DIETARY, PHYSICAL ACTIVITY, AND SEDENTARY BEHAVIORS AND THEIR RELATIONSHIP TO WEIGHT GAIN IN A COLLEGE AGE POPULATION

A Thesis

by

FAEGEN DILLON LEE

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2012

Major Subject: Nutrition

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Approved by:

Chair of Committee,	Alex McIntosh
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ABSTRACT

Dietary, Physical Activity, and Sedentary Behaviors and Their Relationship to Weight Gain in a College Age Population. (August 2012)

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Chair of Advisory Committee: Dr. Alex McIntosh

Weight gain affects all living beings and excessive weight gain can lead to obesity and comorbidities linked to obesity. In order to better understand how the college student population gains weight and increase in BMI, data collected under the Council of Environment and Dietary Activity (CEDA) at Texas A&M University was examined and analyzed in order to understand how physical activity, sedentary behavior, and dietary activity affect weight gain or weight loss. The college population was divided into BMI categories, gender, and where they lived on campus at Texas A&M University. The data shows that physical activity was associated with loss of weight and BMI in females. Sedentary behavior was associated with weight gain in males but also weight loss in females. Meat consumption was associated with weight gain in males. Fish consumption was associated with weight loss in females. Pastries consumption was associated with weight gain in females. Physical activity appeared to have a stronger effect on weight than dietary behavior even though both can interact to affect weight for females. Speed of service and location have a significant effect on where students would eat. In conclusion, physical activity and sedentary activity have an effect on weight and

BMI. Diet can also have an effect on weight and BMI. More specifically, sugar snacks affect weight in females and meat affects weight and BMI in males. However, physical activity appears to have a larger on weight and BMI than diet. Location also affects where a student will eat.

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TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Obesity is a rising epidemic in this country and has also accounted for millions of dollars in health care costs every day. Further, most Americans are said to be overweight (1). One population worth looking at is the college population. There have been numerous studies looking at the college student population, but the results have been conflicting. Once college students leave home, they are free to make whatever decisions they want without many parental restrictions. Further, health education programs on most college campuses focus mainly on alcohol, tobacco, other drugs, sexual health, and mental health; there has been limited focus on weight issues (2). Students will make decisions that involve eating unhealthy foods and spending more time in front of a TV or computer. It is important to examine the decisions of some of these college students, what their obesity level is, and also what is around them, such as dining facilities and exercise facilities. As a matter of fact, there are studies regarding how freshman gain weight in their first year of college and dining halls are believed to play a role in such weight gain. Finding dietary patterns can be useful in assessing dietary intakes and finding possible biomarkers for specific health issues (3). Further, finding dietary patterns can be helpful in determining ways to intervene. It is also important to examine the amount of sedentary behavior that these students take part in.

This thesis follows the style of Journal Of Nutrition.

Importance of Understanding Weight Gain

Why is weight gain an issue?

A small amount of weight gain may not be harmful; however, enough weight gain can lead to obesity. Obesity is considered to be the leading cause of preventable death in the United States (4). There are several health issues that obesity can contribute to including but not limited to cancer, cardiovascular disease, and diabetes (5). As a result, obesity has been linked to a shorter life expectancy (6). Further, obesity can cause other health issues such as shortening of lifespan, depression, physical discomfort, osteoarthritis, and gastrointestinal disease (1). Too much weight gain can lead to a series of negative health effects. Not only is weight gain a concern for physical health, but it is also a concern for mental health (7). Weight gain can create confidence and perception issues. It is because of this group of adverse health conditions that education about obesity and excess weight gain is important.

How many could be effected by obesity?

Weight gain potentially affects every person. It can be caused by anyone who takes part in poor dietary choices and lacks physical activity (8). Obesity can also affect everyone since obesity can involve excess weight gain. Obesity has been known to be a major problem in western countries with the prevalence increasing significantly over the past 30 years (6). However, obesity is not limited to the western world or developed countries. Obesity has also become a rapidly growing threat to adults and children in developing countries (9). It is because obesity is affecting developed and developing countries that it is becoming a worldwide problem. Furthermore, the problem continues to rise. In 2005, the World Health Organization classified at least 400 million as obese and projected this number to be 700 million by 2015 (10). This problem is also American along with it being worldwide. In the US, about 60% of Americans are at least overweight with a rising percentage becoming obese (11). Further, the populations that are most likely at risk are low-income minorities and adolescents (12). Also, about 40% of energy is derived from added sugars with 50% derived from added fats in American foods (13). Processed foods can play a role in weight gain. The adolescent population is the population that will be the focus of this paper considering that it can include the college population.

The Cost of Obesity

Obesity can also be very expensive. There are numerous health care costs that come with the number of comorbidities that obesity can cause. Not only are there obvious costs associated with treating these comorbidities but obesity also has an effect on health insurance. Obesity has also led to increases in healthcare costs for the obese causing employer-sponsored health insurance to increase in cost which results in lower wages for employees (14). This means that the cost to cover obesity in health care insurance gets passed on to obese employees who pay for it through a decreased salary. This increase in health care costs can be attributed to the increase in prevalence of comorbidities in obese as opposed to non-obese such as hypertension and joint pain (14). Obesity is a problem that not only affects health, but also affects individual finances and the economy as a whole.

Why College Students?

The idea for this study began as how students in high school are impacted by sedentary activity and their physical environment. However, there is a great deal of literature that describes how the food environment (such as the presence fast food restaurants near elementary and high schools) play a role in poor eating habits and obesity. However, the literature on college students and the built environment has produced conflicting results. Such campuses provide food services and physical activity opportunities for many students. The foods provided vary in terms of their nutrient densities and there are many opportunities for sedentary activity ranging from studying to socializing to watching television. One of these campuses is Texas A&M located in College Station, Texas. Considering how Sbisa dining center (an "all-you-can eat" or buffet type dining facility) is on the Northside of campus, and numerous fast food opportunities found at numerous locations (such as Chick-Fil-A) on the Texas A&M campus (Northside, Southside, and west campus), it is worth examining how freshman eating habits affect weight or BMI change. Although Texas A&M is a unique campus found in east Texas, many other campuses nationwide face the same issues. These issues include the location of dining facilities on campus and how close they are to student living quarters, the availability of "all you can eat" dining facilities, availability of fast food, what kinds of foods are served in these facilities, and accessibility of recreational facilities. Weight gain is a concern for incoming freshman whose behavior is unsupervised by parents. In fact, one study referenced how most freshmen were actually concerned about their behavior (15). Conclusions reached from this study can be applied to hundreds to college campuses across the nation.

Built Environments

It has been well noted in a previous study that factors that affect obesity in a built environment are supermarket access, exercise facilities, and safety (16). A built environment consists of buildings and roads that make up an area. It has the ability to play a role in the health of those who live in such an environment. In this particular study, the researchers examined the build environment of a low socioeconomic status (SES) area and checked to see how that affected obesity. Numerous studies from January 1995 to January 2009 were examined to see how the surrounding environment affects obesity. One result worth noting from this study is that supermarkets (as opposed to smaller grocery stores or convenience stores), places to exercise, and safety were influential in promoting healthier dietary behavior and more physical activity (16). Supermarkets provided healthier alternatives, especially with fruits and vegetables. They also provide enough food so that consumers are less likely to eat meals away from home. Another study involved adults living in numerous US cities such as New York and how close they are to a supermarket (17). The researchers discovered that those with no supermarket near their home were less likely to have a healthy diet than those who are near a supermarket (17). Although this study does not specifically deal with college campuses, it can be applied to such campuses. Campuses usually lack alternatives to the dining facilities such as stores to buy healthy foods such as fruits or vegetables.

However, fast food facilities and convenience stores also play a role in dietary behavior and increased obesity. In one study showed that the presence of convenience stores was significantly associated with higher prevalence of obesity and overweight (18). Convenience stores offer little variety of foods and usually offer foods with long shelf life. This includes salty foods and junk foods. Convenience stores usually do not offer healthy alternatives. Also, number of residents per fast food and number of square miles per fast food were also associated with obesity and being overweight (18). The more densely populated the area are the ones more at risk of obesity, especially if there is a fast food restaurant in a densely populated area.

Having appropriate facilities for physical activity can also play a role in obesity for a particular neighborhood. Many studies have focused on access to physical activity facilities (18). One study looked at health data belonging to more than 20,000 adolescents and also looked at their socioeconomic status, overweight or obesity status, and number of recreational facilities nearby (19). A population with more minorities, lesser education, or more low socioeconomic status members was less likely to have a recreational facility than a population with more college students or greater education (19). Environments differ in the number of recreational facilities that they have and different populations have different chances of having access to recreational facilities. Further, the odds of being overweight were decreased with the increasing number of recreational facilities (19). In fact, another study adds to this by showing that there is a significant negative association between BMI and number of fitness facilities per 1,000 residents (18). The more recreational facilities there were nearby, the more opportunities that there were to take part in physical activity. Having more recreational facilities in a densely population area helps. However, something that this study confirms is that an increased college population will likely have more recreational facilities available. This is important since low physical activity levels throughout the year have been viewed as a predictor of weight gain in freshman (20). If freshman barely take part in physical activity during the year, then there is a strong likelihood that they gain weight.

Another aspect of the built environment is the accessibility of the neighborhood. How easy could it be to walk from one area to another? Would transportation be needed? One study examined transportation and obesity and found that there was a positive association between motorized transportation and risk of obesity (18). If walking from one place to another is difficult, then motorized transportation is the preferred option. However, walking is a form of physical activity that can play a role in decreasing the likelihood of obesity. This can be applied to college campuses since students will do a lot of walking on campus, but if certain facilities are too far or hard to reach because of car traffic, then those students will likely have to rely on riding the bus. The built environment of a college campus will affect how much walking or bicycling students perform as opposed to other forms of transportation. Even though these studies rely on census data which could be old, they do provide a snapshot of how built environments affect dietary behavior and physical activity levels.

Another factor of the environment’s effect on diet activity is the price of foods. Higher rates of obesity were found in low-income areas (21). Foods that are more costly tend to be less energy dense while cheaper foods tend to be more energy dense such as those with high fat and simple carbohydrates (21). This means that cheaper foods tend to have more energy. Those who want to eat healthier usually have to spend more money (21). Those who are low-income tend to buy cheaper foods even if they are not healthy. Many stores and restaurants in low socioeconomic areas will appeal to those with less money by offering cheaper but less healthy choices. This can be applied to college campuses in that students will try to eat at nearby dining facilities that offers the most affordable (or least costly) choice.

A college student's living environment can play a role in dietary habits. As a matter of fact, one study done at the University of Toronto compared students living on campus and students living off campus and found that those living on campus gained significantly more weight than those living off campus (22). The study pointed out that those living on campus were "restrained" eaters (22). Those living on campus were usually confined to whatever was served on campus at on campus dining facilities. Meanwhile, those living off campus had more flexibility to go out and eat. This study showed that a college's built environment is a factor in obesity just like with any neighborhood. As a matter of fact, a combination living on campus along with of dietary restraint has been viewed as a predictor of weight gain (20).

One excuse for students not going out to exercise is that the student recreation center (REC) at Texas A&M University may be too far on the West side of campus. Texas A&M is considered one of the largest main campuses in the nation that spans about 5,500 acres (23). Walking to the REC could possibly take between 15-20 minutes of walking from a residence hall on either southside or northside of campus.

Construction work could also take away from certain walking trails and provide obstacles to getting to the REC. In terms of eating behavior, students will eat at fast food places because of their proximity. For example, at Texas A&M University, there are three Chick-fil-a's located on campus with one located nearly in every main part of campus: northside, southside, west campus, and a fourth expected to be at the MSC (Central side). This study can apply to colleges in that to examine why students gain weight, it would be worth to look at what places to eat at that are close by and how far they have to go to get to the REC. Other campuses nation-wide will also have the same issues as Texas A&M in which student use of recreation facilities are reduced because of distance or traffic obstacles to getting there. Another issue that these colleges will have in common with Texas A&M is financial issues. Because of budgeting shortfalls, especially for many public state funded colleges, many college campuses will look to make deals with fast food and other restaurant chains such as Chick-fil-A or Which Wich in order to make or save more money. Also, college campuses nation-wide have buffet-type dining facilities. These facilities along with fast foods may be in areas where many students either reside or pass through.

Understanding built environment can help us find ways to treat obesity. As a matter of fact, in the Surgeon General's call to Action to Prevent and Decrease Overweight and Obesity, he states that "individual behavior change can occur only in a supportive environment with accessible and affordable healthy food choices and opportunities for regular physical activity" (24). In order to provide a supportive environment, the built environment must be understood (24). For example, if there is a

McDonald's on campus near several residence halls, then an alternative healthy eating option should also be placed there. Also, if students are trying to find ways to exercise on campus, it may be useful to build and promote facilities for recreation for them to use.

Food Consumption

Meat Consumption

Existing studies have found a positive association with meat consumption and obesity (25). Different meats were examined such as red meat, poultry, and seafood (25). A study was done as part of the 1999-2004 National Health and Nutrition Examination Survey (NHANES) and using linear and logistic regression, there appeared to be a consistent association between meat consumption vs BMI and obesity (25). As a matter of fact, this association was consistent for adults although there were differences between different sociodemographic groups (25). This study only examines meat consumption and contains no data as to how much physical activity each subject got. Ages were included in this study ranged from early childhood to as old as 74 (25). More specifically, chicken, beef, and pork can play a role in obesity. Not only do these meats have generally similar protein content, but they also exert the same effect on satiety on a subject (26). These meats may have differences in fat content, but have been shown to have a significant effect on obesity. This can be applied to studies on college campuses in that students will over-eat all sorts of foods once they are away from home, and this would include meats. Further, some dining facilities have buffet type services and this allows students to eat as much meat as they want.

Fish Consumption

Fish contains omega-3 fatty acids and these fatty acids have been viewed as something that can help treat numerous adverse health conditions. Some have pointed to substituting meat with fish as a healthy protein alternative. One reason why fish would be seen as a healthy alternative is because fish contains lower concentrations of C-reactive proteins (CRP) which is a proinflammatory mediator found in higher concentrations in those who are obese. CRP is something that is linked to obesity and eating fish has been linked to the lower amounts of this obesity indicator (27). More specifically, the Physicians' Health Study and the Nurses' Health Study showed inverse associations between the dietary intake of certain omega-3 fatty acids such as eicosapentaenoic acid (EPA) or docosahexaenoic acid (DHA) and concentrations of certain inflammatory markers that are prevalent in obesity (27). However, there is some conflicting evidence that eating fish does not affect CRP levels especially since there can be fatty fish and lean fish (27). Studies using FFQ's have shown that fish consumption can decrease certain inflammatory markers (28). Another reason why fish could be considered different from meat is involvement in comorbidities that are related to obesity. One study saw that meat consumption (especially red meat) was associated with diabetes which is a comorbidity of obesity, but omega-3 fatty acids from fish were not associated (29). Fish consumption differs from that of meat in that it does not lead to diabetes. However, the information on fish consumption and diabetes appears to be in conflict (30). Also, another question as to if fish consumption can lower the likelihood of obesity is if fish is being eaten with no change in the consumption of meat or if fish is being eaten instead of meat. What makes fish unique from other meats is that it and other seafood contain omega-3 fatty acids. More studies on omega-3 fatty acids still need to be done, but there is much potential in studying fish consumption since it has been linked to treating high blood pressure and other adverse health conditions.

Sugar

Although fats and lipids play a role in obesity, sugar also has a role. There has been much talk in the news and on TV about high carbohydrate diets and their effect on treating obesity. However, it would not be fair to say that consuming foods high in carbohydrates would lead to obesity. Foods with sugar can be classified based on glycemic index. High glycemic index (GI) foods include those with glucose such as sweets or pastries. Western diets are known to produce a high glycemic (GI) response which can affect the way in which fat is burned (31). Several studies examined the differences between high GI diets vs. low GI diets. What most of them appear to show is that a low GI diet is more likely to decrease weight, BMI, and fat mass (31). Low GI diets can be used to prevent or treat obesity. More specifically, in this study, pastries were the focus when it came to sugar snacks. Pastries tend to be very energy dense which means they provide excess energy that needs to be stored (31). Constantly eating sweets and other pastries that are high in GI can lead to increased weight and probably BMI.

Trans Fats

Fast foods not only contain meat and the fats associated with them, but they also contain trans fats. Also, trans fats can also be found in processed snack foods such as chips and other junk foods. According to numerous studies such as the Nurses' Health Study, there is a clear significantly positive relationship between trans fats and numerous inflammatory markers (such as CRP) responsible for obesity (27). Trans fats have a role in obesity in that the more they are consumed, the more likely weight is to be increased. This relationship may explain why fast foods and other junk foods can lead to obesity.

Physical Activity

It's not just dieting, what about the physical activities?

Other than dietary behavior, another aspect that has been shown to effect obesity is physical activity. Some argue with more advanced computers, social networking, more advanced video games, and the increased in popularity of sports on TV, that more people spend their times indoors instead of going out to exercise or take part in physical activity. There are also some campuses where the academic standards are tougher and so students will likely spend more time studying which can also be considered sedentary behavior. Physical activity has been seen as something that can either treat or prevent obesity. Regular physical activity has been shown to increase fat oxidation in healthy individuals (32). Fat oxidation refers to the burning of fat for energy that the body can use. Further, physical activity is the best means by which the obese can burn body fat since obesity has been shown to cause defects in fat oxidation (33). When fats or glucose are not being burned, they are stored as fat in our body. Excess storage of fats can lead to obesity. Physical activity causes the increased use of these fats. A single physical activity session can rapidly increase fat oxidation for up to thirty six hours following physical activity (34). Physical activity can have a significant increase in the short term.

Theoretically, if there was an increased intake of fat and glucose, then there would need to be increased oxidation in order to prevent excess storage. Increased physical activity can lead to excess oxidation.

American College of Sports Medicine and Center for Disease Control and Prevention suggests that people find perform more than 30 minutes of moderate-intensity physical activity on most days of the week (35). Further, the US Surgeon agrees with this general recommends that people get at least more than 30 minutes of moderate-intensity physical activity every day; however, many clinical trials point to how most get that much physical activity three days a week (36). A common problem that is faced is that people are having trouble trying to find the time to partake in physical activity. Another fact worth pointing out is that fat oxidation can be increased with the longer duration of physical activity (37). Thirty minutes should provide enough duration in order to burn significant amount of fat and use energy.

A study was done involving college students at public universities in the United States, Costa Rica, India, and South Korea that examined how often in the past seven days that they spent 20+ minutes doing vigorous (defined by sweating or breathing hard) or moderate (defined by physical activity that did not make them sweat or breathe hard) activity (38). There was a large sample taken in this study which included 2,366 females and 2,314 males (38). Out of this large sample, it was discovered that those who lacked regular physical activity were usually female, underweight, people who perceived themselves as underweight, did not eat fruits and vegetables, watched TV/ video three or more hours per day, and smoked (38). This showed that excessive sedentary behavior such as watching TV could have a negative relationship with regular physical activity. There are clear differences in physical activity levels between genders, ethnic groups, and within ethnic groups. For example, Indian males were more likely to lack regularly physical activity than Indian females, but the opposite was true for Korean students. Americans who saw themselves as overweight or underweight also lacked proper physical activity (38). This study showed that there were differences in physical activity levels between genders, but they varied between races. Physical activity can affect the overall health of college students, but the effects may differ between males and females. However, one theme that appears to be common is that physical activity should be emphasized for all cultures.

One specific demographic being examined in this study is college freshman. College freshman are a unique population in that their behavior is no longer being governed by parents. These freshmen begin to make their own decisions as to what to eat and what they do with their free time for probably the first time in their lives. For many, arriving in college for the first time will mark the first time in their lives that they control what their schedule is, what they eat, and how much they eat. Numerous studies show that many of these freshmen end up exercising less after they first come to college in contrast to how much they exercised before coming (39). A study was done by Utah State University examining both dietary intake and physical activity and their effects on weight and BMI in 159 (68 men and 118 women) freshman college students (40). Students filled out baseline and follow-up questionnaires, and the results of those questionnaires show that the average freshman college students were likely to gain weight (40). As a matter of fact, those who gained more than 5% of their body weight reported less physical activity during college than high school, were more likely to eat breakfast, and slept more hours than those who did not gain more than 5% of their body weight (40). Furthermore, there are few statistically significant differences in characteristics related to diet, physical activity or other health-related behaviors between different BMI baseline groups (of BMI less than 25 and BMI greater than 25 (40). Although about 77% maintained their body weight within 5% of their baseline, there was an increase in the number of subjects with a BMI of greater than 25 (40). More than a quarter of the students surveyed gained a significant amount of weight (40). This study is useful in that it showed that it shows that students who partake in less physical activity and more sedentary behavior such as sleeping were more likely to gain weight. Diet plays a role in weight gain or weight loss, but physical activity can also play a role in such. In order to help students lose weight, it is important to make sure they are aware of exercise facilities and club sports. However, this study does not examine specific meats and their effect on weight gain. Breakfast can include cereal and pastries and so these two types of foods would be worth studying since this study points to breakfast as a factor in weight gain. This study also never examined specific areas where the students were eating at.

However one study that did look at specific foods while also looking at frequency of physical activity. Seven hundred and sixty-four college students at Washington University in St. Louis were tracked from their freshman years to their sophomore years and they were given questionnaires to assess their diet and physical activity (41). More specifically, the diet being assessed referred to how often they ate fruits and vegetables, fast foods, and fried foods (41). Physical activity assessed included aerobic exercise, strength training, and stretching and it was found out that lack of proper exercise was consistent among college students (41). Lack of exercise has been known to play a role in weight gain. Even though more than half of those surveyed did not get adequate fruits and vegetables and also ate fried or fast foods more than three times a week, there was no association found in this study with exercise or dietary patterns and weight gain from freshman to sophomore year(41). Although fast foods and fried foods were examined, it was unclear what exactly they were, but it is likely that meat would have been involved in these two food types which would make meat a food worth looking at. Meat in fast foods and fried foods is a topic worth studying because of the relationship between meat and obesity.

Another study in North Carolina examined how physical activity affects obesity. 5,144 students from Duke, University of North Carolina, and North Carolina State took a survey pertaining to dietary habits and physical activity habits (42). What was found that pertains to what I am studying in that those who reported physical inactivity were more likely to either be overweight or obese (42). Further, those who reported physical inactivity had higher average BMIs (42). This study shows that physical activity can be used to treat obesity. Another finding from this study is that it pointed out that those who were overweight or obese were usually more preoccupied with thoughts of food and let food control their lives than those who were normal weight (42). Even though this study does point to lack of physical activity as a cause of obesity, this study also points to why people overeat. In order to better understand obesity, it would be important to understand what makes people make the decisions they make that lead to obesity.

The methodology behind dietary behavior and physical activity

Another study involved college students at the University of Minnesota. However, this study examined reasons and methods behind dietary behavior. Fifty students who were either freshman or sophomores were split into six different focus groups and were interviewed by investigators as to what were important influences on their weight, dietary intake, and physical activity (43). Numerous themes were discovered from these focus groups. In terms of dining choices, students were challenged by the buffet-style food services which include large portions of food (43). These buffet-style services gave students the ability to eat as much as they wanted, which could lead to increased weight gain. For universities looking to save money, running a buffet-style service helps to decrease labor requirements (43), and so are not in a rush to look into healthier alternatives for students living near these facilities. Furthermore, access to convenience stores was easier from campus than access to grocery stores (43). Dining places and stores on campus have an effect on what students eat, especially if the service is fast. Close location would likely increase student business and ultimately student consumption of products. Another theme that affected dietary behavior was who they ate with and how cheap the meal was (43). College students usually eat on a budget, so they usually find the least expensive place to eat at. If the closest place is fast food and is less expensive than another dining facility with healthy alternatives but farther away, then it is likely that the student will eat at the closer and less expensive fast food restaurant. Cost and distance affects what is eaten and that can affect diet, weight, and BMI. Also, when students eat out as a group, they will likely eat based on what everyone else says, even if it means the closest place, fast food place, or both. This makes the built environment on a college campus an important factor in examining obesity in college students.

Another study examined the effect that environmental stimuli have on freshman weight gain. Cornell University took weight measurements of 68 freshmen twice in between twelve weeks and also questioned them on the frequency with which they ate at an “all-you-can-eat” dining hall or with which they ate junk food (44). Through regression models, “all-you-can-eat” dining halls, frequency of meals and junk food consumption accounted for the variance in weight (44). More specifically, eating at the “all-you-can-eat” dining halls accounted for 20% of weight gain (44). The study did note that eating in such dining halls can lead to a larger meal which helps explain the weight gain (44). Some students may not want to control their appetite and will eat as much as they can, especially with no parental control. Nearby “all-you-can-eat” dining halls will easily attract students especially if they are close by. Questionnaires noted that students usually ate at these dining halls because they gave them a better sense of ‘fullness’ which meant that portions were likely larger than usual size (44). Such dining halls allowed students to define how much they would eat. Not only do these dining halls allow students to define how much they would eat, but they also define what students want to eat. These dining halls give students a variety to choose from, and so students may choose to eat what tastes best as opposed to what would be healthiest. Increased consumption will likely affect weight and BMI.

Another study that supports the idea that increased consumption leads to increased weight is one that examines how buffets effect on body weight (45). Although only 9 males and 4 females were examined, the study was able to show that when larger amounts of food was served, greater amounts of food was consumed and this consumption led to more weight gain (45). Students usually took larger portions of food when offered. College campuses will offer buffet-type dining which can be a significant factor in obesity. In terms of junk food, such food can be easily purchased from convenience stores which are usually more accessible to college campuses than supermarkets. As a matter of fact, high junk food consumption and evening snacking have been considered predictors of weight gain in freshman (20). Weight increase can be attributed to the type of dining facilities and what is served in those facilities depending on whether it is junk food, fast food, meat, fruits, vegetables, and other sugar products.

Another study that used focus groups conducted at Oregon State University that looked at the methods and reasoning behind students' dietary behavior and propensity toward physical activity. Weight and height were collected from about 660 college students and they were split into focus groups in which they discussed struggles in adapting healthy eating and physical activity behavior to their college life (46). Struggles include not being used to structured routines of healthy eating and physical activity, peer pressure to have something that could be unhealthy, and motivation (46). In terms of weight and BMI, females were more likely to maintain or lose weight than males, but males were more likely to gain weight than females (46). The focus groups showed that most of the students say that the environment affected their dietary and physical activity behavior and for some, created an obstacle to healthier behaviors (46). Nearby dining facilities affect diet and nearby recreation facilities and walking trails can affect how often people engage in physical activity. Further, the focus groups established that eating healthier was harder to do than engaging in physical activity (46). Time constraints, social life, nearby dining facilities, and cheap prices all play a role in where and what they eat on campus. This study takes a look at what effects obesity more, diet behavior or physical activity. In this study, it appears diet behavior is harder to control than physical activity. However, no mention is made about controlling sedentary behavior.

The American College Health Association performed a nationwide study throughout the United States in which they obtained information on weight and height (which were then used to calculate BMI), physical activity levels, and how much fruits and vegetables were eaten (47). This was a large scale study that involved 80, 121 students at 106 different colleges that were given a survey (47). Although there were many questions asked, one part dealt with the amount of physical activity and how much fruits and vegetables were eaten. About 45.5% of the students surveyed reported either vigorous exercise for at least 20 minutes or moderate exercise for at least 30 minutes on at least 3 of the past 7 days (47). This means about less than half were able to get adequate physical activity. Lack of physical activity can play a role in the “freshman fifteen.” Because there was such a large sample population, it is safe to say that lack of physical activity can be representative of most freshman college students in America.

However, the only nutritional information from this study deals with fruits and vegetables. There appeared to be no information on junk food, fast food, or meats. Fruits and vegetables have been shown to play a role in weight gain or weight loss, but it is not the only factor. Further, no relationship was examined involving food, physical activity levels, and sedentary behavior together.

Sedentary Behavior

In terms of physical activity, one issue discussed was that students spend so much time on school work, they have little time for physical activity (44). Sedentary behavior including school work could possibly compete with physical activity. Another issue discussed concerning physical activity is that students have difficulty using the recreation center because they could feel intimidated or they had to wait in line to use the machines (44). Although location of the recreation center was not discussed, it was pointed out that people who were not use to exercising may not try unless they are highly motivated to do so. This study does point to studying and exercise as being in competition with each other for a student's time.

A study done in Canada at the University of Guelph examined not only diet and physical activity, but also sedentary behavior. 128 first-year female students attended three different sessions: one before arriving at school, one in the fall, and one in the winter (48). At each visit, body weight, height, dietary assessments, and answers to questions relating to physical and sedentary behavior were gathered (48). The most notable result from this study was that the average weight was increased by 2.4 kg during the course of the study (48). In terms of dietary intake, energy and macronutrients did not significantly change, although the study does admit that energy intake may have been underreported (48). If energy intake was reported correctly, this means that diet did not have an impact on the weight gain. However, it was found out that physical activity (not sedentary behavior) was the only significant predictor of final weight (48). An analysis left undone by the researchers was an examination of whether the effect of diet was reduced by the presences of physical activity.

Significant weight gain appears to be a theme for freshman college students in both Canada and America. For females in this study, increased physical activity led to decreased body weight. This study does raise the question of how much of an effect physical activity has on weight gain as opposed to diet. Does physical activity account for a larger percentage of weight loss than diet? This study did examine diet, sedentary behavior, and physical activity, but it did not examine any specific types of foods such as fast foods or junk foods that students might be eating. The study also was limited to female freshman students in Canada. However, the University of Guelph study can be applied in American students in that they also face similar weight gain/loss issues as do Canadian students.

A study in England examined students' propensity for sedentary behavior. Forty-six males and 38 females recorded what they were doing whether it is watching television, sitting and talking, studying, or playing video games (49). Something important about these students that is worth noting is that the students were chosen from residence halls that also had dining facilities located within them that also received catered food (49). This means that that these students were close to a dining facility, and so the only major difference worth noting among these students is their physical activity levels or sedentary behavior. From the time diaries, it was found that studying was the predominant behavior for both genders followed by television viewing (49). There were numerous differences in types of sedentary behavior between genders.

One difference is that males played more computer games than females while females spent more time sitting and talking than males (49). Further, there were negative correlations between sedentary study and sedentary social times along with sedentary technology and sedentary study for both males and females (49). This means that studying and socializing along with studying and using technology are competitive with each other. Different types of sedentary behavior can be competitive with each other. In this particular study, it was found out that sedentary behavior and physical activity may be able to coexist even though the only negative relationship existed between physical activity and sedentary technology for males (49). Sedentary behavior and physical activity do not necessarily have to compete with each other. It is possible to find the right balance of studying or using the computer and followed by physical activity. However, this study was done in May and June when students were probably studying more because of exams (49). Depending on when the follow-up study was done, there could be different results as to what students were doing although students could change what type of sedentary behavior they were taking part in. Instead of sedentary study, students could spend more time with sedentary technology or sedentary socializing. Also, in terms of sedentary socializing, that can also be done during meals, there is the possibility that increased sedentary socializing could lead to increased food consumption or consumption of less healthy foods such as fast foods. There could also be the possibility that some club sports wrap up their activities near exam time in order to allow students to focus on studying. This research was useful in that it shows us that watching TV and playing games does not necessarily mean less exercise or physical activity. There can exist a healthy balance between physical activity and sedentary behavior. Although this study did examine how sedentary behavior and physical activity correlate with each other, nutritional and health aspects were not examined.

A study done in the Northeastern United States that examined college students who were mostly of Latino American and African American background between 17 and 19 (50). Weight, BMI, parents' education, extracurricular activities in college, and SAT scores were gathered from these students and analyzed (50). According to the results, there were no significant differences in weight and BMI across ethnic groups or between genders (50). There was no data in this study relating to physical activity or sedentary behavior. However, it did state no significant differences in weight or BMI change between different races. The findings of this study could be applied to universities whether they are on the east coast or west coast of the US. Also, this study did propose that American universities need to educate students on how to minimize weight gain (50).

Obesity is a growing problem in the United States. Not only is it a growing problem, but it can also lead to bigger problems such as high blood pressure, cardiovascular heart disease, and Type II diabetes. Once freshmen step onto a college campus, one of their biggest problems is trying to eat healthy and stay active, especially now that they make their own decisions. One issue that effects how healthy they are is the kind of proteins that they get whether it is beef, chicken, lunchmeats, or fish. Also, how often are they eating certain kinds of foods, especially ones that are hypothesized to contribute to obesity. Another issue that effects how healthy they are is how much physical activity that takes part in or how often they are sedentary. It is because of dietary and physical activity issues that make a study like this on college students very critical.

Foods containing larger amounts of fats such as meats, junk food, fast food, and foods containing larger amounts of simple sugars such as pastries, pies, and donuts will likely increase weight gain. Also, overeating or eating more than usual will also increase weight gain. Eating fish will either decrease or at least minimize the weight gain. Physical activity can decrease weight gain or at least minimize while sedentary behavior can increase weight gain. However, both physical activity and sedentary behavior do not necessarily have to be in competition with each other.

Table 1 summarizes the important findings of literature related to diet, physical activity, and sedentary behavior. There are several gaps that this thesis will attempt to fill in using the survey referred to as Campus Environment, Dietary Activity (CEDA). One is to look at if frequency per week of food consumption has any effect on weight gain or weight loss. Also, I would like to find out if sedentary behavior can have a similar effect on weight as physical activity does. Another gap that I want to take a look at is the interaction that physical activity and diet behavior have on weight or BMI change. Does physical activity negate the effects of diet behavior, and to what extent?

Table 1- Summary of Literature Review

Subject	Source	What the literature source tells us
Costs of obesity	14	Obesity drives up insurance costs
Built environment	16	Safety, supermarket access, and places to exercise all effect health behavior
Built environment	18	Convenience stores and fast food places have been associated with obesity. Increased dependence on motorized transport has also been associated with obesity.
Built environment	19	Likelihood of being overweight decreases with nearby recreational facilities
Built Environment	21	Foods high in energy density are cheaper, but more likely to lead to obesity
Built Environment	22	Those who lived on-campus at colleges were more likely to gain weight than those who lived off-campus
Meat	25	Consumption of meats such as red meat and poultry can lead to increased weight gain and obesity.
Meat	26	Chicken, beef, and pork exert the same effect on satiety
Fish and Junk food	27	Fish consumption decreases an inflammatory marker associated with obesity. Junk food consumption increases inflammatory markers associated with obesity
Fish	28	Fish consumption can decrease an inflammatory marker associated with obesity
Meat and Fish	29	Fish Consumption was not associated with diabetes although meat consumption was.
Fish	30	Fish consumption was not associated with diabetes
Sugar	31	Foods high in GI tend to cause weight gain when consumed while foods low in GI tend to decrease weight when consumed
Physical activity	39	Those who watched at least 3 hours of TV or were females lacked physical activity
Physical activity	40	Freshman students exercise less than usual after coming to college
Physical activity and Diet behavior	41	Physical activity, sleep, and breakfast can be linked to weight gain
Physical activity and diet behavior	42	No correlation found between any physical activity or diet behavior vs weight gain in college students from freshman to sophomore year

Table 1 - continued

Subject	**Source**	**What the literature source tells us**
Physical activity	43	Lack of physical activity was associated with higher BMI and obesity
Diet behavior	44	Closeness of facility, abundance of food, eating with friends, and cost effect diet behavior
Diet behavior	45	All you can eat dining halls, junk food, and frequency of meals affect weight gain. Especially larger portion sized at dining halls.
Diet behavior	46	Students tend to eat larger portion sizes when offered
Diet behavior	47	Females were more likely to lose weight but males were more likely to gain weight. Time constraints, social life, closeness of dining facilities, and cheap prices all play a role in diet behavior.
Physical activity	48	More than half examined lack physical activity.
Diet behavior and physical behavior	49	Physical activity has an impact on weight change, but not diet
Sedentary behavior	50	Females spend more sedentary behavior socializing. Sedentary behavior does not have to compete with physical activity
Weight change	51	Weight change not affected by race alone

CHAPTER II

OBJECTIVE

This thesis will examine:

1. Physical activity and sedentary behavior.
    a. Hypothesis: Physical activity will lead to lower weight and BMI. Having more physical activity will lead to weight loss. Sedentary behavior will lead to increased weight and BMI. Physical activity will have a larger effect on weight change.
    b. What is the relationships between amount of physical activity (or exercise or sedentary activity) and weight change or BMI change? What effect would have more or less physical activity in college than before have on weight and BMI. Also, which would have the larger effect on weight or BMI: physical activity or sedentary behavior?
2. Dietary behavior
    a. Increased frequency of consumption of foods such as meat, lunchmeats, pastries, fast foods, and junk foods will increase weight and BMI. Location plays a role in where people will eat. Eating more in college than before does lead to increased weight or BMI.
    b. What is the relationship between food choices and weight change or BMI change? How does eating meat, lunchmeat, fish, pastries, fast food, and

junk food effect weight or BMI? Does location affect dining choices and weight.

3. Interaction of Dietary behavior and physical activity
    a. Physical activity and certain foods will both play a factor in weight and BMI change. Neither one will be a more dominant factor than the other.
    b. How does eating certain type of food and physical activity together affect weight or BMI? Does physical activity have a larger effect on weight or BMI than consumption of a specific type of food or does dietary behavior have a larger effect on weight or BMI than physical activity?

CHAPTER III

METHODS AND PROCEDURES

Methods

The questions that I have examined in specific included how often students ate "chicken, pork, and beef", lunchmeats, fish, fast food, junk food, and pastries. I also looked at the reasons they would choose a specific dining facility such as healthiness, closeness to where they live, and fast service. I also examined how many days students got to exercise at the rec and how many days students got 30+ minutes of physical activity. I also examined how long it took for students to get to class. The diet and physical activity was then correlated with weight loss, weight gain, weight change, and BMI.

Using follow up data that was gathered from the CEDA project (Campus Environment, Diet, and Activity), I examined the responses of 235 freshmen college students at Texas A&M who responded to a baseline and then a follow-up survey that contained a wide range of questions involving diet, frequency of physical activity, and frequency of sedentary behavior. This sample was obtained from a list of freshman living on-campus at Texas A&M who had access to an e-mail account. About 3,461 freshman college students were e-mailed the original baseline survey. These freshmen were randomly selected and originally contacted via e-mail through the services of Survey Monkey. Only 446 students responded to this survey in the fall semester. Then in the spring semester, about 235 students responded to the follow-up. There could have been more people who responded, but because of university rules and regulations, the e-mail could only be sent once. See appendix 1 for information on the demographics.

Measurement

All of the food consumption variables (with the exception of fast food) were measured as categorical variables. The foods that were examined are meats ("chicken, beef, or pork"), lunchmeats, fish, junk food, cereal, and pastries. For each of these food choices, students could respond with the following choices (being presented in this order): "daily", "most days", "more than once a week", "at times or seasonally", or "rarely or not at all". These food choices were also coded and ordered as numbers going from daily to "rarely or not at all". "Daily" meant the person ate seven days a week. "Most days" meant the person ate 4-6 days in a week. "More than once a week" meant the person ate 2-3 days in a week. "At times or seasonally" meant the person ate either once a week or averaged less than that. Finally, "rarely or not at all" meant the person ate never or probably once or twice a semester. Fast food and junk food consumption was measured in the form of how many times the subject ate at a fast food in a 5-day work week and 7-day week. This will be a numerical value measured in days. The food consumption responses not only served as the independent variable, but the categorical food responses will also serve as a control in some data analyses.

Physical activity was measured by several different variables. The first variables deal with general physical activity. Physical activity was measured as how many days did the subject took part in 30+ minutes of physical activity. When the days were assessed, it was done in both per 5-day work week and 7-day week. Another variable deals with exercise in terms of trips to the REC. Exercise was measured as how many trips to the REC for 30+ minutes of exercise did the subject take part over the course of the 5-day work week or 7-day week. Both days of 30+ minutes of physical activity and REC trips can be considered as either categorical variables or numerical variables. Another useful variable is self-reported change in physical activity levels. People could respond by stating whether they were more physically active in college than they were in high school, continued staying physically active at the same levels from high school to college, or were less physically active in college than in high school.

Finally, another important independent variable worth examining is sedentary behavior. Sedentary behavior is a numerical variable and can be measured in the form of hours per weekday, hours per weekend day, and total hours per week. Total average sedentary behavior per week was calculated by multiplying sedentary behavior per weekday by five and adding that to the product of sedentary behavior per weekend day times two.

There were several weight-related dependent variables that were measured. First was “weight change” which was categorical and self-reported. Weight change was a variable only found in the follow-up survey in which the students responded how they felt their weight changed since high school. Weight change had three different categories: weight gain, weight loss, or maintained the same weight.

The next two self-reported categorical weight change categories were “weight loss” and “weight gain”. Each of these two variables was binary. The ‘weight gain’ variable was a binary categorical variable that consisted of either weight gain or no weight gain (which was either weight loss or maintained the same weight). The ‘weight loss’ variable was also a binary categorical variable that was either weight loss or not (which was either weight gain or maintained the same weight). Both ‘weight gain’ and ‘weight loss’ variables were created in order to run logistic binary regression.

BMI was the next weight-related category measured. BMI will be calculated based on the weight and height that the subject reported and was a numerical variable. The actual equation was the following:

$$BMI = (\text{Weight in pounds} * 703)/ (\text{height in inches})^2$$

Numerical weight gain and loss were also calculated by taking the difference between weight at the time they took the follow up survey and weight when they were in high school which came from the baseline survey. Both numbers were also self-reported. A positive number indicates weight gain while a negative number indicates weight loss. BMI change was also calculated taking the difference between follow-up BMI and high school BMI. High school BMI was calculated using the equation shown above using high school weight and high school height. A positive number indicated an increase in BMI while a negative number indicates a decrease in BMI.

BMI category was a categorical variable with four different groups. The first group was those with a BMI of less than 18.5 which is the underweight group. The second group was those with a BMI of between 18.5 and 24.9 which is the normal group. The third group was those with a BMI of between 25-29.9 which is the overweight group. The final group was those with a BMI of greater than 30 which is the obese group.

Data Analysis

First, the food categories were examined first with the weight categories. Certain food categories (such as “chicken, beef and pork”, fish, and fast foods) were examined with weight loss, weight gain, weight difference, and BMI difference. Physical activity (days of 30+ minutes of physical activity, exercise at the rec) was also examined with weight loss, BMI, weight difference, and BMI difference for both males and females. In order to examine these tests, it is important to describe what the hypothesis tests for data analysis will be. There are also tables later in this section that clarify what the variables are for the different tests run.

Chi square analysis was run when two categorical variables were used, especially if the dependent categorical variable was weight change. Chi square analyses featured gender, BMI categories, and days of 30+ minutes of physical activity as control variables. See table 1 for clarification as to what variables were used. First, each of the food categories (such as “chicken, beef and pork”, fish, lunchmeats, and pastries) was examined first with the ‘weight change’ category. Then each of the food categories will be examined with BMI Categories.

Another chi square analysis that was done was between types of foods such as “chicken, beef, or pork” and “fish”. The purpose of this was to see if the meats and fishes were competitive with each other. When these foods are to be examined with weight change, chi-square analysis will be run. This gives us a general idea of how food consumption affects weight change. Also, another chi square test involved examining residential side of the campus (northside or southside) and how often they went to Sbisa

Dining Center at least once a week. Sbisa is located on northside, and so this would allow us to see how location of dining facilities affects diet behavior and weight or BMI differences.

A third variable was also introduced as a control variable. Gender was used as a control. For example, chicken, beef, or pork was examined with weight change for each gender in order to see if there was a different relationship between meat and weight change for males and females. Another control variable that was used was days of 30+ minutes of physical activity. Using this, we see the trends of each food consumption category and their relationship with 'weight change' and then determine this relationship changes by the number an association with days of 30+ minutes of physical activity. Another control variable used was BMI categories in order to see whether the relationship between weight change and meat consumption differed by weight categories (underweight, normal, overweight, and obese).

Table 2- Variables used in the Chi-square analysis

Grouping variables- All independent variables examined based on below groups.	**Independent Variables**	**Dependent Variables**
Gender (male or female)	Weekly frequency of the consumption of Chicken, Beef, or Pork	Lunchmeat Fish Weight change BMI Category
BMI Categories (underweight, normal, overweight, obese)	Weekly frequency of the consumption of Lunchmeat	Weight change BMI Category
Days of 30+ minutes of physical activity	Weekly frequency of the consumption of Fish	Weight change BMI Category
	Weekly frequency of the consumption of Pastries	Weight change BMI Category
	BMI Categories	Days of 30+ minutes of physical activities
	Residential side of the campus	Trips to Sbisa Dining Center at least once a week BMI categories

Binary logistic regression was run when the dependent variable was either 'weight loss' or 'weight gain'. Gender would then be used as a control variable and significance would be tested for each gender. When foods were examined with categorical weight loss or weight gain, a binary logistic regression was run. See table 2 for clarification as to what variables were used. Binary logistic regression tests involved the following as independent variables: consumption of "chicken, beef, or pork", fish, lunchmeats, pastries, and fast food along with days of 30+ minutes of physical activity (per 5-day work week and week), trips to the REC (per 5-day work week and week), sedentary activity (per weekday, weekend day, and total per week), and minutes to class. The meats, lunchmeats, fish, pastries, fast food and sedentary activity were tested vs.

‘weight gain’ while days of physical activity, REC trips, and fish consumption were tested vs. ‘weight loss’. These tests gave us a more detailed look at how food consumption, physical activity, and sedentary behavior affect weight gain or weight loss.

Gender was then used as a control variable. For example, each gender had a separate hypothesis test for the relationship between the meats (chicken, beef, or pork) and weight gain.

Table 3- Binary Regression- All independent variables were matched with each of the dependent variables

Grouping variables- All independent variables examined based on below groups.	**Independent variables**	**Dependent variables**
Gender	Weekly frequency of the consumption of Chicken, beef, or pork	Weight loss
	Weekly frequency of the consumption of Lunchmeat	Weight gain
	Weekly frequency of the consumption of Fish	
	Weekly frequency of the consumption of Pastries	
	Days of 30+ minutes of physical activity (5-day work week, week)	
	Days of trips to the REC (5-day work week, week)	
	Sedentary behavior (weekday, weekend, total per week)	
	Minutes to class	

One way anova was run when there are more than two categorical variables used as the independent variables while the dependent variable would be numerical interval such as weight or BMI difference. See table 3 for clarification as to what variables will be used. Both genders were examined separately. The independent variables include how often "chicken, beef, or pork", lunchmeats, fish, and pastries are consumed since there is more than two responses to those questions. For each food, the dependent variables were either numerical weight difference or numerical BMI difference. After significance was checked, the data was also examined to find out if eating more or less of a certain type of food was more likely to lead an increase or decrease in either weight or BMI. This test gave us another detailed look at how eating different kinds of foods and how much of each food is eaten affect the numerical change in BMI or weight. Another One-way anova performed involved examining weight change or BMI change differences between north and southside of campus. Since Sbisa Dining Center, a buffet type dining facility, is located on northside, it's important to note if built environment effects any numerical weight or BMI changes.

Gender was used as a control variable. For example, each gender had a hypothesis test in order to find a relationship between meat consumption and weight change or meat consumption and BMI change. Another control variable was the BMI categories.

Table 4- One-way ANOVA- Study variables used in one-way ANOVA

Grouping variables- All independent variables examined based on below groups..	**Independent Variable**	**Dependent Variable**
Genders (male or female)	Weekly frequency of the consumption of Chicken, Beef, or pork	Weight change BMI Change
BMI Categories (underweight, normal, overweight, obese)	Weekly frequency of the consumption of Lunchmeat	Weight Change BMI Change
	Weekly frequency of the consumption of Fish	Weight Change BMI Change
	Weekly frequency of the consumption of Pastries	Weight Change BMI Change
	Residential side	Weight Change BMI Change

Linear regression analysis was used if the dependent variable was numerical. Several different control variables were used, all of which involved gender. Each control group was divided by gender will then divided again into a food consumption category. Each of the resulting sub groups would then be used to examine an independent variable and its relationship with a dependent variable (such as days of 30+ minutes of physical activity or trips to the REC) against a dependent variable (BMI, BMI difference, or weight difference). See table 4 for clarification as to what variables will be involved. For example, with “chicken, beef, or pork” there were several different choices (daily, more than once a week, etc). Each choice will be considered a different group in which physical activity or sedentary behavior was associated with BMI, BMI difference or weight difference. This meant that males who ate “chicken, beef, or pork” daily (seven days a week) and those who ate such seasonally (0-1 times a week) would have a separate significance test for days of 30+ minutes of physical activity and BMI difference. Also worth mentioning, a female who ate “chicken, beef, or pork” daily would have made physical activity or sedentary behavior levels correlated with BMI, BMI difference or weight difference. If both physical activity and sedentary behavior or physical activity and a particular food are significantly related to a numerical BMI or weight category at the same time, then the beta value would be examined in order to see which one had a larger influence. The R-squared value will also be examined in order see which one is more predictive of weight or BMI.

One control group was gender. Gender alone was used as a control variable when the independent variables included a food that was clearly measured as a numerical variable such as fast food and junk food. For example, since fast food was already numerical variable, fast food would be the only food consumption to use just gender as a control group and that would be compared with the following dependent variables: BMI, BMI difference, and weight difference. Fast food could also be examined with days of 30+ minutes of physical activity, REC trips, and sedentary behavior vs. BMI, BMI difference or weight difference. If there was a significant relationship between fast food and a physical activity category such as 30+ minutes of physical activity and. a dependent variable such as BMI difference (controlling for gender), then the beta value was examined to see which one had the bigger effect on BMI. Another control group that was used with fast food or junk food as a variable is levels of physical activity. Other control groups were used together such as gender and “chicken, beef, or pork” consumption, gender and lunchmeat consumption, gender and fish consumption, and gender and pastries consumption. For these control groups that involved gender and a particular food together, hypothesis tests were run featuring days of 30+ minutes of physical activity, REC trips for exercise, and sedentary behavior as the independent variables while the dependent variables were either BMI, BMI difference, or weight difference. In some tests, both days of 30+ of physical activity (or REC trips) along with sedentary behavior will be used as the independent variables in order to determine which one had the larger effect on weight or BMI.

BMI, BMI difference, and weight difference were regressed on fast food and physical activity using linear regression. However, for the other food choices with categorical choices, they along with gender were separated into different variables and a linear regression was run for each group with physical activity or sedentary behavior vs. BMI, BMI difference, or weight difference. For example, a female who ate meat seven days a week and a male who ate meat four to six days a week had separate hypothesis tests run to examine the relationship between physical activity and weight difference. Linear regression lets us take a detailed look at how physical activity or sedentary behaviors affect weight or BMI difference at different consumption levels for certain types of foods. In the case of fast food, chips, and vending machine snacks, we can see how each of those interact with physical activity or sedentary behavior to affect a change in BMI or weight and which one of those has the higher influence. Also, if the food had a significant relationship with weight or BMI difference, then that food was used in a linear regression as a numerical variable since the consumption levels were also assigned integers and were ordered. These foods were regressed with weight or BMI difference in order to confirm the relationship that the one-way Anova showed. Table 5 summarizes what variables were used.

Table 5- Linear Regression- All independent variables were included in the equation for each dependent variable

Grouping variables- All independent variables examined based on below groups.	**Independent variables**	**Dependent variables**
Gender	Physical activity	BMI
Gender and "chicken, beef or pork" (interaction)	Rec exercise	BMI difference (BMI during followup – BMI during last year of HS)
Gender and lunchmeats (interaction)	Sedentary activity	Weight difference (weight during followup – weight during last year of HS)
Gender and fish (interaction)	Weekly frequency of the consumption of Fast food	
Gender and pastries (interaction)	Weekly frequency of the consumption of Chicken, beef, or pork	
Gender and physical activity level (interaction)	Weekly frequency of the consumption of Pastries	Gender and physical activity level (interaction)
	Weekly frequency of the consumption of Lunchmeat	
	Weekly frequency of the consumption of Fish	
	Weekly frequency of the consumption of Vending Machine snacks	
	Weekly frequency of the consumption of regular (non low fat) Chips	

I used SPSS data analysis software in order to run numerous hypothesis tests on if eating certain things in the diet effected weight gain and how much of an effect physical activity and sedentary behavior had on it. A significant finding will have a p-value of .05 or less. If there is a significant relationship for both the food category and physical activity (and sedentary behavior) for weight gain or weight loss variable, then the beta value will be examined in order to see which variable (food or activity) had a larger effect. R-squared will also examined to see which one is more predictive of weight gain or weight loss.

CHAPTER IV

RESULTS

Respondents

There were clearly more female respondents than male respondents. In total, about 241 people answered both the baseline and follow up although eight did not indicate a gender. Sixty-one were males while 172 were females. However, there were almost an equal amount of northside and southside residents who answered (northside= 80; southside= 78) although 77 did not answer where they lived.

Table 6 below gives a report of the weight gain and weight loss self-reported by the participants along with the BMI categories of the participants. Table 7 below gives a report of the percentages of different BMI categories for males and females.

Table 6- Males and Females who report weight loss or weight gain.

	Total (%)	**Weight gain (%)**	**Weight loss (%)**
Male	61 (25.3)	14 (23)	9 (14.8)
Female	172 (71.4)	53 (30.8)	28 (16.3)

Table 7- BMI categories for males and females

	Underweight (%)	**Normal (%)**	**Overweight (%)**	**Obese (%)**
Male	2 (3.3)	44 (72.1)	9 (14.8)	2 (3.3)
Female	12 (7)	123 (71.5)	22 (12.8)	10 (5.8)

Physical Activity and Exercise

Physical activity

There was also no significant relationship between categorical weight change and total days in a week of 30+ minutes of physical activity (p=.099). However, there was an inverse relationship between days of 30+ minutes of physical activity and BMI (p=.045).

Days of physical activity was then treated as an independent variable while BMI categories were treated as dependent variables. When days of 30+ minutes of physical exercise was tested with different BMI categories (underweight, normal, overweight, and obese), there appeared to be a relationship between days of 30+ minutes of exercise and BMI categories (p=.001). Looking closely at the data, those who are obese and overweight engage in less days of physical activity as opposed to those with normal weight and those who are underweight. This was true for all subjects (p=.001). Finally, there was no relationship between days of 30+ minutes of physical activity and numerical weight change for all subjects put together (p=.07).

When gender was introduced as a control variable, it can be seen that with more days of 30+ minutes of physical activity, the more likely that female reported weight change. See table 8 for more clarification. In addition to the relationships seen in table 8, there was also a relationship in females between days of 30+ minutes of exercise and BMI categories (p=.001).

The previous test showed us that there was a relationship between weight change and physical activity, but now it becomes necessary to take a look at what kind of relationship existed. There was a significant relationship between days of 30+ minutes of physical activity and reported weight loss in females (p=.034) (see table 8). A separate test was run using gender as one independent variable (as opposed to a control variable) while also using days of physical activity as another independent variable and examining the relationship of both with weight loss. Even though there are clear differences in weight loss between genders, gender itself was not found to be significantly related to weight loss (p=.596). The more days of physical activity, the greater the likelihood that weight loss would be reported in women. When physical activity and gender were both used as independent variables in the same equation, gender had no significant effect on BMI although physical activity did.

Table 8 – Physical activity and self-reported weight loss. Days of 30+ minutes of physical activity along with self-reported weight loss or change and the p-values associated with them. Weight change variable would confirm if there was a difference in weight based on the number of days of physical activity. Weight loss confirms that the weight change that occurred was a decrease in weight.

	Gender	**Weight loss (p-value)**	**Weight change (p-value)**
Days of 30+ minutes of physical activity per 5-day work week	Male	.892	.518
Days of 30+ minutes of physical activity per 5-day work week	Female	.031	.043
Days of 30+ minutes of physical activity per week	Male	.861	.451
Days of 30+ minutes of physical activity per week	Female	.034	.048

Significant at the p<.05 level.

Actual weight change was tested with days of 30+ minutes of physical activity with gender acting as a control variable. For females, there was a significant relationship between days per week of 30+ minutes of physical activity and weight difference (p=.001) (see figure 1 and table 10). For every day per week of 30+ minutes of physical activity, there is likely to be a 1.116 pound decrease in weight (see table 10). The trends in tables 9 and 10 along with figure 1 clearly show that 30+ minutes of physical activity can lower weight by slight amounts.

Table 9 - Days of 30+ minutes of physical activity and BMI. Beta values indicate the extent of the change in BMI if there was a significant relationship between days of 30+ minutes of physical activity and BMI. Negative beta values indicate a decrease in weight with an increase in days of 30+ minutes of physical activity. Positive beta values indicate an increase in weight with an increase in days of 30+ minutes of physical activity.

	gender	**Unstandardized beta**	**standardized beta value**	**p-value**
Days of 30+ minutes of physical activity per 5-day work week	Male	-.156	-.089	.516
Days of 30+ minutes of physical activity per 5-day work week	Female	-.436	-.145	.062
Days of 30+ minutes of physical activity per week	Male	-.057	-.038	.785
Days of 30+ minutes of physical activity per week	Female	-.301	-.124	.116

significant at the p<.05 level.

Table 10: Days of 30+ minutes of physical activity and weight difference (in pounds). Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity and weight. Negative beta values indicate a decrease in weight with an increase in days of 30+ minutes of physical activity. Positive beta values indicate an increase in weight with an increase in days of 30+ minutes of physical activity.

Weight difference	**gender**	**Unstandardized beta**	**Standardized Beta**	**p-value**
Days of 30+ minutes of physical activity per 5-day work week	Male	-.308	-.043	.755
Days of 30+ minutes of physical activity per 5-day work week	Female	-1.528	-.286	<.001
Days of 30+ minutes of physical activity per week	Male	-.26	-.041	.771
Days of 30+ minutes of physical activity per week	Female	-1.116	-.259	.001

significant at the p<.05 level

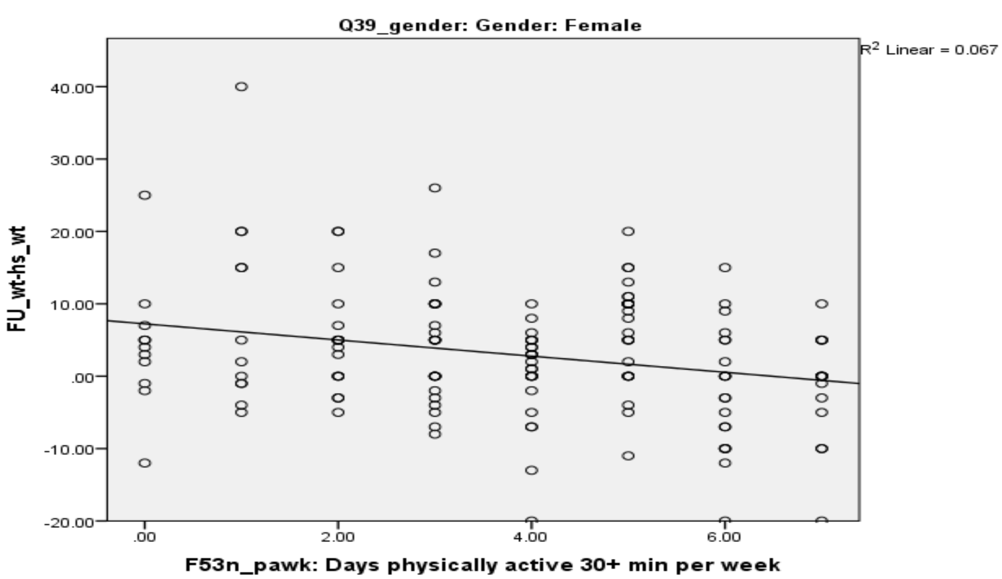


Figure 1- Weight vs days of 30+ minutes of physical activity. Weight is in pounds with positive indicating weight gain and negative indicating weight loss. Best fit line indicates a relationship in women.

For BMI difference, the same trend is true: there was a significant relationship between BMI changes for women. The more days of 30+ minutes of physical activity, the more likely BMI loss is predicted (p<.001) (see table 11 and figures 2 & 3). There is no evidence that physical activity affects weight and BMI change in males. On the other hand, there is very strong evidence that shows females who engage in more physical activity are more likely to decrease both their weight and BMI.

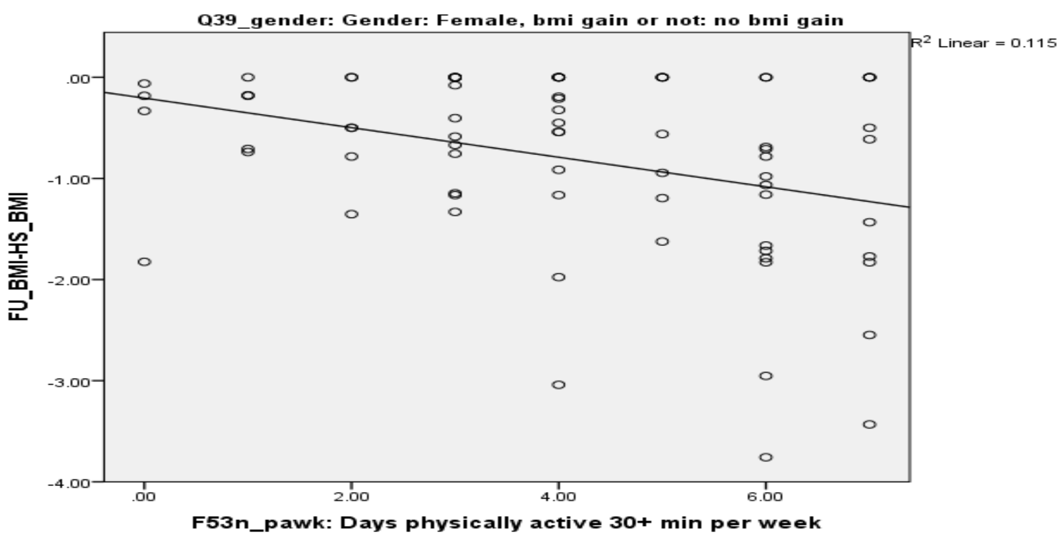


Figure 2- BMI vs days of 30+ minutes of physical activity. Those who do not increase in BMI, show a relationship between physical activity and BMI change.

Table 11 - Days of 30+ minutes of physical activity along with BMI difference. Beta values indicate the extent of the change in BMI if there was a significant relationship between days of 30+ minutes of physical activity and weight. Negative beta values indicate a decrease in weight with an increase in days of 30+ minutes of physical activity. Positive beta values indicate an increase in weight with an increase in days of 30+ minutes of physical activity

BMI Difference	**gender**	**Unstandardized beta**	**Standardized beta value**	**p-value**
Days of 30+ minutes of physical activity per 5-day work week	Male	.02	.019	.891
Days of 30+ minutes of physical activity per 5-day work week	Female	-.295	-.301	<.001
Days of 30+ minutes of physical activity per week	Male	.019	.02	.884
Days of 30+ minutes of physical activity per week	Female	-.219	-.279	.001

significant at the p<.05 level

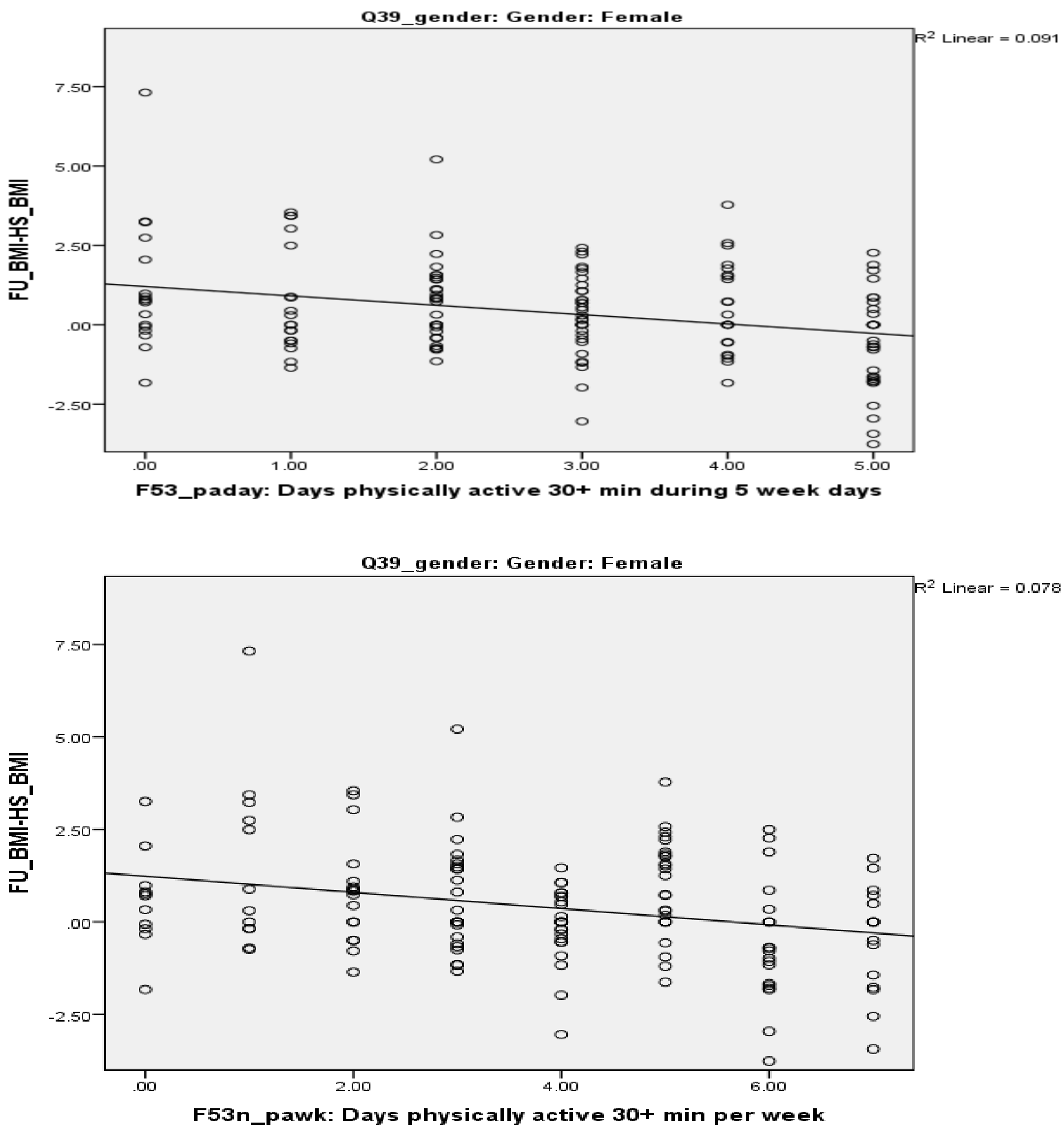


Figure 3- BMI difference vs days of 30+ min. of physical activity. Best fit line indicates a relationship in women between BMI difference and days of 30+ minutes of physical activity.

There was a significant relationship for women between levels of physical activity and weight difference along with BMI difference ($p<.001$ for both) (see figures 4 & 5). Those females who were more physically active in college than in high school were more likely to gain the least amount of weight or decrease their BMI. However, those females who were less physically active in college than in high school gained the most in weight and BMI.

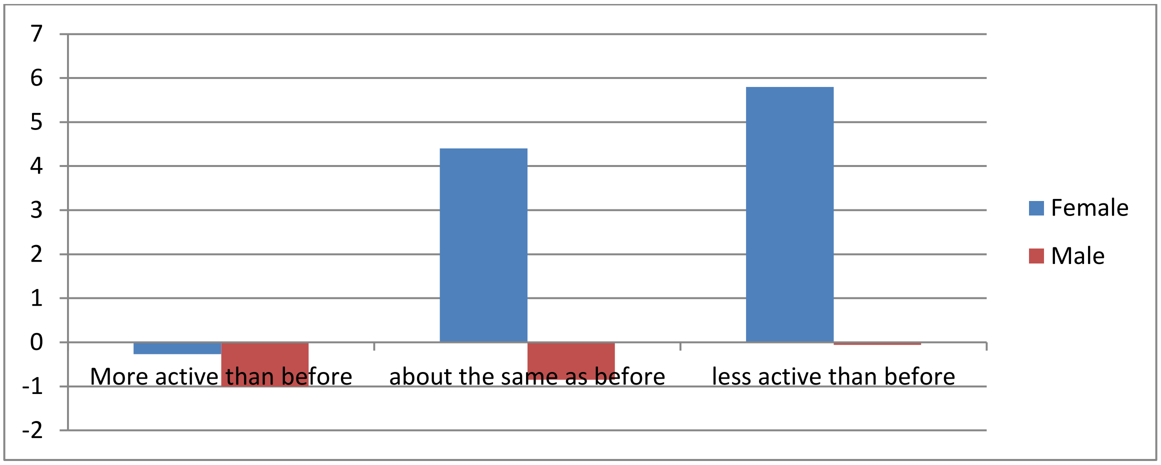


Figure 4- Weight difference & physical activity levels. weight difference in pounds for each level of physical activity in college as opposed to before. Positive numbers indicate a weight gain and negative numbers indicate weight loss

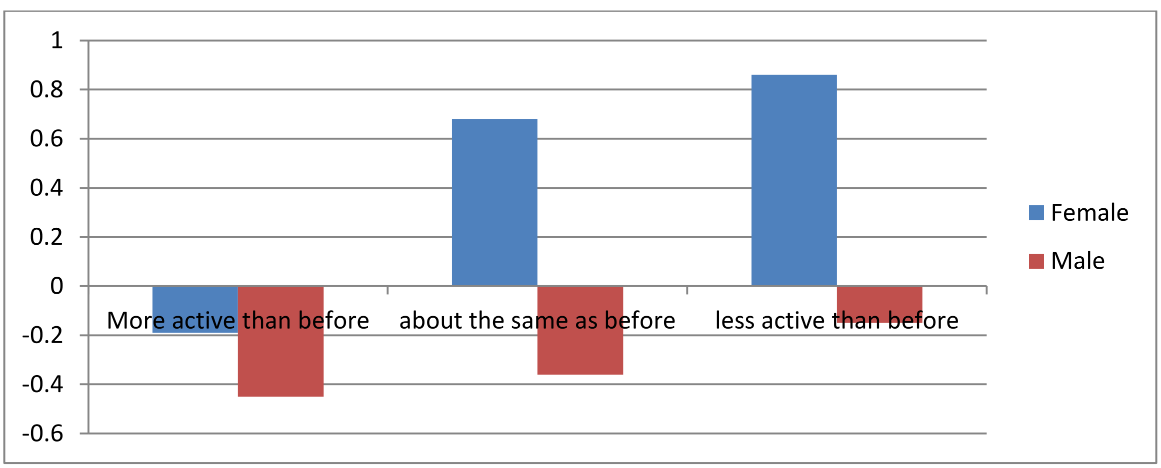


Figure 5- BMI and physical activity levels. BMI for each level of physical activity in college as opposed to before. Positive numbers indicate a weight gain and negative numbers indicate weight loss

REC exercise

Physical activity can include walking, running, exercise, and sports. However, exercise at the student recreation center (also known as the REC) was examined in terms of whether it had a significant relationship with weight loss. Exercise at the REC is considered to be more organized, controlled, and disciplined. First, it was thought that since the rec is far on west side of campus that those who had a longer time of travel were less likely to travel to the rec. However, there was no significant relationship between time taken to travel to the REC and number of trips to the REC (p=.992). Even though the REC is on west campus far away from either the northside and southside residence halls of Texas A&M, location or time to travel there does not appear to be an issue.

Trips to the rec per week were measured for each BMI category group. There was no significant relationship between rec trips per week and weight loss for any of the BMI categories. Further study is needed to examine the relationship between the BMI categories and exercise.

Gender was then used as a control variable for tests involving REC trips and weight loss. There was a significant relationship between REC and weight loss in that the more women go to the rec in a week, the more likely that weight loss is reported (see table 12).

Table 12 - REC trips and weight loss. Students reported if they lost weight and that was tested vs trips to the REC center for 30+ minutes of exercise.

	Gender	**Weight loss (p-value)**
REC trips / 5-day weekday	Male	.654
REC trips / 5-day weekday	Female	.031
REC trips / week	Male	.572
REC trips / week	Female	.026

Significant at the p<.05 level

Self-reported weight loss was also confirmed by numerical weight differences. Females were more likely to lose weight the more they went to the REC in a week (p=.001) (see table 13). For each trip to the REC per week, a decrease of 1.36 pounds was predicted (see table 13). Weight was likely to decline with more trips to the REC. Reported BMI difference shares the same trend as well as weight difference. Females were more likely to experience a decline in BMI with more trips to the REC in a week (p=.003) (see table 14 and figure 6). Something that can be strongly concluded is that more exercise can result in a decrease in weight and BMI for females.

Table 13: REC trips and numerical weight difference in pounds. Beta values indicate the extent of the change in weight if there was a significant relationship between trips to the REC for 30+ minutes of exercise and weight. Negative beta values indicate a decrease in weight with an increase in trips to the REC for 30+ minutes of physical activity. Positive beta values indicate an increase in weight with an increase in trips to the REC.

Weight difference	**gender**	**Unstandardized beta**	**Standardized beta value**	**p-value**
REC trips per 5-day work week	Male	1.318	.158	.281
REC trips per 5-day work week	Female	-1.505	-.245	.002
REC trips per week	Male	1.219	.185	.199
REC trips per week	Female	-1.358	-.281	.001

significant at the p<.05 level

Table 14 - REC trips and BMI difference. Beta values indicate the extent of the change in BMI if there was a significant relationship between trips to the REC for 30+ minutes and weight. Negative beta values indicate a decrease in weight with an increase in trips to the REC for 30+ minutes. Positive beta values indicate an increase in weight with an increase in trips to the REC.

BMI difference	**gender**	**Unstandardized Beta**	**Standardized beta value**	**p-value**
REC trips per 5-day work week	Male	.143	.119	.112
REC trips per 5-day work week	Female	-.243	-.213	.009
REC trips per week	Male	.153	.163	.243
REC trips per week	Female	-.22	-.245	.003

significant at the p<.05 level

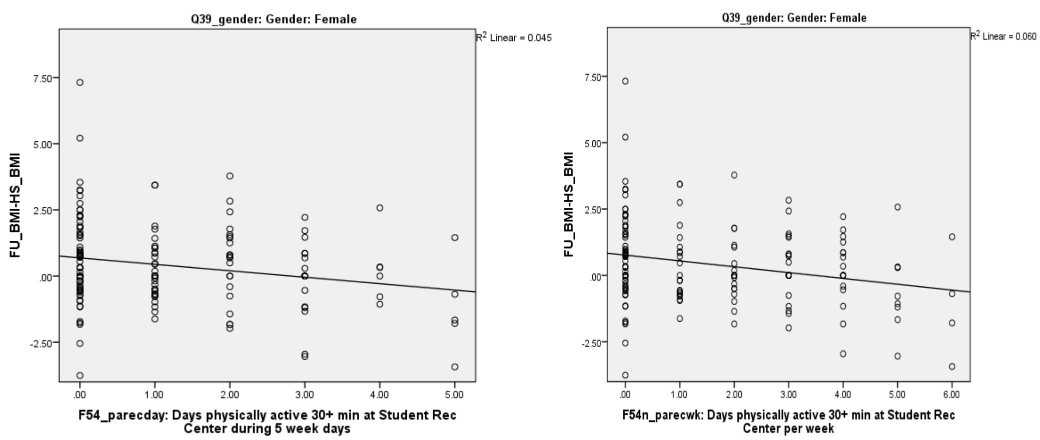


Figure 6- BMI difference and trips to the REC center. BMI vs Days of 30+ min of physical activity at the REC center in women. Best fit line indicates a negative relationship between BMI and trips to the REC.

Sedentary Behavior

Sedentary behavior is defined as activity in which the subject is sitting. This could include sedentary behavior involving watching TV, playing video games, socializing, and napping. For all students, there is a positive relationship between BMI and hours of sedentary behavior (p=.029). The more hours of sedentary behavior there are in a week, the higher the BMI.

Gender was then introduced as a control variable. When examining different genders, it was discovered that there was a relationship between negative relationship between hours of sedentary behavior and BMI in males (see table 15 for more details). This meant that those with a lower BMI were more likely to take part in more sedentary behavior than those with higher BMI. For females, there was a positive relationship between hours of sedentary behavior in a week and BMI. Once again, when sedentary behavior and gender were both examined together in linear regression, it was found that gender alone had no effect on BMI. There may be differences in BMI between males and females, but gender alone does not affect BMI.

Table 15 - Sedentary behavior in hours and BMI. Positive Beta value indicates that those who took part in more hours of sedentary behavior had higher BMI. Negative Beta value indicates that those took part in more hours of sedentary behavior had lower BMI.

Sedentary behavior	**Unstandardized B-value**	**p-value**
Male per weekday	-.338	.009
Female per weekday	.217	.131
Male per week	-.358	.011
Female per week	.326	.004

p<.05 means significant

In terms of actual weight and BMI difference, the trend is not the same. The only significant relationship between sedentary behavior and weight difference is for hours of sedentary behavior per weekend day and numerical weight difference (p=.023) along with numerical BMI difference in females (p=.033) (see table 16). Increased sedentary behavior by women predicted an increase in weight and BMI but only on weekends, not weekdays.

Table 16 - Female sedentary chart: sedentary behavior in hours with BMI difference or weight difference. Beta values indicate the extent of the change in BMI (or weight) if there was a significant relationship between hours of sedentary behavior and BMI (or weight). Positive beta values indicate an increase in weight with an increase in hours of sedentary behavior.

Sedentary	**Unstandardized beta**	**Standardized Beta Value**	**P-value**
Per weekday vs Weight (wt) difference (diff)	.392	.119	.145
Per weekday vs BMI diff	.08	.131	.108
Per weekend vs wt diff	.591	.186	.023
Per weekend vs BMI diff	.102	.174	.033
Per week vs wt. diff.	.233	.086	.295
Per week vs BMI diff	.045	.094	.25

p<.05 means significant

Finally, it was to determine whether physical activity or sedentary behavior had a greater effect on BMI. Days of 30+ minutes of physical activity in a week was examined vs. hours of sedentary behavior in a week in women since both were significant for women. It appeared that sedentary behavior (β=.149) had a slightly larger influence than physical activity (β=-.132). In terms of numerical BMI difference, physical activity per week and hours of sedentary activity per weekend day were examined and it appeared that physical activity had a larger effect on BMI change (β=-.259) than hours of sedentary behavior per day (β=.184). For females, physical activity had no significant relationship with sedentary behavior (p=.242) which means that sedentary behavior and physical activity did not have to be in conflict with each other. However for males, there appears to be a positive relationship between hours of sedentary behavior and days of

30+ minutes of physical activity (p=.019). This means that with increased sedentary behavior, there is increased physical activity. It could mean that with more days of physical activity, the more likely that male could find time to rest in sedentary activity.

Foods and Their Interaction with Physical Activity

Meats

Most of the subjects, whether they be males or females ate chicken, beef, or pork either on most days or daily (see tables 17 or 18). There was no relationship between self-reported weight change and eating meats such as chicken, pork, and beef for all subjects put together. In addition, 30+ minutes of physical activity in a day was not significantly related to either weight change or meat consumption. With regard to weight gain, it was not significantly related to meat consumption. In terms of BMI categories, there is no significant difference among the four BMI groups when it came to meat consumption (p=.647).

Gender was then introduced as a control variable. The weight gain-meat consumption relationship was moderated by gender. When the weight gain-meat consumption relationship was computed for males and females separately, it was found that males who reported eating more meat were more likely to gain weight (p=.05). When BMI's were separated into the four categorical groups, there was no significant difference in meat consumption among the four different groups for either males or females.

In terms of numerical weight difference, there appeared to be a significant relationship in males between eating meat and change in both weight ($p=.035$) and BMI ($p=.039$). This confirms the hypothesis for weight gain and meat. For weight difference, the higher change (on average of about one or two pounds) occurred for those who ate meat 4-7 days a week as opposed to those who ate meat 0-1 days a week. The same trend held true for numerical BMI difference. Further, regression analysis showed that those who ate less frequently were likely to lose more weight confirming what previous tests have shown ($p=.045$). The same relationship was true for BMI and meat consumption ($p=.027$). In order to see the average weight gain for both males and females based on how often the meat was consumed, please see table 17. To see the average BMI gain for both males and females based on how often meat was consumed, please see table 18 and figure 7.

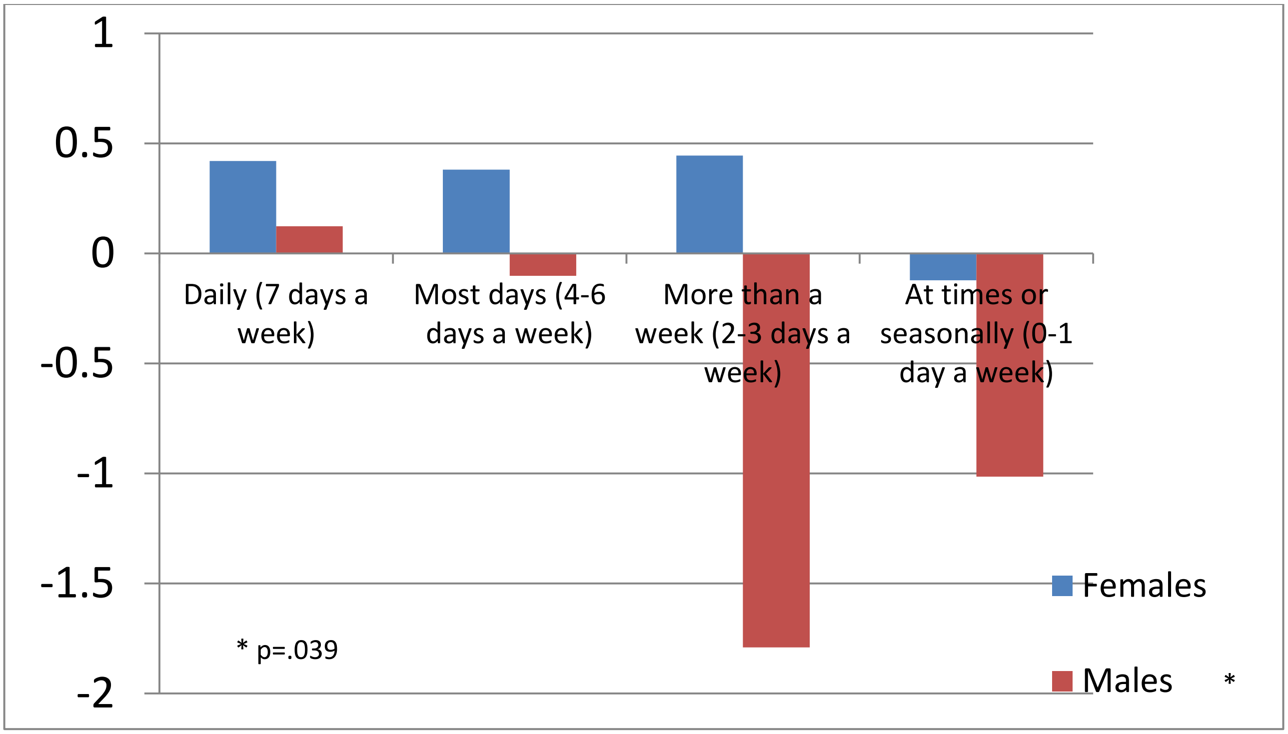


Figure 7- Average BMI change and chicken, beef, or pork consumption . BMI graphed on the y-axis and chicken, beef, and pork consumption is graphed on the x-axis.

Table 17 - Chicken, beef, or pork and weight difference in pounds.

	Times chicken, beef, or pork eaten	**N (%)**	**Mean (SD)**	**95% CI- Lower Bound**	**95% CI Upper Bound**	**Min**	**Max**
Males	Daily (7 days a week)	21 (36.8%)	2.05 (10.8)	-2.88	6.98	-20	20
	Most days (4-6 days a week)	24 (42.1%)	1.04 (7.4)	-2.09	4.17	-20	15
	More than once a week (2-3 days a week)	8 (14%)	-11.75 (21.2)	-29.44	5.94	-50	10
	At times or seasonally (0-1 days a week)	4 (7%)	-3 (9.8)	-18.59	12.59	-15	5
Females	Daily	57 (37.5%)	3.14 (9.3)	.68	5.6	-20	26
	Most days	53 (34.9%)	3.26 (9.3)	.69	5.84	-20	40
	More than a week	26 (17.1%)	2.46 (7.4)	-.55	5.47	-12	20
	At times or seasonally	9 (5.9%)	.33 (6)	-4.28	4.95	-10	8
	Rarely or not at all (few times a semester)	7 (4.6%)	4.2 (6.6)	-1.92	10.39	-4	15

Statistical data on the frequency of meat intake and its effects on weight difference. For mean, 95% CI, Min and Max, a positive number indicates weight gain but a negative number indicates weight loss

Table 18: chicken, beef, or pork and average BMI difference per frequency category

	Times chicken, beef, or pork eaten	**N (%)**	**Mean (SD)**	**95% CI-Lower Bound**	**95% CI Upper Bound**	**Min**	**Max**
Males	Daily (7 days a week)	20 (35.7%)	.12 (1.66)	-.65	.9	-3.45	3.73
	Most days (4-6 days a week)	24 (42.9%)	-.10 (1.01)	-.53	.33	-3.13	1.38
	More than a week (2-3 days a week)	8 (14.3%)	-1.79 (2.81)	-4.14	.56	-6.78	.83
	At times or seasonally (0-1 days a week)	4 (7.1%)	-1.01 (1.77)	-3.83	1.80	-2.73	1.45
Females	Daily	57 (37.5%)	.42 (1.66)	-.02	.86	-3.43	5.21
	Most days	53 (34.9%)	.38 (1.77)	-.11	.87	-3.76	7.32
	More than a week	26 (17.1%)	.44 (1.24)	-.06	.95	-1.82	3.23
	At times or seasonally	9 (5.9%)	-.12 (1.04)	-.92	.68	-1.83	1.46
	Rarely or not at all (very few times a semester)	7 (4.6%)	.73 (1.33)	-.5	1.96	-1.19	2.42

p<.05 means significant. Statistical data on the frequency of meat intake and its effects on BMI difference. For mean, 95% CI, Min and Max, a positive number indicates BMI increase but a negative number indicates BMI decrease

In addition gender and meat consumption were both used as control variables. There was little data on those who ate meat either 0-1 day a week or rarely. No matter how much meat males ate, physical activity appeared to have no effect on weight or BMI difference. Females who ate meat the most frequently (4-7 days a week) still were able to decrease their weight or BMI if they exercised or had at least 30+ minutes of physical activity (see table 19 and figure 8). Meanwhile there was no significant relationship between exercise and BMI among females who ate meat less often 4 days a week. There were 50+ females who ate meat seven days a week and also 50+ who ate meat 4-6 days a week. For females, when the categories of "more than a week" (2-3 days a week), "at times or seasonally" (0-1 days a week), or "rarely or never" were combined to create a larger category (42 in total), there was still no significant relationship between physical activity and weight difference ($p=.801$). Trips to the REC and weight difference appear to have no relationship for males who eat meat only on most days ($p=.055$) but this relationship appeared to be more significant for trips to the REC and BMI difference on most days ($p=.015$). However, there is no difference in weight or BMI for either males or females when it came to amount of sedentary activity in a day or week. The trend seems to show that for males, meat consumption plays a major role in weight and BMI although going to the REC to exercise may possibly play a role. However, for females, no matter how much meat they consume, if they engage in physical activity or exercise, they should still decrease in weight or BMI.

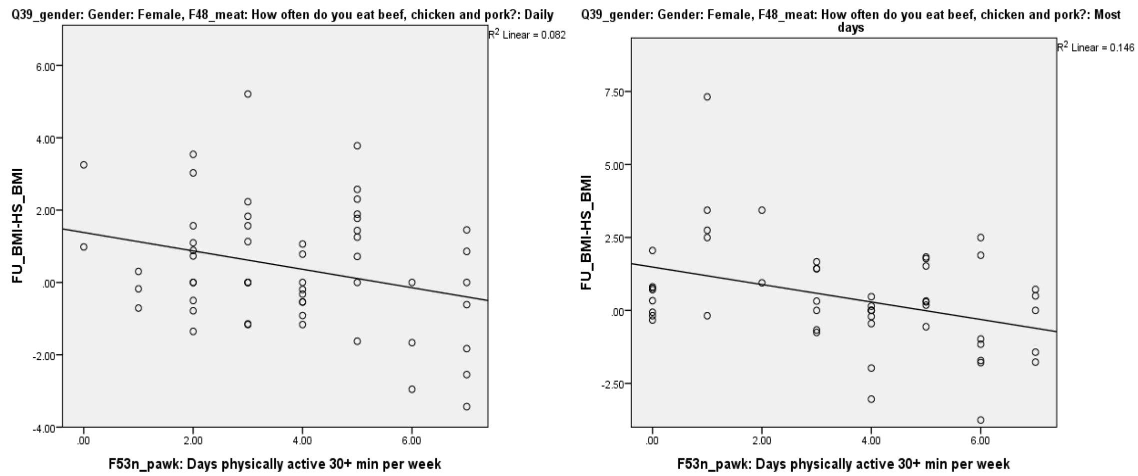


Figure 8- Physical activity and the frequent consumption of meats in females. In females, BMI difference vs days of physical activity in those who eat chicken, beef, or pork daily and Most days. Those who ate chicken, beef, or pork 7 days a week are graphed on the left. Those who ate such meats 4-6 days a week are graphed on the right. Negative slope indicates a BMI decrease with more days of 30+ minutes of physical activity.

Table 19: Females who eat chicken, beef, or pork either daily (7 days a week) or most days (4-6 days a week). Physical activity along with trips to the REC were measured with both weight and BMI difference. Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity (or trips to the REC) and weight (or BMI) difference. Negative beta values indicate a decrease in weight with an increase in trips to the REC for 30+ minutes of physical activity.

	Weight or BMI difference	**Daily or most days**	**Unstandardized beta**	**Standardized Beta**	**P-value**
Weekdays of 30+ minutes of physical activity	Weight	Daily	-2.078	-.335	.011
Weekdays of 30+ minutes of physical activity	BMI	Daily	-.34	-.306	.021
Weekdays of 30+ minutes of physical activity	Weight	Most days	-2.037	-.378	.005

Table 19 – continued

	Weight or BMI difference	**Daily or most days**	**Unstandardized beta**	**Standardized Beta**	**P-value**
Weekdays of 30+ minutes of physical activity	BMI	Most days	-.432	-.418	.002
Days/week of 30+ minutes of physical activity	Weight	Daily	-1.546	-.312	.02
Days/week of 30+ minutes of physical activity	BMI	Daily	-.254	-.286	.034
Days/week of 30+ minutes of physical activity	Weight	Most days	-1.385	-.335	.016
Days/week of 30+ minutes of physical activity	BMI	Most days	-.299	-.382	.006
REC trips per 5-day work week	Weight	Daily	-2.635	-.382	.004
REC trips per 5-day work week	BMI	Daily	-.32	-.258	.055
REC trips per 5-day work week	Weight	Most days	-1.756	-.266	.055
REC trips per 5-day work week	BMI	Most days	-.381	-.282	.043
REC trips per week	Weight	Daily	-2.452	-.433	.001
REC trips per week	BMI	Daily	-.315	-.309	.022
REC trips per week	Weight	Most days	-1.515	-.299	.03
REC trips per week	BMI	Most days	-.313	-.307	.027

$p<.05$ means significant

Lunchmeats

There was no significant relationship between change in either BMI or weight and lunchmeat consumption. However, there was a significant relationship between lunchmeat (ham, bologna, cold cuts) and weight gain when the subject reported no days of at least 30+ minutes of physical activity (p = .028). Further, there was also a significant relationship between eating lunchmeats and weight change when there was only one day of at least 30+ minutes of physical activity (p = .023). If people do not get at least 1 day of physical activity, there is a higher likelihood of gaining weight if one eats more lunchmeats. When BMI's were separated into the four categorical groups, there was no significant difference in lunchmeat consumption among the four different groups for either males or females. In terms of numerical weight or BMI difference, there was no significant with lunchmeat consumption for either males or females alone. There was no significant difference between lunchmeat consumption and the BMI categories (p=.643).

Gender was then introduced as a control variable. There was no significant difference for males or females between BMI categories and lunchmeat consumption (males: p=.881; females: p=.659). Genders along with lunchmeats were used together as control variables. See tables 20-22 for details on hypothesis tests pertaining to physical activity and weight (or BMI) difference for each lunchmeat consumption category. When consumption of lunchmeat daily, most days, and more than a week were combined, there was still a significance between days of 30+ minutes of physical activity per 7-day week and numerical weight (p=.006). Findings for lunchmeat consumption and REC trips relationship were inconsistent and weak. However, one message that we can see from the findings is that physical activity was able to negate the effects of weight (or BMI) increase from lunchmeats.

Table 20: Females who ate Lunchmeat “Most days” (4-6 days a week). Physical activity along with trips to the REC were measured with both weight and BMI difference. Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity (or trips to the REC) and weight (or BMI) difference. Negative beta values indicate a decrease in weight with an increase in trips to the REC for 30+ minutes of physical activity.

	Weight or BMI difference	**Unstandardized beta**	**Standardized Beta**	**P-value**
Weekdays of 30+ minutes of physical activity	Weight	-2.597	-.613	.034
Weekdays of 30+ minutes of physical activity	BMI	-.335	-.393	.206
Days/week of 30+ minutes of physical activity	Weight	-2.026	-.599	.039
Days/week of 30+ minutes of physical activity	BMI	-.274	-.402	.195
REC trips per week	Weight	-1.668	-.437	.156
REC trips per week	BMI	-.287	-.373	.233

p<.05 means significant

Table 21: Females who eat Lunchmeat “more than once a week” (2-3 days a week). Physical activity was measured with both weight and BMI difference. Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity and weight (or BMI) difference. Negative beta values indicate a decrease in weight with an increase in days of 30+ minutes of physical activity.

	Weight or BMI difference	**Unstandardized beta**	**Standardized Beta**	**P-value**
Weekdays of 30+ minutes of physical activity	Weight	-.962	-.188	.259
Weekdays of 30+ minutes of physical activity	BMI	-.294	-.285	.087
Days/week of 30+ minutes of physical activity	Weight	-1.003	-.244	.145
Days/week of 30+ minutes of physical activity	BMI	-.28	-.343	.041

p<.05 means significant

Table 22: Females who eat Lunchmeat at times or seasonally (0-1 days a week). Physical activity along with trips to the REC were measured with both weight difference and BMI difference. Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity (or trips to the REC) and weight (or BMI) difference. Negative beta values indicate a decrease in weight with an increase in physical activity.

	Weight or BMI difference	**Unstandardized beta**	**Standardized Beta**	**P-value**
Weekdays of 30+ minutes of physical activity	Weight	-1.954	-.358	.007
Weekdays of 30+ minutes of physical activity	BMI	-.35	-.36	.007
Days/week of 30+ minutes of physical activity	Weight	-1.381	-.326	.015
Days/week of 30+ minutes of physical activity	BMI	-.245	-.325	.015
REC trips per 5-day work week	Weight	-1.107	-.166	.225
REC trips per 5-day work week	BMI	-.102	-.086	.01

p<.05 means significant

In terms of sedentary behavior, for females who ate lunchmeats daily, there was a positive relationship between BMI difference and sedentary behavior on a weekday (p=.021), but this relationship did not hold true for weight difference (p=.063). However, there was a significant relationship for weight and BMI difference and hours of sedentary behavior in a weekday when a female ate lunchmeats at least every week or few weeks (weight difference: p= .015; BMI difference: p= .021). Meanwhile, on a weekend day for males who ate lunchmeats on most days there was a negative relationship between sedentary activity and BMI (p=.049). Meanwhile for females who ate lunchmeats daily, there was no relationship between sedentary behavior on a weekend day and BMI difference (p=.091). However, for females who ate lunchmeats 2-

3 days a week, there were clear significant positive relationships between sedentary behavior and BMI difference (p=.016) and sedentary behavior and weight difference (p=.007).

This shows that if females ate lunchmeats moderately (2-6 days a week), they decreased in BMI if they engaged in physical activity or exercise. Also, females increased their BMI or weight if they ate lunchmeat and partook in more sedentary behavior. There is a strange occurrence for males that needs to be looked at in which males who ate lunchmeats on most days lost weight with more sedentary behavior. However, no other relationship between BMI and sedentary behavior was found for males consuming lunchmeats.

Fish

Because fish can have a beneficial health effect because of omega-3 fatty acids, it was hypothesized that eating fish instead of meats can lead to weight loss. Most of the subjects, whether they be male or female, had fish seasonally (0-1 day a week) or rarely (see table 23 or 24). There was no significant relationship found between eating fish and categorical weight loss or eating fish and BMI. When BMI's were separated into the four categorical groups, there was no significant difference in fish consumption among the four different groups for either males or females.

Gender was then used as a control variable. There was significant relationship between eating fish and numerical weight difference in females (p=.045) (see table 23). The two females who ate fish on most days did lose weight, and thirteen females who did eat fish on most days actually gained an average nine pounds. Also, females who ate fish seasonally gained on average .4 pounds less than those who rarely ate fish (see table 23). In other words, the women who ate fish more often when they ate seasonally (0-1 day a week) gained less weight than those who rarely ate fish. The statistics say there is a clear difference in weight levels among the consumption categories, but more data needs to be gathered in order to have a better idea of what relationship exists between fish consumption and change. One thing surprising was that there was no relationship found between BMI difference and fish consumption (see table 24). When females who ate fish 4-6 days a week, 2-3 days a week, and 0-1 day a week were combined, there was no relationship found between those who ate fish at least once a week (0-7 days a week) and those who rarely ate fish ($p=.088$). More studies of female consumption of fish are recommended to further understand the relationship between fish consumption and weight loss. There was no significant difference between fish consumption and the 4 different BMI categories ($p=.51$).

Table 23 - Fish Consumption and weight change in pounds.

	Times meat eaten	**N (%)**	**Mean (SD)**	**95% CI-Lower Bound**	**95% CI Upper Bound**	**Min**	**Max**
Males	Males- Daily (7 days a week)	1 (1.8)	-5 (N/A)	-	-	-5	-5
	Most days (4-6 days a week)	9 (15.8)	4.89 (6.43)	-.055	9.83	-1	20
	More than a week (2-3 days a week)	5 (8.8)	-1.4 (7.16)	-10.29	7.49	-10	5
	At times or seasonally (0-1 days a week)	28 (49.1)	.17 (13.97)	-5.24	5.6	-50	20
	Rarely or no (very few times a semester)	14 (24.6)	-5.36 (11.85)	-12.2	1.48	-30	7
Females	Females- Most days	2 (1.3)	-2.5 (3.53)	-34.27	29.27	-5	0
	More than a week	13 (8.6)	9.15 (13.29)	1.12	17.19	-13	40
	At times or seasonally	69 (45.4)	2.23 (8.05)	.3	4.17	-20	26
	Rarely or not at all	68 (44.7)	2.66 (7.94)	.74	4.58	-20	25

N/A- not available. Statistical data on the frequency of meat intake and its effects on weight difference. For mean, 95% CI, Min and Max, a positive number indicates weight increase but a negative number indicates weight decrease

Table 24 - Fish Consumption and BMI change.

	Times meat eaten	**N (%)**	**Mean (SD)**	**95% CI- Lower Bound**	**95% CI Upper Bound**	**Min**	**Max**
Males	Males- Daily (7 days a week)	1 (1.8)	-1.47 (N/A)	-	-		
	Most days (4-6 days a week)	8 (14.3)	.3 (1)	-.54	1.13	-1.16	2.10
	More than a week (2-3 days a week)	5 (8.9)	-.07 (.82)	-1.09	.95	-1.12	.70
	At times or seasonally (0-1 days a week)	28 (50)	-.19 (1.99)	-.96	.58	-6.78	3.73
	Rarely or no (very few times a semester)	14 (26.8)	-.97 (1.69)	-1.95	.0022	-4.70	.72
Females	Most days	2 (1.3)	-.39 (.55)	-5.37	4.58	-.78	.00
	More than a week	13 (8.6)	1.49 (2.42)	.03	2.96	-1.98	7.32
	At times or seasonally	69 (45.7)	.25 (1.53)	-.12	.62	-3.76	5.21
	Rarely or not at all	67 (44.4)	.35 (1.39)	.01	.69	-3.43	3.78

N/A- not available. Statistical data on the frequency of meat intake and its effects on BMI difference. For mean, 95% CI, Min and Max, a positive number indicates BMI increase but a negative number indicates BMI decrease

Gender and fish consumption were then used together as control variables in order to see how physical activity or exercise affected weight or BMI for a specific gender and consumption level. Both males and females had physical activity tested with weight or BMI difference to determine significance. There were insufficient cases of males or females who ate fish on most days or daily to allow us to examine the physical activity along with either weigh tor BMI difference, for the males and females. For males, there was no significant relationship between physical activities and either weight or BMI difference no matter how much fish was consumed.

However, data from females tell a different story. See tables 25 & 26 for details between days of 30+ minutes of physical activity (or REC trips) and weight or BMI difference for those who eat fish either more than once a week or seasonally. Data was inconsistent for those females who ate fish more than once a week, but for those females who ate fish 0-1 day a week, it appears that days of 30+ minutes of physical activity was more predictive of what weight or BMI would be. When all of the fish consumption categories were combined (0-7 days a week), there was a significant relationship between weight difference and physical activity (p=.004). The more days of physical activity, the more likely weight or BMI would be decreased.

Controlling for levels of fish consumption and REC trips, no relationship was found between physical activity and weight change or BMI change. For males, there was no relationship between weight difference and REC trips for those who ate fish on most days. However, since the p-value is between .05 and .1 (per weekday: p=.099; per week: p=.095), there should be more studies on the effect fish consumption and physical activities have on weight gain or loss. There were conflicting results between REC trips and weight difference for females who ate fish 2-3 days a week. For females, see table 26 to see the details of the relationship between days of physical activity and weight (or BMI) difference. However for females who either rarely ate or did not eat fish, there was a significant relationship between REC trips per week and weight difference in that increased trips to the REC led to increased weight loss (p=.013) with the same also being true for BMI (p=006). In terms of sedentary behavior, there was no significance found for any fish consumption level for either males or females. It appeared that it was easier to find weight loss or a decrease in BMI for those who took part in physical activity and ate fish either on average of at most once a week.

Table 25 - Females who eat fish more than once a week (2-3 times a week). Physical activity along with trips to the REC were measured with both weight difference and BMI difference. Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity (or trips to the REC) and weight (or BMI) difference. Negative beta values indicate a decrease in weight with an increase in physical activity.

	Weight or BMI difference	**Unstandardized B-value**	**Standardized Beta**	**P-value**
Weekdays of 30+ minutes of physical activity	Weight	-5.201	-.609	.027
Weekdays of 30+ minutes of physical activity	BMI	-.825	-.531	.062
Days/week of 30+ minutes of physical activity	Weight	-3.792	-.544	.054
Days/week of 30+ minutes of physical activity	BMI	-.583	-.460	.114
REC trips per week	Weight	-3.769	-.59	.034
REC trips per week	BMI	-.519	-.446	.126

p<.05 means significant

Table 26: Females who ate fish at times or seasonally (0-1 times a week). Physical activity was measured with both weight difference and BMI difference. Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity and weight (or BMI) difference. Negative beta values indicate a decrease in weight with an increase in physical activity.

	Weight or BMI difference	**Unstandardized B-value**	**Standardized Beta**	**P-value**
Weekdays of 30+ minutes of physical activity	Weight	-1.608	-.303	.011
Weekdays of 30+ minutes of physical activity	BMI	-.367	-.364	.002
Days/week of 30+ minutes of physical activity	Weight	-1.214	-.294	.015
Days/week of 30+ minutes of physical activity	BMI	-.286	-.365	.002

p<.05 means significant

Substituting meat with other proteins

Meat consumption was treated as an independent variable while fish was introduced as a dependent variable in order to see if meat and fish were competing with each other. However, there was no clear significance between eating meat and eating fish (p=.86). Gender was then introduced as a control variable. Those who ate chicken, beef, or pork were less likely to eat fish and vice versa. In terms of eating chicken, beef, or pork as opposed to eating tofu, there was a significant relationship for all subjects (males and females) and for females only (p<.001) (see table 27). Looking at table 28, it appears that females will likely choose between eating meats (such as chicken, beef, or pork) or eating tofu, along with choosing between eating meats (such as chicken, beef, or pork) or eating lunchmeat.

Table 27: eating other foods instead of meat. Testing to see if eating the above foods would mean eating less meat instead.

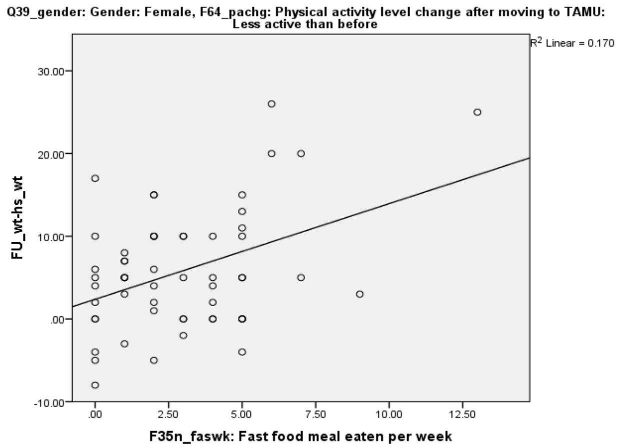
Meat vs.	Gender	P-value
Fish	Male	.935
Fish	Female	.053
Tofu	Male	.098
Tofu	Female	<.001
Lunchmeat	Male	.725
Lunchmeat	Female	.003

p<.05 means significant

Fast food

The number of times a person ate at a fast food place per week was tested with weight change. There was no relationship found between eating fast food and weight gain. Further, there was no relationship was found between eating fast food in a week and BMI difference, weight gain, weight change, or BMI. There was also no relationship between fast food and any of the BMI categories. Also, when gender was used as a control variable, there still was no relationship found between fast food consumption in a week and any of the weight or BMI categories.

However, another hypothesis test was done using physical activity levels as a control variable. For those who were less physically active in college than they were in high school, frequency of fast food consumption in a week was predictive of weight gain in just women (p=.001) (see figure 9) but not men (p=.778). The same is true for BMI (see figure 9). On the other hand, there was no relationship for both men and women between fast food and weight difference for those who maintained the same physical activity levels or became more physically active. Fast food was more predictive of weight and BMI if the female had less physical activity than before.



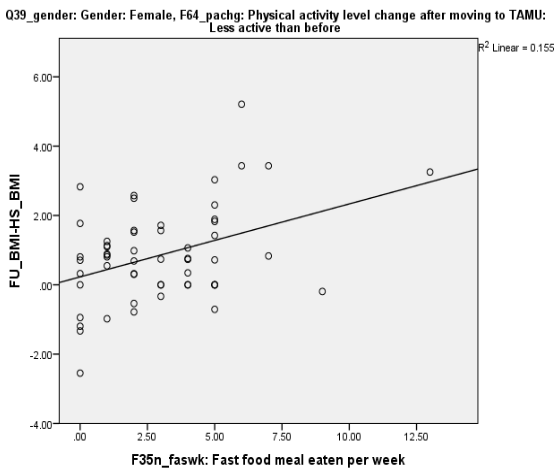


Figure 9- Effects of fast food on those who have less physical activity. On the left- weight difference vs. fast food eaten per week for those who reported being less physical active. On the right- BMI difference vs. fast food eaten per week for those who reported being less active. Positive slope indicates BMI increase while negative slope indicates BMI decrease.

Breakfast foods

The amount of times a person eats cereal was tested with weight change and other relevant variables. In terms of self-reported weight loss, weight gain, or weight change, no significance was found.

Then gender was used as a third control variable. There was no significant relationship between eating cereal and numerical BMI difference or weight difference in either males or females. There was a clear significant relationship between BMI Categories and levels of cereal consumption (p=.019). In fact, the data shows that obese were less likely to eat cereal than those who were normal or underweight. However, there was no relationship for the BMI categories in males (p=.453) or females (p=.194).

Pastries

Donuts were put into a category with pastries along with cakes and pies. In terms of different BMI categories, there was a clear significant relationship between such categories and pastry consumption (p=.038). In fact, it appears that those who ate pastries more frequently were either obese or overweight.

Gender was used as a third control variable. More than half of the males and more than half of the females either had pastries either seasonally or rarely (see table 28). There was a significant relationship between numerical weight difference for females and pastry consumption (p=.045). Although most ate pastries on average of 0-1 days a week, those who do eat pastries more than once a week gain on average more weight. However, only a dozen people said that they eat pastries daily and gain the least amount of weight on average than those who eat pastries less often. There was no relationship between pastries consumption and BMI difference for either males (p=.663) or females (p=.129). In order to see the average weight gain for both males and females based on how often pastries were consumed, please see table 28 and figure 10. When pastry consumption was examined with BMI categories with gender being a third control variable, no such relationship could be found when the data was split between males (p=.145) and females (p=.193).

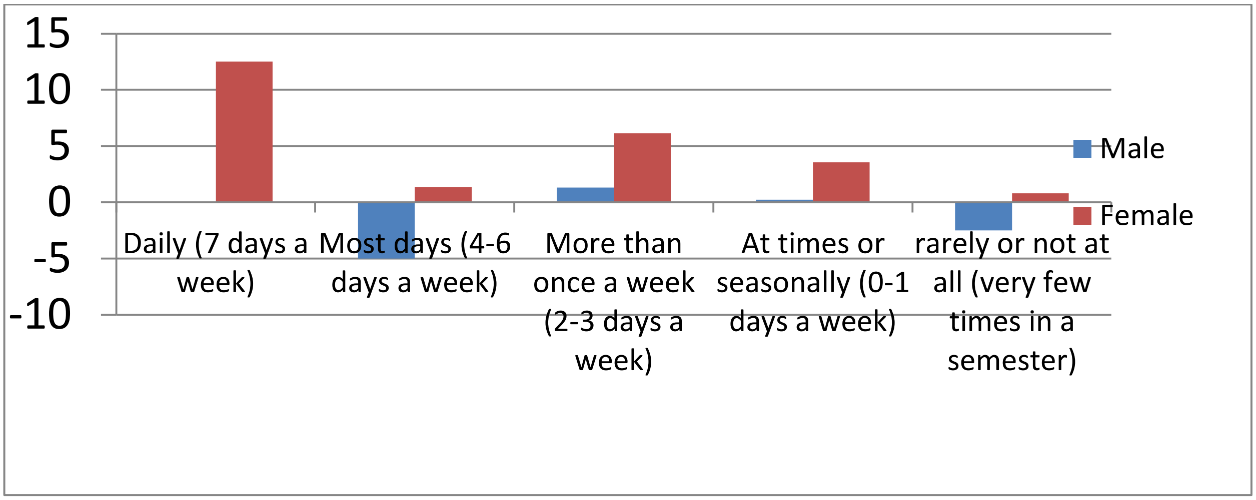


Figure 10- Weight difference vs pastry consumption. Average weight (in pounds) on the y-axis and frequency of pastries consumption on the x-axis

Table 28: Pastries consumption and weight gain in pounds.

	Times meat eaten	N (%)	Mean (SD)	95% CI- Lower Bound	95% CI Upper Bound	Min	Max
Males	Most days (4-6 days a week)	1 (1.8)	-5 (N/A)	-	-	-5	-5
	More than once a week (2-3 days a week)	13 (22.8)	1.31 (13)	-6.55	9.17	-20	20
	At times or seasonally (0-1 days a week)	21 (36.8)	.24 (6.76)	-2.84	3.32	-15	14
	Rarely or never (few times a semester)	22 (38.6)	-2.5 (15.67)	-9.45	4.45	-50	20
Females	Daily (7 days a week)	2 (1.3)	12.5 (3.53)	-19.27	44.27	10	15
	Most days	11 (7.2)	1.36 (8.04)	-4.04	6.77	-7	20
	More than once a week	24 (15.8)	6.13 (7.48)	2.97	9.28	-3	20
	At times or seasonally	61 (40.1)	3.57 (9.65)	1.10	6.05	-20	40
	Rarely or never	54 (35.5)	.81 (7.66)	-1.28	2.91	-20	15

N/A- Not available. Statistical data on the frequency of meat intake and its effects on weight difference. For mean, 95% CI, Min and Max, a positive number indicates weight increase but a negative number indicates weight decrease

Gender and pastry consumption were then both used as control variables in order to see how physical activity or exercise affected weight or BMI for a consumption level for each gender. There was not a lot of data from males or females who ate pastries daily or on most days to get an idea if physical activity would lead to a decrease in weight or BMI. It was because of this that the categories of “daily”, “most days”, and “more than once a week” were combined to give us 37 female subjects. However, there would still be no significance between physical activity and weight difference for this subgroup (p=.081). For females who ate pastries 2-3 days a week there was a significant relationship between physical activity per week and weight difference (see table 29). Also, no relationship existed for going to the REC and either weight or BMI difference for those who eat pastries 2-3 days a week, but when 2-3 days a week along with the two more frequent categories were combined, there was a relationship between REC trips for exercise and weight difference for those who ate pastries two or more days a week (p=.038).

Table 29: Females who ate pastries "more than once a week" (2-3 days a week). Physical activity was measured with both weight difference and BMI difference. Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity and weight (or BMI) difference. Negative beta values indicate a decrease in weight with an increase in physical activity.

	Weight or BMI difference	**Unstandardized B-value**	**Standardized Beta**	**P-value**
Weekdays of 30+ minutes of physical activity	Weight	-2.341	-.431	.035
Weekdays of 30+ minutes of physical activity	BMI	-.407	-.375	.071
Days/week of 30+ minutes of physical activity	Weight	-1.835	-.42	.046
Days/week of 30+ minutes of physical activity	BMI	-.34	-.389	.066

p<.05 means significant

Physical activity was predictive of what weight or BMI would be for females that ate pastries on average of 0-1 days a week (at times or seasonally). See table 30 and figure 11 to see the details of the relationship between physical activity and weight (or BMI). The more trips to the REC for exercise, the more BMI will decrease. It appeared that even though females were consuming pastries, they had an easier time losing weight or going down in BMI if they took part in physical activity. However, it appeared that physical activity is more predictive of weight difference than pastries consumption since the R-square value for physical activity per week is .067 while the R-square value for pastries consumption is about .029. Both values are small, but the one for physical activity is larger than the one for pastries. Also, when pastries consumption and physical activity were run in the same analysis, days of 30+ minutes of physical activity was still significant for weight loss (p=.003) while pastry consumption was no longer significant at this point (p=.086). Even with pastry consumption, physical activity appeared to be the larger factor in weight difference.

Table 30: Females who ate pastries “at times or seasonally”. Physical activity along with trips to the REC were measured with both weight difference and BMI difference. Beta values indicate the extent of the change in weight if there was a significant relationship between days of 30+ minutes of physical activity (or trips to the REC) and weight (or BMI) difference. Negative beta values indicate a decrease in weight with an increase in physical activity.

	Weight or BMI difference	Unstandardized B-value	Standardized Beta	P-value
Weekdays of 30+ minutes of physical activity	Weight	-1.856	-.312	.014
Weekdays of 30+ minutes of physical activity	BMI	-.414	-.372	.003
Days/week of 30+ minutes of physical activity	Weight	-1.289	-.267	.038
Days/week of 30+ minutes of physical activity	BMI	-.286	-.317	.014
REC trips per 5-day work week	Weight	-1.309	-.203	.116
REC trips per 5-day work week	BMI	-.306	-.243	.061
REC trips per week	Weight	-1.201	-.247	.055
REC trips per week	BMI	-.251	-.269	.038

p<.05 means significant

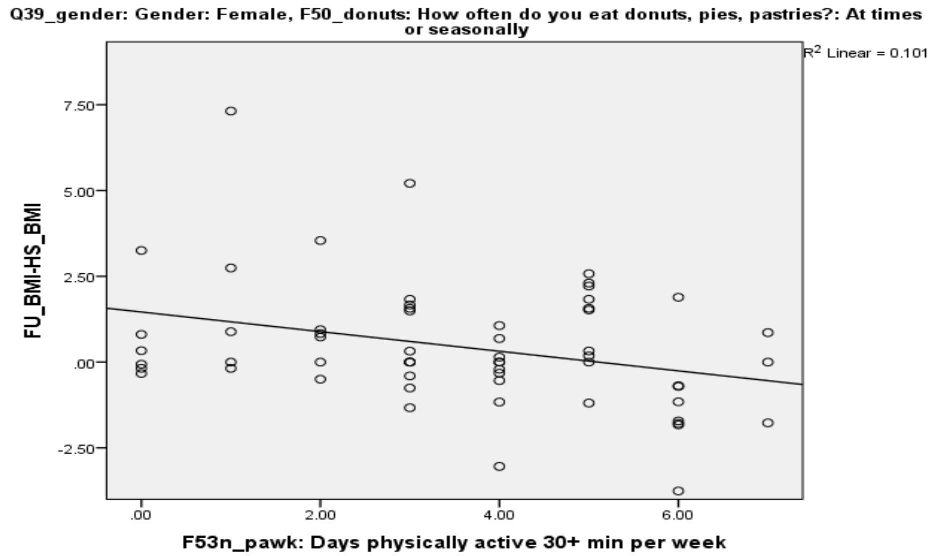


Figure 11- Physical activity and less frequent pastry consumption effect on BMI. Relationship between days of 30+ minutes of physical activity and BMI change for those who eat pastries “at times or seasonally”. Positive BMI indicates BMI increase while negative BMI indicates BMI decrease.

Junk Food

Residents responded to junk food based on how much they eat regular (non low fat) chips or vending machine snacks in a given week and 5-day workweek. No evidence was found between amount of vending machine snacks consumed per 5-day workweek or week and either weight or BMI change.

Then gender was introduced as a third control variable. The only evidence of junk food consumption occurred with amount of chips eaten in a typical 5-day workweek and weight change for women only ($p=.022$). In fact, the more junk food consumed the more weight to be gained. However, the weight gain appears to be small (β-value of .88). Another test was run with both junk food consumption in a weekday and physical activity per 5-day work week in order to see which would have a larger effect. Having 30+ minutes of physical activity in 5-day work week appears to have a larger effect on weight difference than junk food consumption for women since the β-value for physical activity was -.268 whereas the β-value for junk food consumption is .155.

Those who consumed junk food were also separated into three separate groups based on physical activity levels: those who had more in college than in high school, those who had the same, and those who had less. For males, there was no significance for males eating junk food or vending machine snacks no matter if they had more or less physical activity when they arrived at Texas A&M. However, for females, there was only significance for those who ate chips and weight difference if that person got more physical activity in college than in high school ($p=.049$). For those who were more active than before, the more they ate chips in a day, the more likely they were going to gain weight. For junk food, the only thing of significance worth reporting is that females who eat more junk food in a day are more likely to gain weight. This can also be true for those who exercise more than before.

Eating more in general

Data was collected if students were more active in eating in college than in high school. Most ate the same as before they arrived at Texas A&M, but those who ate more than before were more likely to gain weight where as those who ate less than before were not likely to gain significant weight (see table 31 and figure 12). There was a significant relationship in both males and females when it came to if how much they ate in college as opposed to high school and weight difference. For females, there was a significant relationship difference in both weight and BMI between those who ate more in college than in high school as opposed to those who ate less (weight: p=.003; BMI: p=.001). For males, there was a significant relationship in weight for those who ate either more or the same in college as opposed to those who ate less (p=.012).

Table 31- Diet behavior and weight. A chart showing those who ate more than before arriving at Texas A&M, same as before, and more than before and data related to weight gain or weight loss. For mean, CI, min, and max, positive number indicates weight gain while negative number indicates weight loss.

	Diet behavior	N (%)	Mean (SD)	95% CI- Lower Bound	95% CI Upper Bound	Min	Max
Male	More active than before	16 (28.1)	2.63 (8.41)	-1.86	7.11	-20.00	17.00
	About the same as before	20 (35.1)	3.15 (9.33)	-1.22	7.52	-20.00	20.00
	Less active than before	21 (36.8)	-6.81 (14.64)	-13.47	-.15	-50.00	20.00
Female	More active than before	35 (23)	6.83 (8.42)	3.93	9.72	-20.00	26.00
	About the same as before	72 (47.4)	2.69 (8.63)	.67	4.72	-13.00	40.00
	Less active than before	45 (29.6)	.36 (8.02)	-2.05	2.76	-20.00	20.00

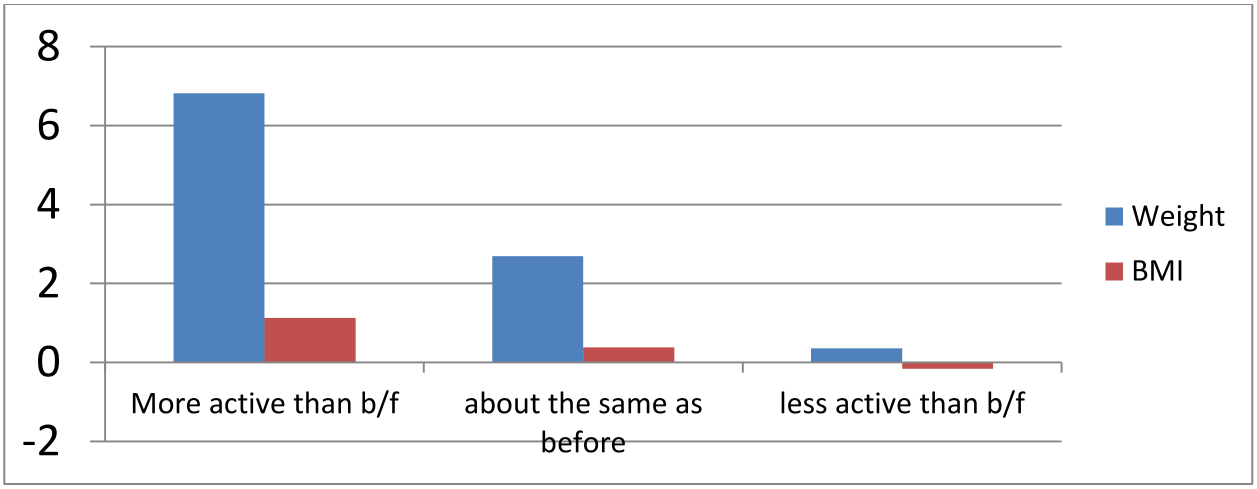


Figure 12 – Eating behavior vs weight (& BMI) for females only. Weight is in pounds. Those who ate more in college than before arriving were more likely to gain the most in terms of weight.

However, for each subset (those who were more active in eating, same as before, or less active), a separate significant test was run to see if physical activity played a role in predicting weight. It was found that physical activity was more predictive of weight gain for those who ate less than before for females only (p=.004) (see figure 13). However, there was no relationship in females between weight and physical activity for those who ate more than before or same as before (see figure 14). For males, there was no relationship between eating more in college and weight gain, and there was no relationship between physical activity and weight for any subset (those who were more active in eating, same as before or less active).

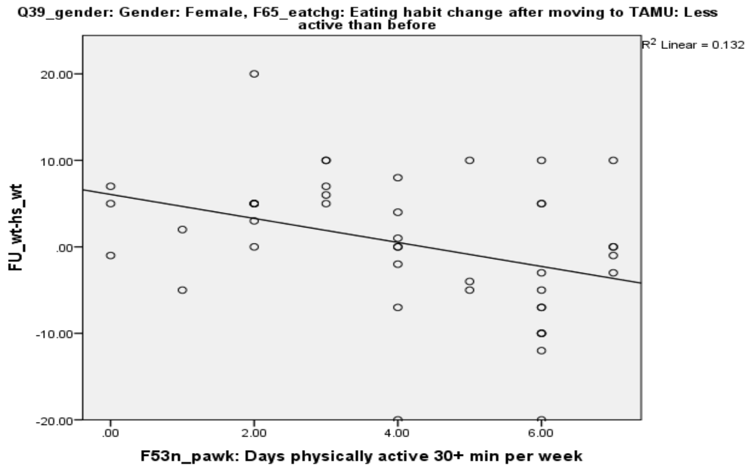


Figure 13- Physical activity and weight difference for those who eat less. For those who were less active than before, their physical activity vs weight difference in pounds. p=.014. Downward slope indicates weight decreases with more days of 30+ minutes of physical activity

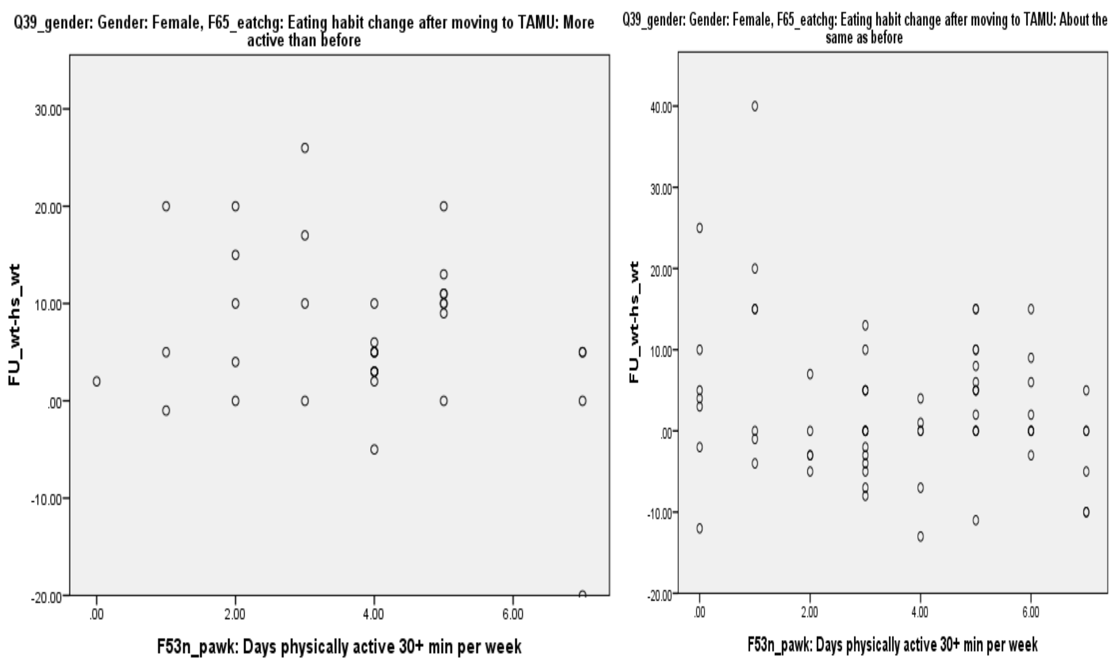


Figure 14- Effects of physical activity and eating levels on females. For females only, more than before (to the left) and same as before (to the right). No relationship was found between physical activity and weight for those who ate more than before or the same as before.

Why they eat what they eat

There were several yes-or-no questions about why a person chose a specific dining facility that they used although there were no indications as to what particular facility they chose. One specific question was did they chose the facility because of healthy choices. No one stated yes to this question, everyone either did not respond or answered no. Most chose a dining facility based on either fast service or close distance. As a matter of fact, there appeared to be a relationship between fast service and close distance in that most people chose both as reasons for choosing the dining facility that they chose ($p < .01$). Most also chose to eat at a dining facility based on close distance whether or not there was fast service.

Locations

The northside of Texas A&M campus is well known for Sbisa Dining Center which offers buffet style dining. In fact, the biggest difference between northside dining and southside dining is how northside has Sbisa Dining Center. In terms of location on campus (northside vs. southside), there was a significant relationship between going to Sbisa at least once a week and location on campus for both males ($p=.02$) and females ($p<.001$). The data shows that those who live on northside are more likely than those who live on southside to go to Sbisa dining center for the buffet style dining. However, there was no significant numerical weight changes for males ($p=.705$) or females ($p=.464$) for living side of the campus. Also, since northside is home to Sbisa dining center, it can be hypothesized that they would overeat in meat, but no evidence has indicated that in both males ($p=.308$) and females ($p=.771$). There was also no significant numerical BMI differences for males (p=.667) or females (p=.92) for living side of the campus. Further, there were no significant differences between the BMI categories and residential side for either males (p=.343) or females (p=.213).

CHAPTER V

DISCUSSIONS

Physical Activity and Inactivity

Physical activity and exercise

Physical activity did play a role in both weight loss and a decrease of BMI, especially in females. More specifically, those females who went to the rec center for exercise more often are more likely to lose weight or have a lower BMI than those who rarely go or don't go. Physical activity defined all exercise and physical behavior that lasted more than 30+ minutes no matter how organized or intense the workout was. Physical activity can include exercise at the REC and other activities not taking place at the REC (club sports, jogging on campus, and dancing). Trips to the REC for 30+ minutes of exercise was also used since trips to the REC entailed more organized forms of training. One thing that was found was that there was no relationship between BMI and physical activity, but there was a relationship (negative) between physical activity and BMI difference. BMI difference is probably the more important statistic to look since not only does it look at what their BMI was at the time that they filled out the survey, but it also looked at the BMI that they input from their last year in high school. Those who were physically inactive and/or overate are going to increase the most in BMI from high school up through their first year of college. BMI alone will not predict although it may in some scenarios. Females appear to have lower BMI or more weight loss than males mainly because males have to account for a larger muscle mass than females. The numerical weight difference confirmed the findings of the categorical weight loss in females in that increased physical activity will likely lead to weight loss.

Other important impacts of physical activity

Physical activity does not just prevent obesity, but also prevents weak bones. Other than building up muscles, physical activity also has the ability to build up bones and joints (51). Strengthening of these bones can help prevent osteoporosis. As a matter of fact, fat mass is negatively correlated with bone mass (52). The more fat there is, the less bone there is. Those who are obese will have less bone mass because of the increased fat storage.

Sedentary behavior

Sedentary behavior also appears to have an influence on weight and BMI. Females are more likely to gain weight or BMI when it comes to increased sedentary behavior but only on weekends. Meanwhile, males have an unusual relationship with sedentary behavior and BMI. According to the data, the more males spend engaging in sedentary behavior, the lower the BMI there is. However, this was for just BMI and not BMI change. Males and females differ in this aspect in that females spend more of their sedentary behavior socializing while males spend more of their sedentary behavior playing video games or using technology (49). Something worth noting was that there was a positive relationship found between days of 30+ minutes of physical activity and hours of sedentary activity. This could also mean that even with increased days of 30+ minutes of physical activity, students can still find time for more sedentary activity in a week. This can help explain that those with lower BMI who had high sedentary behavior also had more days of 30+ minutes of physical activity. This was likely the most unusual finding of this study.

Another aspect of sedentary behavior worth noting is that females were more likely to gain weight or BMI with more hours of sedentary behavior but only on weekends (as opposed to weekdays). This means that on weekends, females are doing something different from weekdays. Since there is more walking around to and from class and around the campus, it is likely that females are getting more physical activity as opposed to weekends in which they usually take it easy and relax instead of going out. Future studies need to take into consideration the different types of sedentary behavior such as socializing, playing video games, watching TV, using the computer, driving a car and studying. In fact, it has been recommended that people spend less time in front of a TV or computer screen and more time in physical activity (53).

Effectiveness of Food Frequency Questionnaires

Food Frequency questionnaires were used to gain data on how often food was consumed in a day. Even though there is a question of reliability, they have had a history of being used. For example, an FFQ was used to show that less than one serving of chocolate intake could prevent heart failure (54). Also, FFQ's in the past have been able to predict obesity based on daily consumption (55). The CEDA FFQ was good enough to give us a general idea of dietary behavior. It also provides future studies something to focus on.

Past FFQ's have linked frequency of meat consumption to obesity (56). However, CEDA data has shown that diet appears to have little effect on self-reported weight loss or weight gain. Eating meat appears to have an effect on only males. Females on the other hand, who do not eat chicken, beef, or pork, are likely to substitute such meat with either lunchmeat or tofu. It was unknown how much meat was consumed, but it was known that meat was consumed. One issue that people could have with this food frequency questionnaire is that no serving size was indicated for any of the foods except fruits and vegetables. Available data suggests that questions pertaining to serving sizes or portion sizes do not add more validity to the data (57). In fact, most of the variation actually occurs in frequency intake as opposed to portion size intake (57). Many large scale studies rely on just frequency of intake instead of trying to find serving or portion sizes (57). Not having serving size does not hurt the validity of the data that was gathered.

Diet and Their Interaction with Physical Activity

Meat

When numerical weight and BMI differences were examined, meat did have an effect on weight gain in males. Also, for males who ate meat on at least 4-6 days a week instead of daily or less than 4 days, there was a noticeable change in BMI for those who went to the REC to exercise more often per week. This means that exercise in males along with moderation of meat consumption can have at least a noticeable effect on BMI. The testing of the relationship between numerical weight difference and meat consumption confirmed the testing of the relationship between categorical weight gain and meat consumption in males. However, there may not have been enough data to find a significant relationship in males for physical activity and weight or BMI loss for any meat consumption levels. There was enough data that told us that males who ate meat on 4-6 days a week and went to the REC center for exercise were able to either decrease their BMI or minimize an increase in BMI. Physical activity can be good, but it was unknown from the data what kind of physical activity took place. More studies need to be done, but it can be recommended that males should moderate their meat intake and get some organized exercise when possible. Also, future studies should try to have more male respondents.

As noted before, there was a relationship between physical activity and weight (or BMI) difference for females who consumed meat 7 days a week or 4-6 days a week but no clear relationship for those who consumed meat less often even. Even when the other of the categories for those who ate meat less often was combined, there was still no significance within that large subpopulation between physical activity and weight loss. Even though this subgroup ate chicken, beef, or pork less often (<3 days a week), they also could have eaten more of other kinds of foods such as fried foods or junk foods. Future studies should try to find a larger number of females who eat meat less frequently in order to confirm these findings. Also, for females who ate meat daily or most days, there was a strong relationship between going to the REC per week and weight loss (or BMI loss) but not that strong a relationship for those going to the REC per 5-day work week and weight or BMI loss. The difference can be seen in that REC per week also considers trips to the REC in a weekend unlike REC per 5-day work week. However, for females, no matter how much meat was eaten, there would be weight loss as long as females engaged in physical activity or exercise.

Future studies should try to quantify how much meat was eaten. Males tend to eat more meat than females, so in the case of meat consumption, it would be important to figure out the portion sizes of what males are eating. Other studies that examined the effect of meat consumption looked at their effect on colorectal cancer by assuming daily meat consumption to be between 200-250 grams (58). However, because e-mail surveys were used in this study, it was hard to educate students as to what a serving of meat was unless an attachment was used. Another suggestion for future studies is to separate chicken, beef, or pork into different categories instead of grouping them as one. All three meats may be similar in terms of protein content, but differ in fat content. Also, certain meats such as red meats have been shown to have a higher effect on obesity than other meats (59). Further, obese people do not tend to eat a wide variety of meats that include red meats and lean meats or stick with eating beef or pork (60). Another suggestion is to separate fried meats from non-fried meats since there is a clear difference in fat content. However, understanding if one eats meat every day of the week or four to six days a week gives us a rough estimate as to how much is usually eaten.

Lunchmeats

Lunchmeats appear to only have an effect on weight gain only if there is little to no physical activity. Most people also reported lunchmeat consumption either at times seasonally or rarely unlike with chicken, beef, or pork consumption. Also, it appears that for some who ate lunchmeat on most days were likely to decrease in weight but not in BMI. One thing to consider is that BMI also takes height into consideration. Weight may be decreased for some people as long as they exercise, but it may not be enough to affect

BMI. One major difference between lunchmeat and other meats (chicken, beef, and pork) is there was a clear relationship between REC trips and weight loss for those females who ate chicken, beef, or pork (instead of lunchmeat) daily although most females ate the other meats instead of lunchmeats. However, when the top three frequencies were combined, there was a negative relationship between days of 30+ minutes of physical activity for those who ate lunchmeats 2-7 days a week. Most of the clear relationships for physical activity and weight or BMI difference occur for those who eat lunchmeat seasonally since most of the female population ate lunchmeat seasonally. As a matter of fact, more people ate lunchmeat seasonally than those who ate daily, most days, and more than a week combined. Looking at the combined categories that examines females who ate lunchmeats most frequently (ranging from 2-7 days a week) along with the individual frequency category of those who ate seasonally, it was possible that females can lose weight and decrease in BMI even with regularity of lunchmeat consumption if they get at least 30+ minutes of physical activity in. Future studies should find more males and females who eat lunchmeats more often than once a week.

Fish

Fish appears to have an effect on weight and BMI, but has a larger effect on weight although more studies need to be done in order to have a better grasp on if eating more fish can have a positive effect on weight or BMI. The fish consumption category makes no difference between fish such as salmon or fried fish. There also needs to be more studies on how physical activity and exercise interact with fish consumption to affect weight and BMI. This is especially true in males where the data seems to show that increased physical activity led to increased BMI in certain groups of fish consumption. However, increased weight or BMI in males could be caused by increased muscle mass which may be affected by omega-3 fatty acids. Females who ate moderate amounts of fish stood a good chance to decrease their weight or BMI. However, with physical activity, females could decrease their weight and BMI as long as they had fish at least once a week. However, one thing that appeared to be clear is that physical activities in general would have a larger effect on weight or BMI loss in females than fish consumption.

Fast food

One surprise from analyzing the data was that there was no clear relationship between fast food and weight or BMI gain. It appeared that physical activity and exercise had a larger effect on weight or BMI difference than fast food intake. However, other studies using food frequency questionnaires do confirm that there is a relationship between fast food and obesity (61). When another test was done to look at the subset of those who exercised more in college than in high school, it was found that those who exercised less in college than in high school were more likely to gain weight with increased fast food consumption. This means that for those who decreased their physical activity levels, diet was going to play a larger role in predicting what weight or BMI would be. However, if the subjects increased their physical activity levels in college, than fast food did not have a large role in predicting weight or BMI. It may be worthwhile future studies to look at the servings of fast food eaten since having a Big Mac is different than having a quarter-pounder.

Pastries

Females also are more likely to gain weight by eating pastries which can include donuts, cakes, and other deserts. However, clear evidence does show that if females eat pastries moderately and get enough physical activity, then they can still lose weight. One possibility of why those who ate pastries 0-1 days a week as opposed to more frequently lose weight with more physical activity is because there were about 60+ females who ate pastries “at times or seasonally” so there was more data to test with as opposed to the other categories. When the three top frequency categories were combined (daily, most days, and more than once a week), those who ate pastries at least two days a week lose weight with more trips to the REC for exercise, but not with increased days of 30+ minutes of physical activity. As stated before, trips to the REC center includes more organized and structured workouts. However, for those who ate pastries once a day (or less) there was no relationship between REC trips for exercise and weight. It is also possible to say that those who took part in physical activity outside of the REC center (club sports or dance) avoided consuming pastry snacks more frequently in order to not adversely affect their performances. The data appears to support that when females ate pastries, they should take part in any physical activity, however, for those who ate at least twice a week, they should have some sort of structured work out regiment.

One strange finding was when females consumed pastries and that did not have an effect on BMI even though it did with weight. However, pastries may still have a role in affecting BMI since those who were overweight or obese consumed pastries more often than those who were of normal body weight or underweight. However, it is possible to say that those who consumed more pastries also had less physical activity. Another point worth noting is that those who eat pastries are not eating other healthier options. Although pastries play a role in increasing weight, physical activity plays a bigger role in decreasing it.

Cereal

In terms of cereal, there is no evidence to show that eating cereal could lead to a change in weight or BMI. However, this is evidence showing that those who are overweight and obese are less likely to eat cereal than those who are normal or underweight. This could mean that those who are not overweight ate cereal as opposed to something else such as donuts. Also, even though cereal does not cause weight change, it may help those who are normal weight to maintain their weight. Something to consider is that cereal is a breakfast food and it could be possible those who frequently ate breakfast got a higher intake of carbohydrates than saturated fats and this frequency of breakfast has been known to have a negative relationship with BMI (62). This may be why eating cereal is more likely done by those at normal weight than overweight.

Junk foods

Junk food also appeared to only affect weight gain in females but only in the way of how much per weekday. It is probably easier to find a relationship for eating regular chips in a day vs. weight difference since there is not too much variation of regular chips eaten in a day while there is a larger variation of chips eaten in a week. One thing that appeared to be surprising is that those who had more physical activity in college than in high school were more likely to increase in weight with increased consumption of chips in a day. They ate more than they could burn off. However, one limit to this study was that there was no indication of what the serving size of the chips was. Also there appeared to be no relationship between vending machine snacks and weight or BMI gain since vending machine snacks can include crackers and pop tarts as opposed to chips and popcorn. Just like with the other foods, there was no relationship found between junk food consumption and weight difference in males.

Summary of Interaction Between Diet and Physical Activity

With more physical activity in college than in high school, the data shows that there is a positive correlation between eating chips and weight in females. However, the data also shows that there is a positive correlation between eating fast food and weight for those who had less physical activity in college than in high school for females. One fact worth noting was that there was a large association among females for those who had less physical activity, between fast food and weight change ($p=.001$) and the beta value was also larger ($\beta=.412$) as opposed to the relationship between eating chips and weight in females who had increased their physical activity levels in college ($\beta=.244$). It can still be said with confidence that for those who had less exercise, diet will play a larger factor in weight gain.

We also see that with numerous food categories, those who ate moderately or less frequently were more likely to have physical activity be predictive of their weight. With other food categories such as chicken, beef or pork or pastries, physical activity can be predictive of what their weight or BMI would be. Physical activity played a large role in negating the effects of fat and simple sugars from a diet on weight, but does not necessarily mean it is the deciding factor.

Dining Facilities

It is not surprising that people will choose a dining facility based on distance. It is natural for people to shop or dine in a nearby area. Location does play a role in where students eat. Students usually eat at dining facilities that are close by. If colleges want to decrease eating of unhealthy foods, they can try to offer healthy alternatives. For example, at the buffet type dining facility, they can offer non-fried fish along with other meats. They can offer fruits instead of donuts or pies. Even though location plays a role in where students eat, location does not mean that students who live closer to buffet type dining facilities will gain more in weight or BMI as opposed to those who live farther.

The Differences Between Males and Females

Through most of this study, diet, physical activity, exercise, and/sedentary behavior appeared to have more of an effect on females than in males. One explanation for this is that males tend to have more fat buildup in muscles and that fat buildup in muscles can also account for weight. Males may increase in weight, but that does not mean it is a result of not engaging in physical activity or exercising. Females tend to store fat in a different part of the body which is more likely to be burned when they engage in physical activity or exercise. As a matter of fact, females store fat in the gluteal-femoral region which is in the lower part of the body while males store fat in the upper abdominal region (63). Further, other studies seem to show that during exercise, females tend to oxidize more fat than males (63). This is especially true in lean body mass where fat oxidation is higher in females than in males (64). This means that females tend to burn more fat than males when they exercise which may help explain why hypothesis tests show that females are more likely to lose weight or decrease in BMI when they take part in physical activity. Also, males tend to have a higher glucose oxidation rate than females during exercise (65). This means that instead of burning fat, males will burn available glucose.

In males, there is muscle mass which may account for the weight and so increased exercise may build up the muscle mass. The build-up in muscle mass does not mean weight gain that will lead to obesity. However, most people in the obese range will have increased levels of body fatness (66). Those who are obese are obese because of extra body fat instead of muscle mass. Further, another study points out that lack of physical activity for males was not related to metabolic syndrome in any BMI category, but lack of physical activity for females was associated with metabolic syndrome (67). Physical activity may have different effect on males and females. Lack of physical activity is more associated with obesity in women than in men which may explain why there is no clear relationship between physical activity and weight change in men. Future studies need to have researchers examine the body fat of the subjects since body fat would help determine if someone is obese or not.

Limitations and Suggestions for Future Studies

Another fact worth pointing out is that there were significantly more women involved in this study than men. Males probably made up about 30% of the respondents while females probably made up about 70% of the respondents. However, there were enough males to show significance for certain things such as the effects of eating more in college and meat consumption. Future studies would benefit from having a larger male population. However, this study was more representative of a diverse college population in terms of ethnic groups. The ethnic makeup of those who took the CEDA follow-up was similar to those who lived on campus, which was also similar to the ethnic makeup of students at Texas A&M.

Another suggestion for future studies is to ask questions to students about if they chose a specific facility, why did they choose that facility (healthiness, close distance, fast service). For example, did one eat at chick-fil-a because of its close distance? Also, there should be a question about how frequently they went to that facility? There is nothing written in this report about facilities and weight gain in that the question referred to if they ever used a specific facility (such as Sbisa Dining Center or Chick-fil-a) in a yes or no manner. Also, for foods, respondents need to be made aware about how much a serving of a particular food is if they answer questions pertaining to how many servings of a food they ate. Another suggestion worth making is that respondents should be asked what kind of exercise was done, more specifically, aerobic or anaerobic since both will differ in how much fat is burned.

Future studies should also look at more psychological aspects of nutrition and physical activity. What are the psychological motivating factors for eating or performing physical activity? Emotional and psychological stress can play a role in eating habits and propensity toward physical activity (68).

One limitation when getting more responses is that the e-mail survey could only be sent once. It may be more helpful to send the e-mail more than once to show the importance of the study. If the e-mail could not be sent more than once, then the survey should be advertised in the on-campus resident halls since all subjects were living on campus. An effort should be made to work with on campus student organizations to get subjects to respond to this survey.

How This Study Fits In?

Many previous studies have looked at the effects that dieting and physical activities have had on weight and BMI. This study was one of many, but does confirm the effects that chicken, beef, or pork can have on males. It also confirms the effects that some non-low fat junk foods and pastries can have on females. The study also confirms the effects that physical activity and exercise can have on weight or BMI in females only. Even though there are several studies dealing with freshman college students, their dietary behavior, their physical activity habits, and their weight, this one in particular also looked at which had the larger effect on weight and BMI: diet, physical activity, or sedentary behavior. In this study, it appeared that physical activity had the largest effect on weight and BMI. Further, this study also examines the interaction between physical activity and diet. It can be seen from this study that even though physical activity plays a large role in determining weight or BMI, physical activity alone does not lead to weight loss. This study is unique in that it shows that it takes a combination of diet moderation and physical activity.

Why is This Study Important?

This study gives us a general idea of what dietary issues that researchers and health educators should focus on. The study also gives us an idea of how physical activity can make up for poor dieting. Physical activity may be able to negate the negative effects of dieting, but it cannot negate all of the effects of dieting. There are many ways that these results can be used to educate others. In fact, one example is how dietary behaviors are being changed through focus on social, ethical, cultural, and environmental issues (69). It is also important that others are educated on what dietary and physical behaviors are necessary in order to maintain a healthy body.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

1. Physical activity and sedentary behavior.

Hypothesis: Physical activity will lead to lower weight and BMI. Sedentary behavior will lead to increased weight and BMI. Physical activity will have a larger effect on weight change

Conclusion: In conclusion, physical activity and more specifically exercise play a role in decreasing weight and BMI in women. Also, sedentary behavior may have a larger impact on weight and BMI than physical activity in women even though diet still plays a significant role in women. However, both sedentary behavior and physical activity can be predictors of weight or BMI gain in women. Physical activity may not have a role in decreasing weight or BMI in men, but more studies on this need to be done. Physical activity may help build muscle mass which can affect weight and especially BMI.

2. Dietary behavior

Hypothesis: Increased frequency of consumption of foods such as meat, lunchmeats, pastries, fast foods, and junk foods will increase weight and BMI

Conclusion: Consumption of meat is the only thing that has a significant effect on male weight and BMI gain. For females, frequencies of consuming fish, junk food, and pastries appear to have a significant effect on weight although for females, more studies need to be done as to how fish affects weight loss or weight gain. In general, eating more in college than in high school would also likely lead to higher weight gain.

3. Interaction of Dietary behavior and physical activity

Hypothesis: Physical activity and certain foods will both play a factor in weight and BMI change.

Conclusion: It appears that physical activity or inactivity plays a large role in weight loss or gain in numerous food consumption subgroups. For one thing, females were at risk of increasing weight if they consumed donuts, pies, and other pastries more often, but physical activity can still be predictive of what their weight is. Another thing worth concluding is that for females, fast food would most likely be predictive of weight for those who exercised less in college than in high school. However, physical activity could only be predictive for those whose eating behavior was described as less active than before.

Recommendations

Locations and speed of service of a dining facility also play a role in where students eat at. Healthy food choices played no role in where someone eats. Also, having buffet-type dining facility does not necessarily cause an increase in weight gain. However, when serving food at the buffet-type dining facilities, it could be helpful to have servers giving small portions of food at a time in order to make sure students do not over serve themselves and then end up trying to eat whatever they put onto their plate. Although colleges need to consider having healthier options at certain dining facilities, they also need to make sure areas for exercise and physical activity are easily accessible. Diet may play a role in change of weight or BMI, but physical activity plays a large role in change of weight or BMI.

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APPENDIX

CEDA: Respondents Profile (Non-Response Bias Check): FRESHMEN ONLY

Nov. 6, 2009; JHK

		TAMU (Fall 2008)		TAMU (Fall 2009)		Residence Hall (2008-2009)		Residence Hall (2009-2010)		CEDA: Baseline (Fall 2008)		CEDA: Follow-Up (Spring 2009)	
		Total Number	%	Total Number	%	Total Number	%	Total Number	%	Total Number	%	Total Number	%
Total Head Count		**8,093**	**100.0**	**8,071**	**100.0**	**5,365**	**100.0**	**5,343**	**100.0**	**356**	**100.0**	**179**	**100.0**
Housing	Off-Campus	2,728	33.7	2,728	33.8	0	0.0	0	0.0	0	0.0	0	0.0
	Dorm	5,365	66.3	5,343	66.2	5,365	100.0	5,343	100.0	356	100.0	179	100.0
Gender	Female	4,043	50.0	4,040	50.1	2,600	48.5	2,630	49.2	240	67.4	135	75.4
	Male	4,050	50.0	4,031	49.9	2,765	51.5	2,713	50.8	112	31.5	42	23.5
Ethnicity	White	5,918	73.1	5,758	71.3	3,810	71.0	3,711	69.5	268	75.3	137	76.5
	Black	304	3.8	308	3.8	208	3.9	219	4.1	6	1.7	4	2.2
	Hispanic	1,315	16.2	1,393	17.3	976	18.2	1,023	19.1	*62**	*17.4**	*26**	*14.5**
	Asian	413	5.1	501	6.2	289	5.4	330	6.2	21	5.9	13	7.3
	American Indian	45	0.6	49	0.6	32	0.6	31	0.6	2	0.6	0	0
	International	87	1.1	53	0.7	44	0.8	27	0.5	n/a	n/a	n/a	n/a
	Unknown/Other	11	0.1	9	0.1	6	0.1	2	0.0	59	16.6	25	14.0
Age	<18	66	0.8	72	0.9	44	0.8	51	1.0	3	0.8	3	1.7
	18-21	8,022	99.1	7,989	99.0	5,321	99.2	5,292	99.0	343	96.6	171	95.5
	22-25	3	0.0	7	0.1	1	0.0	0	0.0	0	0	0	0
	26-30	0	0.0	3	0.0	0	0.0	0	0.0	0	0	0	0
	31-39	1	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0
	40+	1	0.0	0	0.0	0	0.0	0	0.0	0	0	0	0
College	Agriculture	525	6.5	512	6.3	328	6.1	338	6.3	30	8.4	16	8.9
	Architecture	200	2.5	202	2.5	158	3.0	150	2.8	13	3.7	7	3.9
	Business Admin	810	10.0	794	9.8	568	10.6	530	9.9	36	10.1	17	9.5
	Education	422	5.2	485	6.0	284	5.3	319	6.0	20	5.6	12	6.7
	Engineering	1,817	22.5	1,765	21.9	1,487	27.7	1,405	26.3	96	27.0	45	25.1
	Geosciences	77	1.0	108	1.3	54	1.0	81	1.5	1	0.3	0	0
	Liberal Arts	745	9.2	700	8.7	537	10.0	529	9.9	41	11.5	21	11.7
	Sciences	723	8.9	752	9.3	534	10.0	577	10.8	24	6.7	13	7.3

	Veterinary Med	665	8.2	674	8.4	464	8.7	481	9.0	43	12.1	21	11.7
	General Studies	2,109	26.1	2,079	25.8	951	17.7	933	17.5	37	10.4	18	10.1
	Other – Special Populations	0	0.0	0	0.0	0	0.0	0	0.0	15(unknown)	4.2	9(unknown)	5.0
Semester Credit Hour (SCH)	< 6 SCH	586	7.2	577	7.1	30	0.6	38	0.7	n/a	n/a	0	0
	6-8 SCH	14	0.2	16	0.2	7	0.1	12	0.2	n/a	n/a	1	0.6
	9-11 SCH	28	0.3	39	0.5	11	0.2	28	0.5	n/a	n/a	4	2.3
	12-14 SCH	4,327	53.5	4,549	56.4	3,042	56.7	3,123	58.5	n/a	n/a	77	43.0
	15-17 SCH	3,123	38.6	2,865	35.5	2,264	42.2	2,122	39.7	n/a	n/a	81	45.3
	>17 SCH	15	0.2	25	0.3	11	0.2	20	0.4	n/a	n/a	13	7.3

* Not in the question asking ethnicity. Asked as a separated question