy based on a number of attributes. These include whether it is freshly prepared food, meets food-based recommendations as described by the EatWell Plate, and whether fruit and vegetables were consumed. Responses to the Perceived Stress Scale (PSS-14; Cohen et al., 1983) and the Brief-COPE scale (Carver, 1997) psychometric scales were scored according to the instructions published by the authors (as discussed in section 2.1.4). Cronbach's alpha coefficient for the PSS-14 in the current sample was 0.61

and could not be significantly improved by the elimination of any item. Cronbach's alpha for the Brief-COPE was 0.761.

Body Mass Index (BMI) was calculated by using the following formula:

BMI = actual weight (kilograms)/height (m^2).

BMI was categorised based on WHO criteria where <18.5kg/m^2 is underweight, 18.5-24.99 Kg/m^2 is normal, 25-29.99 Kg/m^2 is overweight and > 30kg/m^2 is obese. Participants' self-reported ideal bodyweight was used to calculate their ideal BMI (using the same formula as above). For univariate analysis, age was categorised into two group based on the following split: 17-21yrs and 22-34yrs. Exercise frequency was collapsed into three groups based on qualitative descriptors of frequency (i.e. never, rarely and regular). All continuous data were assessed for normality using Kolmogorov-Smirnov test and appropriate parametric and nonparametric statistics were used to describe the sample. For parametric data, mean and standard deviation (SD) were reported and for non-parametric data, median and interquartile range (IQR).

The relationship between PSS-14 scores and Brief-COPE subscale score on the one-hand, and age (as a categorical variable), year and subject of study, BMI category, exercise frequency (as a categorical variable), and insistence on health eating were explored using Mann Whitney *U* test or Kruskal-Wallis test followed by *post-hoc* Mann Whitney *U* tests and appropriate Bonferroni correction. The level of significance was set at $p \leq 0.05$.

3.3 RESULTS

3.3.1 Response Rate

During the academic year of 2011-2012, 850 questionnaires were circulated to female undergraduate students of King Abdul Aziz University, Jeddah, Saudi Arabia. Of the 541 responses received 491 questionnaires could be used in the research analysis, whilst 9.2% (n=50) were excluded from further statistical analysis due to non-completion of essential data (i.e. the 24hr recall dietary data and the PSS 14 data). Missing data on other non-essential variables are treated with a pair-wise deletion approach. The useable response rate was therefore 58%.

3.3.2 Socio-demographic Characteristics of Sample 1

The normality of data was checked using the Kolmogorov-Smirnov test with the significance of the p value set at > 0.05. The results revealed that the age data were not normally distributed (*D* (466) = 0.114, p=0.001). The median age of respondents was 21.6 years (Min= 17, Max=34, n=467).

A breakdown of the responses received across the different faculties at the university is set out in the Table 2 Sample Distribution by Academic Faculty

2.

Faculty	Frequency	%
Faculty of Medicine	22	4.5
Faculty of Applied Medical Science	49	10.0
Faculty of Science	56	11.4
Faculty of Economic and Administration	121	24.6
Faculty of Art and Humanities	90	18.3
Faculty of Home Economic	134	27.3
Not indicated	19	3.9
Total (n)	491	100%

Table 2 Sample Distribution by Academic Faculty

Analysis of the data showed that 26.7% of respondents (n=442) were in their second year of their academic programme, 29.6% were in their third year, 29.4% were in their fourth year and 14.3% of participants were in their fifth year (illustrated in **Error! Reference source not found.**2).

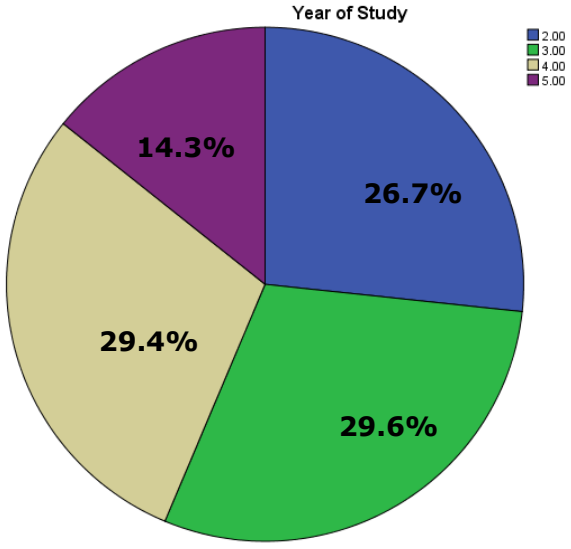


Figure 2 Population distribution by year of study

3.3.3 Anthropometrics and weight-related behaviour

3.3.3.1 Body Mass Index (BMI)

Both self-reported height and weight were not normally distributed. The median height of participants (n=459) was 159 cm (IQR 155cm - 163cm (Min =129cm, Max= 190cm,) and the median weight (n= 474) was 55.5 kg (IQR 48kg - 65kg, Min = 27kg, Max= 124kg). Although inspection of box-plots revealed six cases with height ≤140 cm and four cases with height ≥177 cm, but these were retained as part of the analysis as they were in line with WHO growth charts data.

BMI could be calculated for 454 participants and data were not normally distributed (D (453) = 0.089, p<0.001). The median BMI of respondents was 22.15 (Min=13.85 Kg/m^2; Max=51.26 Kg/m^2). 18.72% of those participants with complete data on weight and height had a BMI that could be classified as underweight (n=85), 51.76% within the normal category (n=235), 18.5% as overweight (n=84), and 11.01% as obese (n=50).

Participants' self-reported ideal BMI was normally distributed with a mean of 20.93 Kg/m^2 (SD=3.38; min-max = 14.68-34.07 Kg/m^2). Analysis of the difference between participants' self-reported actual BMI and their self-reported ideal BMI is shown in Figure 3.

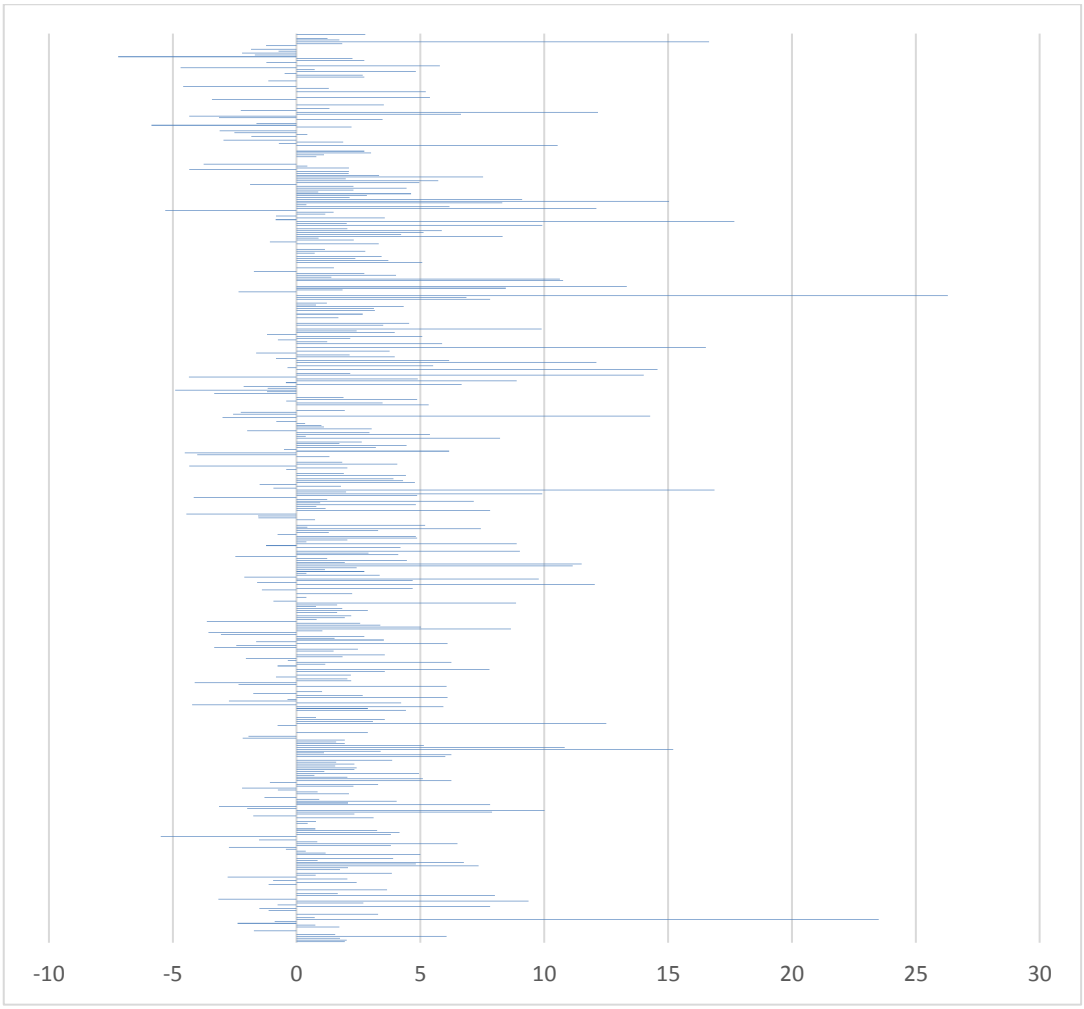


Figure 3 Difference between actual and ideal BMI

When respondents were asked about their intention to lose weight (n=491), 43.8% (n=215) of the participants reported that they were actively trying to lose weight and 56.2% (n=276) indicated that they intended to lose weight in the future.

Out of 215 students who reported that they are actively trying to lose weight (and had complete data on self-reported weight and height) 41.9% (n=90) reported skipping of some meals, while 30.2% (n=65) reported that they have tried a low calorie diet. Fewer students used low fat diet and low

carbohydrate diet to lose weight (14.9% (n=32) and 6.5% (n=14) respectively). 87% (n=187) of those actively trying to lose weight reported a self-reported ideal BMI less than their self-reported current BMI. Similarly, 12.2% (n=27) were within the underweight BMI category, 43.3% (n= 93) were within the normal BMI category, 27.4% (n= 59) were overweight and 16.7% (n= 36) obese BMI category.

Among the subgroup of respondents who indicated that they intended to lose weight in the future (and had complete data on self-reported weight and height, n=313) 88.2% (n=276) reported a self-reported ideal BMI less than their self-reported current BMI. Furthermore the majority of participants 51.4% (n= 147) who intended to lose weight were of a healthy weight, while 2.8% (n=8) of these respondents were underweight 28.7% (n=82) of these respondents were overweight and 17.1% (n= 49) were obese.

3.3.4 Healthy Dietary Behaviours

3.3.4.1 Eating Behaviour and Dietary Adequacy

Out of the 492 students who completed the 24-hour dietary recall interviews, 30.5% of students reported an eating frequency of 4 meals/day and 29.5% reported an eating frequency of 5 meals/day (see Figure 4 for detail breakdown). The mean intake frequency was 4.34 meal/day (SD =1.177; Min – Max = 1-8 meals/day).

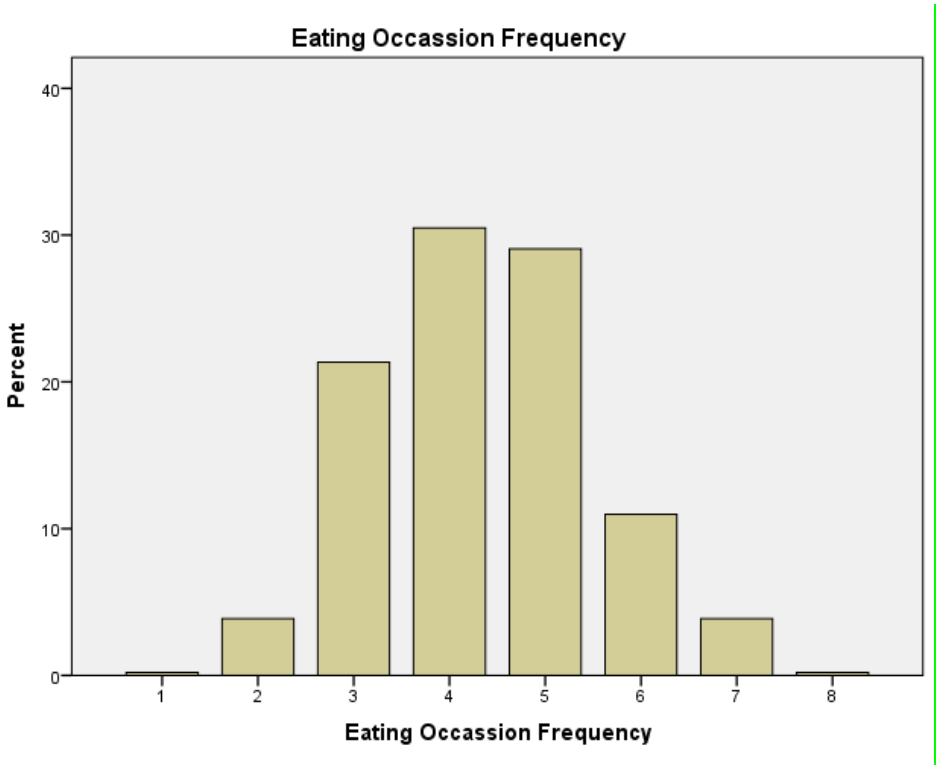


Figure 4 Eating occasion frequency during non-examination period

The descriptive statistics of healthy meal intake compared to that of fast food meals intake per day (N=492) are shown in the table below. The results showed that the mean frequency intake of healthy meals was 2.11 meals/day (SD=1.14; Min-Max=0-7). While the mean intake of fast foods was 2.23 meals/day (SD=1.26; Min =0, Max= 7).

	Food Consumption				
	Mean	SD	Min	Max	Mode
No. Meals/day	4.33	1.27	2	8	4
Healthy meals	2.21	1.16	0	6	2
Fast Food	2.12	1.3	0	7	1

Table 3 Food intake statistics

The data also revealed that 38.4% of students ate fruit and vegetables as part of their daily diet, 18.9% ate no fruits, 9.6% ate no vegetables and 33.1% had neither fruit nor vegetables.

Data from the 24-hour dietary recall on total energy and energy from macro-nutrients revealed that students reported having a diet relatively rich in carbohydrate but low in protein (Table 4). See Appendix F for comparison of energy, micro- and macro-nutrients against Dietary Reference Values.

	Mean (SD)	Median (IQR)	Min-Max
Energy (kcal)	1203 (466)	1154 (885-1454)	192-4782
Protein (% energy)	43 (18)	40 (31-53)	6-181
Fat (% energy)	47 (22)	45 (32-58)	3-221
Carbohydrate (% energy)	161 (69)	154 (113-194)	0-551
Starch (% energy)	77 (31)	73 (56-95)	0-226
Total sugar (% energy)	57 (33)	53 (35-75)	0-263

Table 4 Macronutrient Intake

Two thirds of participants (67.0%) self-reported consuming a high-sugar beverage (such as Coca Cola or Pepsi) during a regular day while 33.0% reported consuming one to 6+ cans per day. Out of the 490 students who provided responses, 73.1% (n=358) of students reported that they never drink high-energy high-caffeine drinks (such as Red Bull) while only 1.2% (n= 6) reported drinking one or more energy high-energy high-caffeine drinks a day. Furthermore, a comparison of the frequencies of chocolate and sweet consumption was commonly reported (figure 5).

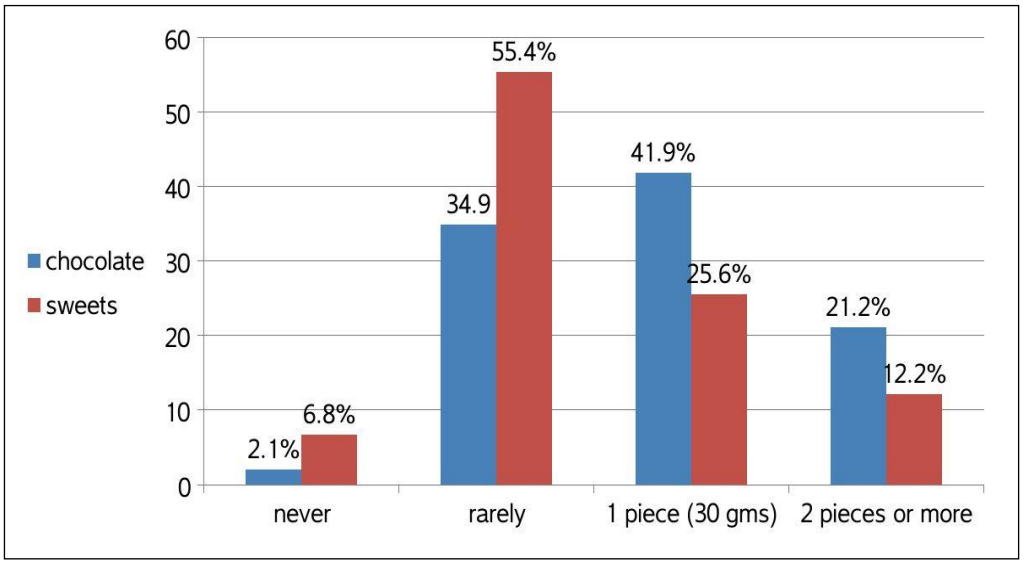


Figure 5 Chocolate/Sweets intake during non-examination period

Out of the 482 students who provided responses to questions about whether or not they insisted on eating healthy foods, 48.3% (n= 233) of students answered "yes", while remaining students (n= 249) reported they do not usually insist on eating healthy foods.

Two fifths of participants (41.8%) self-reported rarely consuming coffee during a regular day, while 38.1% (n= 184) of students reported drinking one to four more cups of coffee a day and another 20.1% (n= 97) of respondents reported that they never drink coffee. Similarly, half of participants (48.5%) self-reported rarely drinking tea, while 35.8% (n= 174) reported drinking one to four cups of tea a day. It was equally reported by 15.7% (n= 76) of students that they never drink tea.

3.3.4.2 Physical Activity

42% (n= 206) of students reported that they rarely exercise, 21.2% (n= 104) of students reported that they never exercise and 36.2% (n = 178) exercise regularly.

Out of the 178 participants who exercise at least once a week, 54.5% (n= 97) reported that they perform light exercise such as normal walking, walking down stairs and bowling, 41% (n= 73) reported taking part in moderate exercise such as brisk walking and ascending stairs and 4.5% (n= 8) reported that they engaged in strenuous exercise such as running (5 km) and cycling (25 km).

3.3.4.3 Smoking

Out of the 488 study participants who provided responses to questions about whether or not they smoked cigarettes, water pipes, shisha, hubbly bubbly, 10.4% (n= 51) of students answered "yes" and 89.6% (n= 437) of students answered that they did not smoke any narcotic.

3.3.5 Perception of Stress

The normality of data was checked using the Kolmogorov-Smirnov test with the significance of the p value set at ≤ 0.05. The results revealed that scores on the PSS-14 were not normally distributed (D (490) = 0.042, $p<0.039$) with a median of 29 (IQR = 23-34 min-max= 4 - 53). A Mann Whitney U test (significance at $p<0.05$) showed that students in the younger age group (17-21yrs) reported significantly higher PSS-14 scores compared to those in the

older age group (22-34yrs) (U= 12402, p=0.001)(Table 5). There were no significant effects on PSS-14 scores from year or subject of study (Table 5)

		PSS14 Score Statistics						
		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	30	11	53	22-33	12402	N/A	0.001
	22-34yr	27	4	53	25-35			
Course of study	Medicine	29	13	41	24-35	N/A	8.912	0.113
	App Medicine	26	10	45	22-32			
	Science	29	8	53	23-34			
	Economics and Administration	29	14	53	25-34			
	Art and Humanities	28	5	53	20-34			
	Home Economics	30	7	45	23-36			
Year of study	Year 2	27	4	53	22-36	N/A	2.705	0.439
	Year 3	28	5	53	22-33			
	Year 4	30	11	51	24-35			
	Year 5	31	12	46	25-34			
BMI category	Underweight	28	5	46	21-35	N/A	8.415	0.038
	Normal	29	4	53	23-34			
	Overweight	27	12	45	23-32			
	Obese	31	7	48	26-37			
Physical Activity	Never	30	4	53	24-37		7.190	0.207
	Rarely	29	5	53	23-34			
	Regular	27	10	45	22-31			
Insistence on eating healthy	Yes	27	4	53	22-33	23108		0.001
	No	30	7	53	24-36			
Smoking	Smokers	31	16	53	24-38	8869		0.017
	Non- Smokers	29	4	53	23-34			

Table 5 PSS 14 Score Statistical Distribution during non-examination period

A Kruskal Wallis H test revealed that there was a statistically significant difference in PSS-14 scores across the BMI categories, χ^2 (3) = 8.415, p = 0.038. *Post hoc* pair-wise comparisons, using Mann Whitney test with a Bonferroni correction of 0.008, revealed that PSS-14 scores of students in the obese BMI category were significantly higher than those in the normal BMI category. Although students who didn't engage in any form of physical exercise

reported the highest median PSS-14 (see table 5) there was no statistically significant difference between exercise frequency (as a categorical variable) and PSS-14 scores (χ^2 (5) = 7.190, p = 0.207) as revealed by a Kruskal Wallis H test.

Furthermore a Mann Whitney U test revealed that participants who smoked reported a statistical significantly higher PSS-14 scores compared to those students who were non-smokers, (U= 8869, p=0.017, r = 0.108). However, the results showed that participants who reported that they insisted on not eating healthy foods had significantly higher PSS-14 scores compared to those who reported that they did (U= 23108, p=0.001) (Table 5).

3.3.6 Coping with Stress

Brief-COPE scale scores

Both the scores on the Brief-COPE problem-focused coping subscale and the emotion-focused subscale were not normally distributed (*D* (477) = 0.083, p<0.001, and *D* (466) = 0.047, p<0.015, respectively) (see Table 6)

Descriptive Statistics	Problem focused	Emotionally focused
Median	18.00	52.00
Minimum	9.00	24.00
Maximum	24.00	75.00
IQR	16-20	52-56

Table 6 Problem and emotionally focused factors of coping

There was a significant difference in the BRIEF Cope problem subscale scores between participants in the different courses of study ($\chi^2(5) = 12.635$, $p = 0.027$) (Table 7).

Post hoc pair-wise comparisons, using Mann Whitney test with a Bonferroni correction of 0.003, revealed that problem focused coping scores of home economics students were significantly higher than those of students from the faculty of economics and administration. There were no significant effects on problem focused subscale scores from students' course year or their age group (Table 7)

There was a statistically significant difference in problem focused coping scores cross the BMI categories, $\chi^2(3) = 8.109$, $p = 0.044$. *Post hoc* pair-wise comparisons, using Mann Whitney test with a Bonferroni correction of 0.008, revealed that problem focused coping scores of students in the overweight BMI category were significantly higher than those in the normal BMI category ($U= 7314$, $p=0.004$).

There was a statistically significant difference between exercise frequency (as a categorical variable) and BRIEF COPE problem focused subscale scores ($\chi^2(3) = 10.032$, $p = 0.018$). Similarly, students who reported that they never engage in any form of physical exercise reported the least median emotional focused coping scores (see table 7).

Furthermore, those students who reported that they insisted on eating healthy foods reported significantly higher problem focused coping scores compared to those who did not (U= 22835, p=0.001,) (Table 7). However, there were no significant differences in median problem focused coping scores for those students who were smokers or non-smokers, (U= 9688, p=0.223).

Problem focused coping Score Statistic		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	18	9	24	16-20	1829	N/A	0.912
	22-34yr	18	9	24	15-20			
Course of study	Medicine	18	10	24	16-20	N/A	12.64	0.027
	App Medicine	17	13	24	16-20			
	Science	18	9	24	16-20			
	Economics and Administration	17	9	23	15-19			
	Art and Humanities	18	12	23	16-20			
	Home Economics	18	9	24	17-20			
Year of study	Year 2	18	9	24	16-20	N/A	1.994	0.574
	Year 3	18	9	24	16-20			
	Year 4	17	10	24	15-20			
	Year 5	18	11	24	16-20			
BMI category	Underweight	18	9	24	16-20	N/A	8.109	0.044
	Normal	18	9	24	16-20			
	Overweight	17	11	24	15-19			
	Obese	18	11	24	15-20			
Physical Activity	Never	17	12	24	15-19	N/A	7.626	0.054
	Rarely	18	9	24	16-18			
	Regularly	19	12	23	16-21			
Smoking	Smokers	17	13	24	15-20	9669	N/A	0.224
	Non- Smokers	18	9	24	16-20			
Insistence on eating healthy	Yes	18	9	24	16-20	22835		0.001
	No	17	9	24	15-19			
Emotion focused coping Score Statistic		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	51	24	73	48-55	1320	N/A	0.416
	22-34yr	52	35	75	47-56			
Course of study	Medicine	53	44	73	49-59	N/A	13.66	0.018
	App Medicine	50	37	66	47-54			
	Science	52	24	72	48-59			
	Economics and Administration	49	34	75	46-55			
	Art and Humanities	52	33	67	49-53			

	Home Economics	52	35	70	48-57			
Year of study	Year 2	52	24	73	47-56	N/A	0.91	0.832
	Year 3	51	35	68	48-56			
	Year 4	52	35	75	47-52			
	Year 5	53	35	70	47-57			
BMI category	Underweight	52	35	70	46-52	N/A	1.860	0.602
	Normal	51	24	72	47-56			
	Overweight	52	33	68	48-56			
	Obese	52	35	73	49-52			
Physical Activity	Never	50	35	68	45-54	N/A	9.752	0.021
	Rarely	53	33	75	48-57			
	Regularly	51	38	72	48-51			
Smoking	Smokers	53	43	73	48-59	8713	N/A	0.064
	Non- Smokers	51	24	75	47-56			
Insistence on eating healthy	Yes	52	35	75	47-57	23640		0.072
	No	52	24	73	47-55			

Table 7 Brief Cope Statistical distribution during non-examination period

A Pearson bivariate correlation coefficient to determine the relationship between PSS14 stress scores and problem focused coping scores was calculated. The results showed a negative correlation between the two variables, r = -0.134, n = 477, p = 0.003.

EMOTIONAL SUB SCALE

The scores on the emotional category of the BRIEF Cope Scale were not normally distributed (*D* (466) = 0.047, p<0.015) with a median of 52 (IQR = 52-56, min-max= 24-75). There was a significant difference in the emotional focused coping scores between participants in the different courses of study (χ^2 (5) = 13.655, *p* = 0.018) (Table 7). *Post hoc* pair-wise comparisons, using Mann Whitney test with a Bonferroni correction of 0.003, revealed that emotional focused coping scores of home economics students were

significantly higher than those of students from the faculty of economics and administration.

There were no significant effects on emotional focused subscale scores from students' BMI and course year or their age group. There was a statistically significant difference between exercise frequency (as a categorical variable) and BRIEF Cope problem focused subscale scores (χ^2 (3) = 9.752, p = 0.021). Similarly, students who reported that they never engage in any form of physical exercise reported the least median problem focused coping scores (see table 7).

Furthermore there were no differences in the emotion focused coping scores for those students who were smokers or non-smokers, (U= 8713, p=0.064), and those students who reported that they insisted on eating healthy foods or not (U= 23640, p=0.072) (Table 7).

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A Pearson bivariate correlation coefficient to determine the relationship between PSS14 stress scores and emotion focused coping scores. The results showed a positive correlation between the two variables (r = 0.093, n = 467, p = 0.044).

3.4 DISCUSSION

The results of this study reveal that the study sample was predominantly made up of young women (median age 21.6years), with over half (51.9%) drawn from the academic faculties of Home Economics and Economics and

Administration. The sample population were of average BMI (23.15 Kg/m^2) and did not routinely engage in physically exercise with 63.2% reporting that they rarely or never engaged in any physical activity. Approximately half of the study participants would normally insist on eating healthy food whilst the half did not.

A principal objective of this study was to investigate the perceived level of stress reported across the demography of the sample of female students over a period when no examinations were scheduled. The results of this study revealed that the reported levels of stress varied modestly across different demographic subsets of the populations. The results showed that students within the younger age group (17-21yrs) reported higher levels of stress compared to those in the older age group (22-34yrs) of the sample population. A review of the literature shows that the significance of age in the perception of stress has been examined by a number of stress studies with inconsistent findings. The results of some of these studies (Seiffge-Krenke et al., 2009; Glozah, 2013; Scott et al., 2013), suggest that there is no observable relationship between levels of reported stress and age. However, other research studies (Hewitt et al., 1992; Martin et al., 2001; Remor, 2006; Bayram and Bilgel, 2008, Archer et al., 2015) report significant difference across age groups in relation to stress and results showed that age was inversely correlated with perception of stress i.e. perception of stress tend to decrease with increase in age.

The results of this study supports the latter and provides a new insight into the relationship between stress and age in the university environment in Saudi Arabia. It is even more pertinent given that the results reported by the majority of non-middle eastern studies that examined the effect of academic stress on undergraduates (Birks et al., 2009, Grubbs and Carter, 2002, Lo, 2002, Shah et al., 2010) showed no correlation between perceived stress and age of undergraduate students. Further investigation is therefore required to understand the significance of age during high stress period.

This baseline study also examined the distribution of perceived stress across other demographic characteristics including the year of academic study, academic faculty and BMI categories. The study results showed that there was a difference in perceived levels of stress within the sample population based on students' year of study. However, analysis showed that there were no statistically significant differences in the reported stress scores of students across the different year of academic study. The results also showed that student's reported levels of stress differed across academic faculties, with students studying home economics reporting the highest median stress score of 30 and students in applied medicine reporting the least median stress score of 26. Statistical analysis however revealed that there were no statistically significant differences in the reported stress scores of students across the different academic faculties.

The association between the reported level of stress and anthropometric variable such as body mass index (BMI) was also considered in this study as it

is broadly regarded to be associated with disordered eating, which may be triggered by stress (Hudson et al., 2007). The results of this study showed that students within different BMI categories reported varied median and IQR levels of stress. Statistical analysis revealed that there were significant differences across the BMI categories. A post hoc analysis revealed that students in the obese BMI category reported scores that were statistically different from that reported by students in the overweight BMI category. These results corroborate existing evidence that suggest that there is significant relationship between stress and BMI (Shimanoe et al., 2015). Nguyen-Rodriquez and her colleagues argue that it is well established in research that stress triggers overeating, which overtime leads to increased body weight and BMI. A meta-analysis of 14 research studies on the relationship between stress and BMI carried out by Wardle et al. (2011) revealed that 69% of correlation coefficients (r) indicated that there was a significant relationship between stress and BMI. Similar results have been reported in studies on academic stress and obesity (Gupta et al., 2009, Weekes et al., 2006).

The relationship between greater BMI potential and high levels stress can be explained by stress mediated disordered eating well known for its moderating effect on BMI. The effect of disordered eating on BMI. Disordered eating has been associated with stress relative to the direct effect of stressors such as body dis-satisfaction and indirectly as a coping response to daily stress (Haines and Neumark-Sztainer, 2006). The theory of restrained eating hypothesizes

that dieting behaviour predicated body dissatisfaction is a key predictor of obesity. Proponents argue that loss of restraint, increase metabolic efficiency, decrease in physical activity leads to food bingeing and eventually elevated BMI levels (Lowe et al., 2013; Haines and Neumark-Sztainer, 2006). Food bingeing is a well-established maladaptive coping strategy to stress in direct response to stressful life events (Dallman, 2010, Rutters et al., 2009, Spoor et al., 2007). It is often expressed as comfort eating, which promotes the allostatic regulation of body weight and eventually leads to obesity (McEwen, 2007; Sterling, 2004).

Another important predictor of stress and its relationship with dietary behaviour is an individual's perception of their body image as satisfactory or unsatisfactory (Kang and Choue, 2010, Yager and O'Dea, 2008). The results of this study showed that 82% of the sample population reported an ideal BMI that was less than their actual BMI, even though 51.76% of the population were within the normal BMI category. The results also showed that a relatively high percentage of students sampled (64.3%, n=487) reported that they intend to lose weight, of which 43.9% (n=214) were actively trying to lose weight. This suggest that a significant proportion of the population may be dissatisfied with their body image, which in turn may influence their perception of stress levels and food intake behaviour. The impact of body image dissatisfaction on dietary behaviour has been examined by a number of studies. Kang and Choue (2010) examined the relationship between body image, stress, eating habit, and dietary quality in 157 middle school girls in

Seoul, South Korea. The study results showed that respondents with higher BMI expressed a greater dissatisfaction with their body image, higher perceived stress and risk of disordered eating than those with lower BMI. Similar studies by Mikolajczyk et al. (2009), and Sweeting et al. (2007) identified female undergraduates dissatisfaction with body image is an important factor in their relatively higher perception of stress compared to male student populations. Other studies (Cooley and Toray, 2001, Martz et al., 1995, Yager and O'Dea, 2008) have also provided evidence, which indicate that there is a link between body image dissatisfaction, stress and disordered eating, however the nature of these relationships are not well understood.

The effect of lifestyle choices in relation to physical activity, smoking and conscious decision to eat healthy meals on reported stress levels by student was also considered in this study. The results indicated that there was no direct relationship between student's engagement in physical exercise and their reported level of stress, as students who never exercise reported higher stress scores (30) than students who exercised regularly (29) but the difference was not statistically significant. These results are not in line with current evidence on the effect of physical exercise on managing stress, which suggest that physical activity reduces stress, anxiety and depression (McEwen and Gianaros, 2011, Salmon, 2001, Scully et al., 1998). There is a large body of evidence that point towards an indirect relationship between perception of stress and physical activity, with higher physical activity in individuals being

associated with lower levels of stress (Lippke et al., 2015). There was no obvious explanation for the absence of similar relationships in the study results.

Whereas, statistical analysis of the results showed that there were significant differences in the stress scores reported by the groups of students who smoked and the group who did not smoke, with smokers reporting higher levels of perceived stress than non-smokers. These results corroborate existing research evidence on the nature of the relationship between smoking and stress.

The relationship between smoking and stress has been the focal point of many empirical studies, the majority of which have concluded that smokers largely report high levels of perceived stress compared to non-smokers (Maloneetal., 2003; Parrottetal.,2004; Parrott and Murphy, 2012).

In a review of real world studies on the relationship between smoking and stress, Parrott and Murphy (2012) concluded that there is sufficient evidence to show that smoking is associated with adverse psychological effects underlined by repeated mood swings and higher levels of stress. They however argue that research results have shown that these effects are more noticeable in regular high volume smokers. In this study, the population of students who smoked were high level smokers (smoking at least 5 cigarettes a day) and as such provides an explanation for the results of this study.

The study findings also show significant differences in the reported levels of stress between the group of students who insisted on eating healthy food and group who did not insist on eating healthy food. These results suggest that dietary lifestyle may play an influential role in moderating the level of stress perceived by undergraduate students. The results of the analysis of the 24 hour recall food data provided additional insight into the eating habits and dietary quality of the sampled population of students. The results indicated that during the baseline study (no examination scheduled) a higher proportion of the student sample (64%) reported an intake of carbohydrate as well as fat (53.2%) above their dietary reference values. These results suggest that a higher proportion of the sample population had a dietary pattern of relatively high carbohydrate/fat and low protein, which is considered to be useful in reducing stress. According to some researchers (Blundell et al., 2003, Chaouloff et al., 1999, Rao et al., 2008, Stevenson, 2006) the relative proportions of protein and carbohydrate in a person diet can influence build-up of serotonin and dopamine in the brain, which is responsible for regulating the mood, emotional and social wellbeing of an individual. These researchers argue that a low protein diet can result in low concentrations of these neurotransmitters (serotonin and dopamine), which is associated with depression and mood swings. Whereas, a carbohydrate-rich diet promotes the secretion and build-up of serotonin levels in the brain, which heightens brain activity counteracting the effects of depression (Firk and Markus, 2007, Rao et al., 2008, Rogers, 2001). However, the proposition that protein and

carbohydrate levels in a person's diet can influence behaviour has been disputed by other researchers (Rogers, 1995).

The study revealed that students employed a range of coping measures that could be described as either problem focused or emotional focused. Results showed that students reported using relatively more problem focused coping measures (median, 18; IQR, 16-20 out of a score range of 6 to 24) compared to emotional coping measures (median -52; IQR 52-56 out of a score range of 20-80). A comparison of the BRIEF-COPE emotional and problem focused subscale scores with PSS-14 stress scores revealed that there was a negative correlation between PSS14 stress scores and problem focused coping scores. This suggests that increases in PSS14 stress scores were correlated with decreases in the use of problem coping strategies. Similarly, there was a positive correlation between PSS14 stress scores and emotion focused coping scores. This suggests that increases in PSS14 stress scores were correlated with increases in the use of emotion coping strategies.

The moderating effect of coping mechanism in reducing academic stress levels has been well researched. According to Sominsky and Spencer (2014) coping strategies have the capacity to modify a person's cognition and behaviour in order to mitigate against the emotional and physical impacts of stress. Regehr et al. (2013) carried out a meta-analysis of 24 research studies on the effectiveness of coping strategies in decreasing academic stress in university students. The results of the analysis showed that cognitive, behavioural, and

mindfulness coping strategies had a positive effect in reducing academic stress.

In other to better understand how students cope or respond to stress this study also investigated the eating habits and dietary choices of the sample of female students during a period when no examinations were scheduled. The importance of understanding the relationship between food habits and stress in Saudi Arabian society is underlined by evidence which show that food environment and culture in Saudi Arabia is changing with growing westernisation of the diet and associated increase in the rates of food associated disorders and disease (Al-Daghri et al., 2014b, Majeed, 2015). A recent study by Memish et al. (2014) showed that observed rates of obesity, hypercholesterolemia, and hypertension was high amongst Saudis. Whilst, involvement in physical exercise and intake of healthy food like fruit and vegetables was low as most Saudis are physically inactive and consume low levels of fruits and vegetables (Memish et al., 2014). Although the results of this baseline study indicate that more than half of the sampled student population reported having a diet that comprise of relatively high carbohydrate/fat and low protein, it is not possible to infer from the results that these students are intentionally/unintentionally managing their stress and associated emotional health with a high carbohydrate diet.

Another important dietary component of the study sample of students was their consumption of beverages, snacks and sugar-rich drinks. The study results revealed that the regular consumption of caffeine rich beverages i.e.

coffee, tea and energy drinks by students was 38.1%, 35.8% and 1.2% respectively of the sample population (n=483).

This results suggest that students at this point in the academic cycle were not experiencing significant levels of stress or using caffeine to cope, given that caffeine consumption is directly associated with academic stress in university students (Ríos et al., 2013, Tannous and Al Kalash, 2014, Zunhammer et al., 2014). Similar academic research (Spillman, 1990, Zunhammer et al., 2014) have also reported that female undergraduate increase their intake of carbonated drinks, sweets and chocolate when stressed. However, the results of this study showed that the regular intake of carbonated drinks amongst the sample population of students was relatively low, with only 8.2%, (n=488) reported having more than 1 can/day; 21.2% and 12.2% (n=484) reported consuming more than 1 piece of chocolate and 1 piece of sweet/day respectively. It therefore suggests that the period of no exam is associated with low stress for the sample population as their intake of soft drinks, sweets and chocolate were on average relatively low.

In summary, this study has examined the reported levels of stress by female students in King Abdul-Aziz University in terms of a number of demographic variables. The results revealed that the academic year of study and academic faculty of students were possible predictors of stress and it is suggested that further studies examine this proposition in much greater detail. The results of the study also revealed that a large proportion of students were dissatisfied with their body image, which may in turn influence their dietary habits and

food choices as well as their perception of stress during high stress periods such as examination. Further examination of this relationship is needed to provide corroborative evidence.

4 Study Two: Stress, diet and coping during academic examinations

4.1 Study Two Aim

The aim of this study was to compare the reported stress levels, dietary habits and coping mechanisms of a sample female undergraduate student at the King Abdul-Aziz University, during examination period. The principle objectives are as follows;

1. To investigate the perceived level of stress reported across the demography of a sample of female students during examination period (high stress conditions).
2. To examine the healthy lifestyle choices of the sample of female students during examination period (high stress conditions).

4.2 Study Two Methods

4.2.1 Study Design

The study design comprised of a longitudinal survey of female undergraduates at the King Abdul-Aziz University during examination and non-examination periods.

4.2.2 Sampling

A random sample of female undergraduate students at King Abdul-Aziz University in Jeddah, were invited to participate in the study during the start of the first and second semester of the 2011-2012 academic year. The entire

population of students who participated in the first part of the study were invited to take part in the follow up study of the research, during first and second semester examination periods of the 2011-2012 academic years.

4.2.3 Measures

As previously discussed in sections 2.1.4 and 3.2.3, an adapted survey instrument was used to measure perceived levels of stress and stress coping strategies of the sample during the non-examination and examination period. During the non-examination period, the survey instrument consisted of a general questionnaire, stress questionnaire, and coping questionnaire. Whilst during the examination period the instrument included only two subsets, namely, a stress questionnaire and a coping questionnaire. The general questionnaire subset was not administered during this study. Respondents also took part in 24 hour dietary recall interviews to describe the type, frequency and quantity of their food intake.

4.2.3.1 Perceived Stress Scale (PSS)

The Perceived Stress Scale (PSS) is a 14-item instrument which aims to measure the extent to which an individual's own life situations are perceived as stressful. All items in the PSS scale are structured to be self-reported and are rated on a 5 point Likert scale response format. The continuous scale scores are obtained by reverse-scoring (i.e. 0 = 4, 1 = 3, etc.) on all positively stated items and then summing the scores of all items. Scores on this scale

range from 0 to 56. Relatively high PSS scores were subsequently considered to be indicative of higher perception of stress within the sample.

4.2.3.2 Brief Cope Questionnaire

An adapted version of the Brief Cope questionnaire was used to measure a range of coping responses. The ensuing instrument consisted of 26 items that have been categorised into two subscales that measure problem focused and emotional focused strategies. All items in the adapted Brief Cope scale are designed to be self-administered and base on a four–point scale (1–4). Continuous scores for each subscale are obtained by summing the scores of all the items within that subscale. Possible scores on the problem focused coping subscale range from 6 to 24, while those on the emotional coping subscale range from 20 to 80.

4.2.3.3 24 Hour Recall Method

A detailed record of participant's food intake (type, frequency and quantity) over a 24 hour period during the examination period was collected using 24 hour dietary recall interviews. The interviews were designed to capture participants daily dietary intake, including main meals, snacks and drinks consumed over the course a given day. The interviews also allowed for participants to describe key events or stressors that could have influenced their diet.

4.2.4 Procedures

4.2.4.1 Data Collection

Data was collected as outlined in 3.2.5. The Perceived Stress Scale (PSS) and the Brief Cope questionnaire were used to collect stress and coping data during non-examination and examination period. Whilst data on the sample's social demographic characteristics and healthy lifestyle choices were collected once during the first half of the study. Data on participants' three day dietary intake during non-examination period and one day food intake during examination period were recorded in food diaries.

4.2.4.2 Data Analysis

Data was analysed as outlined in 3.2.6.

4.3 Result

4.3.1 Response Rate

Out of the 491 participants who took part in the baseline study (T1) during the start of the academic year of 2011-2012, 322 continued with the follow-up study (T2) during examination period, whilst 169 participants dropped out of the study (34.4%). The response rate for the follow-up study was therefore 65.58%.

4.3.1.1 Rationale for Dropout

The baseline data on participants who participated in the baseline study (T1) was reviewed to investigate whether withdrawal from the study was due

to underlying bias. Statistical analysis was carried out to examine the moderating effect of stress at T1 on the decision to stay or drop out of the study. Additionally, comparative analysis of anthropometric variables was carried out between the group of students who dropped out and those that continued on with the study based.

The median stress scores of participants who dropped out of the study was 30 (n=169), whilst the median stress scores of participants who completed the follow up study was 29 (n=322). A Mann Whitney U Test was performed to determine if there was a significant difference in the stress scores of the drop-out and follow-up groups ($p \leq 0.05$). The results showed that participants who dropped out of the study reported significantly higher stress levels than those that continued in the study (U=23485, p=0.013, r= 0.113).

The association between the reported level of stress and the anthropometric characteristics of students who drop out of the study was also investigated and the results are shown in the table 8 below;

		PSS14 Score Statistic – Dropout Cohort						
		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	30	8	45	24-35	1524	N/A	0.215
	22-34yr	30	12	53	25-36			
Course of study	Medicine	20	20	23	20-23	N/A	6.849	0.232
	App Medicine	20	20	22	20-21			
	Science	23	20	26	22-23			
	Economics and Administration	22	18	28	21-23			
	Art and Humanities	22	19	27	21-23			
	Home Economics	22	20	34	21-23			
Year of study	Year 2	32	8	53	24-37	N/A	1.984	0.371
	Year 3	29	10	42	22-34			
	Year 4	29	16	51	25-35			

	Year 5	31	12	42	24-34			
BMI category	Underweight	31	17	43	24-37	N/A	0.957	0.812
	Normal	30	8	53	23-36			
	Overweight	29	18	45	26-34			
	Obese	33	24	41	26-37			
Physical Activity	Never	34	18	51	25-40		4.573	0.334
	Rarely	31	12	53	26-35			
	Regular	28	8	53	23-35			
Insistence on eating healthy	Yes	30	10	53	25-34	3211		0.738
	No	31	8	53	24-36			
Smoking	Smokers	31	22	53	24-38	1570		0.727
	Non- Smokers	30	8	53	25-35			

Table 8 PSS14 Score Statistic – Dropout Cohort

The mean coping score of participants that dropped out of the study was 69.53 (n=169) and the mean coping score of participants who completed the follow up study was 69.42 (n=322). In order to determine if there was a statistically significant difference in the mean coping scores of participants in the two groups, an independent T-test was performed ($p \leq 0.05$). The results indicated that there was no significant difference in the coping score of participants who dropped out and participants who completed the follow up study ($t(464) = -1.26$; $p=0.9$).

The results of analysis of the association between the reported coping strategy and demographic characteristics of students who drop out of the study are shown in Appendix G.

4.3.2 Socio-Demographic Characteristics of examination sample

The normality of data was checked using the Kolmogorov-Smirnov test with the significance of the p value set at > 0.05. The results revealed that the age data was not normally distributed ($D(322) = 0.014$, $p=0.001$). The median age

of respondents was 21years (Min= 18, Max=34, n=322). A breakdown of the responses received across the different faculties at the university is set out in the table 9 below.

Faculty	Follow up	%
Faculty of Medicine	19	5.9
Faculty of Applied Medical Science	43	13.4
Faculty of Science	30	9.3
Faculty of Economic and Administration	78	24.2
Faculty of Art and Humanities	54	16.8
Faculty of Home Economic	86	26.7
Not indicated	12	3.7
Total (n)	322	100%

Table 9 Sample 2 Distribution by Academic Faculty

The results of data analysis of the data showed that 25.3% of respondents (n=296) were in their second year of their academic programme, 29.4% were in their third year, 32.4% were in their fourth year and 12.8% of participants were in their fifth year (see **Error! Reference source not found.**6).

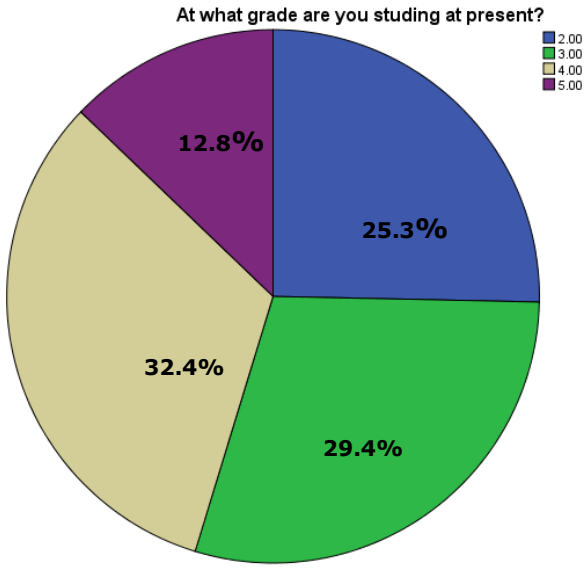


Figure 6 Age Distribution by Year of Study

4.3.3 Anthropometrics and weight-related behaviour of examination sample

4.3.3.1 Body Mass Index (BMI)

Analysis of the data revealed that both self-reported height and weight were not normally distributed. The median height of participants who took part in the follow-up study (n=300) was 159 cm (IQR 155cm - 164cm; Min = 133cm, Max= 186cm) and the median weight (n= 310) was 55kg (IQR 47kg - 68kg; Min = 27kg, Max=124kg). Descriptive statistics of the resultant BMIs for the sampled population (n=298) at T2 revealed a mean BMI of 23.38Kg/m^2 (Min= 14.6, Max=47.25, SD=5.70). The results of further analysis revealed that participating students fall within four BMI categories as shown in table 10 below;

BMI	Underweight BMI <18.5 Kg/m^2	Normal 25-29.99 Kg/m^2	Overweight 25-29.99 Kg/m^2	Obese >30 Kg/m^2
%	18.86	49.83	18.19	13.15

Table 10 BMI descriptive statistics

Participants' self-reported ideal BMI was normally distributed with a mean of 20.97 Kg/m^2 (SD=2.47; Min=14.69, Max= 34.07 Kg/m^2). Analysis of the difference between participants' self-reported actual BMI and their self-reported ideal BMI is shown in figure 7 below.

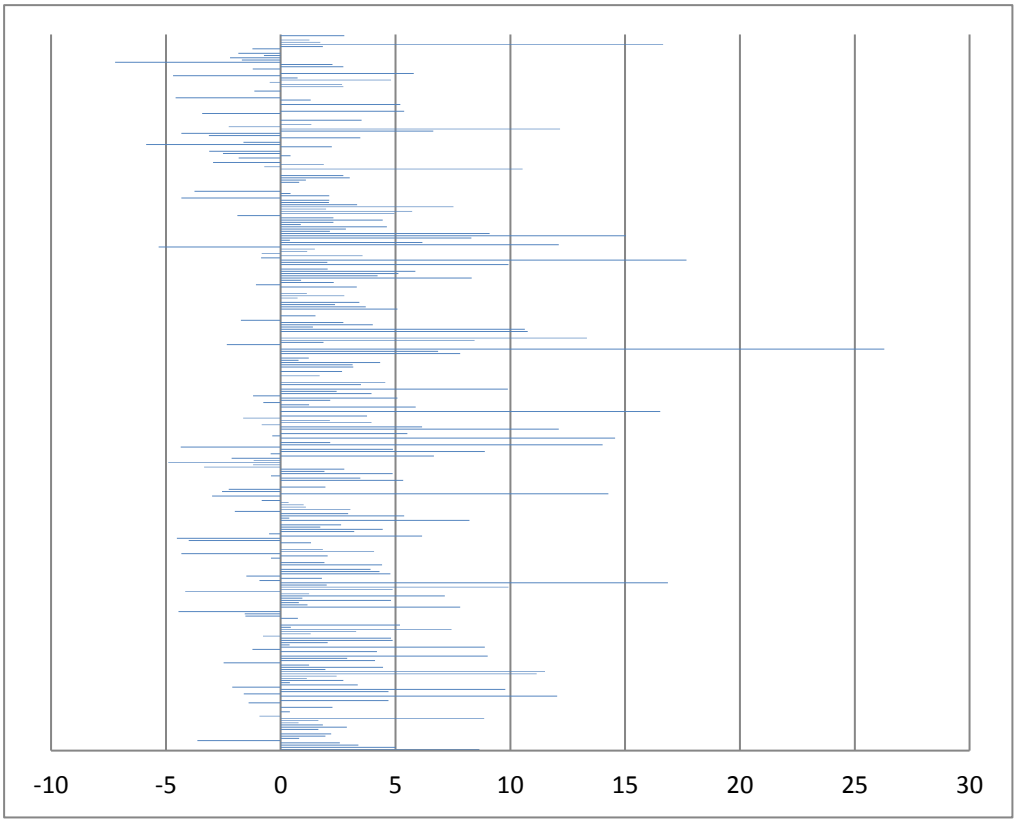


Figure 7 Difference between actual and ideal BMI

When respondents were asked about their intention to lose weight (n=320), 45.3% (n=145) of the participants reported that they were actively trying to

lose weight and 54.7% (n=175) indicated that they intended to lose weight in the future.

Out of 145 students who reported that they are actively trying to lose weight (and had complete data on self-reported weight and height) 49.3% (n=72) reported skipping of some meals, while 28.8% (n=42) reported that they have tried a low calorie diet. Fewer students used low fat diet and low carbohydrate diet to lose weight 15.1% (n=22) and 6.8% (n=10) respectively. 98% (n=142) of those actively trying to lose weight reported a self-reported ideal BMI less than their self-reported current BMI. Similarly, 2.2% (n=3) were within the underweight BMI category, 46.3% (n= 62) were within the normal BMI category, 30.6% (n= 41) were overweight and 20.9% (n= 28) obese BMI category.

Among the subgroup of respondents who indicated that they intended to lose weight in the future (and had complete data on self-reported weight and height, n=205) 97.6% self-reported an ideal BMI less than their current BMI. Furthermore, 2.6% were within the underweight BMI category, 49.5% were within the normal BMI category, 27.9% were overweight and in the obese BMI category.

4.3.4 Healthy Dietary Behaviours during examination

4.3.4.1 Eating Behaviour and Dietary Adequacy

A comparative analysis of the eating behaviour of 321 students who completed the 24-hour dietary recall interviews was carried out. The results

Study Two: Stress, diet and coping during academic examinations

show changes in the eating frequency between low stress and high stress periods (see Figure 8 for a detail breakdown).

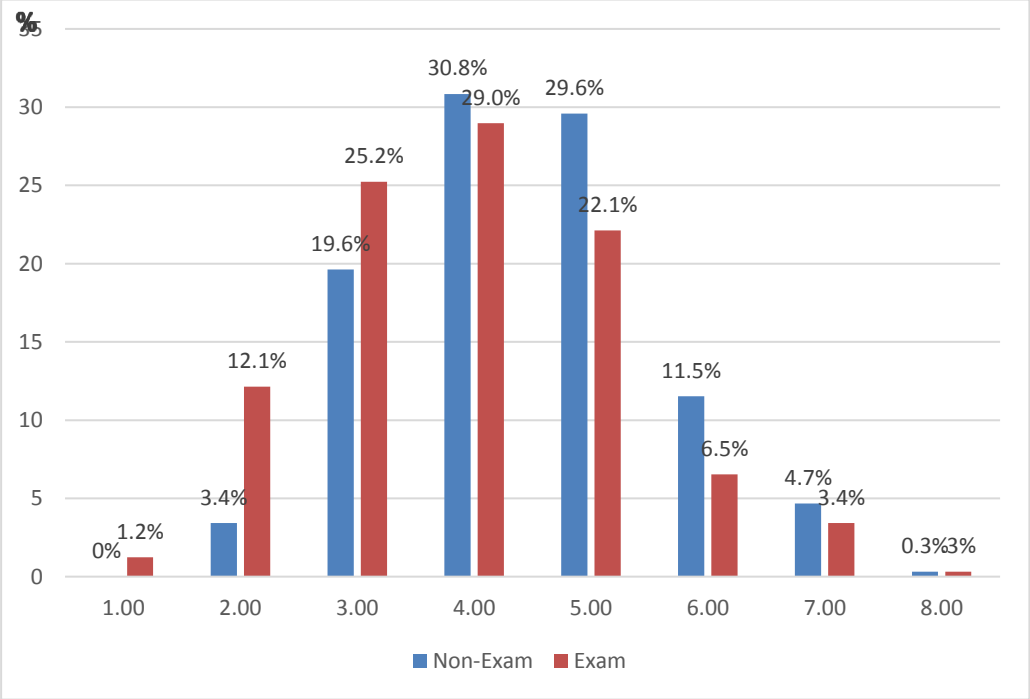


Figure 8 Eating occasion frequency

The data on daily meal frequency, healthy meals and fast food meals were analysed. The descriptive statistics of meal intake by students during low stress (T1) and high stress (T2) periods were compared (N=321) and the results are shown in table 11 below.

	Food Consumption @T1					Food Consumption @T2				
	Mean	SD	Min	Max	Mode	Mean	SD	Min	Max	Mode
No. Meals/day	4.33	1.27	2	8	4	3.9	1.3	1	8	4
Healthy meals	2.21	1.16	0	6	2	1.79	1.27	0	5	2
Fast Food	2.12	1.3	0	7	1	2.14	1.24	0	6	2

Table 11 Healthy and Fast Food Consumption

The stress scores and the daily dietary intake of students who took part in the study during non-examination (T1) and examination (T2) periods (n=322) were analyse. A paired t-test was performed to determine whether there was a statistical significant change in the daily frequency of meal intake, healthy and fast food ($p \leq 0.05$).

The results also showed that there is a statistical significant decrease in students' reported frequency of total food intake between non-exam and exam periods ($t(320) = 6.195$; $p=0.001$). Similarly, there was a decrease in the mean intake of healthy food during examination period, however the change was not significantly different ($t(320) = -1.317$; $p=0.189$). The results also showed that there was an increase in the intake of fast food meals by students during examination period ($t(320) = -3.439$; $p=0.001$).

The data also revealed that 44.9% of students ate fruit and vegetables as part of their daily diet, 17.4% ate no fruits, 9.0% ate no vegetables and 28.7% had neither fruit nor vegetables (illustrated in the figure below).

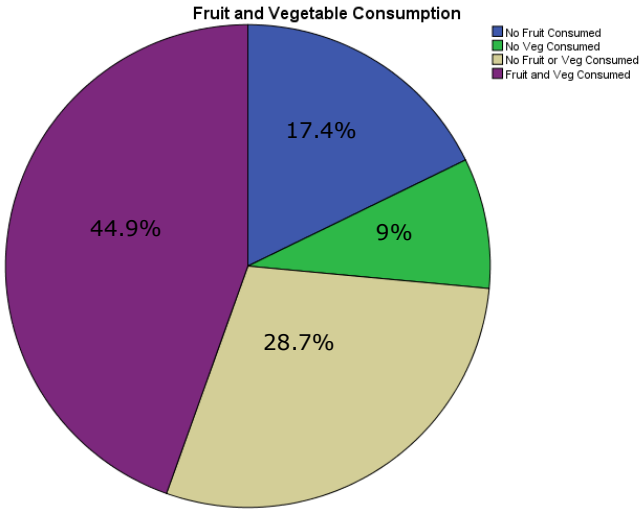


Figure 9 Fruit and Vegetables Consumption

Data from the 24-hour dietary recall on total energy and energy from macro-nutrients revealed that students reported having a diet relatively rich in carbohydrate but low in protein (Table 12). See Appendix H for a full comparison of energy, micro- and macro-nutrients against Dietary Reference Values).

	Mean (SD)	Median (IQR)	Min-Max
Energy (kcal)	1192 (543)	1103 (787-1543)	272-3365
Protein (% energy)	42 (22)	39 (26-55)	5-124
Fat (% energy)	45 (24)	41 (27-60)	6-161
Carbohydrate (% energy)	163 (85)	148 (105-148)	27-564
Starch (% energy)	76 (41)	70 (44-100)	0-233
Total sugar (% energy)	60 (43)	54 (30-80)	0-238

Table 12 Macronutrient Intake during examination period

The majority of participants (72.4%) self-reported consuming a high-sugar beverage (such as Coca Cola or Pepsi) during a regular day, while 27.6% reported consuming one to 6+ cans per day. Out of the 322 students who

provided responses, 75.8% of students reported that they never drink high-energy high-caffeine drinks (such as Red Bull) while only 5.6% reported drinking one or more energy high-energy high-caffeine drinks a day. Furthermore, a comparison of the frequencies of chocolate and sweet consumption was commonly reported (figure 10).

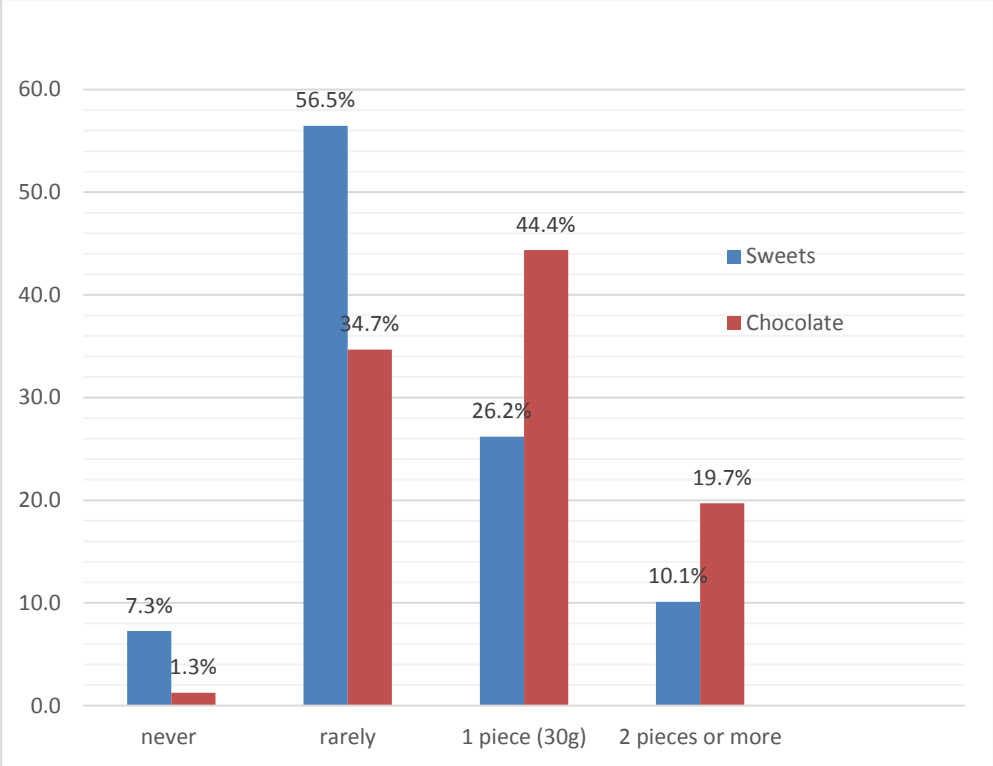


Figure 10 Reported Chocolate/Sweets intake of participants

Out of the 316 students who provided responses to questions about whether or not they insisted on eating healthy foods, 50.3% of students answered "yes", while remaining students reported they do not usually insist on eating healthy foods.

46.5% of participants (n=316) self-reported rarely consuming coffee during a regular day, while 34.8% of students reported drinking one to four more cups of coffee a day and another 18.7% of respondents reported that they never drink coffee. Similarly, close to half of participants (49.1%) self-reported rarely drinking tea, while 35.2% reported drinking one to four cups of tea a day. It was equally reported by 15.7% of students that they never drink tea.

4.3.4.2 Physical Activity during examination period

41.7% (n= 321) of students reported that they rarely exercise, 21.5% of students reported that they never exercise and 36.8% exercise regularly. Results also showed that out of the 118 students who exercise regularly, 55% reported that they perform light exercise such as normal walking, walking down stairs and bowling. 43% reported taking part in moderate exercise such as brisk walking and ascending stairs and 2% reported that they engaged in strenuous exercise such as running (5 km) and cycling (25 km).

4.3.4.3 Smoking

Out of the 320 study participants who provided responses to questions about whether or not they smoked cigarettes, water pipes, shisha, hubbly bubbly, 8.8% of students answered "yes" and 91.2% of students answered that they did not smoke.

4.3.5 Perception of Stress

The normality of the PSS14 data was using the Kolmogorov-Smirnov test (p value set at > 0.05) revealed that scores on the PSS-14 were normally distributed (*D* (321) = 0.042, p<0.200) with a mean of 29.61 (SD = 8.24, min= 5, max= 53). A Mann Whitney U test showed that students in the younger age group (17-21yrs) reported significantly higher PSS-14 scores compared to those in the older age group (22-34yrs) (U= 8763, p=0.004). Results also showed that participants who smoked reported a statistical significantly higher PSS-14 scores compared to those students who were non-smokers, (U= 8869, p=0.017, r = 0.108). Whereas Kruskal Wallis H test revealed that there was a no statistically significant difference in PSS-14 scores across the BMI categories, year or subject of study, exercise frequency and insistence on eating healthy (see Table 13 for details).

		PSS14 Score Statistic of Examination Cohort						
		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	28	7	48	21-31	8763	N/A	0.004
	22-34yr	32	5	49	23-32			
Course of study	Medicine	32	18	53	23-37	N/A	9.367	0.095
	App Medicine	27	7	45	21-34			
	Science	27	11	47	24-32			
	Economics and Administration	30	15	49	23-33			
	Art and Humanities	26	9	47	21-35			
	Home Economics	32	5	48	23-33			
Year of study	Year 2	28	7	49	21-35	N/A	3.598	0.308
	Year 3	30	9	49	22-33			
	Year 4	31	16	47	23-33			
	Year 5	32	5	53	22-30			
BMI category	Underweight	28	5	48	22-35	N/A	7.507	0.057
	Normal	30	10	49	24-34			
	Overweight	29	9	47	23-33			
	Obese	33	11	53	26-37			
Physical Activity	Never	29	7	49	23-34		4.044	0.40
	Rarely	30	5	53	23-33			

	Regular	28	9	47	21-31			
Insistence on eating healthy	Yes	29	5	48	21-31	10973		0.063
	No	30	7	53	23-35			
Smoking	Smokers	34	7	47	24-38	3059		0.028
	Non- Smokers	29	5	53	23-33			

Table 13 PSS14 Score Statistic of Examination Cohort

4.3.6 Coping with Stress during examinations

4.3.6.1 Brief-COPE scale scores

The median coping score of the students who completed the coping scale (n=297) was 72 (IQR = 67 - 78). The normality of the data on total coping scores was checked using the Kolmogorov-Smirnov test with the significance of the p value set at > 0.05. The results revealed that the data were not normally distributed (*D* (297) = 0.083, p=0.001).

The respondents total coping scores during T1 (non-exam period) was compared with T2 (exam period) using a Wilcoxon Signed Rank Test to determine if there was any significant difference in the reported coping scores (P≤ 0.05). The test results revealed that reported total coping scores of students were significantly higher during exams periods (Z=4.205, P =0.001).

Both the scores on the Brief-COPE problem-focused coping subscale and the emotion-focused subscale were not normally distributed (*D* (315) = 0.081, p=0.001, and *D* (300) = 0.070, p=0.001, respectively). The respondents reported coping strategies before and during exam were broken up into emotional and problem focus coping categories and their descriptive statistic compared.

A Wilcoxon Signed Rank Test was performed to establish whether there were significant differences in reported problem and emotional focused scores between non-exam (T1) and exam (T2) periods (P≤ 0.05). The result of the test revealed that there was no significant difference in students' problem focused scores during exams periods (Z=4.025, P =0.121). Whereas, students emotion focused scores increased significantly during exams periods (Z=4.205, P=0.001).

Analysis of data revealed that there were no significant differences in the BRIEF Cope problem subscale scores between participants in the different age groups, courses of study and other anthropometric variables (see Appendix I). A Pearson bivariate correlation test was carried out to determine the relationship between PSS14 stress scores and problem focused coping scores was calculated. The results showed that there was a negative correlation between the two variables, r = -0.171, n = 315, p = 0.002.

Emotional Subscale

The results of statistical analysis revealed that there was a significant difference in the BRIEF Cope emotional subscale scores between participants in different year of study (χ^2 (3) = 9.167, p = 0.027). *Post hoc* pair-wise comparisons, using Mann Whitney test with a Bonferroni correction of 0.0083, revealed that emotional coping scores of students in their second year were significantly higher than those of students in their fifth year (U= 819.5, p=0.003). Analysis of data also revealed that there were no significant

differences in the BRIEF Cope emotional subscale scores between participants in the different age groups, courses of study and other anthropometric variables (see Appendix I).

A Pearson bivariate correlation test was carried out to determine the relationship between PSS14 stress scores and emotion focused coping scores. The results showed a positive correlation between the two variables but it was insignificant ($r = 0.067$, $n = 300$, $p = 0.250$).

4.3.6.2 Changes in perceived levels of stress

The normality of PSS14 data at both time points (n=322) was checked using the Kolmogorov-Smirnov test with the significance of the p value set at > 0.05. The results revealed that the data was not normally distributed ($D(321) = 0.042$, $p=0.001$). A Wilcoxon Signed Rank Test was carried out to determine if there was a significant difference in stress scores reported by participant at T1 and T2 ($P> 0.05$). The results of the test revealed that reported perceived stress levels were significantly higher during exams periods ($Z=4.207$, $P <0.001$).

Out of the 322 students that took part in study two, 57.14% (n=184) reported an increase in stress levels between T2 compared to T1. A description of the statistical distribution of PSS14 data of this group of students across anthropometric and demographic variables is shown in table 14 below.

A Mann Whitney U test showed that students in the younger age group (17-21yrs) reported significantly higher PSS-14 scores compared to those in the

older age group (22-34yrs) (U= 2595, p=0.001). The results also showed that the group of students who did not insist on eating healthy food reported significantly higher PSS-14 scores than those who did (U= 3293, p=0.0019). Likewise, students who smoked reported significantly higher PSS-14 scores compared to non-smokers (U= 931, p=0.021). Kruskal Wallis H test revealed that there was a no statistically significant difference in PSS-14 scores across other anthropometric and demographic variables (see Table 14).

		PSS14 Score Statistics						
		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	30	11	48	21-34	2595	N/A	0.001
	22-34yr	34	19	49	24-31			
Course of study	Medicine	37	18	44	23-37	N/A	4.511	0.478
	App Medicine	33	24	41	21-32			
	Science	27	15	47	22-32			
	Economics and Administration	32	19	49	23-33			
	Art and Humanities	29	11	47	21-36			
	Home Economics	34	16	48	24-32			
Year of study	Year 2	34	15	49	22-39	N/A	4.370	0.224
	Year 3	31	11	48	22-33			
	Year 4	32	17	47	23-33			
	Year 5	34	24	47	22-32			
BMI category	Underweight	28	11	48	23-39	N/A	7.475	0.058
	Normal	32	17	49	24-35			
	Overweight	32	18	47	24-35			
	Obese	36	23	47	26-31			
Physical Activity	Never	33	20	49	24-35		2.035	0.844
	Rarely	32	11	53	24-35			
	Regular	31	15	46	22-32			
Insistence on eating healthy	Yes	31	11	48	20-30	3293		0.019
	No	34	15	53	23-35			
Smoking	Smokers	36	22	47	27-38	931		0.021
	Non- Smokers	32	11	53	22-33			

Table 14 PSS14 Score Statistic of Students with increased Stress Levels

4.3.6.3 Change in Stress and Coping

Out of the 322 students that took part in study two, 57.14% (184 students) reported an increase in stress levels between T2 compared to T1. A paired t-test was carried out to determine whether there was a significant increase or decrease in total coping scores of these students between T1 and T2 ($p \leq 0.05$).

The results of the paired t-test revealed that there was a significant increase in these students total coping scores during exam period (T2) compared to the period when there was no exams ($t(169) = 4.559$; $p = 0.001$).

Likewise, the reported use of emotion and problem focus coping strategies by students who experienced a higher level of stress during exams was analysed. A paired t-test was used to investigate whether that was a significant increase or decrease in the use of emotion and problem focus coping strategies between T1 and T2 ($p \leq 0.05$). The results revealed that there was a significant increase in the use of emotion focused coping strategies by these students during exam periods compared to non-exam time ($t(170) = 4.559$; $p = 0.001$). However, a similar test showed that there was no significant increase in the use of problem focused strategies ($t(179) = 2.361$; $p = 0.109$).

A description of the statistical distribution of BRIEF Cope of this group of students across anthropometric and demographic variables is shown in Appendix J**.**

A Pearson bivariate correlation test was carried out to determine the relationship between PSS14 stress scores and emotion focused coping scores. The results showed a positive correlation between the two variables but it was insignificant ($r = 0.067$, $n = 300$, $p = 0.250$).

4.3.6.4 Change in Stress and Dietary Behaviour

The dietary behaviour of students who reported an increase in stress levels (n=184) during exams was analysed from data collected from 24-hour dietary recall interviews.

The data revealed that 44.9% of students ate fruit and vegetables as part of their daily diet, 17.4% ate no fruits, 9.0% ate no vegetables and 28.7% had neither fruit nor vegetables.

Data from the 24-hour dietary recall on total energy and energy from macro-nutrients revealed that students reported a relatively high carbohydrate diet but low a low protein diet (Table 15).

	Median (T1)	Median (T2)
Energy (kcal)	1184.83	1102.5
Protein (% energy)	42.23	39.15
Fat (% energy)	46.83	41.55
Carbohydrate (% energy)	157.12	148.4
Starch (% energy)	73.82	70.4
Total sugar (% energy)	54.12	53.75

Table 15 Macronutrient Intake of students with higher stress scores at T2

A comparison of the eating frequency of these students before (T1) and during examinations (T2) is shown in Figure 11.

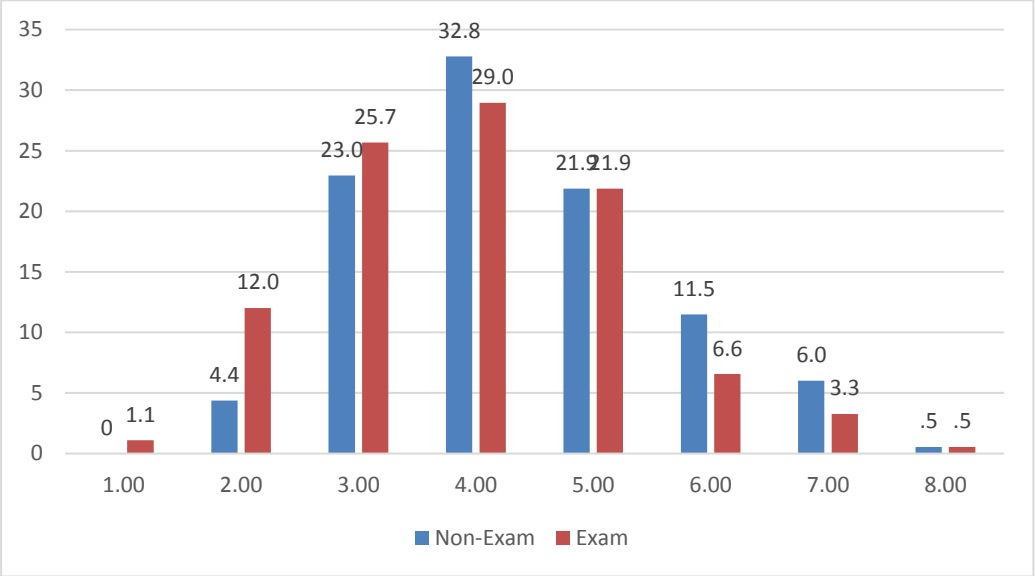


Figure 11 Comparison of eating occasion frequencies

Similarly, the data on daily meal frequency, healthy meals and fast food meals were compared (N=321) and the results are shown in Table below.

	Food Consumption @T1					Food Consumption @T2				
	Mean	SD	Min	Max	Mode	Mean	SD	Min	Max	Mode
No. Meals/day	4.33	1.27	2	8	4	3.9	1.3	1	8	4
Healthy meals	2.21	1.16	0	6	2	1.79	1.27	0	5	2
Fast Food	2.12	1.3	0	7	1	2.14	1.24	0	6	2

Table 16 Comparison of Student's Healthy and Fast Food Consumption at T1 and T2

The stress scores and the daily dietary intake of students who took part in the study during non-examination (T1) and examination (T2) periods (n=182) were analyse. A paired t-test was performed to determine whether there was a statistical significant change in the daily frequency of meal intake, healthy and fast food ($p \leq 0.05$).

The results also revealed that there was no significant change in the mean intake of fast foods (t (182) =-0.207; p=0.836). The results showed that there is a statistical significant decrease in students' reported frequency of total food intake (t (182) = 3.583; p=0.001). It equally showed that there was a decrease in the intake of healthy meals by students during examination period (t (182) = 4.125; p=0.001).

4.4 Discussion

The goal of this study was to examine the perception of academic stress by a sample of female undergraduate students in King Abdul-Aziz University in Saudi Arabia. The study also examined the healthy lifestyle choices of these students during examination periods.

491 participants were recruited onto the first phase of the study (T1) during a period when no examination were scheduled, of whom 322 completed the follow-up study (T2) during a period of academic examination, producing a useable response rate of 65.58%. Dropouts from longitudinal studies such as these are not uncommon and they can often have adverse implications such as selection bias and inappropriate conclusions of any study (Hogan et al., 2004). Given the size of the study sample, follow-up interviews with the dropout cohort was not possible, however analysis of explanatory and response variables was carried out to determine if the drop out was random or non-random. The results showed that there was no evidence to suggest

that the anthropometric characteristics or dietary behaviour of students systematically influenced the drop out from the study.

However, results showed that students who dropped out of the study reported significantly higher stress levels than those that continued in the study (U=23485, p=0.013). This suggests that stress might have been a key factor in the decision to pull out of the follow-up study during examinations. According to a number of researchers (Philips et al., 2015; Abdulghani et al., 2014; Edwards et al. 2014; Boparia et al., 2013) academic testing has been associated with increases in anxiety, stress and depression in undergraduates. It is therefore possible that students susceptible to stress were unable to cope with the demands of a longitudinal study.

The demography of students who took part in this study is quite similar to those that participated during the non-examination period. The median age of students (N-322) that took part in this study during their first semester examinations was 21years, with the majority of participants being drawn from the faculties of Home Economics (26.7%) and Economics and Administration (24.2%). The median BMI for the student sample population was 23.38Kg/m2 (Min= 14.6, Max=47.25, SD=5.70) and they did not routinely engage in physically exercise with 63.2% reporting that they rarely or never engaged in any physical activity. Similarly, 50.3% of the study participants would normally insist on eating healthy food whilst the other half did not. The regular consumption of caffeine rich beverages i.e. coffee, tea and energy drinks by

students was 34.8%, 35.2% and 5.6% respectively of the sample population (n=483), which are not significantly dissimilar from the results reported during the baseline study.

A key objective of this study was to examine the perceived level of stress reported by a sample of female students during a period when examinations were scheduled (high stress) and to identify any differences across demographic groups when compared with what was reported during a low stress period. The results revealed that students reported significantly higher levels of stress ($p<0.001$) during examinations compared to the period when no examinations were scheduled.

The significance of examination as a key academic stressor for universities has been identified by a number of studies (Misra and McKean, 2000, Shah et al., 2010, Supe, 1998, Gaynor et al., 2006, Zajacova et al., 2005). In a study by Austin et al. (2010) that investigated the effect of examinations as an acute academic stressor in a group of 475 Canadian undergraduate students. The results showed that students reported a significantly higher level of stress before exams compared to the beginning of the study. Similarly, research into academic stress in Saudi Arabian universities have identified examinations as a common source of stress amongst undergraduate students (Al-Sowygh, 2013, Ibrahim et al., 2013, Pani et al., 2011). A study by Al-Dabal et al. (2010) examined academic predictors of stress in 319 female medical undergraduates compared to that of 297 non-medical students in Dammam University, Saudi Arabia. Al-Dabal and his colleagues reported that

examinations was a significant stressor for both medical and non-medical students and was associated with changes in lifestyle (tea and coffee intake, smoking, use of sedatives and anti-depressants) in an attempt to cope with exam stress. The results of this study therefore contribute to existing understanding of academic examinations as a key stressor in the university environment. The results equally corroborate the notion that examination initiated stress is a cross-cultural phenomenon present in academic environments irrespective of cultural or national settings (Allgower et al., 2001, Mikolajczyk et al., 2009, Pulido-Martos et al., 2012, Tavolacci et al., 2013).

The effect of examination stress across the student population was examined as part of this study. The results showed that during a period of scheduled examinations, younger students (17-21yrs) reported significantly higher levels of stress compared to older students (22-34yrs), similar to that observed during periods of low stress. These results suggests that age is a possible moderator of stress in the university environment.

Other studies have reported similar results linking exam related stress with age. In a longitudinal study by Austin et al., (2010) of undergraduate students in a Canadian university at the start of the semester and just before examinations commenced, the results showed that students in the younger age group (17-21yrs) reported higher levels of exam related stress than those in the older group (=>22yrs). It has been theorised that age is a factor in the level of stress perceived by individuals in any given situation. According to

Aldwin et al., (1996) older individuals are more likely to report fewer stressors and perceive these hassles as less stressful than their younger counterparts. It has been argued that there are two possible reasons that may account for the moderating effect of age on perceived levels of stress. The first being that older individuals are more likely to have developed more robust and different coping mechanisms as a results of a wider range of experience. Similarly, they may have experienced more acute stressful episodes than there younger peers and as such are more likely to perceive recurrent life events (like examinations) as less stressful (Aldwin, 1994a; Aldwin, Levenson, & Spiro, 1994; Aldwin et al., 1996). The alternative explanation is that the observed difference in the perception of stress amongst age groups may be due to a reporting bias similar to the observed bias in older adults reporting less adverse impact of stress and less emotional symptoms of stress (Cohen, 1990; Lawton, Kleban, & Dean, 1993).

In this study, the rationale for the moderating effect of age on stress perception was not explored in any great detail. Although comparisons between low and high stress periods indicated that the moderating effect of age was not influenced by the application of a stressor (examinations) as the results did show that age is not a discriminating factor for the sample of students who reported significantly higher levels of stress during exams. However, given that this relationship has not been controlled for other variables such as income, social status or anthropometrics, generalisation of this result beyond this study should be treated with caution. Further

investigation is therefore required to understand the significance of age during high stress period.

The perception of stress across other demographic characteristics such as student's year of academic study and academic faculty was also examined as part of this study. The study results showed that during examination period there was a no significant difference in perceived levels of stress within the sample population based on students' year of study and academic faculties. These results were similar to that observed during low stress periods (no examinations scheduled), which suggests that students' perceived levels was not influenced by these demographic variables. As previously discussed, there is a dearth of research into the importance of theses variables as predictors of academic stress. Although the study results showed noticeable, notwithstanding insignificant differences in perception of stress across different year of study and academic faculties, there is a need for more detailed research to improve understanding of any possible associations.

The relationship between the reported level of stress and body mass index (BMI) of students was also investigated and the results showed that there was no significant difference in the reported levels of perceived stress across the different BMI categories during high stress period. This is in contrast with observed results from the first study where results showed that students in the obese BMI category reported statistically higher levels of perceived stress than students in the overweight BMI category. It is possible that these results may have been influenced by the dropouts from the study.

BMI has been identified by several commentators and in several studies (Andersson and Rössner, 1997; Inelmen et al., 2005) as an indicator of dropout. In a study by Kaiser et al., (2014) that looked at baseline characteristics and the risk of dropout, results showed that there was a significantly increased risk of dropout associated with increasing BMI. In this study there was no evidence to suggest that there was a significant difference in BMI of students in the two different time points even though there was an observable difference in the mean BMI.

The significance of students' healthy lifestyle choices during academic examinations and how these choices influenced the level of perceived stress was investigated as part of this study. The four variables considered were physical activity, smoking, insistence on eating healthy meals and reported dietary behaviour by students. The results of the study showed that during examinations there was no significant change in the scale of students involvement in physical activity compared to period when no examinations were planned. Similarly, there was only a marginal increase in the proportion of students who reported that they were actively trying to lose weight (43.8% to 45.3%) between non-exam and exam times. The same was observed in the percentage of students who declared that they did not smoke cigarettes during examination (increase from 89.6% to 91.2%). The results of analysis showed that student's involvement in physical activity as well as their insistence on eating heathy meals during examinations was not significantly associated with their reported level of perceived stress. However, the results

of this study showed that smokers reported higher levels of perceived stress than non-smokers during examinations.

Smoking is an important lifestyle choice that is believed to have adverse health and social effects. The relationship between smoking and stress has been the subject of a large body of research (Parrott, 1999; Kassel et al., 2003; Hajek et al., 2010; Parrott and Murphy, 2012). A review of the literature indicates that nicotine in cigarettes is closely linked to perception of stress by smokers and that there are two key models of the smoking-stress relationship. The traditional model also known as the nicotine resource model describes smoking as a coping mechanism that relieves the adverse effects of stress and anxiety (Parrott and Murphy, 2012). Proponents of this model (Warburton, 1992; Kassel, 1997) argue that the nicotine derived from cigarettes acts as a beneficial mood regulator that produces calming effect and increases concentration, and as such it is theorised that stopping smoking will lead to increase levels of stress and anxiety (Rusted and Trawley, 2006; Perkins et al., 2010; Parrott and Murphy, 2012). This theory has been supported by a number of studies (Hughes et al., 1990; Parrott, 1995; Kassel, 1997; McEwen and McRobbie, 2008), which found that people who smoke regularly are more stressed when they abstain from smoking compared to when they were smoking, and they feel less stressed once they begin smoking again.

However, there is a contrary view which theorizes that nicotine in cigarettes heighten mood swings and anxiety rather than soothe them, and is

responsible for smokers reporting higher levels of perceived stress than non-smokers (Hajek et al., 2010; Parrott and Murphy, 2012). The abstinence reversal model explains the reported mood decline and higher levels of perceived stress during short periods of abstinence from smoking (Parrott, 1999; Kassel et al., 2003; Hajek et al., 2010; Parrott and Murphy, 2012). The model theorizes that the deprivation of nicotine during the short period in-between cigarettes triggers stress and anxiety in smokers and that the positive mood regulation experienced once smoking is resumed is simply a temporary reversal of the adverse effects of abstinence. The aggregate effect of mood swings and heightened anxiety in between cigarettes explains why smokers typically experience higher levels of stress than non-smokers (Parrott, 2003, 2006). This theory has been corroborated by a number of empirical studies. A study by Johnson et al., (2000) reported that young adult smokers were associated with higher levels of stress, anxiety and mood swings over a 5yr period, compared to non-smokers. A New Zealand based study by McGee et al. (2000) into the predictors of behavioural and psychological disorders in adolescent's reported that those who smoked regularly displayed higher levels of anxiety and depression than those who didn't. A similar study by Steuber and Danner (2005) that monitored the cigarette smoking behaviour of 14,000 young adults reported that higher rates of stress and depression amongst smokers. These studies all point at nicotine dependency as a key factor as higher stress levels were directly proportional increasing frequency and reliance on smoking. The findings of

this study are in line with these and other similar studies (Parrott, 1999; Kassel et al., 2003; Hajek et al., 2010; Parrott and Murphy, 2012) as female undergraduate student who smoked, consistently reported higher levels of stress irrespective of the presence or absence of academic stressors. However, any generalisation of these results should be treated with caution as only a fraction of students (< 10%) that took part in this study were smokers. Furthermore, the stress-smoking relationship can be very complex and can be controlled by multiple factors that are psychological, social, bio-genetic in nature (Parrott and Murphy, 2012). There is therefore a need to further study this phenomena in Saudi Arabian universities in order to better understand the nature of the smoking- stress relationship in these communities.

The perception of high levels of stress by students during examination period is not uncommon and it is expected that students will ordinarily adopt or intensify the use of a range of coping strategies to manage exam stress. In this study, students reported a significant increase in the use of coping strategies during exams. Whilst there was a significant increase in the use of emotion focused coping strategies, there was no significant increase in the use of problem focused strategies. These results are similar to that reported by Sulkowski et al. (2011), who examined the relationship between stress, emotion focused coping and disorder eating. Sulkowski and his colleagues reported that emotion-focused coping in the form of increased emotional eating is often the preferred response to stress particularly amongst female

students. Other studies like that of Struthers et al. (2000) have reported contrary results that suggest that students are more likely to adopt problem focused strategies than emotion focus alternatives when dealing with academic stress. While there are conflicting opinions and research evidence of students preferred approach to managing stress, the results of this study supports the proposition by Elzubeir et al. (2010). They argue that people from middle-eastern countries are culturally inclined to adapt emotion focused strategies such as religion and/or social support when coping with stress rather than adopt a problem centred approach (Elzubeir et al., 2010). In this study, results showed that emotional coping scores of students in their second year were significantly higher than those of students in their fifth year ($U= 819.5$, $p=0.003$). This corroborates the earlier results that identified age as a moderating factor in the perception of stress during examinations. It suggests that the younger group of students who are more likely to be in their second year experienced high levels of stress employed a higher degree of emotional coping strategies.

Emotional focused coping has been associated with stressful events that are perceived by an individual to be unavoidable and out of their control (Bargh and Williams, 2007, Carver et al., 1989, Gross, 1998). The stress experienced by students during examination period can be considered to fall under this category as they are usually of a psychological nature and are often associated with embarrassment, anxiety, depression, frustration and the fear of failure that are often managed using emotion focused coping strategies (Folkman

and Lazarus, 1985, Folkman and Moskowitz, 2004, Gross, 1998). A number of researchers (Aldao et al., 2010, Carver et al., 1989, Fryer et al., 1997, Swindells et al., 1999) are of the opinion that emotion focused coping strategies are maladaptive in nature. Emotion focused strategies that concentrate on the suppression and avoidance of psychological experiences, emotional expression and thoughts are considered maladaptive emotional responses. This is because they have been shown to increase stress by precluding individuals from taking necessary action (Hayes, 2004, Hayes et al., 1999, Wenzlaff and Wegner, 2000). Emotional suppression and avoidance have been associated with a number of psychological conditions including disordered eating (Chang et al., 2004, VanBoven and Espelage, 2006).

This study examined the dietary behaviour of students during examinations. An important choice that students make while at school relates to the type, quantity and quality of food that they eat. The frequency and type of food consumed by students as well as their intake of key nutrients as a result of their diet was investigated as part of this study. The results of the analysis of the 24 hour recall food data broadly indicated that the dietary pattern during periods of low and high stress were similar i.e. most students reported a relatively high carbohydrate/fat and low protein diet. However, a closer comparison of student diets during the two time-points indicate that while there was an increase in the mean intake of carbohydrates and total sugars during periods of high stress, this increase was not significant.

Further analysis showed that there was a statistical significant decrease in the eating frequencies reported by students between low stress and high stress periods. In particular, the proportion students who ate more than 3meals/day decreased significantly. The results also showed that students mean intake of healthy food decreased during examination period and the decrease was statistically significant amongst students who reported an increase in stress. However, the results showed that there was a no significant increase in the intake of fast food meals by students during examination period.

The data also revealed that more students ate fruit and vegetables as part of their daily diet during examinations (38.4% to 44.9%), conversely the proportion of students who ate nether fruit nor vegetables as part of their diet decreased (33.1% to 28.7%). However, these results were not significant but suggest that there were changes to the dietary behaviour of students during examination period. The reported decrease in the frequency of food intake by students during examinations can possibly be explained by concerns about body image and weight gain. The results of this study showed that a relatively high proportion (64.1%) of students who reported high levels of stress also stated that they wanted lose weight, were actively trying to lose to weight (54.7%), skipped some meals (69.3%) and self-reported ideal BMIs less than their self-reported current BMI (97.6%). The results of the study showed that at T1, 41.9% (n=90) of students actively trying to lose weight reported skipping of meals, while at T2, 49.3% (n=72) reported skipping of meals.

These results supports recent studies on poor perception of body image and increasing rates of bariatric surgery amongst female populations in Saudi Arabia (Aldaqal et al., 2013, Al-Nozha et al., 2005, As-Sa'edi et al., 2013, Madani, 2000). This provides a possible explanation as to the observed overall decrease in food intake by students during examinations as concerns about body image and weight gain may discourage increased food intake. According to some researchers (Alqout and Reynolds, 2014, Al-Subaie et al., 1996, As-Sa'edi et al., 2013, Rasheed, 1998) there is a growing perception that in Saudi Arabia, cultural views on body weight is moving from conventional positive associations of large-size body with well-being and prosperity towards more Westernised norms of thinness. Consequently, it could be inferred that these new cultural norms on body image may be important moderators of stress induced changes in dietary behaviour. However, further research is required to corroborate this supposition.

The observed decrease in the intake of healthy food by students during examinations may be linked to attitudes towards healthy food and the constraints of food preparation. The study results showed that 46.4% of students who reported higher levels of stress during exams do not usually insist on eating healthy food. Likewise 71% of these students (n=130) reported that they find it difficult to eat healthy food during exams. Food preparation can play a key role in these decisions as time is perceived to be scarce and cooking is likely to be less of a priority during the run up to examinations. A study by Larson et al. (2006) examined food-preparation behaviours amongst

young adults. It reported that lack of time was the most common reason given by young adults for not engaging in food preparation. Larson and his colleagues reported that young adults who regularly prepared their food ate less fast-food. Similarly, other studies (Neumark-Sztainer et al., 1999, Papadaki et al., 2007, Story et al., 2002) have reported that food preparation is a key determinant of food choice and consumption amongst adolescents and young adults. Given that the preparation of healthy cooked meals require more effort and time to prepare (Story et al., 2002), it can be inferred that students are more likely to skip healthy cooked meals in place of ready meals and pre-packed food items during examination period. Conversely, there may be an inclination towards the consumption of healthy portions of fruit and vegetables that do not require any preparation.

On the other hand, the reported increase in the intake of fast foods by students during examinations is telling of recently observed socio-cultural changes in Saudi Arabian society in relation to food choices and eating patterns in the Saudi population (Al-Nuaim et al., 1997, Gasbarrini and Piscaglia, 2005). A number of studies (Amin et al., 2008, Mahfouz et al., 2008) have shown that the diet of Saudis is increasingly made up of animal products and refined foods and less of fruits and vegetables, which is similar to that of western nations. Similarly, dietary changes have been observed in terms of increased portions and reduced nutritional quality of meals consumed both of which have been implicated in the rise of the proportion of obese and overweight individuals in the Saudi Arabia population (Al-Nozha et al., 2005,

Al-Rethaiaa et al., 2010, Trainer, 2012). According to Badran and Laher (2011), and Musaiger (2011), health data show that there are approximately 30% of Saudi men and 40-50% of Saudi women are obese. It has been suggested that students in Saudi universities are particularly at a high risk of adopting these aforementioned unhealthy eating habits and associated body weight gain (Al-Daghri et al., 2014b, Al-Rethaiaa et al., 2010) and more so female students (Al-Rethaiaa et al., 2010, Rasheed et al., 1994, Sheikh-Ismail et al., 2009). Furthermore, a number of studies (Al-Daghri et al., 2014a, Al-Rethaiaa et al., 2010, Majeed, 2015, Sheikh-Ismail et al., 2009) have reported that in Saudi Arabian universities, changes in students eating habits linked to academic stress have been associated with an increased intake of unhealthy foods such as fast food, sugar-rich foods, chocolates, biscuits, sweets and other confectionaries etc.

The results of this study supports the view that students experiencing academic stress during examinations and reporting higher emotional focused coping scores are likely to significantly lower their of frequency food intake. These results suggest that vulnerability to stress was associated with emotion-focused coping and changes in food intake. It therefore supports the proposition that the increased use of emotional coping and low use of adaptive coping is associated with changes in eating pattern that may eventually lead to disordered eating. It has been argued by some researchers (Aldao et al., 2010, Elfhag and Rössner, 2005, Fryer et al., 1997, Macht, 2008, Mikolajczyk et al., 2009, Polivy and Herman, 2002, Whiteside et al., 2007) that

individuals with poorly managed emotional responses to stressful events resort to either increased or decreased food intake as a means of avoiding or inhibiting their negative emotions. It has equally been suggested that women are more prone to demonstrate disordered eating triggered by dysfunctional emotional coping methods compared to men (Mikolajczyk et al., 2009). A proposition that is supported by the results of a number studies (Macht et al., 2005, Mikolajczyk et al., 2009, Sulkowski et al., 2011) that have examined the relationship between stress, emotion oriented coping and disordered eating, and have concluded that emotion-focused coping is related to increased levels of emotional eating in female undergraduate students. The findings from this study however indicate the opposite i.e. decreasing levels of food intake during periods of stress. This is not uncommon as Macht (2008) argues that the changes in eating behaviour triggered by stress and associated emotional coping can express itself in terms of a lessening in the intake of food. According to Fryer et al. (1997) disordered eating such as bulimia and anorexia can arise as a result of emotional coping strategies that use suppression of food intake to alleviate negative emotions linked to stress or to reduce the effect of a stressor by exercising control over diet. These stress-induced changes in the frequency of food intake are often regulated by the food choices made by individuals under stress. In a study by Oliver and Wardle (1999) that examined the effect of stress on the food intake and diet of 212 undergraduates, results showed that there was a direct relationship between increased levels of stress experienced and the food choices of undergraduate

students. According to Oliver and Wardle (1999) students who reported high levels of stress also reported an increased intake of unhealthy foods (e.g. sweets, pizza, fast food etc.) and a corresponding decrease of healthy meals (fruit and vegetables, meat and fish). There was however a dichotomy in the total amount of food intake reported by students experiencing high levels of stress as some reported increased intake in the overall amount of food eaten, whilst others reported a decrease. Similar results have been reported by Kandiah et al. (2006) in their study of 270 female undergraduate students in a US college and by Mikolajczyk et al. (2009) as part of a cross –national student health survey of universities in three European countries involving 1,839 undergraduate students. These studies reported results that showed students (particularly female students) experience changes in their food intake and diet when stressed, increasing unhealthy food intake and reducing the amount of healthy foods eaten. In the study by Kandiah et al. (2006), a majority of students reported eating less food overall when stressed.

In summary, the results of this study show that there was a significant increase in the perception of stress by students during examination period compared to a period when no examinations were scheduled. It also showed that age and smoking were discriminating factors in students' perception of stress during examinations. The results also showed that students' preferentially choose emotional coping strategies to manage stress during examinations. It was also observed that there were possible connections

Study Two: Stress, diet and coping during academic examinations between the use of emotion focused strategies and changes in the dietary behaviour of students during examination period.

5 Conclusion and Recommendations

In this study the effect of academic stress on the dietary behaviour of female undergraduate students in King Abdul-Aziz University in Saudi Arabia was investigated using a longitudinal research design methodology. The results of the initial study carried out during a period when no examinations were planned (low stress) showed that the reported levels of stress by students was significantly different across a number of demographic groups. The key discriminating factors were age, BMI, smoking and students insistence on eating healthy food.

The results of the follow-up study carried out during examination period indicated that there was a statistically significant increase in the perceived levels of stress reported by students. The levels of stress during the follow up study were however only moderated by age and smoking status of students. A further examination of the sample of students with higher levels of stress revealed that it was associated with the use of emotional coping strategies, which is similar to results reported by several studies. The study results also showed that high stress levels amongst students was associated with significant reduction in the intake of food, with students more likely to reduce their eating of healthy meals and increase their intake of fast foods. It was therefore hypothesised that the observed changes to the food choice and intake by student during examinations are moderated by their use of emotional coping strategies. These findings provide a useful insight into a number of factors that influence students' perception of stress in Saudi

Arabian universities. It also identifies possible areas for targeting interventions and building students' resilience to stress whilst at universities.

There are a number of methodological limitations associated with this longitudinal study that also need to be taken into consideration. Firstly, this research was a naturalistic study, situated in one Saudi University that examined the reported perception, attitude and behaviour of a sample of students towards examination stress and as such the results cannot be easily generalised. Secondly, the study used a convenience sample of female students and whilst effort was made to make it representative, however self-selective bias of individual participants cannot be said to be eliminated or reduced, further undermining the generalisability of the study results. The study result also does not take into consideration the effect of 34.4% of participants dropping out of the study and how that has influenced the outcome of the longitudinal study and its reproducibility. Similarly, the effects of repeated surveys of the student sample on the behaviour and response of participants have not been considered in the interpretation of the study result. Another limitation of this research is that the effect of other stressful events and non-exam factors on students between the initial and follow-up study have not been taken into account in the analysis of the results.

It is therefore recommended that future studies addresses these methodological limitations by using a research design that incorporates randomised sampling of both male and female student populations in more than one university. It is also recommended that studies that examine the

effect of academic stress on food intake should consider controlling for the effect of other non-exam stressors on undergraduates student.

Nonetheless, the study findings point towards areas where practical stress management initiatives can be applied and new areas of research should be considered. It is recommended that any future stress management interventions in Saudi Arabian universities should consider designing measures that are age sensitive. Similarly, smoking cessation programmes that target vulnerable students should be considered.

It is equally suggested that interventions take into consideration the local food environment at the university in terms of the availability and access to healthy food options. The food environment in any academic setting is considered an important moderating factor of students' eating behaviours (Wechsler et al., 2001). It has been theorised that physical factors (alongside socio-cultural elements such as perception of body image) can influence the eating behaviour of individuals (Lytle, 2009, McKinnon et al., 2009). By controlling students' exposure to different types of food, the type and quality of their diet can be influenced and the maladaptive influence of stress mitigated. This view has been backed up by a number of studies (Caspi et al., 2012) that have reported that an in low income environment with very few healthy food sources is associated with poor quality diet and higher rates of obesity and diabetes. Stress management programmes at universities in Saudi Arabia should therefore consider influencing the local food environment to

increase the availability of healthy food options and reduce the proliferation of fast foods.

These findings also underline the need to further examine the influence of these variables on the dietary behaviour of students. Future studies should consider examining in detail, the effect of socio-cultural and physical components of the food environment in universities. Research should focus on how the food environment modulate the quality of student diets in terms of the intake of healthy and unhealthy food. The availability of vending machines and other food outlets and the type of food they dispense plays a crucial role in any food environment and thus influences the diet of students (Kubik et al., 2003, Vernez Moudon et al., 2013). It is therefore imperative that future studies explore their impact on students' diet during exams. Similarly, prevailing cultural norms about food and body image in universities is another important variables that are worth exploring in future studies as the results of this study identified these as possible moderators of stress induced changes to diet.

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7 Appendix

7.1 Appendix A

The effect of stress on university female students' dietary behaviour in Jeddah KSA.

Name of Investigators: Manal Mansoury,

Questionnaire

Dear student,

My name is Manal Mansoury. I'm doing a research in Nutritional Sciences. It is about the relationship between stress and dietary behaviour for female university students.

You have been invited to take part in a research study. Before you decide whether to take part it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and ask me if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part or not. Thank you for reading this.

Background

We believe and scientific research suggests that Students face more than one kind of stressors during their academic life: academic pressures, social issues and financial problems. These stressors can influence students life, food habits and their achievements if they are faced by high stress level.

The present study will evaluate the food intake of university students at King Abdul Aziz University. Food intake will be recorded for each student over

a 4 days period. Students will be asked to complete a questionnaire and take part in an interview to recall their food intake over a 24 hour period for 3 non-exams day and one day during exams time during the academic year.

What do you have to do?

- It is important that you continue with normal dietary practice throughout the study.
- Take part in an interview to recall their food intake over a 24 hour period for 3 non-exams day and one day in exams.
- Complete the stress questionnaire.
- Complete this questionnaire.
- How would you like to be contacted?
- Throughout the study I'll need to contact you for twice as a minimum to collect the research booklet after you complete it.
- So, please tick on the best way you prefer to be contact with:
  - By phone.
  - By email.
  - By interview in the university.

Appendix



CONSENT FORM

Student Name:

Email address:

Signature:

Date: …….

I confirm that I have fully explained the purpose of the study and what is involved to:

……

I have given the above named a copy of this form together with the information sheet.

Investigators Signature: ……..

Name: ……

Appendix

Study Volunteer Number:

Thank you for taking the time to fill out this questionnaire. This questionnaire is an important part of the study. Accurate completion of this form will help us to identify the relationship between stress and dietary practices.

Please answer every question otherwise we will not be able to include your survey in the final analysis.

Please answer in the spaces provided or put a tick in the appropriate box □	
Name:	Father or family name:
Phone:	
Email:	
What is your date of birth?	___/___/19___ DDMM
What subject are you studying?	□ Faculty of medicine □ Faculty Applied medical sciences □ Faculty of sciences □ Faculty of economic and administration □ Faculty of Arts and humanities □ Home economics

Appendix

At what grade are you studying at present?	
What is your height?	____cm
What is your weight?	____kg
What can be considered an ideal weight for you?	____kg
Do you intend to lose weight?	□ Yes □ No
Are you actively trying to lose weight?	□ Yes □ No
If yes, how are you trying to lose weight?	□Low calorie diet. □Low fat diet. □ Low carbohydrate diet. □Other diet, what is it? ..... □Skipping some meals. □Other, what is it?
Do you take vitamin tablets, supplements or herbs?	□ Yes □ No ....
If yes, Please list all current vitamins, nutritional	.....

supplements, herbs, etc., and how often do you take them usually?	
Do you drink Coffee?	□never □ rarely □ 1cup/day □ 2-3cups/day □ 4-5cups/day □ 6 and more cups/day.
Does your Coffee intake increase during exams?	□ Yes □ No
Do you drink Tea?	□never □ rarely □ 1cup/day □ 2-3cups/day □ 4-5cups/day □ 6 and more cups/day.
Does your Tea intake increase during exams?	□ Yes □ No
Do you drink Coca or Pepsi?	□never □ rarely □ 1can/day □ 2-3 cans/day □ 4-5cans/day □ 6 and more cans/day.
Does your Coca or Pepsi intake increase during exams?	□ Yes □ No
Do you eat Chocolate?	□never □ rarely □ 1piece(30gm)/day □ 2-4 pieces/day □ 5- and more pieces/day.

Appendix

Does your Chocolate intake increase during exams?	□ Yes □ No
Do you eat Sweets?	□never □ rarely □ 1piece(5 gm)/day □ 2-4 pieces/day □ 5- and more pieces/day.
Does your Sweets intake increase during exams?	□ Yes □ No
How many bottles of Red Bull, Bison or any other energy drinks do you drink?	□never □ rarely □ 1can/day □ 2-3can/day □ 4-5can/day □ 6 and more can/day.
Does your energy drinks intake increase during exams?	□ Yes □ No
How often do you exercise:	□ never □ rarely □ Once a week □ twice a week □ three times a week □ daily
Describe your exercise:	□light: Normal walking, walking down the stairs, bowling.

	□Moderate : Brisk walking, ascending stairs □Heavy: running (5 miles a hour), cycling (25 Km /hr)
Do you smoke? (Cigarettes or Hubbly bubbly or Shisha .....etc.) If yes, Do you smoke more when you are stressed?	□ Yes □ No □ Yes □ No
Do you usually insist on eating healthy food?	□ Yes □ No
Do you find it more difficult to eat healthy food during exams?	□ Yes □ No
If the answer yes, what are the reasons :	□Healthy food is not available. □There is no sufficient time to cook or buy food. □There is no sufficient money to buy healthy food. □I have appetite for specific kinds of food. □I do not care of taking healthy food during exams period. □ other reason, what is it?.....

Appendix

Do you skip meals during exams?	☐ Yes	☐ No
Do you over – eat during exams?	☐ Yes	☐ No
Does your weight fluctuate during exams?	☐ Yes	☐ No

Do you experience any symptoms during your exams or stressful period?

If yes: please tick from the list below:

Mental symptoms	
Anger.	☐
Feeling down/ blue/ low.	☐
Anxiety.	☐
Changes in behaviour.	☐
Food cravings.	☐

Lack of appetite.	
Frequent crying.	
Difficulty sleeping (mental).	
Feeling tired.	
Difficulty concentrating.	

Physical symptoms

Chest pains.	
Constipation or diarrhoea.	
Cramps or muscle spasms.	
Dizziness.	
Fainting spells.	
Nail biting.	
Nervous twitches.	

Pins and needles.	
Feeling restless.	
A tendency to sweat.	
Breathlessness.	

THANK YOU!

Please take a moment to fill in any questions you may have skipped.

7.2 Appendix B

Stress questionnaire:

For each question choose from the following alternatives:		
In the last week, how often have you been upset because of something that happened unexpectedly?	Never. Almost never. Sometimes. Fairly often. Very often.	☐ ☐ ☐ ☐ ☐
In the last week, how often have you felt that you were unable to control the important things in your life?	Never. Almost never. Sometimes. Fairly often. Very often	☐ ☐ ☐ ☐ ☐
In the last week, how often have you felt nervous and " stressed"?	Never. Almost never. Sometimes. Fairly often. Very often	☐ ☐ ☐ ☐ ☐
In the last week, how often have you dealt successfully with irritating life hassles?	Never. Almost never. Sometimes. Fairly often.	☐ ☐ ☐ ☐

	Very often	□
In the last week, how often have you felt that you were effectively coping with important changes that were occurring in your life?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □
In the last week, how often have you felt confident about your ability to handle your personal problems?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □
In the last week, how often have you felt that things were going your way?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □
In the last week, how often have you found that you could not cope with all the things that you had to do?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □

Appendix

In the last week, how often have you been able to control irritations in your life?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □
In the last week, how often have you felt that you were on top of things?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □
In the last week, how often have you been angered because of things that happened that were outside of your control?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □
In the last week, how often have you found yourself thinking about things that you have to accomplish?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □

Appendix

In the last week, how often have you been able to control the way you spend your time?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □
In the last week, how often have you felt difficulties were piling up so high that you could not overcome them?	Never. Almost never. Sometimes. Fairly often. Very often	□ □ □ □ □

7.3 Appendix C

These items deal with ways you've been coping with the stress in your life since you found out you were going to have to have this operation.

There are many ways to try to deal with problems. These items ask what you've been doing to cope with this one. Obviously, different people deal with things in different ways, but I'm interested in how you've tried to deal with it. Each item says something about a particular way of coping.

I want to know to what extent you've been doing what the item says. How much or how frequently. Don't answer on the basis of whether it seems to be working or not—just whether or not you're doing it. Use these response choices. Try to rate each item separately in your mind from the others.

Make your answers as true FOR YOU as you can.

1. I've been turning to work or other activities to take my mind off things.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
2. I've been concentrating my efforts on doing something about the situation I'm in.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □

3. I've been saying to myself "this isn't real.”	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	
4. I've been getting emotional support from others.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	
5. I've been giving up trying to deal with it.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	
6. I've been taking action to try to make the situation better.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	
7. I've been refusing to believe that it has happened.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	

8. I've been saying things to let my unpleasant feelings escape.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
9. I've been getting help and advice from other people.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
10. I've been trying to see it in a different light, to make it seem more positive.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
11. I've been criticizing myself.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
12. I've been trying to come up with a strategy about what to do.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □

13. I've been getting comfort and understanding from someone.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
14. I've been giving up the attempt to cope.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
15. I've been looking for something good in what is happening.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
16. I've been making jokes about it.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
17. I've been doing something to think about it less, such as going to movies, watching TV, reading, daydreaming,	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □

sleeping, or shopping.		
18. I've been accepting the reality of the fact that it has happened.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
19. I've been expressing my negative feelings.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
20. I've been trying to find comfort in my religion or spiritual beliefs.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
21. I've been trying to get advice or help from other people about what to do.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
22. I've been learning to live with it.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □

23. I've been thinking hard about what steps to take.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
24. I've been blaming myself for things that happened.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
25. I've been praying or meditating.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □
26. I've been making fun of the situation.	I haven't been doing this at all. I've been doing this a little bit. I've been doing this a medium amount. I've been doing this a lot.	□ □ □ □

THANK YOU!

Please take a moment to fill in any questions you may have skipped.

Appendix

7.4 Appendix D

24 Hour Recall

Interview Sheet

Name:

Email:



Appendix

Date :

	Time	Food items	Amount	Description and cooking method
Breakfast				
Snacks				
Lunch				

Appendix

Snacks				
Dinner				
Snacks				
Drinks				

How do you describe your mood today? (eg. very good, Stressful….)

Any extra information/ comments:

7.5 Appendix E

دراسة تأثير الضغوط النفسية على

عادات طالبات جامعة الملك عبد العزيز الغذائية

الباحثة : منال منصوري

مقدمة

عزيزتي الطالبة:

انت مدعوة للمشاركه في بحث يدرس العلاقة بين الضغط النفسي خاصة خلال فترة الإختبارات والعادات الغذائيه . قبل ان تقرري المشاركه من المهم ان تعرفي ماهو هدف الدراسة وماهي الإجراءات المطلوبة منك . ارجو ان تقرئي المعلومات التالية بدقه ويمكنك الإستفسار عن اي معلومات غير واضحة لك.

المعلومات السابقة:

ذكر الباحثون ان الطلاب يواجهون اكثر من نوع واحد من الضغوط النفسيه خلال حياتهم الدراسيه مثل: الضغوط الدراسية , مشاكل إجتماعية, ومشاكل مالية. هذه الضغوط قد تؤثر على حياة الطالب , عاداته الغذائية و طموحاته خاصة إذا كان يواجه ضغوط نفسية شديدة.

الدراسة الحالية سوف تقييم المتناول الغذائي لعينة من طالبات جامعة الملك عبد العزيز وسوف يطلب من المشاركات ان يكملوا إلاجابه على الإستبيان المرفق وتسجيل المتناول من الغذاء لمدة ثلاثة

ايام غير متتالية خلال السنة الدراسيه بالإضافة إلى تسجيل الغذاء المتناول ليوم واحد خلال فترة الإختبارات. بذلك سيتم المقارنة بين المتناول من الغذاء في فترة الإختبارات وغير الإختبارات خلال العام الدراسي.

ماذا عليك ان تفعلي :

من المهم ان لا تغيري اي شئ في عاداتك الغذائية خلال فترة البحث.

1- تعبئة استمارة تذكر غذاء يوم كامل عن اربعة ايام متفرقة (ثلاثة ايام في ايام الدراسة العاديه ويوم رابع أثناء فترة الإختبارات)

2- الإجابة على الاسئلة الخاصة بقياس الضغط النفسي في فترة الدراسة العاديه وكذلك تعبئتها مرة اخرى فترة الإختبارات وذلك للمقارنة في مستوى الضغوط النفسيه بين الفترتين .

3- الإجابة على الإستبيان التالي.

ماهي الطريقة التي تفضلي ان نتواصل فيها معك اثناء البحث ؟

اثناء البحث ساحتاج ان اتواصل معك على الاقل مرتين خلال العام الدراسي لجمع اوراق الإستبيان وإستمارة تذكر غذاء 24 ساعة . فماهي الطريقة التي تفضلينها للتواصل معك :

المقابلة ☐ البريد الالكتروني☐ الهاتف☐

الشخصية في الجامعة

Appendix



نموذج الموافقه

اسم الأب: الاسم الأول:.....

رقم الهاتف : .....

الايميل :

التاريخ: التوقيع :

أقر بأنني قد بينت هدف الدراسة وما تشتمل عليه بوضوح لـ :

.....

.....

أقر بأنني قد قمت أيضا بإعطاء الموضح إسمها أعلاه صورة من نموذج الموافقة هذا مع

صفحة المعلومات.

منال محمود منصوري إسم الباحثة :

توقيع الباحثة :

رقم الطالبة المشاركة :

Appendix

شكرا لموافقتك على المشاركه في هذه الدراسة . هذا الاستبيان يعتبر جزء هام في جمع البيانات لهذا البحث والتعرف على تأثير الضغوط النفسية على عاداتك الغذائية .

أرجو منك الإجابه على جميع الاسئلة لأن عدم الإجابه على بعض الأسئله يؤدي إلى إستبعاد الإستبيان بكامله.

□الرجاء الأجابه على الأسئله التالية بتعبئة الفراغات أو بوضع علامة صح في

الاسم الاول :	اسم الأب او العائلة :
رقم الهاتف :	
الايميل :	
العمر أو تاريخ الميلاد :	___/___/_____ اليوم / الشهر / السنة
ماهو التخصص الذي تدرسينه حاليا ؟	كلية الطب□ كلية العلوم الطبية□ كلية العلوم□ كلية الادارة والاقتصاد□ كلية الاداب والعلوم الانسانية□ كلية الاقتصاد المنزلي□

في أي سنة دراسية تدرسين حاليا؟		
ماهو طولك ؟	_____سم	
ماهو وزنك الحالي؟	_____كجم	
ماهو في اعتقادك الوزن المثالي لك ؟	_____كجم	
هل ترغبين في تخفيض وزنك؟	لا□نعم	□
هل تحاولين تخفيض وزنك حاليا ؟	لا□نعم	□
اذا كانت اجابتك بنعم على السؤال السابق تخفيض وزنك ؟ فكيف تحاولين	حمية قليلة السعرات الحرارية□ حمية قليلة الدهون□ حمية قليلة النشويات□ حمية أخرى ماهي؟ .....□ الغاء بعض الوجبات الغذائية□ غيره. ماهو؟ .....□	
هل تتناولين حبوب الفيتامينات او المدعمات الغذائية او الاعشاب ؟ اذا كانت اجابتك بنعم :	لا□نعم	□

اذكري نوع الفيتامين او الاعشاب او المدعم

الغذائي الذي تتناولينه :

كم مره تتناولينها عادة :

هل تتناولين القهوة ؟	كوب نادرا لا اتناولها
	في اليوم
	4- 3-2 اكواب في اليوم
هل يزيد معدل تناولك للقهوة أثناء الاختبارات؟	5 اكواب في اليوم
	6 اكواب او اكثر في اليوم
	نعم
	لا
هل تتناولين الشاي؟	كوب نادرا لا اتناوله
	في اليوم
	5-4 3-2 اكواب في اليوم
هل يزيد معدل تناولك للشاي أثناء	اكواب في اليوم
الاختبارات؟	6 اكواب او اكثر في اليوم
	لا نعم

هل تتناولين الكوكا كولا او البيبسي ؟	علبة □ نادرا □لا اتناوله □
	في اليوم
	5-4 □ 3-2 علب في اليوم□
هل يزيد معدل تناولك للكوكاكولا او البيبسي	علب في اليوم
أثناء الاختبارات؟	6 علب او اكثر في اليوم □
	لا□نعم □
هل تتناولين الشوكولاته ؟	قطعة □ نادرا □ لا اتناولها □
	(30 جم تقريبا)/ اليوم
هل يزيد معدل تناولك للشوكولاته أثناء	5 قطع □ 4-2 قطع في اليوم □
الاختبارات؟	او اكثر في اليوم
	لا□نعم □
هل تتناولين قطع الحلوى ؟	□ نادرا □ لا أتناولها □
	قطعة (5 جم)/ اليوم
هل يزيد معدل تناولك للحلوى أثناء	5 □ 4-2 قطع في اليوم □
الاختبارات؟	قطع او اكثر في اليوم
	لا□نعم □

هل تتناولين مشروبات طاقة (مثل Bison / Red Bull؟)	علبة □ نادرا □لا اتناولها □ في اليوم
هل يزيد معدل تناولك لمشروبات الطاقة أثناء الاختبارات؟	2–3 علب في اليوم □ 4–5 علب في اليوم 6 علب او اكثر في اليوم □ لا□نعم □
هل تمارسين الرياضه عادة :	نادرا □ لا أمارس الرياضه □ ما أمارس الرياضه □ مره في الاسبوع □ مرتين في الاسبوع □ ثلاث مرات في الاسبوع □ يوميا
إذا كنت تمارسين الرياضه فكيف تصفين نوع الرياضه التي تمارسينها ؟	رياضه خفيفة : مشي عادي , □ نزول سلالم ، لعب بولنج

رياضه متوسطة: مشي سريع ،

صعود سلالم

رياضه شديدة : جري (خمسة

اميال في الساعه) ركوب دراجه (25 كم/

الساعه)

هل تدخنين ؟ (سجائر او شيشه او معسل)	لا□نعم	
اذا كانت اجابتك بنعم ، هل يزيد تدخينك عندما تزيد ضغوطك النفسية؟	لا□نعم	
هل تحرصين عادة بشده على تناول غذاء صحي ؟	لا□نعم	
	لا □نعم	
هل تجدين صعوبه أكبر في تنظيم غذائك خلال فترة الاختبارات ؟	عدم توفر الغذاء الصحي	
	لا يوجد وقت للطهي او الشراء	
اذا كانت اجابتك بنعم . فهل هذا بسبب :	لا يوجد مال كاف	
	لا اشتهي الا انواع محدده من الاطعمه	

لا اهتم بهذا بتناول اغذيه صحيه

أثناء الاختبارات

سبب آخر ماهو؟ .....

هل تلغين بعض من وجباتك الغذائية اثناء الاختبارات؟	لا نعم	
هل تتناولين اطعمة اكثر من المعتاد ايام الاختبارات ؟	لا نعم	
هل يزيد او ينقص وزنك خلال فترة الاختبارات ؟	لا نعم	

ضعي علامة صح على الاعراض تشعرين بها خلال فترة الاختبارات او الضغوط النفسية:1 – أعراض عقلية

	غضب
	اكتئاب
	قلق
	تغير في السلوك

☐	رغبه ملحه في تناول الطعام
☐	نقص في الشهية
☐	بكاء متكرر
☐	أرق
☐	شعور بالتعب
☐	صعوبة في التركيز

2 – أعراض جسمية

☐	آلام في الصدر
☐	امساك او اسهال
☐	شد عضلي
☐	دوار ودوخة
☐	نوبات إغماء
☐	عض الأظافر
☐	تشنجات في العضلات
☐	إحساس بالتنميل
☐	إحساس بالتوتر

☐	زيادة التعرق
☐	ضيق في التنفس

لتتاكدي من اجابة جميع الاجزاء ارجو ان تاخذي دقائق بسيطة

Appendix

رقم الهاتف: الاسم :

الجزء الخاص بقياس الضغط النفسي أثناء الاختبارات

الجزء الاول / مقياس مستوى الضغوط النفسية :

اختر الاجابة المناسبة لكل سؤال من الاسئلة التالية :-

	مطلقا	نادراً	احيانا	غالبا	كثيرا
كم مرة خلال الاسبوع الماضي شعرت بالإنزعاج لوقوع شيئ لم تتوقعيه؟					
كم مرة خلال الاسبوع الماضي شعرت انك غير قادرة على التحكم في الاشياء المهمة في حياتك؟					
كم مرة خلال الاسبوع الماضي شعرت انك متوترة ولديك ضغوط نفسية؟					
كم مرة خلال الاسبوع الماضي تعاملت بنجاح مع منغصات الحياة المزعجة؟					
كم مرة خلال الاسبوع الماضي شعرت انك تأقلمت بنجاح مع التغيرات الهامة التي تحدث في حياتك؟					
كم مرة خلال الاسبوع الماضي شعرت بالثقة في قدرتك على التعامل مع مشاكلك الشخصية ؟					
كم مرة خلال الاسبوع الماضي شعرت ان الأحداث تسير وفق رغبتك؟					
كم مرة خلال الاسبوع الماضي وجدت انك لا تستطيعين تحمل عبء إنجاز كل ما يلزمك إنجازه؟					
كم مرة خلال الاسبوع الماضي إستطعت التحكم في المضايقات في حياتك؟					

Appendix

					كم مرة خلال الاسبوع الماضي شعرت انك تتعاملين مع الامور بنجاح ؟
					كم مرة خلال الاسبوع الماضي غضبت لأن هناك بعض أشياء حدثت والتي كانت خارجة عن نطاق سيطرتك؟
					كم مرة خلال الاسبوع الماضي وجدت نفسك تفكرين في الأشياء التي لابد لك من إنجازها؟
					كم مرة خلال الاسبوع الماضي كانت لديك القدرة على التحكم في طريقة قضاء وقتك؟
					كم مرة خلال الاسبوع الماضي شعرت بان الصعوبات تتراكم كثيرا لدرجة انك لاتستطيع التغلب عليها ؟

الجزء الثاني / التغلب على الضغوط النفسية:

هناك العديد من الطرق التي تستخدم للتعامل مع الضغوط في الحياة .

الفقرات التالية تتناول بعض هذه الطرق التي تستخدم للتعامل مع الضغوط النفسية.

فضلا حددي القدر الذي تستخدمينه مؤخرا من كل عنصر في التغلب على اي موقف ضغط نفسي في حياتك.

ملحوظة: لا تربطي بين إجابتك وفعالية أو فائدة العنصر المذكور، المطلوب توضيح ما إذا كنت تفعلينه أم لا.

1 - أشغل نفسي بالعمل أوأنشطة أخرى حتى لا افكر في شئ.	1 - لم اعمل ذلك مطلقا 3 - اعمل ذلك معظم الوقت	2 - اعمل ذلك قليلا جدا 4 - اعمل ذلك كثيرا
2 - أركز جهودي للتعامل مع الوضع الحالي الذي انا فيه.	1 - لم اعمل ذلك مطلقا 3 - اعمل ذلك معظم الوقت	2 - اعمل ذلك قليلا جدا 4 - اعمل ذلك كثيرا
3 - أقول لنفسي " ما يحدث ليس حقيقي ".	1 - لم اعمل ذلك مطلقا 3 - اعمل ذلك معظم الوقت	2 - اعمل ذلك قليلا جدا 4 - اعمل ذلك كثيرا
4 - أحصل على دعم عاطفي من الاخرين .	1 - لم اعمل ذلك مطلقا 3 - اعمل ذلك معظم الوقت	2 - اعمل ذلك قليلا جدا 4 - اعمل ذلك كثيرا
5 - اتوقف عن محاولة التعامل مع الضغوط.	1 - لم اعمل ذلك مطلقا 3 - اعمل ذلك معظم الوقت	2 - اعمل ذلك قليلا جدا 4 - اعمل ذلك كثيرا
6 - أقوم بعمل ما لمحاولة تحسين الموقف.	1 - لم اعمل ذلك مطلقا 3 - اعمل ذلك معظم الوقت	2 - اعمل ذلك قليلا جدا 4 - اعمل ذلك كثيرا

7 - استمر في رفض تصديق ان الموقف قد حدث.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
8 - أقول أشياء تبعد عني الاحاسيس الغير سارة.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
9 - أحصل على المساعدة والنصيحة من الاشخاص الاخرين.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
10 - أحاول أن أنظر الى الموقف من وجهة نظر مختلفة لجعله يبدو أكثر إيجابية.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
11. - أنتقد نفسي.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
12 - أحاول التوصل الى خطة لما سأقوم به.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
13 - أحصل على الراحة والتفهم من شخص ما.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
14 - أتوقف عن محاولة التغلب على الصعاب.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
15. - أبحث عن شئ جيد فيما يحدث.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا
16. - أتفكه عن الموقف وأجعله مضحكا.	1- لم اعمل ذلك مطلقا 3- اعمل ذلك معظم الوقت	2- اعمل ذلك قليلا جدا 4- اعمل ذلك كثيرا

- أقوم بأشياء أخرى تخفف من 17 تفكيري في الموقف مثل مشاهدة التلفزيون، القراءة، النوم، أحلام اليقظه، أو التسوق.	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
-أتقبل حقيقة أن الأمر قد حدث.18	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
- أعبر عن أحاسيسي السلبية.19	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
- أحاول أن أجدالراحة في قناعاتي 20 الدينية أو الروحانية.	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
- أحاول الحصول على النصيحة 21 والمساعدة من الاخرين عما يمكن فعله.	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
- أتعلم التعايش مع الأمر.22	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
- أركز تفكيري على الخطوات التي 23 سأقوم بها.	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
- ألوم نفسي على الاشياء التي 24 حدثت.	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
- أقوم بالصلاة أو التأمل.25	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4
- أجعل من الموقف تسلية.26	- لم اعمل ذلك مطلقا1 - اعمل ذلك معظم الوقت3	- اعمل ذلك قليلا جدا2 - اعمل ذلك كثيرا4

Appendix

استمارة تذكر الغذاء خلال 24 ساعة الماضية

مثال

الوجبه الغذائيه	الوقت	نوع الطعام	الكميه	الوصف وطريقة الاعداد
الافطار	9	كروسون جبنه قهوه كابيتشينو	متوسط الحجم كوب	من بارنيز
وجبه خفيفة	11	كيك مفن بالشوكولاته عصير برتقال	قطعة متوسطة الحجم كوب صغير 200 مل	عصير برتقال طازج
الغداء	3	ارز كبسه صدر دجاج سلطه خضراء بيبسي	صحن ارز متوسط الحجم ربع دجاج في الفرن 320 مل	في المنزل السلطه (طماطم وخيار وجزر مع ليمون وملح)
وجبه خفيفه	6	قهوه عربي مع تمر	ثلاث فناجين صغيره خمسة حبات رطب	

Appendix

العشاء	11	جبنه تونه زيتون اسود خبز	شريحتين شدر ثلاث ملاعق طعام خمسة حبات نصف رغيف خبز ابيض شامي	شدر قليل الدسم تونه بالمايونيز
وجبه خفيفه	11:30	موز برتقال	حبه متوسطه نصف حبه كبيره	
مشروبات اخرى لم تذكر	12 ظهرا	Red Bull	علبه	

الرجاء كتابة افطار اليوم وغداء وعشاء الامس ويشمل جميع المشروبات والحلويات .... الخ

1–اليوم / التاريخ:

Appendix

الوجبه الغذائيه	الوقت	نوع الطعام	الكميه	الوصف وطريقة الاعداد
الافطار				
وجبه خفيفة				
الغداء				
وجبه خفيفه				
العشاء				

وجبه خفيفه				
مشروبات اخرى لم تذكر				

شكرا جزيلا

أرجو أن تاخذي دقيقة للتاكد من اجابة جميع الفقرات

حيث ان الاستبيان الغير كامل لا استطيع الاستفادة منه

7.6 Appendix F

	Median	Minimum	Maximum	IQR
Energy (kcal)	1153.67	192.00	4783.00	885-1453
Protein (g)	40.43	5.80	181.00	30.67-52.53
Fat g	45.13	2.70	221.00	32.37-57.63
Carbohydrate (g)	154.40	.00	550.70	113.3-194.13
Starch (mg)	72.93	.00	226.00	55.6-95.2
Total sugar (mg)	52.90	.00	263.10	35-74.47
Fiber (g)	5.4700	.00	17.80	4.00-7.37
Sodium Na (mg)	1301.00	119.00	13265.67	932-1697
Calcium Ca (mg)	426.00	13.00	1897.00	296.17-570.16
Iron Fe (mg)	5.0500	1.17	42.90	3.8-7.13
Zink Zn (mg)	3.7600	.54	15.90	2.9-5.15
Vitamin B12	1.4500	.00	24.13	0.83-2.50
Vitamin A retinol	110.00	.00	8062.00	0.00-233
Vitamin E	2.99	.00	14.10	1.95-4.33
Vitamin C	51.00	.00	327.00	24-86.33
VitaminB1 thiamine	.40	.00	2.37	0.00-0.64
VitaminB2 riboflavin	.82	.09	7.24	0.53-1.15
Vitamin B6	.72	.04	3.69	0.52-0.96
Vitamin D	.75	.00	16.57	0.33-1.75

Nutrient intake

7.7 Appendix G

Problem focused coping Score Statistic of Dropout Cohort

Problem focused coping Score Statistic of Dropout Cohort		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	18	9	24	15-20	2685	N/A	0.750
	22-34yr	18	9	24	15-20			
Course of study	Medicine	20	16	20	16-20	N/A	11.27	0.046
	App Medicine	20	15	24	17-23			
	Science	18	9	24	15-21			
	Economics and Administration	16	9	23	14-18			
	Art and Humanities	18	13	23	16-19			
	Home Economics	18	10	24	15-20			
Year of study	Year 2	18	9	24	15-20	N/A	2.617	0.454
	Year 3	18	9	24	16-20			
	Year 4	17	10	23	15-19			
	Year 5	17	11	24	16-20			
BMI category	Underweight	18	9	24	16-20	N/A	7.395	0.06
	Normal	18	9	24	16-20			
	Overweight	16	13	23	14-20			
	Obese	16	11	21	13-18			
Physical Activity	Never	17	12	21	15-19	N/A	2.976	0.562
	Rarely	18	9	24	15-20			
	Regularly	19	12	23	16-21			
Smoking	Smokers	16	13	22	15-20	1265	N/A	0.169
	Non- Smokers	18	9	24	15-20			
Insistence on eating healthy	Yes	19	9	24	16-20	2274		0.013
	No	17	9	24	15-19			
Emotion focused coping Score Statistic		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	53	24	68	46-57	2456	N/A	0.914
	22-34yr	52	35	72	46-58			
Course of study	Medicine	56	56	66	56-56	N/A	13.71	0.018
	App Medicine	54	46	66	47-59			
	Science	57	24	72	50-61			
	Economics and Administration	48	34	69	43-56			
	Art and Humanities	53	33	67	50-58			
	Home Economics	51	42	68	46-58			
Year of study	Year 2	53	24	69	46-57	N/A	1.711	0.634
	Year 3	51	38	68	48-58			
	Year 4	53	43	68	47-57			
	Year 5	49	35	68	45-60			
BMI category	Underweight	54	38	68	45-59	N/A	3.066	0.382
	Normal	52	24	72	47-57			
	Overweight	56	33	68	46-58			
	Obese	47	35	68	42-56			
Physical Activity	Never	51	39	68	47-56	N/A	2.441	0.655
	Rarely	52	33	69	46-58			
	Regularly	53	24	72	46-57			

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Smoking	Smokers	54	43	72	46-59	1223	N/A	0.351
	Non- Smokers	52	24	69	46-57			
Insistence on eating healthy	Yes	54	35	72	46-58	2232		0.105
	No	51	24	69	46-56			

7.8 Appendix H

Nutrient intake compared

	Median (T1)	Median (T2)
Energy kcal	1184.83	1102.5
Protein (g)	42.23	39.15
Fat (g)	46.83	41.55
Carbohydrate (g)	157.12	148.4
Starch (mg)	73.82	70.4
Total sugar (mg)	54.12	53.75
Fibre (g)	5.6	5.6
Sodium Na (mg)	1317.83	1132.5
Calcium Ca (mg)	434.83	398.5
Iron Fe (mg)	5.39	4.79
Zinc Zn (mg)	3.92	3.68
Vitamin B12	1.55	1.05
Vitamin A retinol	198.33	172.5
Vitamin E	3.15	2.69
Vitamin C	52.5	38.5
VitaminB1 thiamine	0.57	0.54
VitaminB2 riboflavin	0.86	0.69
Vitamin B6	0.74	0.66

7.9 Appendix I

Problem focused coping Score Statistic		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	18	12	24	17-20	10235	N/A	0.824
	22-34yr	19	9	24	16-20			
Course of study	Medicine	17	9	24	16-21	N/A	3.004	0.0699
	App Medicine	18	13	24	16-21			
	Science	18	13	23	17-20			
	Economics and Administration	18	13	23	16-19			
	Art and Humanities	18	12	23	16-20			
	Home Economics	19	12	24	16-21			
Year of study	Year 2	18	13	24	17-20	N/A	0.537	0.911
	Year 3	19	9	24	16-21			
	Year 4	19	13	23	17-19			
	Year 5	19	12	24	16-21			
BMI category	Underweight	18	14	24	16-21	N/A	1.198	0.753
	Normal	19	13	24	16-20			
	Overweight	18	12	23	16-21			
	Obese	18	9	23	16-20			
Physical Activity	Never	19	12	24	16-19	N/A	1.273	0.866
	Rarely	18	13	24	16-21			
	Regularly	18	13	23	16-20			
Smoking	Smokers	17	9	23	16-19	3155	N/A	0.066
	Non- Smokers	18	12	24	17-20			
Insistence on eating healthy	Yes	18	13	24	17-20	11293		0.411
Emotion focused coping Score Statistic		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	52	36	68	47-56	8433	N/A	0.112
	22-34yr	54	39	67	47-56			
Course of study	Medicine	55	36	67	45-59	N/A	11.008	0.051
	App Medicine	51	41	65	47-56			
	Science	53	42	66	48-56			
	Economics and Administration	54	39	67	47-55			
	Art and Humanities	53	43	67	49-53			
	Home Economics	54	41	68	48-57			
Year of study	Year 2	52	36	67	47-57	N/A	9.167	0.027
	Year 3	52	41	68	47-56			
	Year 4	53	41	67	46-54			
	Year 5	56	45	67	47-53			
BMI category	Underweight	52	41	67	46-53	N/A	3.211	0.360
	Normal	54	36	68	47-56			
	Overweight	55	41	67	47-58			
	Obese	53	42	66	48-55			
Physical Activity	Never	53	39	67	47-56	N/A	1.882	0.757
	Rarely	53	41	71	48-57			
	Regularly	54	41	70	48-55			
Smoking	Smokers	54	44	65	47-58	3665	N/A	0.986

	Non- Smokers	53	36	71	47-56			
Insistence on eating healthy	Yes	53	36	71	47-56	10445		0.554
	No	53	39	68	45-55			

7.10 Appendix J

Problem focused coping Score Statistic		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	18	13	24	16-19	3169	N/A	0.232
	22-34yr	18	9	23	16-20			
Course of study	Medicine	17	9	24	17-20	N/A	5.667	0.340
	App Medicine	18	13	24	17-21			
	Science	18	15	22	17-20			
	Economics and Administration	18	14	23	16-19			
	Art and Humanities	18	14	23	16-20			
	Home Economics	19	12	24	16-20			
Year of study	Year 2	17	13	24	17-20	N/A	1.299	0.729
	Year 3	19	9	24	16-21			
	Year 4	18	13	22	17-20			
	Year 5	19	12	23	17-20			
Physical Activity	Never	19	13	24	16-19	N/A	3.382	0.641
	Rarely	18	14	24	16-20			
	Regularly	19	14	23	16-19			
Smoking	Smokers	17	9	21	16-21	1028	N/A	0.078
	Non- Smokers	18	12	24	17-20			
Insistence on eating healthy	Yes	19	13	24	17-20	3646	N/A	0.324
	No	18	9	24	16-20			
BMI category	Underweight	18	14	22	16-21	N/A	4.124	0.248
	Normal	19	13	24	17-20			
	Overweight	18	13	23	16-20			
	Obese	18	9	20	16-20			
Emotion focused coping Score Statistic		Median	Min	Max	IQR	U	X^2	p
Age Groups	17-21yr	52	36	68	47-56	2999	N/A	0.300
	22-34yr	54	39	67	47-56			
Course of study	Medicine	55	36	67	45-61	N/A	4.990	0.417
	App Medicine	50	41	60	47-57			
	Science	53	42	65	48-56			
	Economics and Administration	52	39	66	47-53			
	Art and Humanities	52	43	66	48-56			
	Home Economics	55	46	68	47-57			
Year of study	Year 2	51	36	66	47-58	N/A	5.342	0.148
	Year 3	52	41	68	47-56			
	Year 4	54	45	66	46-52			
	Year 5	55	47	67	48-56			
BMI category	Underweight	52	41	66	46-54	N/A	3.180	0.365
	Normal	54	36	68	47-55			
	Overweight	55	42	67	47-57			
	Obese	52	45	66	45-53			
Physical Activity	Never	53	39	66	47-56	N/A	0.907	0.970
	Rarely	52	41	67	48-56			
	Regularly	54	40	69	48-55			
Smoking	Smokers	55	44	62	46-54	1252	N/A	0.917

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	Non- Smokers	53	36	68	47-56			
Insistence on eating healthy	Yes	53	36	67	47-56	3402	N/A	0.258
	No	53	39	68	45-54			