Bakhsh, Duaa M. *Dietary Acculturation and Blood Chemistry Changes of Saudi Arabia Students Moving to the United States.*

**Abstract**

This study investigated dietary acculturation and the resulting changes on the health status of KSA students. **Objective:** Changes in KSA students’ dietary habits, acculturation to the American diet, and degree of commitment to their native diet was assessed through a survey tool, blood chemistry and anthropometric measurements of a cohort of UW-Stout students. **Methodology:** The survey was posted in USA Facebook group. Blood chemistry and anthropometric measurements to indicate the relationship between the health changes and factors of dietary acculturation of UW-Stout students’ was ascertained (N = 40). **Outcome:** KSA students were acculturating to the American diet with correlation to negative and positive changes in weight. An overall increase in body weight for KSA students was 1.26 ± 10.94 kg \( (p = 0.013) \). Some participants (n = 130) gained weight with an increase of 13.86 ± 11.13 kg; whereas, 85 participants lost weight (-16.56 ± 14.66 kg). UW-Stout students had no change in average body weight or fat percent. There was no correlation between body weight changes, TC, and food frequency. There were negative correlations between the average changes of TG, LDL, GLU, and some food frequency items. **Conclusion:** KSA students showed dietary acculturation that impacts weight and blood chemistry.
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Chapter I: Introduction

An increasing number of international students enroll in United States universities and colleges each year (Institute of International Education, 2013). Currently, more than 71,000 students from the Kingdom of Saudi Arabia (KSA) are studying in the United States (USA) (Naffee, 2013). The behavior and pattern of food intake for international students is extremely vulnerable to change. The United States has a wide variety of cultures, socioeconomic interactions, and food types. International students find themselves in a conflict between these new cultural traditions and their original ones. The impact of this switch in food patterns may affect the quality of their health. In the adaptation process, international students face multiple obstacles such as discrimination, financial concerns, a lack of accommodations, and language, as well as dietary limitations that might result in depression, stress, anxiety, confusion, and sleeping disorders (Lin & Yi, 1997). As part of their lives on campus, many international students tend to change their eating habits according to the changes in their lifestyles.

Long-term consumption of a modern and/or urbanized American diet is scientifically proven to cause obesity, atherosclerosis, and diabetes (Edwards, Hartwell, & Brown, 2010). Such harmful effects might increase exponentially among middle-eastern students, particularly KSA students (Edwards, Hartwell, & Brown, 2010). Generally, American diets are high in saturated fat and simple carbohydrates while complex carbohydrates, whole grains, and fiber appear in lower concentrations (Abbot & Byrd-Bredbenner, 2007; Deshmukh-Taskar, Nicklas, Yang, & Berenson, 2007). About 80 percent of Americans of all ages and 36 percent of American adults consume a full meal thrice a day, with a number of snacks between their meals (Louisville, 2012). American youth consume processed food as a major part of their daily meals and snacks (Abbot & Byrd-Bredbenner, 2007; Pereira, et al., 2005). Deshmukh-Taskar, Nicklas,
Yang, and Berenson (2007) found that American adolescents do not rely on fruits, vegetables, and dairy products; alternatively, they prefer to have large portions of processed food and sweetened beverages among their choices. Only 26% of American eat three to five servings of vegetables, 14% of Americans eat three to five servings of fruit, and only 1 out of 10 drink the recommended 8 glasses of water per day (Louisville, 2012).

Obesity is increasing at an alarming rate in Saudi Arabia. Amin, Al-Sultan, and Ali (2008) indicate that one out of six children ages 6 to 18 is obese, stating that the reason for this dramatic increase seems to be unhealthy intake habits, including increased dependency on unhealthy food (Amin, Al-Sultan, & Ali 2008). This study brings to light the fact that students from Saudi Arabia may increase their intake of unhealthy food choices in the United States. It is easier to consume this type of food because they have eating habits that include unhealthy choices.

Researchers focus on dietary acculturation, which concerns the process of adjusting to a new environment and adaption to the dietary habits of a new culture (Satia, 2003). It is not just the dietary practices that vary from one culture to another; it is also the style and practice of cooking that varies.

**Preliminary Data**

A spring 2013 pilot study conducted in EDUC-740, Research Foundations, evaluated 30 Saudi students using a modified survey from Noyongoyo (2011). The group’s overall weight change from KSA moving to USA was $2.2 \pm 7.8$ kg. Eighteen students (60%) self-reported weight gain, with an average of $7.0 \pm 4.7$ kg ($15.4 \pm 10.3$ pounds). One student’s weight remained stable. Eleven students (37%) self-reported losing weight at an average of $6.6 \pm 3.7$ kg ($14.52 \pm 8.14$ pounds). An increase in body weight might be correlated with increased
triglyceride, cholesterol, and glucose levels, which are known risk factors for cardiovascular disease and diabetes (Bellows & Moore, 2012; Hogan, 2000). Weight loss may have a negative impact on students’ health; this study, however, did not differentiate between weight gain or loss.

**Statement of the Problem**

International students who move to the United States seeking higher education face many challenges, including dietary acculturation issues (Kittler & Sucher, 2000). International students often become more sedentary and gain weight when studying at universities in the United States (Edwards, Hartwell, & Brown, 2010; Lin, 1997). Countries sending students abroad need to know how their particular citizens may be affected and take actions to prepare the individuals for changes, including diet and exercise. While studies have examined the association between the American diet and weight change for international students (Almohanna, 2010), there is little research done on students specifically from Saudi Arabia.

**Purpose of the Study**

The purpose of this study was to examine the effect of dietary acculturation issues on health and determine what factors contribute to these changes in students from the Kingdom of Saudi Arabia studying in the United States. Specifically, this part of the study had the following objectives:

1. Determine if there is a change in dietary habits and food preferences of KSA students after coming to the United States.
2. Identify factors that influence KSA students’ eating habits in the United States.
3. Determine if there is a change in physical activity of KSA students after coming to the United States.
4. Identify any relationship between weight change, diet, factors that influence diet, and physical activity for KSA students in the United States.

A study of dietary acculturation of a smaller group focused on subjects’ body weight, fat composition, and blood chemistry was also conducted with freshmen students enrolled at the University of Wisconsin-Stout. This group included a control group of United States citizens and group of KSA students. Specifically, this part of the study addressed the following objective:

5. Identify if dietary acculturation correlates with body weight, fat composition, and blood chemistry including total cholesterol (TC), high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, triglycerides (TG), and glucose (GLU).

Assumptions and Limitation of the Study

Researching human participants involves various assumptions. The researcher perceived that the participants of the study behaved responsibly and answered survey questions accurately.

The researcher identified some limitations of this study. One limitation was that participants may not have answered all the survey questions completely and/or honestly. Another limitation was that students might have consumed fast food, but might also participated in physical activity regularly. In this situation the researcher may not find any change in weight. During the survey, some of the questions in this study asked students to reflect on what they ate before they came to the United States and what they usually eat each day; participants might not have remembered what they ate before they moved to the United States. The survey also asked students to provide their weight before and after they lived in the United States. The participants might not have provided an accurate figure for their weight. The small number of KSA students among UW-Stout’s population limits conclusions about all Saudi students in the USA.
Definition of Terms

**Acculturation.** A situation in which distinct cultural individuals or groups come together in first-hand contact, resulting in a change in patterns of culture in either one or both the distinct groups (Berry, 2011).

**Breakfast.** The first meal of the day, which is eaten in the morning ("Breakfast," 2003).

**Burger.** A sandwich containing one or more cooked patties of ground meat, typically a beef patty placed inside a sliced burger bun. The term "burger" could also be applied to the meat patty on its own, especially in KSA where the term hamburger is never used because of religious beliefs. The term may be prefixed with the type of meat such as chicken burger or beef burger ("Burger", 2003).

**Dietary acculturation.** “The process that occurs when members of a minority group adopt the eating patterns or food choices of the host country,” (Satia, 2010, p. 220). The degree of “dietary acculturation” is operationally defined as the position on a scale (ranging from “daily” to “never”) used to measure the characteristic of dietary changes of a minority group, as well as shifts in American diet and increases in body-weight trends.

**Dinner.** A meal that eaten in the evening ("Dinner," 2003).

**Eating habits.** The way a person or group eats, considered in terms of what types of food are eaten, in what quantities, and when (Judith, 2013). Eating habits are the extent to which groups of individuals consume and use available food before and after living in the United States by using a five-point scale from “daily” to “never” (De Garine, 1994).

**Fast food.** Food that is quickly prepared and served at fast-food chains and outlets is called fast food (Jones, 2006). A scale of “daily” to “never” was used to measure consumption
of American fast foods (such as McDonalds, Burger King, Dominos, Pizza Hut, Kentucky Fried Chicken) before and after living in the United States.

**Lunch.** A meal that is eaten in the middle of the day between breakfast and dinner. In the USA, it is usually less formal than an evening meal ("Lunch," 2003).

**Overweight.** A BMI ranging from the 85th to 95th percentile for youth per the standards of the Centers for Disease Control (CDC, 2011b). It can also be represented as a BMI in the range of 25.0 to 29.9 kg/m² in adults ages 20 and above (CDC, 2011).

**Standard American Diet (S.A.D.).** It is a comparable phrase of ‘Western Diet’, particularly used to explain the stereotypical diet of Americans. The typical American diet consists of approximately 50% carbohydrates, 35% fat, and 15% protein. This diet is over the dietary guidelines for the amount of fat (below 30%), below the guidelines for carbohydrates (above 55%), and at the upper end of the guidelines for the amount of protein (below 15%) recommended in the diet (Layman, et al., 2003; Last & Wilson, 2006). A S.A.D. typically contains many processed carbohydrates such as breads, cereals, cakes, pasta, cookies, etc., as well as processed meat foods, and only a few fruits and vegetables (Aitken, 2007).

**Methodology**

This study had three main components: survey, anthropometric measurements, and blood analysis. All aspects of the study were reviewed by the institutional research board (IRB) for safe and ethical use of human subjects. Data was collected from two different study groups: a general Saudi student population currently living in the United States (survey data only), and a population of Saudi and American freshmen at the University of Wisconsin-Stout (UW-Stout).
Chapter II: Literature Review

This study examined the effect of dietary acculturation issues on health and factors that contribute to these changes for students from the Kingdom of Saudi Arabia (KSA) now living in the United States (USA). This chapter includes a discussion of dietary acculturation for international students with a focus on KSA students. It also contains a review of studies of American diets, eating habits, and food choices among American university students, as well as the change in eating habits and food choices among university students from Saudi Arabia before and after they moved to the United States. This chapter concludes with a discussion of American diets which might increase the body weight for KSA students because of changes in eating habits after they moved to the United States, and examines the relationship between dietary acculturation and chronic diseases for students transitioning to the United States culture.

International Students in the United States

An increasing number of international students enroll in United States universities and colleges each year (Institute of International Education, 2013). Over the past ten academic years (2000 – 2001 to 2009 – 2010), the number of international students who enrolled in United States’ universities and colleges increased approximately 26%. This is an increase from approximately 547,867 to approximately 690,923 students (Institute of International Education, 2013). During the 2010 – 2011 academic year, the number of international students in the United States increased by 6.5 %. This increase caused a number of students from around the world to become interested in American education (Mcmurtrie, 2012). In 2012, the number of international students at universities and colleges in the United States increased by 6.5% more bringing the number of international students to 764,495 in the academic year of 2011- 2012 (Institute of International, 2013). The major reason for this increase was a higher number of
students from Saudi Arabia that come to the United States for education (Naffee, 2013).

Currently, more than 71,000 KSA students are studying in the United States (Naffee, 2013). Between 2005 and 2012, the number of KSA students increased by 98% (Naffee, 2013). The number of Saudi students increased by 50% in 2011 alone (Naffee, 2013). The King Abdullah Foreign Scholarship Program offers admission into the world’s top universities and allows Saudi students to study abroad to pursue bachelor’s, master’s, and doctoral degrees, as well as medical fellowships (Naffee, 2013).

**Acculturation for International Students**

The United States is an immigrant country where acculturation is a common occurrence (Peng, 2005). Most international students coming to the United States face acculturation issues. Acculturation is defined as a multidimensional progression that explains how people from a certain cultural group adapt to the varying cultural beliefs they encounter in the new areas where they move (Kittler & Sucher, 2000). In so doing, students’ political, socioeconomic, psychological, and cultural practices change (Lee & Sobal, 1999).

The two-dimensional model of acculturation describes four different types of adaptation according to immigrants identification with their home countries and host countries, respectively (Noyongoyo, 2011). According to the “bicultural” strategy, or double-culture approach, immigrants identify with both their home and host country cultures to a high degree. In the “marginalized” strategy, immigrants identify minimally with both their home and host country cultures (Berry, 2008). In the “assimilated or incorporated” strategy, immigrants identify more with their host country cultures than their home country. According to the “separated” strategy, immigrants undergo an extremely low level of adaptation to the host country but a high level of adaptation to the beliefs of their home country (Berry, 2008). Therefore, each of the above
approaches either augments or minimizes the degree of psychological stress or strain accompanying migration into new cultures (Noyongoyo, 2011).

Adaptation can be defined more generally as a change that takes place within a certain group as a result of the demands imposed by a new environment. Such adaptations can take place over long or short durations or on a short-term basis. Short-term changes can have adverse, habitually disruptive effects during the process of acculturation. Such changes can assume varying forms and might include internal factors such as beliefs and values, but also such external factors as language and dress (Noyongoyo, 2011). According to Nicholson (1997), some of the stresses associated with the acculturation process include learning a new language, seeking immediate employment, attempting to rebuild social support, and redefining societal roles. These factors are key in defining the state of an individual’s mental health status before and after undergoing the emigration process.

Similarly, Berry, Phinney, Sam, and Vedder (2006) argue that the idiosyncratic psychological and demographic traits of an individual immigrant greatly affect how they undergo the process of acculturation. Such factors include one’s age, educational background, gender, social and economic status, and the ability to acquire or learn a new language. A combination of such individual factors increases the degree of adaptation to the foreign culture. The above acculturation theory can be used to examine the dietary acculturation theory culminating from a combination of acculturation and nutrition.

**Dietary Acculturation**

People from different regions of the world eat according to inherited indigenous traditions and make food combinations per the local norms and trends. Eating habits can be generally defined as the manner in which people eat different quantities of food, their selection
of food, and the means of getting food. There are many factors which determine what a person eats. Preferences and personal taste play a great role in food selection, along with cultural, religious, social, or economic factors.

Dietary acculturation takes place when immigrants adopt the eating behaviors and types of food consumed by the inhabitants of their host country (Satia et al., 2001; Woods, 1992). The acquisition of certain eating habits, routine physical activities, and choice of food may lead to the development of diseases such as obesity in immigrants. Furthermore, immigrants’ beliefs regarding the causes of diseases, their treatment, and prevention modalities may hinder them from making proper use of the health-care services provided by the host country (Woods, 1992). In most cases, the global culture of food consumption is greatly affected by a local culture influenced by the changed habits of people after acquiring an understanding of cultural and identity-related eating habits (Noyongoyo, 2011).

Dietary acculturation is multifaceted, dynamic, and multidimensional (Satia et al., 2000; Satia, 2003; Woods, 1992). Researchers concluded that during the process of dietary acculturation, immigrants may retain their traditional eating habits on special occasions while excluding their host country’s eating habits; alternatively, they may find new ways of utilizing their traditional meals, or adapt to the host country’s foods (Pan, Dixon, Himburg, & Huffman, 1999; Yang & Fox, 1979). The study of a specialized ethnic group’s culturally based food habits is essential for establishing its members’ nutritional status and employing dietary changes. This analytical information is fundamental because it can be applied by dietitians working with the identified ethnic groups to protect them from potentially harmful dietary changes, while at the same time helping them to employ healthy changes (Peng, 2005).
Various research conducted in this field have studied the implications of dietary acculturation on dietary intake and dietary patterns. Findings affirm that dietary acculturation has injurious consequences on the diets of individual immigrants and certain minor ethnic or racial groupings (Ayala, Baquero, & Klinger, 2008; Gray, Cossman, Dodson, & Byrd, 2005; Kim, Lee, Ahn, Bowen, & Lee, 2007; Satia et al., 2001; Varghese & Moore-Orr, 2002). A study conducted by Satia (2003) described an example of the manner in which a certain ethnic group such as Mexican American adapted their eating behaviors and patterns to those of their host country. As per this example, the dietary acculturation of the Mexican immigrant to the diets of the United States is characterized by decreased consumption of legumes and whole grains as well as elevated consumption of meals including food such as hamburgers (Satia, 2003).

Factors that Affect Dietary Acculturation

Satia (2003) found that dietary acculturation is divided into three categories of demographic, socioeconomic, and cultural factors (Satia, Patterson, Neuhouser, and Elder, 2002; Brittin & Oeidat, 2011). This research indicates that the increased receptivity to successful dietary acculturation increases when the immigrant lives in the host country for a long time, possesses a high level of education, has an income, is from a large ethnic group (large population density), is young in age, is fluent in the foreign language of the host country, and is married with young children who intermingle with other children from the host country (Lee, Sobal & Fronquillo, 1999; Pan, Dixon, Himburg, & Huffman, 1999; Yang & Fox, 1979). Furthermore, the lack of availability of traditional food from the immigrant’s home country in the host country may encourage increased consumption of the host country’s food (Satia et al., 2000). An immigrant may be further interested in consuming the host country’s food if their traditional
meals are expensive, difficult to purchase, and have a time consuming during the preparation process.

This leads to an increased preference of easily available and affordable foods over traditional foods (Pan, Dixon, Himburg, & Huffman, 1999; Satia et al., 2000). Preference is given to foods such as Arab American foods, which are ethnically localized, or host country foods. Studies on the duration of stay indicate that students newly arrived in a host country have varying levels of adaptation. Some adjust very quickly, while others take longer due to strong attachments to their traditions and culture, culminating in negative emotions. This can result from difficulties in socializing stemming from language barriers, hostility, homesickness, and preconceived notions of discrimination (Almohanna, 2010). As a result, most international students only associate with people of their own ethnic stream, due to their collectivist cultures (Poyrazli & Lopez, 2007; Day, 1986; Swagler & Ellis, 2003). However, students from individualistic or secluded cultures easily become assimilated into the United States’ mainstream traditions (Poyrazli & Lopez, 2007; Day, 1986; Swagler & Ellis, 2003).

Studies of Arab Americans, particularly on risk factors that lead to chronic diseases such as cardiovascular disease, indicate there is a need for programs that prevent obesity (Hatahet, Khosla, and Fungwe, 2002). In addition, lack of knowledge about acculturation, particularly in women, is significant enough to indicate high numbers of diabetes cases in immigrant Arab Americans (Jaber, Brown, Hammad, Qian, & Herman, 2003). Tami, Reed, Boylan, and Zvonkovic (2012) found that most Arab mothers were dining out once a month and preferred having meals in buffet-type hotels. Similarly, more than half of the population studied was eating take-out food and deliveries at least once in a single month. Most of their meals were
acquired from Arab stores and supermarkets, and rarely included food that they carried from their native countries (Tami, Reed, Boylan, & Zvonkovic, 2012).

Homesickness is one factor that greatly affects the dietary acculturation of international students. It causes feelings of hostility, anxiety, depression, and loneliness. This explains why most international students are likely to experience culture shock and ethnic and racial prejudice after migrating to foreign countries (Ying, Lee & Tsai, 2000; Zheng & Berry, 1991). Such factors may negatively affect individual students’ health if they end up adopting poor eating habits.

Saudi Diets

Saudi Arabia, the third-largest country in Asia, forms about four-fifths of the Arabian Peninsula. According to the Saudi Arabian Cultural Mission (SACM) (2013), the Saudi Arabian population in July 2013 was 26,939,583, including 5,576,076 non-nationals. The ethnic composition of Saudi nationals is 50% Arab, 5% Bedouin Arab, 10% Afro Asian, and 35% al-Arab al-Afriqiyah (Egyptian, Sudanese, Libyan, etc.) (SACM, 2013).

Currently, Saudis are traditional and still consume the same types of food they have eaten for thousands of years (SACM, 2013). The average meal of the Bedouin nomads who continue living in Saudi Arabia is much simpler than that of the urban Saudis who make up the majority of Saudi Arabia's population today. Saudi cuisine includes many types of food, with the most common being fava beans, rice, chicken, lamb, wheat, yogurt, and dates. In Saudi Arabia, chicken is a staple food for all Saudis. Saudis are the biggest consumers of chickens in the world, with an average of 88.2 lbs. of chicken consumed per person per year. Saudis follow Islamic law, which means they do not consume pork or drink alcohol ("Food In Every", 2013).

Dates are very popular in Saudi Arabia. The Prophet Mohammed (peace be upon him) is
reported to have said, “A house without dates has no food” (Muhammad, 2009). Saudi Arabia produces 600 million pounds of dates each year because it has over 18 million date palms ("Food In Every", 2013).

Arabic coffee (Gahwa) is a very important drink in Arabian Gulf countries in general, and Saudi Arabia in particular. The preparation, serving, and drinking of gahwa originated from Bedouin hospitality. According to the history of Saudi Arabia, serving coffee in Saudi Arabia is a sign of generosity and hospitality. Typically, visitors are served Arabic coffee and dates (SACM, 2013).

**Dietary habits and food choices for Saudi students.** Over the past few decades, Saudi Arabia has witnessed tremendous lifestyle changes. Sedentary lifestyles are becoming more common among Saudi youth and children. Research shows that 71% of Saudi youth do not participate in physical activity of adequate length and frequency compared to the recommended (Al-Hazzaa, 2002; Al-Hazzaa, 2004).

Moreover, in the Eastern Mediterranean countries during the past four decades, food-consumption patterns have changed dramatically. High-calorie foods and sweetened beverages are becoming more accessible to adolescents and children (Musaiger, 2011).

Some research (Collison et al, 2010; Mahfouz et al, 2008) has assessed certain aspects of the dietary and lifestyle habits among Saudi children and adolescents. Unfortunately, the authors acknowledged that the majority of this research used invalid physical-activity instruments, a small sample size, or did not evaluate sedentary behaviors, dietary habits, and physical activity.

Al-Hazzaa, Abahussain, Al-Sobayel, Qahwaji, & Musaiger, (2011) studied male and female students in three cities in Saudi Arabia, Al-Khobar, Jeddah, and Riyadh, and found major public-health concerns for Saudi students. The researches showed that students have a high
prevalence of sedentary behaviors, physical inactivity, and unhealthy dietary habits. The study expressed a need for national policy reducing sedentary behaviors and promoting active living and healthy eating.

American Diets

Throughout the past two decades, the overall quality of the American diet has not improved. Based on the literature review of nutrition patterns among the American population in general, and adult university students in particular, the American diet can be described as having heavy components of high-energy processed foods that are high in saturated fats, protein, sugar, sodium, simple carbohydrates, and sweetened beverages. Meanwhile, complex carbohydrates, vegetables, fruits, whole grains, calcium-rich foods, and fiber appear in lower quantities (McCracken, Jiles, & Blanck, 2007; Miller & Savyer, 2005; Neumark-Sztainer, French, Hannan, Story, & Fulkerson, 2005; Taylor, Keim, Gilmore, Parker, & Van Delinder, 2006). According to Pimental (1994), the average American drinks 600 cans of soda per year, which is 90,000 calories, totaling 50 pounds of sugar per person per year.

Woolston (2013) divides the American diet into two types: prudent and Western. The prudent diet is composed of fish, legumes, vegetables, poultry, and whole grains. Furthermore, prudent dieters avoid foods rich in fats and calories. On the other hand, the Western diet is high in red meats and fatty foods, and avoids greens. Woolston (2006) provided evidence that food rich in calories and red meat had negative dietary effects. Liebman (2006) supported evidence by describing the Western diet as an Atkins diet, which is high in red meat, butter, and other foods rich in saturated fats. He found that red meat could also increase the risk of prostate and colon cancer.

Taylor, Keim, Gilmore, Parker, & Van Delinder (2006), preformed a study including two
groups of Native American women in Oklahoma (N = 175). Seventy-one women kept a 4-day weighed food record, while the other group of 74 women kept a 1-day list of the foods they most commonly consumed. A list of various food items was offered to participants, showing commonly consumed foods such as white bread, fats, coffee, tea, and sodas. Numerous participants considered mashed/baked/boiled potatoes and jam/jelly to be high-fat food items. A weakness of this study was that there were no male participants; all of the participants were women. Kennedy, Bowman, and Powell, (1999) found that women’s total intake of fat increased during the years 1989 – 1995, and that the fried potato was a main calorie source in a high-fat diet.

Dietary habits and food choices for American college students. Recent national data on the US population indicated widespread obesity due to greater intake of fast food items. This relationship between overweight status and obesity has been ascribed to the fast-paced daily lives of individuals which prevent them from cooking meals at home, causing them to resort to processed and fast food (Hogan, 2000).

Throughout the United States, the obesity epidemic has impacted every population demographic; the USA is in the center of a nutritional crisis (Ogden, Carroll, Kit, & Flegal, 2012). National health and nutrition surveys have indicated that 64% of the total US population falls into the obese or overweight category (Ogden, Carroll, Kit, & Flegal, 2012). In addition, considerable disparities exist based on demographics such as, geographic region and socioeconomic status. Drewnowski & Darmon (2005) indicated that the economic power to purchase wholesome meals including grains, meat, vegetables, and fruits play a major role in avoiding obesity.

For most people, body mass index (BMI) presents a reliable indicator of body fat and is
used to screen for weight categories that may lead to health problems. Research by McCracken, Jiles, & Blanck (2007) into nutrition and health among a young population (18 - 24 years old) in relationship to their BMI revealed quite disturbing results: A high percentage (78%) of the participants admitted to eating less than five fruits and vegetables in a day. Of the respondents, 43% disclosed that they do not have the time to engage in exercise or any other sort of physical activity that would help them burn extra calories and fat. 30% of the total respondents were regular smokers, and 12% of the targeted population showed symptoms of stress and depression. Out of all the respondents, 26% fell into the overweight category and 14% into the obese category.

Levitsky, Halbmaier, and Mrdjenovic (2004) examined the behavioral patterns of students during their first three months at Cornell University. New students are more prone to weight-gain due to various environmental incentives, which motivate them to eat unhealthily, causing weight gain. Numerical measurements illustrate an increase in weight of 1.97 ± 2.4 kg. The study’s methodology included testing and weighing 60 students during the first week of their semester and then weighing them again after three months. The students underwent a thorough analysis of their eating habits according to their own descriptions of what and how they had eaten during the evaluation period.

Healthy eating choices over time can lead to better eating habits; this common knowledge has been ignored by many in the United States. A review of the literature surrounding eating habits and diet patterns amongst students showed a failure to adhere to a healthy diet (Marietta, Welshimer & Long, 1999). Poor eating habits were largely influenced by foods high in saturated fat, sodium, and sugar. Maintaining a low budget for food forces students to go out and grab what is easily available, rather than opting for healthy foods. Busy class schedules, ease of
availability of unhealthy food, fatigue from late nights, and eating in a distracted environment were some other factors mentioned by Marietta, Welshimer and Long (1999). Health and nutrition officials have expressed serious concerns about these patterns and argue that students’ intakes should include higher levels of fruits, vegetables, and whole grain foods rich in essential minerals and vitamins (Huang, Song, Schemmel, & Hoerr, 1994).

Students’ dietary patterns are largely attributable to their efforts to familiarize themselves with their new environment away from home, selecting food options that help in settling into new surroundings (Marietta, Welshimer, & Long, 1999; Huang, Song, Schemmel & Hoerr, 1994). More than half of the total American population would be more comfortable doing their yearly tax calculations than working on a healthy diet schedule (USDA, 2002). Health and nutrition data from 2011 found that the average American consumes the following amounts annually: 632 lbs. of dairy products, of which 31 lbs. is cheese; 415 lbs. of vegetables, of which 29 lbs. is in the form of potatoes; 273 lbs. of fruit; 184 lbs. of meat, of which 60 lbs. is chicken, 62 lbs. is beef, and 16 lbs. is fish; 142 lbs. of sweeteners; and 53 gallons of soda. Over 10 billion donuts are eaten in the USA each year (USDA, 2002).

A recent analysis has indicated that Americans generally prefer to eat foods rich in fat, calories, and sugar ("Study Identifies Factors," 2007). The choice of selecting sodium-rich foods over fruits and vegetables is largely influenced by random purchases rather than acceptable diet scheduling. Only 77% of American’s requirements for fiber and essential vitamins are being met through fruits and vegetables showed that the intake of sugar products is threefold the daily recommended amount of added sugar amongst young American kids and teenagers, regardless of gender ("Study Identifies Factors," 2007). Research stresses various ways that Americans can improve their choices of food selection and make efforts to develop meal plans. Deciding at the
last moment what to prepare for dinner can lead to the inclusion of unhealthy foods in one’s diet ("Study Identifies Factors," 2007).

Snacks can actually help curb hunger while adding a nutritious energy boost to our daily lives. Snacking is not all bad if done in a moderate manner, with healthy choices. However, 20% of the calorie intake for Americans comes from junk food and snacks, which provide little nutritional value. According to new research by the USDA (2013), the fast-paced lives of Americans allow little or no time for breakfast, with a majority of the young population going to work without breakfast. Preferring to pick up a bagel or a donut on the way to work, saving time but risking health. Lunch is also skipped, while dinners are rarely eaten at home. Working mothers do not have the time to prepare a healthy meal at home, which makes the young generation rely more on snacks to control their hunger. Children’s consumption of snacks at irregular times can lead either to malnourishment or excessive weight gain. Also to blame are the increasing number of companies offering a large variety of consumer snack items such as chocolate, cookies, and chips.

The concept of fast food restaurants originated in the US and was later followed in other regions of the world. America’s obesity crisis is largely dependent on its fondness for dining out (USDA, 2013). Before eating out, it is important to understand your diet and avoid excessive amounts of sugary beverages. Fifty percent of the adult population dines out at least three times in a week, with 12% of the population eating at restaurants every night for the entire week. According to Gustafson (2011), eating out is not just restricted to weekends, as on weekdays people come back from work and are either tired or undecided on what to fix for dinner. What people fail to realize is that dining out once a week can lead to a weight gain of two extra pounds every year. This might look negligible, however, when people go out more than one time a
week, it can lead to permanent weight gain (Gustafson, 2011). According to USDA data from 2013, eating out at breakfast adds about 75 calories to one’s intake, eating out at lunchtime adds 160 calories, and eating out at dinnertime adds 140 calories.

Helping families eat better and stay healthy is the main concern for the academy of Nutritional and Dietetic because excessive weight and obesity are linked to an increased risk of diseases and chronic conditions (Gustafson, 2011). Americans need to concentrate on the environment in which they make food selections. Moreover, they need to be sure that the energy they are taking in by eating is in balance with the energy they burn from physical activity. Large food portions at restaurants should be avoided and emphasis should be placed on menu selection. Alarming obesity rates have finally made Americans receptive to eating habits eating healthy diets. Though more expensive than fast food, Americans are now inclined toward purchasing natural and wholesome products. Still, the average intake for fresh fruits and vegetables is less than the recommended serving size of five per day. Even dairy products such as milk and cheese are eaten less, which is compensated for by a higher consumption of meat and poultry (Gustafson, 2011).

At East Carolina University, 185 female students aged 18 to 24 years participated in a study researching the eating patterns of obese females (Malinauskas, Raedeke, Aeby, Smith, & Dallas, 2006). The researches compared the consumption habits of normal students with the extra measures overweight students took to control their weight. The study was based on a questionnaire asking for feedback and opinions on dieting. The students were also asked to identify any physical exercise they had undertaken during the last month. The BMI, height, and weight of each student was recorded. Eighty three percent of the respondents controlled their diet in order to decrease their weight and admitted to a 2%-6% increase in their weight when
physical exercise was not performed. Health counselors and dietitians can play an active role in devising a healthy diet plan for students, regardless of their current weight, allowing them to adopt a healthy eating lifestyle.

**Diet and its Relationship with Chronic Diseases**

The word “cholesterol” has negative connotations. The truth is that cholesterol is needed by the body. It is the basis for healthy cell membranes, hormone production, and the metabolism of certain fat-soluble vitamins (Gropper & Smith, 2009). Cholesterol becomes a problem when the diet contains too much in addition to what the body produces. Cholesterol can be deposited along the lining of arterial walls. This can result in heart disease, stroke, and the hardening of arteries (Bellows & Moore, 2012; Gropper & Smith, 2009).

In general, LDL moves cholesterol through the body where excessive amounts can raise the risk of heart disease. HDL removes cholesterol away from the periphery to the liver where the excess cholesterol is removed from the circulation (Gropper & Smith, 2009).

The food eaten affects the level of cholesterol in the body. High-fat diets have been found to increase the level of cholesterol in the blood. The American Heart Association recommends that consuming no more than 30% of our daily calories from fat. For the average person, this would fall somewhere between 50 and 80 grams of fat per day (Koh, Yuan, Gross, & Pereira, 2012).

At the beginning of this literature review, the researcher described an American diet high in saturated fat, protein, sugar, sodium, and simple carbohydrates. Excessive amounts of sodium in the body raise blood pressure. High blood pressure can cause small injuries in the walls of blood vessels. To repair injuries, the body uses lipoprotein, a substance produced by the body that contains cholesterol. Therefore, high sodium intake can also lead to high blood pressure and
an effect to repair injury with cholesterol produced by the body, even if there is no cholesterol in the diet (Nefer, 2013).

According to the World Health Organization (2002), the most important risks of non-communicable diseases (NCDs) included high concentrations of cholesterol in the blood, high blood pressure, insufficient consumption of vegetables and fruit, being obese or overweight, tobacco use, and physical inactivity (Mutangadura, 2004). Five of these risk factors are closely correlated to physical activity and diet. Therefore, physical activity and diet play an important role in staying healthy and avoiding disease (Lee, 2005).

For instance, Liou and Bauer (2010) who conducted a study of young Chinese American adults ascertained that sedentary lifestyles and poor or unhealthy dietary behaviors led to an individual’s weight gain and a decrease in consumption of traditional foods. This indicates that individuals require knowledge and the technical skills for choosing healthy foods, coupled with environments that provide convenient, healthful, inexpensive, and tasty meals (Liou & Bauer, 2010). Similarly, research conducted in America has indicated that dietary acculturation culminates in an increase in certain health complications (Kang & Garey, 2002; Woods, 1992). Individuals studied demonstrated possible negative effects of dietary acculturation as evidenced by complications including diabetes, cardiovascular disease, abdominal obesity, as well as breast, prostate, and colorectal cancers (Wahlqvist, 2002).

**Summary**

The addition of immigrants to the US has made the health status of minority groups a key issue in the field of public health (Brittin & Obeidat, 2011; Satia et al., 2000). United States immigrants may adopt dietary changes that raise risk of chronic diseases owing to increased exposure in the US to foods high in fat, along with lower vegetable and fruit consumption (Satia,
Patterson, Neuhouser, & Elder, 2002). This increased risk of disease increase the need to study the level of influence that acculturation has on chronic disease development. This result should aid determining culturally specific resolutions for managing the health requirements of these specific populations of interest (Satia et al., 2000; Brittin & Obeidat, 2011).

The present study attempted to identify the change in dietary habits, physical Activity, and weight changes that were influenced by diet and physical Activity of Saudi Arabia students who came to the USA. The methodology of this study is presented in chapter 3.
Chapter III: Methodology

This study focused on students from the Kingdom of Saudi Arabia (KSA) who moved to study in the United States (USA) to measure changes in their body weight because of changes in eating habits. This study was designed to determine the main factors affecting dietary acculturation of KSA students studying at universities in the United States. In addition, dietary, anthropometric, and blood chemistry changes caused by acculturation were studied.

Understanding eating habits related to culture and identity will aid in seeing why people change their eating habits. This chapter begins with information on selection and description of the subjects. Also included in this chapter is information on the instrument used to collect the data, details on the data collection, and information for data analysis. The chapter concludes with a brief description of methodological limitations.

Subject Selection and Description

A proposal for this research was approved by Institutional Review Board for the Protection of Human Subjects in Research (IRB) at the University of Wisconsin-Stout (UW-Stout) (Appendix A). Students were allowed to withdraw from the study at anytime during completion of the survey. Once students submitted the online survey, participants were unable to withdraw their answers due to the inability to identify the anonymous completed surveys. Data was collected from different study groups: a general Saudi Arabia student population who were currently living in the United States and a population of freshmen at the UW-Stout.

Subjects were 18 years of age or older and lived in the United States at least 6 months. Saudi participants at UW-Stout must have not lived in the United States before they came to UW-Stout. The investigator excluded everyone not meeting the research criteria. All subjects had no preexisting health conditions or any other condition that might inhibit them from eating.
As well, women subjects were not pregnant or had delivered a child in the past 6 months. Moreover, participants could not have had any weight loss surgery such as a gastric gastroplasty, gastric bypass, and gastric sleeve or banding.

**Saudi Arabia population in general.** Students entering the United States through the Saudi Arabia Cultural Mission (SACM) program were invited to participate via SACM Facebook page. There are over 73,000 Saudi participants on this site. Everyone on the page was invited to participate (n = 73,000). Current sophomores, juniors, seniors, and graduate KSA students at UW-Stout were also surveyed (n = 159). The Stout KSA students were identified through a list provided by the Office of International Education at UW-Stout.

**UW-Stout student population.** The second study group consisted of UW-Stout students entering as freshmen from Saudi Arabia (n = 20) and freshman who have lived in the United States all of their lives (n = 17). KSA students were identified through the Office of International Education. All freshmen KSA students on the list were invited to participate. In addition, the investigator attended orientation days for Fall 2013 and invited students to participate. Email addresses of American students were obtained from the Planning, Assessment, Research and Quality (PARQ) Office. The study was also advertised by flyers posted around campus.

**Data Collected from Saudi Arabia Population in General**

**Survey.** The introduction and link for the survey (Appendix B) were placed within the investigator’s Facebook page on September 15, 2013. A reminder was posted at the same page on September 21, 2013. An initial email was sent using the UW-Stout Qualtrics survey software on September 15, 2013 for current KSA students at UW-Stout. The sending email included an introduction, a description of how the participants were to be involved in the study, and a consent
declaration (Appendix C). A reminder email was sent on September 21, 2013 through Qualtrics to the remaining students who did not complete the survey. A final reminder email was sent on September 28, 2013.

The survey (Appendix B) was completed on-line and no name or other identifying information was included on any of the materials. The first section of the survey included questions about participant’s selection of food, eating habits, food preferences, and fast food consumption before and after moving to the U.S. The second section explored acculturation factors and adaptations that influence the food intake. Questions were asked about availability of native food, time, availability, friendship ties, and places and time where students eat. The third section asked questions regarding student’s physical activity. Questions were asked about normal daily activities and length of time for those activities. The last section focused on demographic questions such as age, gender, length of time of living in the US, and where the participants lived (on-campus, off-campus).

**Data Collection from UW-Stout Students**

This cohort was administered the survey; had body measurements taken including height, weight and percentage of body fat; and had a small drop of blood sampled for total cholesterol (TC), high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, triglycerides (TG), and glucose (GLU). Assessments were completed at the beginning of the fall semester (Sept. 2nd - 8th) and again at the end of the fall semester (Dec.15th – 20th). At the beginning of the study, the students were given information and consent documentation (Appendix D). Each student was assigned a code number (Appendix E) and all surveys and data sheets (Appendix F) were be identified only by the code number.
**Survey.** The researcher gave each KSA participant a hard copy of the same survey used for the general KSA population (Appendix B) one week before the second set of measurements were completed. Only the first section about participant’s selection of food, eating habits, food preferences, and fast food consumption before and after moving to the USA was analyzed. There was no survey for the UW-Stout group.

**Anthropometric measurements.** The Tanita scale used to measure height and weight also determined body composition through bioelectrical impedance. Participants were asked to remove their shoes and socks and stand on the platform of the Tanita scale looking straight ahead. The head, shoulder, buttocks, and heels were aligned. The height marker was placed right above the head, touching but without pressure. The readings for height, weight, and body composition were written on the data sheet (Appendix F). The printout from the instrument was stapled to the data sheet.

**Blood analysis methods.** Blood tests for students revealed information about total cholesterol, LDL cholesterol, HDL cholesterol, triglyceride, and glucose levels in the blood. Preceding testing, participants were asked to fast for 8-12 hours. They were also encouraged to not consume caffeine or additional fluids the morning of testing. Data collection occurred in the Nutrition Assessment Lab (427 Heritage Hall). A trained researcher in the Nutrition Assessment Laboratory conducted the finger prick. Blood was squeezed from the opening and transferred to the test strip. Pressure and a bandage were applied to the wound to stop bleeding. The test strip, when used with the Alere Cholestech LDX System, is capable of measuring total cholesterol (TC) as well as high-density lipoprotein (HDL) cholesterol, triglycerides (TG), and glucose levels. The Alere Cholestech LDX System also calculated the TC/HDL ratio, non-HDL cholesterol, and estimated low-density lipoprotein (LDL) cholesterol. Data was recorded on the
data collection sheet and the printout from the machine stapled to the form. Beverages were provided to students following sample collection to help students recover from the fasting period. After completion of data collection in September, participants were given a gift card ($10) and when the second blood test was completed in December, they received another gift card ($20). All compensation for participation was funded from a UW-Stout Student Research grant.

**Data Analysis**

Data was coded and analyzed using the Statistical Program of Social Sciences (SPSS), version 18.0. To examine general trends, frequency, percentages, standard deviation, and mean were determined. Correlational analyses were completed to examine associations between variables as identified in the results. A standard p-value of $p < 0.05$ was used as the significance level for all tests conducted. The specific tests are identified within the results chapter 4 and include Pearson Correlation, Spearman Correlation, Paired t-Test, Wilcoxon Signed Rank test and McNemar test.

**Limitations**

The sample size for KSA students at UW-stout did not fully represent the population of KSA students at all United States universities because there were only 20 students. The participants, who took the survey, might have made errors when reporting their height and weight. Before the blood draw students might not have fasted for 8 - 12 hours. Another limitation is that participants may not have answered all the survey questions completely and/or honestly.
Chapter IV: Results

The purpose of this study was to investigate the effect of dietary acculturation issues on health and what factors contribute to these changes for students from the Kingdom of Saudi Arabia (KSA) who are now studying in the United States (USA). Specifically, this study addressed the following objectives:

1. Determine if there is a change in dietary habits and food preferences of KSA students after coming to the United States.
2. Identify factors that influence KSA students eating habits in the United States.
3. Determine if there is a change in physical activity of KSA students after coming to the United States.
4. Identify any relationship between weight change and diet, factors that influence diet, and physical activity for KSA students in the United States.

A smaller focus group of KSA freshmen and USA students enrolled at the University of Wisconsin-Stout (UW-Stout) were used to achieve the following objective:

5. Identify if dietary acculturation correlates with body weight, fat composition, and blood chemistry including total cholesterol (TC), high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, triglycerides (TG), and glucose.

Demographic Information of Both Groups of Subjects

The data was collected from different study groups: a general KSA student population currently living in the United States and a population of KSA and USA freshmen at UW-Stout.

Saudi Arabia students in general. A total of 591 people opened the survey link. However, 240 individuals met the research conditions of this study and answered a majority of the questions. The majority of the KSA participants were male (69.5%, n = 166) (Table 1). All
of the subjects were college students, and their ages ranged from 18 to 35 years old (Table 2). Most of the KSA participants (93.3%) lived off-campus and had been living in the United States between one and three years (85.1%) (Tables 3 and 4).

Table 1

Gender of KSA Participants

<table>
<thead>
<tr>
<th>Gender</th>
<th>(N)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>166</td>
<td>69.5</td>
</tr>
<tr>
<td>Female</td>
<td>73</td>
<td>30.5</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 2

Age of KSA Participants

<table>
<thead>
<tr>
<th>Age</th>
<th>(N)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 - 21</td>
<td>37</td>
<td>15.4</td>
</tr>
<tr>
<td>22 - 25</td>
<td>71</td>
<td>29.4</td>
</tr>
<tr>
<td>26 - 29</td>
<td>90</td>
<td>37.6</td>
</tr>
<tr>
<td>30 - 33</td>
<td>31</td>
<td>13.0</td>
</tr>
<tr>
<td>34 - 35</td>
<td>11</td>
<td>4.6</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 3

_Housing of KSA Participants_

<table>
<thead>
<tr>
<th>Housing</th>
<th>(N)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-campus</td>
<td>16</td>
<td>6.7</td>
</tr>
<tr>
<td>Off-campus</td>
<td>224</td>
<td>93.3</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4

_Time Living in USA of KSA Participants_

<table>
<thead>
<tr>
<th>Period</th>
<th>(N)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 3 years</td>
<td>204</td>
<td>85.1</td>
</tr>
<tr>
<td>4 – 6 years</td>
<td>33</td>
<td>13.7</td>
</tr>
<tr>
<td>7 – 9 years</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100.0</td>
</tr>
</tbody>
</table>

_Saudi and American freshmen at the University of Wisconsin-Stout._ The subjects who participated in this part of the study were 20 KSA and 17 USA freshmen, for a total of 37 students. All of the subjects were college students and their ages ranged from 18 to 33 years old (Table 5). In the USA group the students’ ages ranged from 18 – 21 years and in the KSA group the students’ ages ranged from 18 – 33 years. KSA students have a broader range in age compared to the USA students. In the Saudi Arabia group, the majority of the participants were male, while in the control group the majority of the participants were female. In the KSA group, the majority of the students reported that they lived off-campus (Table 6). However, because the groups were so variable for age and gender, the data was analyzed by country and gender.
### Table 5

**Age of KSA & USA Participants at UW-Stout**

<table>
<thead>
<tr>
<th>Age</th>
<th>KSA group (N=20)</th>
<th>USA group (N=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>18 - 21</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>22 - 25</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>26 - 29</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>30 - 33</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7</td>
<td>13</td>
</tr>
</tbody>
</table>

### Table 6

**Housing of KSA Participants at UW-Stout**

<table>
<thead>
<tr>
<th>Housing</th>
<th>(N)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-campus</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Off-campus</td>
<td>19</td>
<td>95.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Objective 1: Determined If There is a Change In Dietary Habits And Food Preferences of KSA Students After Coming to the United States

Meal habits. Tables 7 and 8 summarize the descriptive statistics for participants when asked to describe how their mealtimes and whether the largest meal consumed in each day had changed since coming to the United States.

Consumption of lunch and dinner decreased after living in the United States, whereas the consumption of breakfast increased. When in the United States, KSA students began to eat lunch and dinner with similar frequency. The largest meal of the day shifted from lunch to dinner time (Table 8). Moreover, there was an increase in the percentage of students who consider breakfast as the largest meal of the day (Table 8).

Table 7

Comparison of Meals Consumed from Living in KSA & USA

<table>
<thead>
<tr>
<th>Mealtime</th>
<th>In Saudi Arabia</th>
<th>In United States</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Yes (%)</td>
</tr>
<tr>
<td>Breakfast</td>
<td>234</td>
<td>120 (51.3)</td>
</tr>
<tr>
<td>Lunch</td>
<td>239</td>
<td>216 (90.0)</td>
</tr>
<tr>
<td>Dinner</td>
<td>238</td>
<td>193 (80.4)</td>
</tr>
</tbody>
</table>
Table 8

Comparison of Largest Meal of the Day from Living in KSA & USA

<table>
<thead>
<tr>
<th>Mealtime</th>
<th>In Saudi Arabia</th>
<th>In United States</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Largest meal (%)</td>
<td>Largest meal (%)</td>
</tr>
<tr>
<td>Breakfast</td>
<td>6 (2.6)</td>
<td>16 (6.7)</td>
</tr>
<tr>
<td>Lunch</td>
<td>172 (73.5)</td>
<td>125 (52.1)</td>
</tr>
<tr>
<td>Dinner</td>
<td>56 (23.9)</td>
<td>99 (41.3)</td>
</tr>
<tr>
<td>Total</td>
<td>234</td>
<td>240</td>
</tr>
</tbody>
</table>

Table 9 shows the students’ meal habits changed in the United States. About half (46.6%) of the students disagreed with eating healthier food since they moved to the United States. About half (53.5%) of the students had changed their habits in the United States by snacking more often between meals similar to most American people do (USDA, 2013).

Table 9

Changes in Students’ Meal Habits

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Disagree (%)</th>
<th>Neither / Nor (%)</th>
<th>Agree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I eat more food.</td>
<td>239</td>
<td>88 (36.8)</td>
<td>69 (28.9)</td>
<td>82 (34.3)</td>
</tr>
<tr>
<td>I eat healthier food.</td>
<td>238</td>
<td>111 (46.6)</td>
<td>53 (22.3)</td>
<td>74 (31.0)</td>
</tr>
<tr>
<td>I snack more often between meals.</td>
<td>237</td>
<td>54 (22.7)</td>
<td>56 (23.6)</td>
<td>127 (53.5)</td>
</tr>
</tbody>
</table>
Consumption of meals cooked at home and who did the cooking. Figure 1 compares students’ consumption of meals cooked at home in Saudi Arabia and after living in the United States. In Saudi Arabia, about 38.3% (n = 92) of students ate meals cooked at home twice a day. In contrast, 32.5% (n = 78) of students changed their habits by eating a meal cooked at home only 2-3 times a week.

Figure 1. Students’ consumption of meals cooked at home

Figure 2 shows the primary food preparer in the household. In Saudi Arabia, about 74.2% (n = 178) represented that the parents were the primary food preparer in the household. However, when students migrated in the United States, 70 % (n = 168) reported that they prepared the food themselves.
Fast food and consumption of different food groups. To determine how dietary habits and food preferences have changed after living in the United States, several questions asked participants to describe how often they ate certain food items before and after moving to the United States. In the original survey, the items were coded as 1 = Daily; 2 = 5-6 times a week; 3 = 3-4 times a week; 4 = 1-2 times a week; 5 = 1-3 times a month and; 6 = never (Appendix B). To analyze responses in a more convenient manner, responses were combined into 1 & 2 = nearly daily; 3 & 4 = at least weekly; 5 = monthly; and 6 = never. The results showed that the frequency of consumption of some food items did not change since the students moved to the United States such as fruit, ice cream, bakery goods, candy or chocolate, seafood, potato, milk or yogurt and non-diet soda. Table 10 describes foods that were more commonly consumed in the USA. Since moving to the USA, there was significant increase in nearly daily consumption of cheese by 11.3%, coffee (17.5%), fast food (16.1%), burger (7.2%), and pizza (8.0%).
### Table 10

*Foods More Commonly Consumed in the USA Compared with KSA*

<table>
<thead>
<tr>
<th>Food Eaten More</th>
<th>Country</th>
<th>N</th>
<th>Nearly Daily</th>
<th>At least weekly</th>
<th>Monthly</th>
<th>Never</th>
<th>Sig (P value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheese</td>
<td>KSA</td>
<td>239</td>
<td>36.4</td>
<td>51.0</td>
<td>10.5</td>
<td>2.1</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>239</td>
<td>47.7</td>
<td>38.1</td>
<td>13.0</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Coffee</td>
<td>KSA</td>
<td>239</td>
<td>38.1</td>
<td>31.4</td>
<td>18.0</td>
<td>12.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>239</td>
<td>55.6</td>
<td>22.2</td>
<td>11.3</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>Fast Food</td>
<td>KSA</td>
<td>220</td>
<td>10.0</td>
<td>47.7</td>
<td>36.8</td>
<td>5.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>226</td>
<td>26.1</td>
<td>44.7</td>
<td>20.8</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>Burger</td>
<td>KSA</td>
<td>236</td>
<td>5.1</td>
<td>38.1</td>
<td>44.9</td>
<td>11.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>235</td>
<td>12.3</td>
<td>49.8</td>
<td>25.1</td>
<td>12.8</td>
<td></td>
</tr>
<tr>
<td>Pizza</td>
<td>KSA</td>
<td>230</td>
<td>1.7</td>
<td>22.2</td>
<td>61.7</td>
<td>14.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>236</td>
<td>9.7</td>
<td>46.6</td>
<td>36.4</td>
<td>7.2</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The numbers in the table are percentages (%). The Statistical test used was Wilcoxon Signed Rank test and McNemar test.

Table 11 shows foods that were less commonly consumed in the United States compared to Saudi Arabia. For example, Saudi students consumed significantly less in nearly daily consumption of meat by 25.0%, rice by 39.9%, pasta by 3.0%, and bread by 8.1%, respectively.
Table 11

*Foods Less Commonly Consumed in the USA Compared with KSA*

<table>
<thead>
<tr>
<th>Food Eaten Less</th>
<th>Country</th>
<th>N</th>
<th>Nearly Daily</th>
<th>At least weekly</th>
<th>Monthly</th>
<th>Never</th>
<th>Sig (P value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>KSA</td>
<td>235</td>
<td>82.1</td>
<td>14.9</td>
<td>3.0</td>
<td>0.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>238</td>
<td>57.1</td>
<td>37.0</td>
<td>5.9</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>KSA</td>
<td>237</td>
<td>64.1</td>
<td>32.5</td>
<td>3.4</td>
<td>0.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>239</td>
<td>24.3</td>
<td>54.4</td>
<td>18.8</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Pasta</td>
<td>KSA</td>
<td>237</td>
<td>13.5</td>
<td>57.8</td>
<td>24.9</td>
<td>3.8</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>238</td>
<td>10.1</td>
<td>56.7</td>
<td>26.5</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>Bread</td>
<td>KSA</td>
<td>235</td>
<td>73.2</td>
<td>22.6</td>
<td>2.6</td>
<td>1.7</td>
<td>0.041</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>240</td>
<td>65.0</td>
<td>28.3</td>
<td>5.0</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The numbers in the table are percentages (%)
The Statistical test used was Wilcoxon Signed Rank test and McNemar test.

**Objective 2: Identify Factors That Influences Saudi Arabia Students’ Eating Habits in the United States**

**Factors of choosing to eat a meal cooked at home.** One of the survey sections asked participants to tell to which degree they agreed with the importance of statements to eat meals cooked at home. The results indicated that the most obvious factor that lead students to eat a meal cooked at home was the importance of preparing food the way they liked it (Table 12). On the other hand, there were other important factors of choosing to eat meals cooked at home...
which include having enough time (64.7%), saving money (62.0%), desiring to eat healthy food (74.0%), and religious beliefs (60.0 %) (Table 12).

Table 12

*Students’ Factors of Choosing to Eat Meals Cooked at Home*

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Not Important n (%)</th>
<th>Neither / nor Important n (%)</th>
<th>Important n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have enough time.</td>
<td>235</td>
<td>39 (16.6)</td>
<td>44 (18.7)</td>
<td>152 (64.7)</td>
</tr>
<tr>
<td>I save money.</td>
<td>234</td>
<td>48 (20.5)</td>
<td>41 (17.5)</td>
<td>145 (62.0)</td>
</tr>
<tr>
<td>I prepare the food the way I like it.</td>
<td>235</td>
<td>22 (9.4)</td>
<td>24 (10.2)</td>
<td>189 (80.4)</td>
</tr>
<tr>
<td>There is health history in the family.</td>
<td>235</td>
<td>98 (41.7)</td>
<td>53 (22.6)</td>
<td>84 (35.7)</td>
</tr>
<tr>
<td>I want to eat healthy.</td>
<td>235</td>
<td>26 (11.1)</td>
<td>35 (14.9)</td>
<td>174 (74.0)</td>
</tr>
<tr>
<td>Religious beliefs.</td>
<td>235</td>
<td>50 (21.3)</td>
<td>44 (18.7)</td>
<td>141 (60.0)</td>
</tr>
</tbody>
</table>

**Factors of Choosing to Eat Fast Food.** Another survey section asked participants to tell to which degree they agreed with the importance of statements to eat fast food meals. The most obvious factor that led students to eat fast food in the United States was that they did not have enough time to prepare their own meals (64.9%) (Table 13). As well, almost half (47.7%) of the students reported that saving money or family influence (54%) were not important factors of choosing to eat fast food (47.7%; 54.0%, respectively). In addition, slightly less than half (43.9%) of the students reported that the food taste was not an important factor of choosing to eat fast food (Table 13).
Table 13

*Students’ Factors of Choosing to Eat Fast Food*

<table>
<thead>
<tr>
<th>Factor</th>
<th>N</th>
<th>Not Important (%)</th>
<th>Neither/ Nor (%</th>
<th>Important (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I do not have enough time.</td>
<td>239</td>
<td>52 (21.8)</td>
<td>32 (13.4)</td>
<td>155 (64.9)</td>
</tr>
<tr>
<td>I save money (compared to formal restaurant)</td>
<td>237</td>
<td>113 (47.7)</td>
<td>45 (19.0)</td>
<td>79 (33.3)</td>
</tr>
<tr>
<td>Tastes good.</td>
<td>237</td>
<td>104 (43.9)</td>
<td>62 (26.2)</td>
<td>71 (30.0)</td>
</tr>
<tr>
<td>Convenience.</td>
<td>235</td>
<td>85 (36.2)</td>
<td>61 (26.0)</td>
<td>89 (37.9)</td>
</tr>
<tr>
<td>Friend’s influence.</td>
<td>237</td>
<td>92 (38.8)</td>
<td>58 (24.5)</td>
<td>87 (36.7)</td>
</tr>
<tr>
<td>Family influence.</td>
<td>237</td>
<td>128 (54.0)</td>
<td>48 (20.3)</td>
<td>61 (25.7)</td>
</tr>
</tbody>
</table>

*Other factors.* The research examined other factors that influences KSA students to adapt to an American diet. About half (46.1%) of the students agree with the statement of native food was not available. As students, almost half (40.5%) agree with spending less time eating because of their busy schedule. A similar pattern was shown for eating while watching TV. About half (47.4) of the students disagree with the statement of making their meal choices based on cost more than content, it seems that food cost was not a big concern for the participants (Table 14).
Table 14

*Factors that Influences KSA Students’ Eating Habits*

<table>
<thead>
<tr>
<th>Statement</th>
<th>N</th>
<th>Disagree (%)</th>
<th>Neither / Nor (%)</th>
<th>Agree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native food is not available.</td>
<td>236</td>
<td>60 (25.4)</td>
<td>67 (28.4)</td>
<td>109 (46.1)</td>
</tr>
<tr>
<td>It is important to me to consume my native diet.</td>
<td>237</td>
<td>72 (30.3)</td>
<td>95 (40.1)</td>
<td>70 (29.5)</td>
</tr>
<tr>
<td>I tend to go out more with friends to eat a meal and socialize.</td>
<td>237</td>
<td>70 (29.5)</td>
<td>78 (32.9)</td>
<td>89 (37.5)</td>
</tr>
<tr>
<td>I spend less time eating because of my schedule.</td>
<td>239</td>
<td>68 (28.4)</td>
<td>74 (31.0)</td>
<td>97 (40.5)</td>
</tr>
<tr>
<td>I eat more often while watching TV.</td>
<td>237</td>
<td>76 (32.0)</td>
<td>66 (27.8)</td>
<td>95 (40.0)</td>
</tr>
<tr>
<td>I make meal choices based on cost more than content.</td>
<td>238</td>
<td>113 (47.4)</td>
<td>72 (30.3)</td>
<td>53 (22.2)</td>
</tr>
</tbody>
</table>

**Objective 3: Determine if There is a Change in Physical Activity of KSA Students After Coming to United States**

**Changes in exercising.** The results showed that Saudi students are more active in the United States compared to when they lived in Saudi Arabia (Table 15). More than half of the students (56.3%) reported that they were not physically active when living in Saudi Arabia while 60 percent reported that they were active after they moved to the USA.
Table 15

Comparison of Whether or Not Students Engaged in Physical Activity

<table>
<thead>
<tr>
<th></th>
<th>In Saudi Arabia</th>
<th></th>
<th>In United States</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N)</td>
<td>(%)</td>
<td>(N)</td>
<td>(%)</td>
</tr>
<tr>
<td>Yes</td>
<td>105</td>
<td>43.8</td>
<td>144</td>
<td>60.0</td>
</tr>
<tr>
<td>No</td>
<td>135</td>
<td>56.3</td>
<td>95</td>
<td>39.6</td>
</tr>
<tr>
<td>Total</td>
<td>240</td>
<td>100.0</td>
<td>240</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Changes in level of activity. The results indicated there is an increase in amount (Figure 3A) and intensity (Figure 3B) of physical activity between living in KSA and in the USA. In KSA, the students’ data is skewed to the left, i.e. as nearly 50% of the students were sedentary, whereas, in the USA the students’ data has shifted to the right to indicate more vigorous levels of activity with more than 65% of the students moderately, vigorously, or extremely active.
Objective 4: Identify any Relationship Between Weight Change and Diet, Factors That Influence Diet, and Physical Activity for KSA Students in the United States

An objective of this study was to see if there were changes in average body weight since the participants came to the United States and if a change was correlated with diet and physical activity. Weight since the participants (n = 237) came to the United States was higher \( (p = 0.013 \text{ paired t-test}) \) than the weight before they came the United States by \( 1.26 \pm 10.94 \text{ kg (2.77 lbs.)} \). The average weight in KSA was \( 72.6 \pm 21.7 \text{ kg} \) and after living in the USA, it was \( 73.9 \pm 20.4 \text{ kg} \). Although statistically different, an average weight gain of 1.26 kg is not a magnitude of change that would be expected to cause changes in health status. The maximum weight gain was 44 kg, and the maximum weight loss was 68 kg. For participants who gained weight (PGW), the
average increase was 13.86 ± 11.13 kg. On the other hand, the participants who lost weight (PLW) did so by -16.56 ± 14.66 kg. The majority of the population was those participants who gained weights (PGW) (Table 16).

Table 16

_Change of Body Weight_

<table>
<thead>
<tr>
<th>Participants Lost Weight (PLW)</th>
<th>Participants Gained Weight (PGW)</th>
<th>Participants with no Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>N =237</td>
<td>85</td>
<td>130</td>
</tr>
<tr>
<td>%</td>
<td>35.80%</td>
<td>54.85%</td>
</tr>
<tr>
<td>Average Weight Change (SD)</td>
<td>-16.56 (± 14.66)</td>
<td>13.86 (± 11.13)</td>
</tr>
</tbody>
</table>

_The relationship between weight change and food frequencies._ To see if there was a relationship between weight change and food frequencies in the United States a Spearman correlation was conducted. In the survey, the items were coded as 1 = Daily; 2 = 5-6 times a week; 3 = 3-4 times a week; 4 = 1-2 times a week; 5 = 1-3 times a month; and 6 = never (Appendix B). To analyze responses in a more convenient manner, responses were combined into 1 & 2 = nearly daily; 3 & 4 = at least weekly; 5 = monthly; and 6 = never.

Figure 4 shows correlational changes in frequency of ten items with weight change. A negative correlation \( p = 0.007 \) was observed between weight change and eating fruit, indicating participants who ate fruit less frequently in the United States were likely to have with higher weight gain. No other negative correlations were found. Positive correlations were observed between weight change and drinking sugar beverages, eating baked goods, candy/chocolate, pasta, or potatoes \( p = 0.001, p = 0.019, p = 0.007, p = 0.015, p = 0.002, \) respectively, indicating the participants who ate these food items more frequently in the United States were
likely to have higher weight gain. Also, when considering fast food positive correlations were found for all four options: fast food in general \((p = < 0.001)\), burger \((p = 0.005)\), pizza \((p = 0.028)\), and fried chicken \((p = 0.028)\).
Figure 4. The correlation between average weight change (kg, y-axis) and food consumed in USA (x-axis). *1 = never; 2 = 1-3 times a month; 3 = 1-2 times a week; 4 = 3-4 times a week; 5 = 5-6 times a week; 6 = Daily. Error bars are not shown.
The relationship between weight change and changes in factors that influence diet.

The significance of the relationships of weight change and other factors that influence diet were determined using Spearman and Pearson correlations. There was a negative correlation that indicated higher weight gain was associated with those who ate less meals cooked at home when living in the United States ($p = 0.014$, Figure 5). There was also a negative correlation with weight gain and the desire to eat healthy ($p = 0.015$). In an analysis of the factors related to eating fast food, there was a negative correlation with weight gain and lack of time ($p = 0.046$, data not shown). All the other factors related to eating a meal cooked at home or eating fast food were not significant.

![Weight Change & Meal Cooked at Home](image)

Figure 5. The correlation between average weight change and meal cooked at home in USA.

1 = never cooked at home; 2 = once a week; 3 = 2-3 times a week; 4 = 4-6 times a week; 5 = once a day; 6 = 2 times a day; 7 = 3 times a day. Error bars are not shown.
The relationship between weight change and changes in physical activity. To determine if there was a relationship between weight change and changes in physical activity, Spearman and Pearson correlations were conducted. Both comparisons showed negative correlations. Namely, students who reported not exercising in USA showed higher weight gain \((p = 0.012, \text{data not shown})\), those who reported exercising at a lower intensity were more likely to gain weight \((p < .001, \text{Figure 6A})\) and those who considered that they were less active in the USA were also more likely to gain weight \((p < .001, \text{Figure 6B})\).

**Figure 6.** The correlation between average weight change and change in intensity (a) and amount (b) of physical activity after living in USA. Error bars are not shown.
Objective 5: Correlated Factors of Dietary Acculturation with Body Weight, Fat Composition and Blood Chemistry including Total Cholesterol (TC), High Density Lipoprotein (HDL) Cholesterol, Low Density Lipoprotein (LDL) Cholesterol, Triglycerides (TG), and Glucose (GLU)

This research had additional value by also assessed the blood chemistry and anthropometric measurements of a cohort of UW-Stout KSA and USA students. Thus, correlations were made between blood chemistry changes in KSA students in relation to their survey answers for food frequency questions.

To determine if there were physiological changes, the researcher tested for differences in several variables; body weight, fat composition (Fat%), total cholesterol (TC), high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, triglycerides (TG), and glucose (GLU). The anthropometric results indicated no significant changes in body weight and average change in fat percentage for both female and male students from KSA and the USA (Table 17). The results of blood chemistry (Table 18) indicated no significant changes in any variable.

Table 17

Change of Body Weight and Fat Composition

<table>
<thead>
<tr>
<th>Gender</th>
<th>Country of Origin</th>
<th>(N)</th>
<th>Average weight change (SD)</th>
<th>P-value</th>
<th>Average change of Fat %</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>KSA</td>
<td>7</td>
<td>0.78±1.53</td>
<td>0.97</td>
<td>1.82±1.5</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>12</td>
<td>0.81±2.76</td>
<td></td>
<td>0.86±3.31</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>KSA</td>
<td>13</td>
<td>-0.24±3.05</td>
<td>0.35</td>
<td>0.04±3.51</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>5</td>
<td>0.7±1.16</td>
<td></td>
<td>2.1±2.36</td>
<td></td>
</tr>
</tbody>
</table>

Note. Analysis was done using a two-tailed paired t-test
Table 18

*Change of Blood Chemistry*

<table>
<thead>
<tr>
<th>N</th>
<th>Δ TC (mg/dL)</th>
<th>Δ HDL (mg/dL)</th>
<th>Δ TG (mg/dL)</th>
<th>Δ LDL (mg/dL)</th>
<th>Δ GLU (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female KSA</td>
<td>7</td>
<td>22±14.0</td>
<td>8±8</td>
<td>6±103</td>
<td>-26±74</td>
</tr>
<tr>
<td>Male USA</td>
<td>12</td>
<td>10±14.0</td>
<td>4±14</td>
<td>-21±68</td>
<td>13±34</td>
</tr>
<tr>
<td>P-value</td>
<td>0.10</td>
<td>0.53</td>
<td>0.54</td>
<td>0.21</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Male KSA | 13 | 4±33 | 5±22 | 15±43 | -7±50 | 4±12 |
| Male USA | 5 | 17±15 | 1±6 | 39±63 | 310±50 | -3±11 |
| P-value | 0.26 | 0.52 | 0.47 | 0.19 | 0.29 |

*Note.* The sensitivity of all blood chemistry values was at the xx mg/dL level. Analysis was done using a two-tailed paired t-test.

To see if there was a relationship between weight change and changes in TC, HDL, TRG, LDL, TC/HDL, GLU, and the change of food frequency consumption when living in the United States, Spearman correlations were conducted. The results found:

1. No correlation existed between body weight changes or TC and frequency of any food item.

2. A negative correlation occurred between blood chemistry and frequency of specific foods:
   - HDL and eating a serving of bakery goods, \( p = 0.028 \).
   - TG and eating a serving of rice, pasta, or pizza, \( p = 0.009, p = 0.023, \text{ and } p = 0.014 \), respectively).
   - LDL and eating a serving of potato, \( p = 0.023 \).
   - GLU and eating a serving of ice cream or pasta, \( p = 0.019 \text{ and } p = 0.038 \), respectively).
This concludes the data analysis. The significance of these findings will be discussed in chapter 5.
Chapter V: Discussion

An increasing number of international students enroll in United States’ universities and colleges each year (Institute of International Education, 2013). Currently, more than 71,000 students from the Kingdom of Saudi Arabia (KSA) are studying in the United States (USA) (Naffee, 2013). International students who move to the United States seeking higher education face many challenges including dietary acculturation issues (Kittler & Sucher, 2000). Countries sending students abroad need to know students are faced with many negative acculturation issues and should take actions to prepare the individuals for the many changes, including diet and exercise. Institutions hosting these students must also be prepared to address the impact acculturation has on health and fitness.

Most international students coming to the United States face acculturation issues. Acculturation is defined as a multidimensional progression that explains how people from a certain cultural group adapt to the varying cultural encountered in the new areas where they move (Kittler & Sucher, 2000). Dietary acculturation takes place when immigrants adopt the eating behaviors and types of food consumed by the inhabitants of their host country (Satia et al., 2001; Woods, 1992; Satia, 2003). It is not just the dietary practices that vary from one culture to another; it is also the style and practice of cooking that varies.

This study was designed to determine the main factors affecting dietary acculturation of KSA students studying at universities in the United States. This study had three main components: survey, anthropometric measurements, and blood analysis. Data was collected from two different study groups: a general KSA student population currently living in the United States (survey data only), and a population of KSA and USA freshmen at the University of Wisconsin-Stout (UW-Stout) (all three study components). The study population was selected in
September 2013.

The first part in the results showed the demographic information for the study’s population. In the general population the percentage of male students from Saudi Arabia is higher than the female students (69.5% male; 30.5% female). In the UW-Stout Saudi Arabia population the percentage of male students is also higher than the female students (65% male; 35% female).

According to SACM (2013), the number of male students who are enrolled with the King Abdullah scholarship program in the United States show a similar gender ratio (63% male; 37% female). According to the Office of International Education at UW-Stout, the number of international students from Saudi Arabia has increased between 2011 and 2013. However, most of them are male students, which reflected the study’s population of 65% males and 35% females. The general Saudi population matches UW-Stout’s percentages.

Discussion

Determine if there is a change in dietary habits and food preferences of KSA students after coming to the United States. In Saudi Arabia, lunch is considered the main meal of the day (Ochsenwald, 2014), while in the United States dinner is considered to be the main meal of the day (USDA, 2013). Participants were asked to indicate whether they ate breakfast, lunch, and dinner every day, as well as which meal they considered the largest. This study found that after KSA students lived in the USA, their consumption of dinner as the largest meal of the day increased while the frequency of lunch being the largest meal decreased. Almohanna’s study (2010) on the impact of the American diet on international students in the United States found that the consumption of dinner between the first week in the USA and after 11 weeks had
increased from 57% to 77%, respectively. The results of this study of Saudi students’ adaptation to American mealtimes reflect the results of Almohanna’s study (2010).

In KSA, about 38.3% of students ate at least two of their daily meals at home and their parents were the primary food preparers in the household. In contrast, 32.5% of those students consumed only 2 to 3 of their weekly meals at home when they moved to the USA, and they prepared the food by themselves primarily because of living away from their families and responsibility for preparing their own food.

This research question examined how the food preferences of KSA students changed after living in the United States. This study found that KSA students in the United States increased their consumption of food items that represent the standard American diet and are high in calories, such as cheese, coffee, and fast food including hamburgers and pizza. Satia (2003) described an example of the manner in which a certain ethnic group adapted their eating behaviors and patterns to those of their host country. As per Satia example, the acculturation of a Mexican immigrant to the diets of the United States is characterized by decreased consumption of legumes and whole grains as well as elevated consumption of meals including foods such as hamburgers (Satia, 2003). This example reflects the results found in this study with KSA students. The acculturation of Saudi students to the diets of the United States is characterized by decreased consumption of meat and rice and higher consumption of fast food items. Generally, the Saudi students were acculturating to the American diet.

Various research on dietary acculturation has concluded that during acculturation, immigrants may retain their traditional eating habits on special occasions while excluding their host country’s eating habits; alternatively, they may find new ways of utilizing their traditional meals, or adapt to the host country’s foods (Pan, Dixon, Himburg & Huffman, 1999; Yang &
Fox, 1979). The current study shows that students from Saudi Arabia adapted to the United States’ food items. They also decreased their consumption of a traditional Saudi diet, which included meat and rice, as well as pasta and bread.

The students made their lives more convenient by consuming fast food rather than the healthy food options around them. Lack of time for the students to find healthy foods and cook healthy meals, especially during lunch, led them to consume American fast food, and snack more frequently during the day, which may have impacted their weight and well-being. In the study of Almohanna (2010) determined that students tended to increase consumption of snacks, skipped meals, and dinner became considered the main meal.

**Identify factors that influence KSA students’ eating habits in the United States.** The participants admitted that the difference in diet before and after moving to the USA was characterized by their increased consumption of unhealthy food. The changes showed a major diet preference for the American diet. The students were also aware of an increase in the quantity of food they consumed since moving to the United States.

There were many factors affecting KSA students’ adaptation to the American diet. The availability of native food in the United States was a concern causing KSA students to shift their diets. Satia, et al. (2000) showed that the unavailability of traditional food from the immigrant’s home country in the host country might encourage increased consumption of the host country’s food. Additionally, immigrants may be further interested in consuming the host country’s food if their traditional meals are expensive. The current study has some similarity to the results of Satia, et al. (2000); students in both studies had some interest in consuming an American diet. However, in opposition to Satia, et al. (2000), the current study found that 47.4% of students were making their meal choice based not on cost, but on nutritional content. The cost of the food
was not a major concern influencing Saudi students living in the United States to eat unhealthy food rather than healthy food.

In Saudi Arabia, it is common for the mother and father to be financially responsible for their families. However, the mother is responsible for taking care of her family and preparing food for them (Ochsenwald, 2014). Within most families in Saudi Arabia, all family members eat their lunch and dinner together, unless parents work late. It is also common for households to employ a housekeeper. Students, whether female or male, do not have experience preparing meals (Ochsenwald, 2014). Saudi students studying in the USA obviously do not have their mothers or housekeepers preparing food for them. This may lead them to eat fewer home-cooked meals and increase their consumption of food outside the home, because of a lack of cooking experience.

Social relationships also impact eating habits; some of the students responded that they went out with friends to eat fast food and socialize. Students did not want to eat alone and try to get involved in the social life around their school. Participants reported an awareness that a lack of healthy eating can affect their health and a desire to eat healthier, but they did not follow through on these beliefs. Due to the fast-paced nature of their daily lives, students skip meals or eat fast food (Noyongoyo, 2011).

**Determine if there is a change in physical activity of KSA students after coming to the United States.** The results indicated that students became less active upon moving to the United States. Al-Hazzaa, Abahussain, Al-Sobayel, Qahwaji, and Musaiger (2011) showed that students who lived in KSA have a high prevalence of sedentary behaviors, physical inactivity, and unhealthy dietary habits. In addition, the Al-Hazzaa et al. study expressed a need for national policy reducing sedentary behaviors and promoting active living and healthy eating. It is
common for international students to become more sedentary and gain weight when studying at universities in the United States (Edwards, Hartwell, & Brown, 2010; Lin & Yi, 1997).

This current study contradicts previous these studies (Edwards, Hartwell, & Brown, 2010; Almohanna, 2010; Lin & Yi, 1997) in that students were more active when living in the USA. Social life and living with friends in the United States, as well as the desire for healthy living, may have helped students from Saudi Arabia increase their physical activity levels.

**Identify any relationship between weight change and diet, factors that influence diet, physical activity for KSA students in the United States.** Weight is an important factor related to health status. The study found a significant increase in body weight in KSA students, however the average weight gain is not a magnitude of change that would be expected to cause changes in health status. These findings show that there is a positive trend in weight gain and preferences for foods such as baked goods, candy/chocolate, pasta, potatoes, sugary beverages, and fast food, including hamburgers (e.g., MacDonald’s and Burger King); pizza (e.g., Domino’s and Pizza Hut); fried chicken (e.g., Popeye’s, KFC, and Buffalo Wild Wings). The results indicated a significant negative correlation between weight and physical activity, which meant a higher weight gain associated with students who did not exercise.

Students’ body weight increased due to an increased consumption of food high in calories. According to "Burger King" (2013), there are 1,160 calories in a meal consisting of one Whopper® Beef Patty sandwich, a Coca-Cola (small), and french fries (small). According to "Pizza Hut" (2013), one slice of medium hand-tossed pepperoni pizza contains 260 calories. Recent national data on the US population indicates widespread obesity due to greater intake of fast-food items (Hogan, 2000). The relationship between overweight status and obesity has been ascribed to the fast-paced daily lives of individuals, which prevent them from cooking meals at
home and cause them to resort to processed and fast food (Hogan, 2000). Deciding at the last moment what to prepare for dinner can lead to the inclusion of unhealthy foods in one’s diet ("Study Identifies Factors," 2007). This provides evidence that students have experienced an increase in body weight because of changes in their food preferences. For a healthy lifestyle, students need to consume balanced diets and increase their physical activity.

The study of Amin, Al-Sultan, and Ali (2008) indicate that one out of six children ages 6 to 18 is obese, stating that the reason for this dramatic increase seems to be unhealthy food intake habits, including increased dependency on unhealthy items. The current study brings to light the fact that students from Saudi Arabia increase their intake of unhealthy food choices in USA. It is easier for these students to consume unhealthy food because they are already used to consuming it.

**Correlated factors of dietary acculturation in body weight, fat composition, and blood chemistry, including total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, and triglycerides.** Actual measurements of anthropometric data and blood chemistry were important in validating common claims regarding health status related to weight change.

In this study the general Saudi population matches UW-Stout’s KSA population because they have similar percentages in gender, age, and living status. In the general population, the percentage of male students from Saudi Arabia is higher than the female students (69.5% male; 30.5% female), the UW-Stout group show a similar gender ratio (65% male; 35% female). Age is similar in the most of the population for both groups were between 18 and 29 years old (82% general KSA, 95% at UW-Stout). Most of UW-Stout participants (95%) were living off-campus. On the other hand, the general population had 93% living off-campus. In conclusion, blood
chemistry and weight changes of KSA students at UW-Stout might very well represent possible changes in KSA students in general.

The anthropometric results and blood chemistry indicated no significant average change in body weight and fat compositions for both genders before and after living in the United States. Because the timeline of the study was only about three months, there was no evident change in the anthropometric and blood chemistry levels of the participants at UW-Stout.

The food eaten affects the level of cholesterol in the body. High-fat diets have been found to increase the level of cholesterol in the blood. The American Heart Association (2013) recommends no more than 30% of our daily calories come from fat. For the average person, this would fall somewhere between 50 and 80 grams of fat per day. The results showed that there was significant negative correlation between the average changes in HDL–cholesterol and eating a serving of baked goods; triglycerides and eating a serving of rice, pasta, and pizza; LDL-cholesterol and eating a serving of potato; and glucose and eating a serving of ice cream and pasta. All the food items above, which correlated with the blood-test results, were characterized as high in fat, carbohydrates, or sugar. Immigrants to the United States might adopt dietary changes that raise their risk of chronic disease, owing to increased exposure to foods high in fat, along with fewer vegetables and fruits (Satia, et al., 2002). This is supported by the findings in this current study.

In seeking correlations between the results of the general Saudi student population and the UW-Stout group, the study found that the food items that students consumed in high quantities had similar nutrition profiles as food items high in fat, carbohydrate, and sugar. According to the World Health Organization (2002), the most important risks of non-communicable disease (NCDs) included high concentrations of cholesterol in the blood, high
blood pressure, insufficient consumption of vegetables and fruit, being obese or overweight, tobacco use, and physical inactivity (Mutangadura, 2004). Five of these risk issues are closely correlated to physical activity and diet. Therefore, physical activity and diet play an important role in staying healthy and avoiding disease (Lee, 2005).

The general population of the study showed an increasing trend in the rates of increased body weight, which may lead to excess weight gain and obesity in the long term. The UW-Stout population also showed an increase in fast food and food high in fat, sugar, and carbohydrates, which might be associated with blood chemistry and health status.

Conclusions

The Saudi students were acculturating to the American diet. This impacted their weight either negatively or positively. This research has identified some of the dietary patterns among Saudi students in the United States. The results highlighted noticeable changes in weights and dietary habits, as it found that participants who showed a preference for the American diet were more susceptible to weight gain. This study indicated that Saudi students in universities in the United States were facing challenges because of lack of food preparation time and availability of native foods. Additionally, it appeared that convenience also played a role in affecting food choices and increasing the dependence of Saudi students on fast food. Participants showed a slight significant weight change after living in the USA, this might correlate to an increase in their consumption of unhealthy food and snacking. The increase might have been because of an increase in physical activity.

The study concluded that the Saudi students were increasingly acculturated to the American diet, which had an impact on their weight and may potentially have a negative impact on their health. Further studies would consider other international groups in the United States to
realize more differences, as well as to study the impact of availability of native foods on Saudi students compared to other international students.

**Recommendations**

This study identified the degree of weight change as well as changes in blood chemistry of Saudi students transitioning to US culture. These potential areas should be given greater priority when planning orientation programs to help students adapt to a new country. One of UW-Stout’s goals is to recruit and retain a diverse university population and advance the knowledge of diversity. UW-Stout students, faculty, and staff must know the needs and health concerns of their international community. Effective orientation must address all facets of acculturation, including diet and exercise. Educating the international students about the advantages of eating healthy balanced diet and familiarizing them with a new cuisine will aid students in making smart choices.

Several recommendations can be made regarding this study. First, a larger sample size would have been most advantageous. However, the number of Saudi students who participated in the UW-Stout group (N = 40) did not create a sample size that truly represented the total number of Saudi students enrolled in USA colleges and universities.

Second, within Saudi Arabia’s general population and among the Saudis at UW-Stout, the majority of participants were male students; on the other hand, within the UW-Stout control group of USA students, the majority of participants were female students. This did not allow the researcher to unfold realities about students from Saudi Arabia and freshmen from the United States. Further studies should look to a larger group size and focus on gender differences.

The study period in this research was short, lasting only three months. Due to the short time period of this study, the participants had only two measurements (at the beginning, and at
the end), which prevented the researcher from observing striking differences in body weight and blood chemistry. Further studies should have a shorter timeline between the visits and take more measurements across a longer time period.
References


http://www.pizzahut.com/nutritionpizza.html


http://www.saudiembassy.net/about/country-information/history.aspx


Appendix A: UW-Stout IRB Approval

June 11, 2013

Duaa Bakhsh
Biology Department
UW-Stout

RE: “Dietary Acculturation and Blood Chemistry Changes of Saudi Arabia Students Moving to the United States”

Dear Duaa,

In accordance with Federal Regulations, your project, “Dietary Acculturation and Blood Chemistry Changes of Saudi Arabia Students Moving to the United States” was reviewed on June 11, 2013, by a member of the Institutional Review Board and was approved under Expedited Review through June 10, 2014.

If your project involves administration of a survey or interview, please copy and paste the following message to the top of your survey/interview form before dissemination:

This research has been approved by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.

If you are conducting an online survey/interview, please copy and paste the following message to the top of the form:

“This research has been approved by the UW-Stout IRB as required by the Code of Federal regulations Title 45 Part 46.”

Responsibilities for Principal Investigators of IRB-approved research:

1. No subjects may be involved in any study procedure prior to the IRB approval date or after the expiration date. (Principal Investigators and Sponsors are responsible for initiating Continuing Review proceedings.)
2. All unanticipated or serious adverse events must be reported to the IRB.
3. All protocol modifications must be IRB approved prior to implementation, unless they are intended to reduce risk.
4. All protocol deviations must be reported to the IRB.
5. All recruitment materials and methods must be approved by the IRB prior to being used.
6. Federal regulations require IRB review of ongoing projects on an annual basis.

Thank you for your cooperation with the IRB and best wishes with your project.

Should you have any questions regarding this letter or need further assistance, please contact the IRB office at 715-232-1126 or email foxwells@uwstout.edu.

Sincerely,

Susan Foxwell
Research Administrator and Human Protections Administrator,
UW-Stout Institutional Review Board for the Protection of Human Subjects in Research (IRB)

*NOTE: This is the only notice you will receive – no paper copy will be sent.
Appendix B: Survey

Dietary Acculturation Questionnaire

UW-Stout population (Saudi Students only)

Code #: ________

This research has been approved by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.

How long have you been living in the United States?!

Less than one month!

One month!

Two months!

Three months!

Four months!

Five months!

Six months!


Everyone's body is different and goes through changes from time to time. Please tell me some things about how you may have changed since coming to the United States.

Approximately how tall are you in centimeter?!

_______cm!

Before you came to the United States, in Saudi Arabia!

approximately how much did you weigh?!

_______Kg!! or!! _______ pounds!

Today, after living in the United States, how much do you weigh?!

_______Kg!! or!! _______ pounds!

Please think about how your meal times have been changing since coming to the United States.

<table>
<thead>
<tr>
<th>Q1 (A) In Saudi Arabia, it usually had!</th>
<th>Yes!</th>
<th>No!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast every day!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch every day!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dinner every day!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(B) My largest meal in Saudi Arabia was usually:!

A. Breakfast!
B. Lunch!
C. Dinner!

<table>
<thead>
<tr>
<th>Q2 (A) In the United States, it usually had!</th>
<th>Yes!</th>
<th>No!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast every day!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch every day!</td>
<td></td>
<td></td>
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<tr>
<td>Dinner every day!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(B) My largest meal in the United States is usually:!

A. Breakfast!
B. Lunch!
C. Dinner!
The next part of the survey asks you to think about how often you usually have various kinds of food. For the first set of questions, think about how you usually eat in Saudi Arabia. For the second set of questions, think about how you currently eat in the United States.

**Q3 (in Saudi Arabia) how many times did you usually:**

<table>
<thead>
<tr>
<th>In Saudi Arabia</th>
<th>Never!</th>
<th>1-3 times per month!</th>
<th>1-2 times per week!</th>
<th>3-4 times per week!</th>
<th>5-6 times per week!</th>
<th>Daily!</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eat a serving of fruit (e.g., dates, oranges, apples, bananas, etc.).!</td>
<td></td>
<td></td>
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<tr>
<td>2. Eat a serving of ice cream or frozen yogurt.!</td>
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</tr>
<tr>
<td>3. Eat a serving of bakery goods (e.g., cookies, cakes, pies, croissants, etc.).!</td>
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<tr>
<td>4. Eat a piece of candy or chocolate.!</td>
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</tr>
<tr>
<td>5. Eat a serving of meat (e.g., beef, lamb, chicken, etc.).!</td>
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</tr>
<tr>
<td>6. Eat a serving of seafood (e.g., tuna, shrimp, salmon, fish, etc.).!</td>
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<td></td>
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<tr>
<td>7. Eat a serving of cheese (e.g., feta, cheddar, American, etc.).!</td>
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<tr>
<td>8. Eat a serving of rice (e.g., white, brown, kabsa, Jambalaya, Israeli, etc.).!</td>
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<tr>
<td>9. Eat a serving of pasta (e.g., spaghetti, fettuccine, etc.).!</td>
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<tr>
<td>10. Eat a slice of bread (e.g., Whole grain bread, white bread, etc.).!</td>
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<tr>
<td>11. Eat a serving of potato (e.g., French fries, baked potato, mashed potatoes, hash browns).!</td>
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</tr>
<tr>
<td>12. Drink one or more cups of coffee with milk or sugar.!</td>
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<tr>
<td>13. Drink one or more servings of milk or yogurt.!</td>
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<tr>
<td>14. Drink beverages like non diet soda, energy drinks, fruit juices, etc.!</td>
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</tbody>
</table>
### Q4: Now that you're living in the United States, how many times do you usually:?

<table>
<thead>
<tr>
<th>Description</th>
<th>Never!</th>
<th>1 to 3 times per month</th>
<th>1 to 2 times per week</th>
<th>3 to 4 times per week</th>
<th>5 to 6 times per week</th>
<th>Daily!</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eat a serving of fruit (e.g., dates, oranges, apples, bananas, letc.)!</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2. Eat a serving of ice cream or frozen yogurt!</td>
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<tr>
<td>3. Eat a serving of bakery goods (e.g., cookies, cakes, pie, cream, etc.)!</td>
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<tr>
<td>4. Eat a piece of candy or chocolate!</td>
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<tr>
<td>5. Eat a serving of meat (e.g., beef, lamb, chicken, etc.)!</td>
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<tr>
<td>6. Eat a serving of seafood (e.g., tuna, shrimp, salmon, fish, etc.)!</td>
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<tr>
<td>7. Eat cheese, with a meal or snack (e.g., feta, cheddar, American, etc.)!</td>
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<tr>
<td>8. Eat a serving of rice (e.g., white, wild rice, kabsa, biryani, etc.)!</td>
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<tr>
<td>9. Eat a serving of pasta (e.g., spaghetti, indoni, lasagna, fettuccine, etc.)!</td>
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<tr>
<td>10. Eat a slice or piece of bread (e.g., whole grain bread, white bread, etc.)!</td>
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<td></td>
</tr>
<tr>
<td>11. Eat a serving of potato (e.g., French fries, baked potato, mashed potatoes, or hash browns)!</td>
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<td>12. Drink one or more cups of coffee with milk or sugar!</td>
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<td>13. Drink one or more servings of milk or yogurt!</td>
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</tr>
<tr>
<td>14. Drink beverages high in sugar like non diet soda, energy drinks, fruit juices, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q5 Fast food is now part of many different cultures. The next questions ask about how you usually ate fast food in Saudi Arabia and eat now in the United States.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>1-3 times per month</th>
<th>1-2 times per week</th>
<th>3-4 times per week</th>
<th>5-6 times per week</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In Saudi Arabia, how often did you eat fast food?</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>2. In Saudi Arabia, how often did you eat fast food burgers (e.g., McDonalds, Burger King, Wendy’s).</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>3. In Saudi Arabia, how often did you eat fast food pizza (e.g., Dominos, Pizza Hut).</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>4. In Saudi Arabia, how often did you eat fast food fried chicken (e.g., Popeyes, KFC, Buffalo Wild Wings).</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>5. Now while living in the United States, how often do you eat fast food?</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>6. Now while living in the United States, how often do you eat fast food burgers (e.g., McDonalds, Burger King, Wendy’s).</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>7. Now while living in the United States, how often do you eat fast food pizza (e.g., Dominos, Pizza Hut).</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>8. Now while living in the United States, how often do you eat fast food fried chicken (e.g., Poppies, KFC, Buffalo Wild Wings).</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
</tbody>
</table>

Q6 Please rate the level of importance for choosing fast foods in the United States.

<table>
<thead>
<tr>
<th></th>
<th>Not at all important</th>
<th>Very unimportant</th>
<th>Neither important nor unimportant</th>
<th>Very important</th>
<th>Extremely important</th>
</tr>
</thead>
<tbody>
<tr>
<td>I do not have enough time</td>
<td>☐</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>I save money (compared to formal restaurant)</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Tastes good</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
<tr>
<td>Convenience</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
<td>☒</td>
</tr>
</tbody>
</table>
The following questions ask about how your eating habits have been changing since you moved to the United States.

Q7: In Saudi Arabia, how many times per week did you eat a meal cooked at home?!
   - Never
   - Once a Week
   - 2-3 times a Week
   - 4-6 times a Week
   - Daily
   - 2 times a Day
   - 3 times a Day

Q8: In Saudi Arabia, in your household who cooks most often?!
   - Myself!
   - Boy/Girlfriend!
   - Spouse!
   - Parent!
   - Other Relative!
   - Roommate!
   - Never eat at home!

Q9: In the United States, how many times per week did you eat a meal cooked at home?!
   - Never
   - Once a Week
   - 2-3 times a Week
   - 4-6 times a Week
   - Daily
   - 2 times a Day
   - 3 times a Day

Q10: In the United States, who cooks most often?!
   - Myself!
   - Boy/Girlfriend!
   - Spouse!
   - Parent!
   - Other Relative!
   - Roommate!
   - Never eat at home!
Q 11 Please rate the level of importance for choosing to eat a meal cooked at home?

<table>
<thead>
<tr>
<th></th>
<th>Not at all important</th>
<th>Very unimportant</th>
<th>Neither important nor unimportant</th>
<th>Very important</th>
<th>Extremely important</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have enough time</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I save money (compared to eating out)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I prepare the food the way I like it</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>There is health history (diabetes, cardiovascular disease) in the family.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I want to eat healthy.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Q 12 How have your overall meal habits changed now that you are living in the United States?

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Neither agree nor disagree (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I eat more food.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I eat healthier food.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I snack more often between meals.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Native food is not available.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>It is important to me to consume my native diet.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I tend to go out more with friends to eat a meal and socialize.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I spend less time eating, because of my schedule.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I eat more often while watching TV.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I make meal choices based on cost more than content.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

How has your physical activity been changing since moving to the United States?

Q 13 Did you exercise in Saudi Arabia?

☐ Yes
☐ No

Q 14 How would you describe the level of your physical activity in Saudi Arabia?

☐ Sedentary (little or no exercise)
☐ Moderately active (2-3 hours of exercise per week)
☐ Vigorously active (6-9 hours of exercise per week)
☐ Extremely active (hard daily exercise; training 2 times a day)
Q 15 Are you currently exercising in the United States?

- Yes
- No

Q 16 What is your current level of activity in the United States, when compared to Saudi Arabia?

- More active.
- Less active.
- Same active.

Q 17 How would you describe the level of your physical activity in the United States?

- Sedentary (little or no exercise)
- Moderately active (2-3 hours of exercise per week)
- Vigorously active (6-9 hours of exercise per week)
- Extremely active (hard daily exercise; training 2 times a day)

Q 18 The last step in this survey is to share a few things about you.

What is your gender?

- Male
- Female

If you are female, are you pregnant or delivered in the past 6 months?

- Yes
- No

Q 19 How old are you?

- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25 +

Q 20 Where do you live?

- On-campus
- Off-campus

Q 21 In the last five years before you came to the United States, have you lived outside of the Middle East for more than one year?

- Yes
- No

If yes, Since when have you been there?

From _____ To _____

Q 22 Are you currently taking medications that affect your appetite?

- Yes
- No

Q 23 Have you had any weight loss surgery such as gastric bypass, gastric sleeve or banding?

- Yes
- No

😊 Thank you for your participation. I wish you all the best in your studies 😊
Appendix C: Consent Form for Survey

Consent to Participate In UW-Stout Approved Research
(Survey)

Title: Dietary Acculturation and Blood Chemistry Changes of Saudi Arabia Students Moving to the United States

Note: this text will be posted to the Saudis in USA Facebook group and emailed to UW-Stout Saudi sophomores, juniors, seniors and graduate students.

Dear Saudi Students,
It is my pleasure to invite you to participate in my research. My name is Duaa Bakhsh. I am a graduate student, fourth semester, in the department of Food and Nutritional Sciences at the University of Wisconsin–Stout. I am conducting a research study for my thesis as part of the requirements of my degree in Human Nutritional Science. Your knowledge and experience in this area is critical to my research. I would appreciate if you can be a participant in this research. I am looking forward to sharing my research and learning from this experience. If you have any questions please don't hesitate to contact me through my email.

Statement of Consent:
By clicking the link below for the survey you agree to participate in the project. For more information please read the text below.

The Link.

Contact Persons:
Duaa Bakhsh, graduate student
University of Wisconsin–Stout
Dept. of Food and Nutritional Sciences
617-818-5662
bakhshd9653@my.uwstout.edu

Ann Parsons, Ph.D.
University of Wisconsin–Stout
Dept. of Biology
715-232-2563
parsonsa@uwstout.edu

Description:
The objective of this study is to examine the effect of dietary acculturation issues on changes in body weight and what factors contribute to this change for Saudi students in the United States.

Risks and Benefits:
You will be asked questions about your age, education level, eating behavior before and after you moved to the United States, food preferences, acculturation factors, and physical activity. Risks that may be involved when taking the survey include embarrassment or anxiety due to the questions about your weight and lifestyle. The survey will not include any identifiers, and it will be completed online. The results of this project will be used to help make suggestions for improving food choices for you in the United States. The researcher anticipates that informing Saudi
Appendix D: Consent Form for Anthropometric & Blood Analysis

Consent to Participate in UW-Stout Approved Research
(Anthropometric & Blood analysis)

Title: Dietary Acculturation and Blood Chemistry Changes of Saudi Arabia Students Moving to the United States

Description:
The objective of this study is to examine the effect of dietary acculturation issues on changes in body characteristics and what factors contribute to these changes for Saudi students in the United States. Correlation factors of dietary acculturation of a smaller focus group to changes in your body weight and blood chemistry will also be conducted. You will be asked to come to the UW-Stout Nutrition Assessment Laboratory, which is located in Room 427 of Heritage Hall, at the beginning of the Fall semester (Sept. 2nd - 8th) and again at the end of the Fall semester (Dec. 15th - 20th). You will be asked to fast for 8-12 hours. It is also encouraged that no caffeine or additional fluids are consumed the morning of the testing. First, body weight, height, and body fat will be measured simply by standing bare footed on scale. Then a trained researcher in the Nutrition Assessment Laboratory will conduct the finger prick blood sample for total cholesterol (TC) as well as high-density lipoprotein (HDL) cholesterol, triglycerides and glucose levels. Finally, if you are a Saudi Student you will be asked to complete a survey in December.

Risks and Benefits:
A potential risk includes the possibility of experiencing slight discomfort with the finger-prick, which will be administrated by a trained assistant in a laboratory that is certified by the Division of Laboratories and Acute Care Services State of Wisconsin Department of Health and Human Services. The laboratory also follows strict rules and has a policy to prevent blood borne pathogens. You might be uncomfortable having your height, weight and body fat measured; however this will be done in a private setting.
The results of this project will be used to help make suggestions for improving food choices for Saudi students in the United States. The researcher anticipates that informing the Saudi Arabia students about the importance of healthy diet will assist them in choosing a healthier lifestyle.

Time Commitment and Compensation:
The anthropometric and blood analysis measurements will take place twice. These will be conducted at the beginning of the Fall semester (Sept. 2nd - 8th) and again at the end of the Fall semester (Dec. 15th - 20th), with an approximate time of 15 minutes required per testing session.

Confidentiality:
No names or identification numbers will be reported. At the beginning, your name will be collected. But, after that your name will be replaced with codes. Then, for future collection a matching code will be used. The codes with your name will be locked in a file to ensure the confidentiality and only numeric identifiers will be used on forms outside of the file. However, the primary data will be destroyed as soon as data is
Appendix E: Coding Sheet & Sign up Sheet

**Participant Coding Sheet**
To be viewed only by primary researcher. Destroyed as soon as data is compiled.

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Gender</th>
<th>Group</th>
</tr>
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<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>Experimental</td>
</tr>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>3.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>40.</td>
<td>139</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Participants sign up for a specific time and day in which they will come to the Nutrition Assessment Lab (427 Heritage Hall) to have anthropometric measurements taken and a drop of blood sampled.

<table>
<thead>
<tr>
<th>Saudi student group:</th>
<th>Control group:</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>Code</td>
</tr>
<tr>
<td>1.</td>
<td>101</td>
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<tr>
<td>2.</td>
<td>102</td>
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<td>3.</td>
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<tr>
<td>4.</td>
<td>104</td>
</tr>
<tr>
<td>5.</td>
<td>105</td>
</tr>
<tr>
<td>6.</td>
<td>106</td>
</tr>
<tr>
<td>7.</td>
<td>107</td>
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<td>8.</td>
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<tr>
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</tr>
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<tr>
<td>15.</td>
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<td>16.</td>
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<td>17.</td>
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<tr>
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<tr>
<td>19.</td>
<td>119</td>
</tr>
<tr>
<td>20.</td>
<td>120</td>
</tr>
</tbody>
</table>
Appendix F: Data Collection Sheet

**Data Collection Sheet**

1. Due to the nature of the testing an 8-12 hour fast is required before your blood draw.
2. It is also encouraged that no caffeine or additional fluids are consumed the morning of the testing.

**Code #: __________**

**Baseline data**

<table>
<thead>
<tr>
<th>Date: ________________</th>
<th>Date: ________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Hours fasted: __________ hrs</td>
<td>Number of Hours fasted: __________ hrs</td>
</tr>
<tr>
<td>Caffeine consumed: YES / NO</td>
<td>Caffeine consumed: YES / NO</td>
</tr>
<tr>
<td>How much? __________</td>
<td>How much? __________</td>
</tr>
<tr>
<td>Are you smoking: YES / NO</td>
<td>Are you smoking: YES / NO</td>
</tr>
</tbody>
</table>

**Anthropometric Data:**

<table>
<thead>
<tr>
<th>Height: __________ in __________ cm</th>
<th>Height: __________ in __________ cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight: __________ lb. __________ kg</td>
<td>Weight: __________ lb. __________ kg</td>
</tr>
<tr>
<td>Body Fat %: __________ %</td>
<td>Body Fat %: __________ %</td>
</tr>
</tbody>
</table>

**Biochemical Data:**

<table>
<thead>
<tr>
<th>Triglycerides: __________ mg/dL</th>
<th>Triglycerides: __________ mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol: __________ mg/dL</td>
<td>Total Cholesterol: __________ mg/dL</td>
</tr>
<tr>
<td>LDLc: __________ mg/dL</td>
<td>LDLc: __________ mg/dL</td>
</tr>
<tr>
<td>HDLc: __________ mg/dL</td>
<td>HDLc: __________ mg/dL</td>
</tr>
<tr>
<td>Blood Glucose: __________ mg/dL</td>
<td>Blood Glucose: __________ mg/dL</td>
</tr>
</tbody>
</table>