

GENDER AND THE DIFFERENCE IN SNACK CHOICES

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To the Dean of the Graduate School:

I am submitting herewith a thesis written by Jessica Burditt entitled "Gender and the Difference in Snack Choices". I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science with a major in Nutrition.

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## ABSTRACT

JESSICA BURDITT

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The purpose of this study was to investigate if there were differences in snack choices between males and females. Participants were recruited at local grocery stores during weekends. The participants included 284 females and 146 males aged 18 years or over. Shoppers were asked to participate in a study by completing a brief survey and then selecting a snack. The snack choices consisted of high energy dense foods or low energy dense foods. Snack choice and gender were recorded. The results were analyzed using the Chi-square test for significance at  $p < 0.05$ . The data showed that there was a significant relationship between gender and snack choice with a  $p$  value of  $p = 0.017$ . The data indicated that women chose the low energy dense snack more often than the men.



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## CHAPTER I

### INTRODUCTION

The obesity problem in this country is reaching an all time high. Research from the National Health and Nutrition Examination Survey (NHANES) conducted from 1999-2000 showed that 29.57% of participants were classified as obese (BMI >30), and the average BMI was 27.85 (Chou, Grossman, & Saffer, 2004). This means that on the average, the American population is overweight (BMI>25). This study solely used BMI as a measure of obesity. Other methods of obesity measurement include waist circumference and waist-to-hip ratio. A person would be considered obese for a man if the waist circumference is greater than 40 inches and for a woman if it is greater than 35 inches. A waist-to-hip ratio of greater than one would also classify a person as obese.

With an elevated BMI, above normal waist circumference, or a waist to hip ratio greater than 1.0, the risk of serious medical complications, such as type 2 diabetes mellitus, hyperlipidemia, hypertension, coronary heart disease, stroke, hypercholesterolemia, osteoporosis, arthritis, sleep apnea, and certain cancers, increases dramatically (Krause et al., 2001). Obesity is an independent risk factor for premature death. Increased mortality rates can be due to being obese or overweight. Individuals who are overweight or obese use more medical services than individuals who are not overweight or obese (Krause et al., 2001).

Several organizations have developed dietary recommendations for Americans to help guide their food choices to achieve optimal health and control or prevent obesity. The organization that provides comprehensive recommendations for all Americans is the United States Department of Agriculture (USDA). Other organizations that mirror the guidelines of the USDA are the American Heart Association (AHA), the American Diabetes Association (ADA), and the American Cancer Society (ACS). The guidelines set by the AHA are used to help individuals reduce their risk of cardiovascular disease (CVD) by the adoption of a healthy eating pattern. The AHA also describes lifestyle changes, such as participating in physical activity and not smoking that counteract the risk of death from CVD (Krauss et al., 2001). The AHA recommendations regarding food intake focus on inclusion of a variety of foods.

The USDA has recently published the new Dietary Guidelines for 2005 using the internet. Along with the new dietary guidelines, an updated food guide pyramid (FGP) was developed. At the website, users enter their age and activity level and receive an individualized FGP featuring the recommended number of servings in each food group that the person should consume daily. The nutritional advice the new FGP focuses on is consuming whole grains, fruits and vegetables, lean meats such as poultry and fish, and low-fat or fat free milk products. The advice presented in the pyramid describes recommendations for a diet that limits saturated fats, *trans* fats, cholesterol, salt (sodium), and added sugars (United States

Department of Agriculture, 2005). The FGP makes additional recommendations for healthy eating. Fruits and vegetables are also beneficial to the diet because they are a low fat choice, have low calorie content, and contribute to early satiety. Servings from the bread, cereal, and grain group should be eaten at least six times a day. This group provides much of the daily fiber needed to lower high cholesterol levels (Krauss et al., 2001). The USDA has stated that whole grain products should be the foundation of a healthy diet. Whole grain foods, such as 100% whole wheat bread, are not as refined and generally contain more fiber than refined foods, such as white bread.

Maintaining a healthy weight may ensure a longer, happier life, and fewer medical complications. To achieve a healthy body weight the AHA has two recommendations: (a) equal energy consumed as expended, and (b) physical activity should equal the amount of energy from food taken in (Krauss et al., 2001). The energy from food should be a nutrient dense choice. To create a foundation for a healthy diet and lifestyle the AHA and USDA recommend limiting foods high in fat, consuming the majority of daily calories from fruits, vegetables, and whole grains, and including more daily physical activity.

Regarding fat intake, the AHA and USDA recommend that saturated fat intake should be limited to <10% of total daily calories, and consumption of *trans*-fatty acids should be restricted (Krauss et al., 2001). Though fat is needed in the diet for absorption of fat soluble vitamins (A, D, E, and K), Americans should

adhere to moderation in selection of foods with a high fat content. Another recommendation regarding fat intake includes limiting cholesterol intake to an average of 300mg per day for those without heart disease. Fish consumption is recommended two times per week for the health benefits of omega-three fatty acids.

Healthy food choices by Americans may be adversely affected by the need for convenience, quick preparation time, and palatability. Americans are continuing to consume less than the recommended five servings of fruits and vegetables. Also, the total energy content of the average American diet has increased over the years, possibly contributing to the obesity problem.

There are several factors that affect food choices. Food choice is affected by nutrition knowledge, household income, and taste preferences. Nutrition knowledge has been shown to play a role in the quality of an individual's diet. One study that focused on adults linked nutrition knowledge to diet quality. The more knowledgeable a person is about nutrition and how it affects his/her health, the higher the diet quality will be based on the Healthy Eating Index. The level of nutrition knowledge has also been linked to scholastic education, income, and race (Variyam & Blaylock, 1998). Second, the household income of the family plays a role in food choice and nutritional status of each family member. A limited budget forces a family to sacrifice good nutrition for other, more important needs (shelter, electricity, and clothing). Finally, taste preferences will significantly affect the types and amount of food consumed daily. The sense of taste encompasses smell



and texture of the food. Some people prefer foods that are spicy, while others will prefer foods that are sweet. Some people may prefer foods with a high fat content, which may contribute to obesity (Duffy, Peterson, Dinehart, & Bartoshuk, 2003).

Genetics play a role in how a person perceives a taste. Genetically, bitter tastes are not well liked by the public, and there are differing degrees of bitterness that people perceive. The 6-n-propylthiouracil (PROP) test is used to determine if someone has the gene to taste bitterness (Duffy et al., 2003). Subjects in research studies are usually termed tasters or non-tasters, based on the ability to taste PROP. Research has shown that tasters perceive all tastes (sweet, sour, salty, and bitter) at a higher intensity (Duffy et al., 2003), and the general population is composed of 70% tasters and 30% non-tasters (Tepper & Ullrich, 2002). Tasters usually do not like the taste of sweets and non-tasters prefer the taste of sweet solutions (Duffy et al., 2003). Tepper and Ullrich (2002) found that super-tasters and medium-tasters could differentiate a high-fat vs. a low-fat salad dressing, but the non-tasters could not.

These findings indicate there may be a genetic basis for the difference in food selection, and taste is one factor that influences people to make the choices to eat what they eat. The genetic variation could serve as the genetic link to obesity due to the increased taste for sweets. Sweets are usually high in sugar, fat, and calories; those nutrients that contribute to obesity. The research on this topic is inconclusive because not all tasters are obese. Researchers also feel that there is more than one gene that plays a role in taste preference (Tepper & Ullrich, 2002).

Taste can also be altered by effects of the environment. One such effect happens when the nerves connecting the tongue and the brain are damaged in some way (Duffy et al., 2003). Head/neck trauma and/or anesthesia of the chorda tympanic nerve can increase the sensitivity to bitter tastes by causing other nerves to respond to taste (Duffy et al., 2003). Finally, the different cravings during hormonal changes that a woman goes through during menstruation, pregnancy, or menopause can affect her taste perceptions.

#### Purpose of the Study

Americans do not meet the nutritional recommendations described in the Food Guide Pyramid. Intakes are high in fat, cholesterol, and sugar, and low in the disease-fighting foods, such as whole grains, fruits, and vegetables (Krauss et al., 2001). This contributes to the growing trend of increased incidence of obesity among Americans, which leads to an increased risk of obesity related diseases, including type 2 diabetes mellitus, hyperlipidemia, hypertension, coronary heart disease, stroke, hypercholesterolemia, osteoporosis, arthritis, sleep apnea, and certain cancers (Krauss et al., ). There is little research based evidence to support a gender difference in food selection. Other factors have been shown to be associated with food selection. Research shows people eat the foods they eat due to taste, nutrition knowledge, income, and race (Variyam & Blaylock, 1998). But when offered, which snack choice will each gender chose, healthy or energy dense? Therefore, this study investigated if there was a gender difference in snack choice.

## Hypothesis

There was one hypothesis tested during this investigation. The hypothesis of this study was: There is a difference in snack choice between males and females.

## CHAPTER II

### REVIEW OF LITERATURE

#### *Obesity*

Obesity is a word that can have as many definitions as there are researchers who are willing to try to define it. This causes much confusion among the scientific population when research studies are begun to investigate “obese” individuals. The question of “Who is considered obese?” must be defined in order to begin the research. Sonmez et al. (2003) used three different methods of measuring obesity in patients with coronary artery disease and compared the results to the International Guidelines Committee for Body Mass Index (BMI). The authors found that when using BMI, 15% of males and 32% of females were deemed obese. The waist circumference measurement alone and waist-to-hip ratio found 20% and 51% of males, respectively, and 72% and 86% of females, respectively, to be obese. It is probable that these discrepancies in obesity measurement would be seen in the general public due to the varying body types of Americans.

The Body Mass Index (BMI) is the most widely used method to define obesity today because it accounts for a person’s weight and height. The formula used is  $\text{kg}/\text{M}^2$ . A healthy BMI is 18.5-24.9 as stated by the Center for Disease Control (CDC). The CDC classification for overweight is a BMI of 25-30, and obese is a BMI  $>30$  (“Defining Overweight and Obesity”, 2004). This gives a

healthy weight range based on an individual's height that would be considered healthy to fall within. BMI however does not take into consideration fat mass or muscle mass. Therefore, someone who may be a body builder can have a BMI much greater than 30 and be considered obese and unhealthy, when in fact he/she simply has a significantly larger amount of muscle mass than the average person, but is in optimal health. The National Health and Nutrition Examination Survey (NHANES) conducted from 1999-2000 found that 29.57% of participants were classified as obese (BMI >30), and the average BMI was 27.85 (Chou, Grossman, & Saffer, 2004). Based on these results, the average American is about fifteen pounds overweight (1 BMI point increase is equal to five additional pounds). Not only is the prevalence of obesity on the rise, the percentage of people classified as overweight from 1999-2000 also increased from 55.9% to 64.5% (Flegal, Carroll, Ogden, & Johnson, 2002). Overweight and obesity are not only problems in the United States. In Morocco and Tunisia, the percentage of adult women who were classified as overweight is 51.3% and 50.9%, respectively (Mokhtar et al., 2001). The prevalence of obesity in Europe has been found to be comparable to that in the U.S. It has been reported that 50-65% of Europeans are overweight or obese (Raben, 2003).

Other ways to identify obesity is through the measurement of the circumference of the waist and hip. The waist measurement alone can be indicative of greater risk of chronic diseases ("Defining Overweight and Obesity", 2004). The

Center for Disease Control (CDC) suggested measurements of greater than 40 inches for men and greater than 35 inches for women to be at risk for health complications associated with obesity. In addition, the ratio of waist-to-hip measurements can be used to indicate obesity. The CDC suggests a ratio of 1.0 for men and women to be considered at risk for health complications (“Defining Overweight and Obesity”, 2004).

### *Obesity Risks*

Based on current figures, obesity could soon be the number one cause of preventable death in the United States (Medical Letter, 2004). The CDC released a report on March 9, 2004, stating 400,000 people died in the year 2000 as a result of inadequate nutrition and a sedentary lifestyle, a 33% increase from 1990. There is virtually no doubt in the scientific community that obesity contributes to an increased risk of health complications. Studies have documented a higher incidence of type 2 diabetes mellitus, hyperlipidemia, hypertension, coronary heart disease, stroke, hypercholesterolemia, osteoporosis, arthritis, sleep apnea, and certain cancers in obese persons (Douketis & Sharma, 2004; Spence-Jones, 2003). It has also been noted that obesity can cause premature death (Spence-Jones, 2003). Fontaine, Redden, Wang, Westfall, and Allison analyzed the results of the NHANES III to determine the amount of life that would be lost due to severe obesity (BMI >45). They found that younger adults had more “years of life lost” (YLL) due to obesity than older adults. The highest number of YLL in white adults,

20-30 years old, was 13 for men and 8 for women. It was slightly higher for African American adults of the same age; 20 YLL for men and 5 YLL for women (Fontaine et al., 2003).

Due to the increasing numbers of obese Americans, health care costs are expected to rise. People with obesity may suffer from a number of diseases which would increase their health care costs. Bungum, Satterwhite, Jackson, and Morrow (2003) found that workers with a BMI <25 spent a mean of  $\$114 \pm 256$  per year, a BMI between 25-30 spent a mean of  $\$536 \pm 1251$ , and a BMI > 30 spent a mean of  $\$620 \pm 1535$  on health care. Another study found that obesity contributes to a 36% rise in inpatient/outpatient spending and a 77% increase in medication costs (Danner & Molony, 2002). These results show that there is much needed education from dietetics professionals to encourage a healthy lifestyle and regular exercise.

### *Dietary Guidelines*

Different organizations have set specific dietary guidelines for Americans. The organizations usually searched for dietary guidance are the American Heart Association (AHA), the United States Department of Agriculture's (USDA) Dietary Guidelines for Americans, the Healthy People 2010 campaign, and the American Diabetes Association. Each of these involves recommendations for eating the right foods to prevent a certain disease or health complications and/or suggesting ways to improve overall health.

The guidelines set by the AHA are used to help individuals reduce their risk of cardiovascular disease through adoption of a healthy eating pattern and changes that should be made in their lives to improve their overall health status (Krauss et al., 2001). The current recommendations strive to meet four goals: (a) consume the right amount of food from each of the food groups, (b) attain and maintain a healthy body weight, (c) blood lipids within the normal range, and (d) achieve a safe blood pressure level (Krauss et al., 2001). These four goals are also underlined in the USDA's Guidelines for Americans.

The AHA recommendations regarding food intake focus on inclusion of a variety of foods. The USDA advises Americans to allow the Food Guide Pyramid to be the source to follow for a healthy diet. The AHA recommends that five servings of fruits and vegetables should be consumed daily for their nutrient density and fiber content (Krauss et al., 2001). The USDA parallels this recommendation. It suggests that Americans should consume a minimum of two servings of fruit and three servings of vegetables daily for their nutrient density, low fat content, low calorie content, and satiating factor (USDA, 2000). Servings from the bread, cereal, and grain group should be eaten at least six times a day. This group provides much of the daily fiber needed to lower high cholesterol levels (Krauss et al., 2001) and have normal bowel function (USDA, 2000). The USDA states that whole grain products should be the foundation of a healthy diet. Examples of whole grain



products are brown rice, oatmeal, and whole oats. These foods provide vitamins, minerals, and carbohydrates that may lower the risk of heart disease (USDA, 2000).

Maintaining a healthy weight may ensure a longer, happier life, and fewer medical complications. To achieve a healthy body weight the AHA has two recommendations: (a) equal energy consumed as expended, and (b) physical activity should equal the amount of energy from food taken in (Krauss et al., 2001). The energy from food should be a nutrient dense choice. The AHA recommends limiting foods high in fat that can increase energy intake. The USDA suggests creating a base for diets consisting of fruits, vegetables, and whole grains, and monitoring portion sizes of each food group (USDA, 2000). Both the AHA and USDA recommend daily physical activity. It should be performed for 30-45 minutes to maintain physical fitness and overall cardiovascular health (Krauss et al., 2001). The USDA states that adults should achieve at least 30 minutes and children at least 60 minutes of physical activity most days of the week (if not every day) to maintain healthy weight and prevent weight gain (USDA, 2000).

The AHA gives three specific guidelines to achieve a normal blood pressure. Sodium intake should be limited to no more than 2400mg per day. The national average far exceeds that number. The results from NHANES 1999-2000 concluded that the average sodium consumption per day is 3,375 mg per day (USDHHS, 2003). This is about 40% more than what is considered a healthy limit. Second, healthy body weight should be maintained. Alcohol consumption for men should be

restricted to not more than two drinks per day, and women should have no more than one drink per day (Krauss et al., 2001). A healthy blood pressure ensures hypertension will not become a problem.

The AHA describes three guidelines Americans should abide by to maintain blood lipids within the normal limits. First, saturated fat intake should account for <10% of total daily calories, and consumption of *trans*-fatty acids should be restricted (Krauss et al., 2001). Though fat is needed in the diet for absorption of fat soluble vitamins (A, D, E, and K), the USDA advocates moderation in selection of foods with a high fat content (USDA, 2000). Examples of techniques to decrease fat in the diet are to limit cooking with fat, choose low-fat or fat-free dairy products, choose lean meats over processed meats, and limit consumption of whole eggs. Second, a daily cholesterol intake of <300mg is advisable. Finally, the AHA and USDA recommend fish consumption two times per week for the health benefits of omega-three fatty acids.

Omega-three fatty acids commonly found in fish and certain nuts have shown health benefits for cancer patients during chemotherapy (Hardman, 2002). Patients suffering from rheumatoid arthritis also noticed a reduction in joint pain when taking 3gm per day of eicosapentaenoic (EPA) and docosahexaenoic (DHA) acids (Kremer, 2000). Reduced heart disease risk, a lower lipid profile, and an overall improvement in cardiovascular health are attributable to consumption of omega-3 fatty acids (Hu & Willet, 2002).

Healthy People 2010 is a national campaign that is twenty years in the making. The 1979 Surgeon General's Report *Healthy People*, was the first publication of the campaign to address the nation and set goals and objectives for the states and its communities. Following this, came *Promoting Health/Preventing Disease: Objectives for the Nation* in 1980, and followed by *Healthy People 2000: National Health Promotion and Disease Prevention Objectives* (USDHHS, 2000). Healthy People 2010 is composed of twenty-eight focus areas (a) Access to Quality Health Services; (b) Arthritis, Osteoporosis, and Chronic Back Conditions; (c) Cancer; (d) Chronic Kidney Disease; (e) Diabetes; (f) Disability and Secondary Conditions; (g) Educational and Community-Based Programs; (h) Environmental Health; (i) Family Planning; (j) Food Safety; (k) Health Communication; (l) Heart Disease and Stroke; (m) HIV; (n) Immunization and Infectious Diseases; (o) Injury and Violence Prevention; (p) Maternal, Infant, and Child Health; (q) Medical Product Safety; (r) Mental Health and Mental Disorders; (s) Nutrition and Overweight; (t) Occupational Safety and Health; (u) Oral Health; (v) Physical Activity and Fitness; (w) Public Health Infrastructure; (x) Respiratory Diseases; (y) Sexually Transmitted Diseases; (z) Substance Abuse; (aa) Tobacco Use, and (bb) Vision and Hearing, which were written by a collection of federal, state, and local agencies. The two main goals of Healthy People 2010, which encompass all of the focus areas, are to (a) increase quality and years of healthy life and (b) eliminate health disparities (USDHHS, 2000). A customized approach from Healthy People

2010 can be incorporated into any organization's health plan by choosing which focus areas fit the goals and needs of that particular group to improve an individual's health.

The number of people diagnosed with diabetes each year is on the rise. In the year 2002 there were 13.3 million people with diabetes, a 229% increase since 1980 ("Prevalence of Diabetes", 2004). The American Diabetes Association has established several evidence based guidelines to improve overall blood glucose control, stimulate weight loss in obese people with diabetes, and contribute to a healthy lifestyle (Franz et al., 2002). First, the ADA emphasizes the daily consumption of healthy carbohydrate foods (fruits, grains, and low fat milk). Daily dietary protein should account for 15-20% of total calories, unless a renal complication is present. With regards to fat, the ADA recommends total saturated fat intake of <10% of daily calories, no more than 300 mg of cholesterol are allowed, and avoidance of *trans*-fatty acids. Increased physical activity is beneficial in reducing weight and controlling blood glucose levels. Alcohol intake is limited to one drink per day for women and two per day for men. Finally, the ADA has set a limit of 2400 mg per day of sodium to control blood pressure (Franz et al., 2002).

#### *Present Dietary Habits*

The present diet of a typical American warrants much improvement. Today's society is so fast paced that the diet is riddled with "fast food", extra calories, and high amounts of sugar and fat. With more households requiring both

parents to work, it is difficult to have the majority of meals at home with everyone around the dinner table at the same time. The current dietary habits of Americans are impacted by the need for convenience, low preparation time, and palatability. Because of this, diets may be adversely affected, and many people do not follow the Food Guide Pyramid. The American diet scored a 63.8 on the USDA's Healthy Eating Index (HEI) from 1994-1996 (Dinkins, 2000), which indicated a need for improvement. Using data from the NHANES 1999-2000, the reported HEI was again 63.8. It was also reported that 74% of Americans' diets need improvement, 10% have a good diet, and 16% had a poor diet (Basiotis, Carlson, Gerrior, Juan, & Lino, 2002).

Most Americans have heard and understand that eating adequate fruits and vegetables daily is healthy and may lower their risk of several health problems they may face in the future. Current results indicate that Americans are consuming, on average,  $5.2 \pm 3.2$  servings of fruits and vegetables daily (Johnston, Taylor, & Hampl, 2000). These results are not as good as the numbers would indicate. First, the study found that of the vegetables consumed, 30% was from white potatoes (Johnston et al., 2000). Of the white potatoes, french fries made up 0.4 servings per day. This is striking because of the fat and calorie content of French fries. One McDonald's large container of French fries contains 520 calories and 25 grams of fat (McDonald's Corporation, 2004). The results of Johnston et al.'s study seems to portray Americans being healthier, when in fact only 18% met the guidelines of 2

fruits per day and 3 vegetables per day. A 1997 study that excluded fried potatoes from the vegetable category found an average consumption of fruit and vegetables to be 3.98 servings per day (Stables et al., 2002). Knowledge of the health benefits of cruciferous and dark green vegetables and citrus fruits may be lacking in the general public. Stables and colleagues (2002) found that while knowledge of the 5 A Day program had increased from 1991 to 1997, only 17.8% of those surveyed understood the program.

The Dietary Guidelines for Americans, established by the US Department of Agriculture and Health and Human Services (DAHHS), recommends that no more than 30% of daily energy consumption come from fat (Kennedy & Bowman, 2001). This recommendation was set on the basis that research has shown that a low fat diet can reduce the risk of high blood pressure, heart disease, and cancer (Connor & Connor, 1997). The trend in the percentage of fat in the diet from the 1930s until 1984 was analyzed (Stephen & Wald, 1990). It was found that fat comprised 34% of the diet in the 1930s, 40-42% in the 1960s, and then dropped to 36% in 1984. The NHANES 1999-2000 reported that the overall average fat consumption was 33% of daily calories, and the overall average saturated fat content was 11% (USDHHS, 2003), which is greater than what is recommended by the DAHHS and AHA. However, the study did not investigate if the total energy in the diet increased. If total energy was to increase and the amount of fat was to remain the same, then the percentage of fat would appear to decrease. A study completed by

Chanmugam et al. in 2003 recorded the amount of dietary fat in Americans' diets in total grams, not percentage. It was found that the total energy content of the diet increased more dramatically than the total fat grams. These data caused the percentage of fat in the diet to decrease when the actual number of fat grams rose. The increase in total energy was attributed to an increase in beverages and products in the grain group (Chanmugam et al., 2003). Furthermore, it has been recommended that cholesterol be limited to 300 mg per day. NHANES 1999-2000 found that males consumed an average of 307 mg per day, and females consumed 225 mg per day average (USDA, 2003).

Finally, the intake of an adequate amount of whole grains daily will lower the risk of diabetes and cardiovascular disease (McKeown, Meigs, Liu, Wilsonand, & Jacques, 2002). The current recommendation is 6-11 servings per day of breads, cereals, and legumes (Moshfegh, Cleveland, Goldman, & Lacombe, 2001). This food group also contributes to the daily fiber intake. The most current research indicates Americans are consuming an average of seven servings per day of grains. However, this study highlighted that only one third of Americans are meeting the FGP requirements (Moshfegh et al., 2001). This could serve as the link to the obesity crisis because more than 50% of Americans are overweight or obese. Following the FGP may serve as the remedy for persons overweight or obese.

Popular low carbohydrate diets, such as the Atkins', Sugar Busters, and South Beach diets, have been portrayed as the secret to weight loss with the

numerous books and media attention given to the topic. The theory purported by advocates of the low carbohydrate diet is that it will rid your body of its supply of carbohydrates and put your body in a state of ketosis, which produces ketones that are believed to aid in the fat burning process (Kaplan, 2001). Research has also stated that the dramatic weight loss experienced in the beginning of the low carbohydrate diet can be attributed to water weight (Krauss et al., 2001). The questions still remain though, are low carbohydrate diets more effective than low fat diets, and are low carbohydrate diets safe for cardiovascular health? Several studies have tried to address these questions. In a 2004 study, researchers selected overweight men (average BMI of 34) for a 6-week, low carbohydrate diet (<10% of energy) followed by a 6-week low fat diet (Sharman, Gomez, Kraemer, & Volek, 2004). The results of the study showed that the low fat diet was effective in reducing the low density lipoprotein cholesterol (LDL-C) level (-18%). The low carbohydrate diet lowered the triacylglycerol (TAG) level, the TAG/HDL-C ratio, and serum glucose levels. These results reflect only a 6-week study for each of the diets.

Long term safety of a low carbohydrate diet is still being debated by health professionals and researchers. Studies have been conducted to determine the long term effects. However the researchers consider a year or sometimes less to be long term, the sample size is often less than 100, and the drop out rate is usually high (Samaha et al., 2003), which limits the interpretation of the results. One study that



did last for a year did not find a significant difference between a low-carbohydrate and low-fat diet in the amount of weight loss at the 12 month mark (Foster et al., 2003).

The results of research on low carbohydrate diets are causing the government and health professionals to reconsider the current food guide pyramid. However, the traditionally recommended low fat diet will continue to serve as the foundation for a healthy lifelong diet until conclusive, evidence based, long term studies are available regarding low carbohydrate diets.

#### *Factors Affecting Food Choice*

There are several factors that affect why a person eats what he/she eats. In today's society, Americans want food that is easy to prepare, cooks fast, tastes good, and is convenient. Food choice is affected by nutrition knowledge, household income, and taste preferences.

*Nutrition Knowledge.* First, nutrition knowledge has been shown to play a role in the quality of an individual's diet. As early as elementary school, there should be some form of nutrition education incorporated into the school curriculum. Research has found that children aged 8-12 years are beginning to form permanent dietary habits and will respond well to a structured educational program (Kandiah & Jones, 2002). After three weeks, the group that received nutrition education had healthier diet recalls.

Adolescents tend to consume a diet that does not follow the guidelines set by the Food Guide Pyramid. Their diets are typically low in fruits, vegetables, calcium content, and high in fat (Story, Neumark-Sztainer & French, 2002). Peer pressure, mass media, body image, and parental practices are factors associated with adolescents' food choices (Pirouznia, 2001). Adolescents in the 6<sup>th</sup> to 8<sup>th</sup> grades were given the Comprehensive Assessment of Nutrition Knowledge, Attitudes, and Beliefs (CANKAP) test to evaluate their knowledge of nutrition concepts. The average score was 53.9% among all students (Pirouznia, 2001). The results indicate that adolescents are not being educated about nutrition, or they did not learn it when presented.

Studies focusing on adults have linked nutrition knowledge to diet quality. The more knowledgeable a person is about nutrition and how it affects his/her health, the higher the diet quality will be based on the Healthy Eating Index (Variyam & Blaylock, 1998). The level of nutrition knowledge has also been linked to scholastic education, income, and race.

*Income.* Second, the household income of the family plays a role in food choice and nutritional status of each family member. It has been suggested that the more affluent an individual is, the healthier his/her diet will be (McLaughlin, Tarasuk, & Kreiger, 2003). A limited budget forces a family to sacrifice good nutrition for other, more important, needs (shelter, electricity, and clothing). Families with a low income have shown a decreased number of individuals meeting

the dietary guidelines for disease prevention (Smith & Brunner, 1997). The Continuing Survey of Food Intakes by Individuals (CSFII) 1994-1996 reported data describing the diets of those under 131% of the poverty level. The average daily fiber intake was 13.6 grams (US Department of Agriculture, Agricultural Research Service, 1999), well below the 25 gram daily recommendation. These data may prove that individuals with lower incomes consume a poorer diet because foods with the highest content of fiber are whole grains, vegetables, and fruits. However, grocery stores frequented by low-income families are usually smaller, older, and have a different food selection than stores receiving less funding from governmental assistance (Webber & Dollahite, 2005). These store differences may explain the reasons why low-income families' diets are lower in fruits and vegetables.

This information raises the question: Is a healthier diet more expensive than an energy dense diet? Energy density is defined as the available energy per unit weight (MJ/kg). This question was investigated in an article written by Drewnowski and Barratt-Fornell in 2004. They stated that foods with a higher energy density are typically less expensive than healthier foods because the higher energy dense foods are dry (Drewnowski & Barratt-Fornell, 2004). For example, potato chips (23 kJ/g), chocolate (22kJ/g), and dry cereals, cookies, and cake (18 kJ/g), are loaded with fat and sugar making them very energy dense. However, fruits and vegetables have a much lower energy density, 0.4-2.0 kJ/g (Drewnowski & Barratt-Fornell, 2004). It is less expensive to process, add sugar and fat, and

store non-perishable energy dense foods than it is to store and keep fruits, vegetables, and lean meat fresh. The inverse relationship occurring between energy density and cost of food may be the link to the reason why minorities and lower economic groups have a higher rate of obesity (Darmon & Drewnowski, 2005).

*Taste Preferences.* Taste preferences will significantly affect the types and amount of food consumed daily. The sense of taste encompasses how a food smells and the texture that is felt in the mouth when eating (Duffy & Bartoshuk, 2000). Some people have tastes for spicy foods, while others will claim to have a sweet tooth. The literature also indicates that people with a taste preference for fat may have a higher risk of developing obesity in the future (Drewnowski, 1997; Mela & Sacchetti, 1991) due to the nutrient density of the higher fat containing foods. How a taste is perceived is affected by genetics (Drewnowski, 1997) and the environment (Duffy et al., 2003).

Genetically, bitter tastes are not well liked by the public, and there are differing degrees of bitterness that people perceive (weak tasters, medium tasters, and super tasters). The 6-n-propylthiouracil (PROP) test is used to determine if someone has the gene to taste bitterness (Duffy et al., 2003). Subjects in research studies are usually termed tasters or non-tasters, based on the ability to taste PROP. Research has shown that tasters perceive all tastes (sweet, sour, salty, and bitter) at a higher intensity (Duffy et al., 2003). The general population is composed of 70% tasters and 30% non-tasters (Tepper & Ullrich, 2002). Duffy and Bartoshuk (2000)

found a significant difference when comparing men and women. Women who perceived PROP to be very bitter liked energy dense foods (sweets and high-fats) less. In men, when the papillae on the tongue were in greater number, the liking of the higher calorie foods and beverages increased (Duffy & Bartoshuk, 2000). Tasters usually do not like the taste of sweets, and non-tasters prefer the taste of sweet solutions (Duffy et al., 2003). Tepper and Ullrich (2002) found that super-tasters and medium-tasters could differentiate a high-fat vs. a low-fat salad dressing, but the non-tasters could not. These results indicate there may be a genetic basis for the difference in people's diets, and taste is what drives people to make the choices to eat what they eat. The genetic variation could serve as the genetic link to obesity due to the increased taste for sweets. Sweets are usually high in sugar, fat, and calories that can contribute to obesity. The research on this topic is inconclusive because not all tasters are obese. Researchers also feel that there is more than one gene that plays a role in taste preference (Tepper & Ullrich, 2002).

Taste can also be altered by effects of the environment. One such effect happens when the nerves connecting the tongue and the brain are damaged in some way (Duffy et al., 2003). Head/neck trauma and/or anesthesia of the chorda tympanic nerve can increase the sensitivity to bitter tastes by causing other nerves to respond to taste (Duffy et al., 2003). Another environmental factor thought to affect taste is aging (Drewnowski, 1997). Research studies have investigated the theory that taste and smell diminish with age which affects intake and nutritional status of

the elderly (Mattes, 2002). The findings presented by Mattes (2002) concluded that aging is an independent factor that affects the ability of the aged to properly taste foods. Studies have not clearly presented if this significantly affects clinical outcomes or food choice.

Finally, the hormonal changes that a woman goes through can affect her taste perceptions (Duffy & Bartoshuk, 2000). Duffy and Bartoshuk (2002) reported that during pregnancy or menstruation (changes in hormone levels), a woman will have increased inconsistency in taste as compared to a man.

### *Conclusion*

Obesity is an expanding problem. The number of overweight and obese Americans continues to rise, which may lead to increased health risks such as heart disease, high cholesterol, hypertension, cancer, and a premature death. Dietary guidelines have been established by several organizations to educate Americans on a healthy diet and lifestyle to prevent these complications, but few follow them. It has been proven that Americans' diet quality is poor, lacking considerably in fruits, vegetables, and whole grains. Nutrition knowledge, income, and taste preference are factors leading to food choice. To date, there is little research regarding a gender difference in the choice of foods.

## CHAPTER III

### METHODOLOGY

#### *Participants*

Participants included 150 male and 234 female grocery shoppers at least 18 years old from two different grocery stores. The age of the participant was asked by the researcher before acceptance into the study. Shoppers not at least 18 years of age were not allowed to participate.

#### *Design and Procedure*

*Institutional Review Board (IRB) approval.* The research protocol was approved by the Texas Woman's University IRB prior to initiation of the study (see Appendix A). Permission from the individual grocery stores where subjects were recruited was also attained (see Appendix C).

*Pilot study.* A pilot study using the basic design described below was completed at a third and separate grocery store to determine the best way to administer the survey, observe potential subjects, and accurately record their snack choice.

*Recruitment of participants.* Participants were recruited from local grocery stores in the Houston, Texas area. Prior approval from the store manager was obtained before research began. Research occurred on weekends when it was more likely to achieve a proportionate sample of males and females. When potential

participants entered the store the researcher asked if they would be willing to complete a brief survey (see Appendix B) regarding shopping practices and participate in a study for a graduate student at Texas Woman's University. The researcher also asked the age of the individual to ascertain if he or she was at least 18 years old.

*Offering snacks.* After a participant completed the survey, the researcher offered a choice of snacks from two trays on the table. One tray consisted of assorted cookies (vanilla and chocolate cream filled Great Value brand) and chips (Cheetos), and another tray was filled with fruit (grapes and sliced apples) and vegetables (carrots and celery). The position of the trays was swapped half way through each visit at each site. In the middle of the trays there were plastic glasses and gallons of water for the participants. Once a snack choice was taken, the researcher discretely recorded on the data collection form (see Appendix D) which choice was made (low energy density, high energy density, or both) in a discreet manner so as to not bias the results. The study participants did not know that snack choice was actually the variable being studied, but they were aware that they were participating in a research study.



## CHAPTER IV

### RESULTS

The study included a total of 380 participants. Sixty-two percent (234) were female, and 38% (150) were male. There were only 4 males (1%) and 0 females that chose both snack options. Because this number is extremely low and does not have a significant affect on the data, these four participants were excluded from the study, resulting in a total of 146 males.

Snack choice was recorded for each participant and is presented in Table 1. The results reflect that more females (65%) chose the low energy dense snack than males (52%); whereas, the high energy dense snacks were chosen by more males (48%), than females (35%). These results can also be seen graphically in Figure 1. The most frequently chosen snack of all participants was the low energy dense snack, with a total of 60% of the participants choosing it.

The Chi-square test was used to determine if the hypothesis should be accepted or rejected. Based on this test,  $\chi^2(1, N = 380) = 5.710$ , and  $p = 0.017$ , the hypothesis is accepted. The results of this study show a significant difference in snack choice between males and females at a significance level of  $p < 0.05$ .

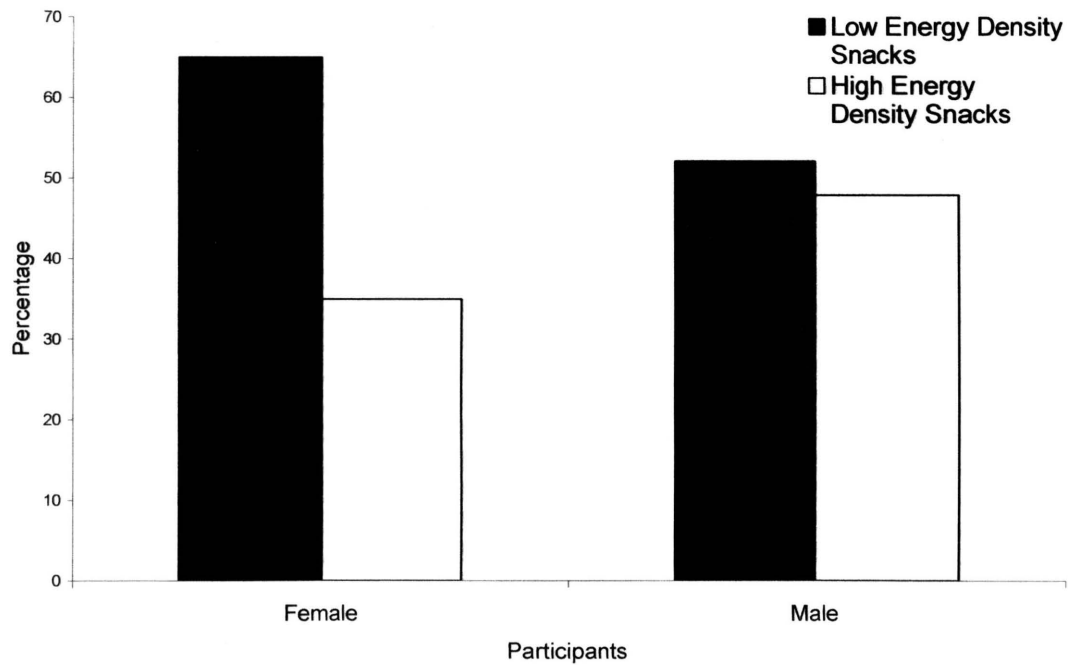
Although the questionnaire served only as the distracter, results were tabulated and are presented in Figures 2, 3, and 4. The results presented in Figure 2 indicate that more shoppers (54%) shop five or more times per month at the grocery

Table 1

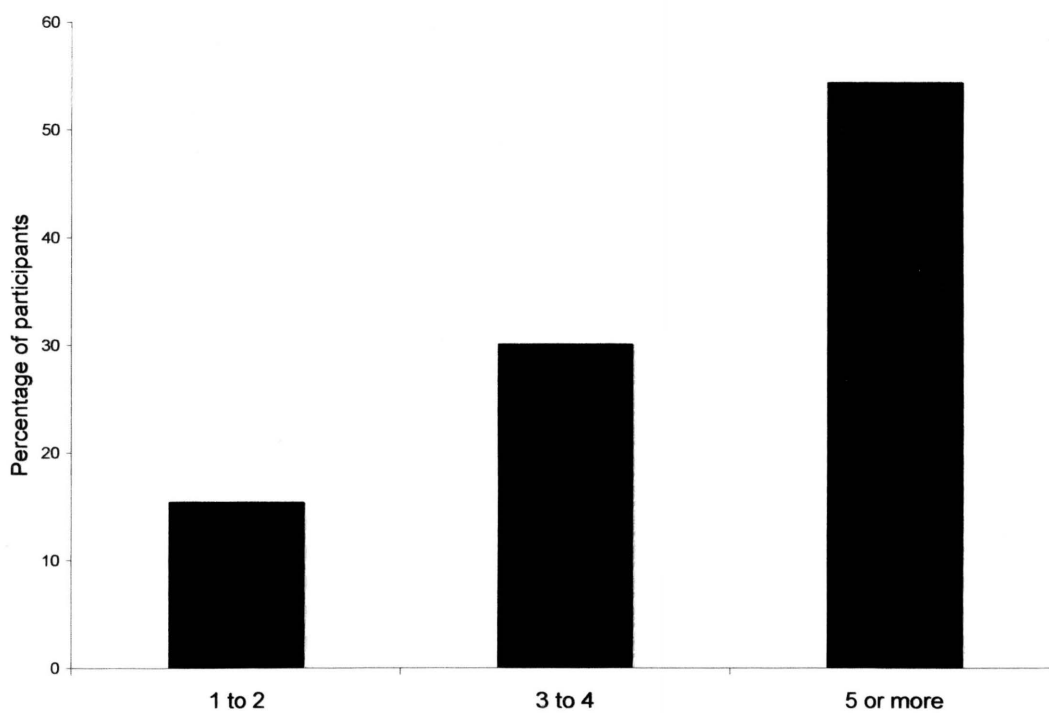
*Snack choice among the genders*

	Low energy density		High energy density	
	N	%	N	%
Female	152	65	82	35
Male	76	52	70	48

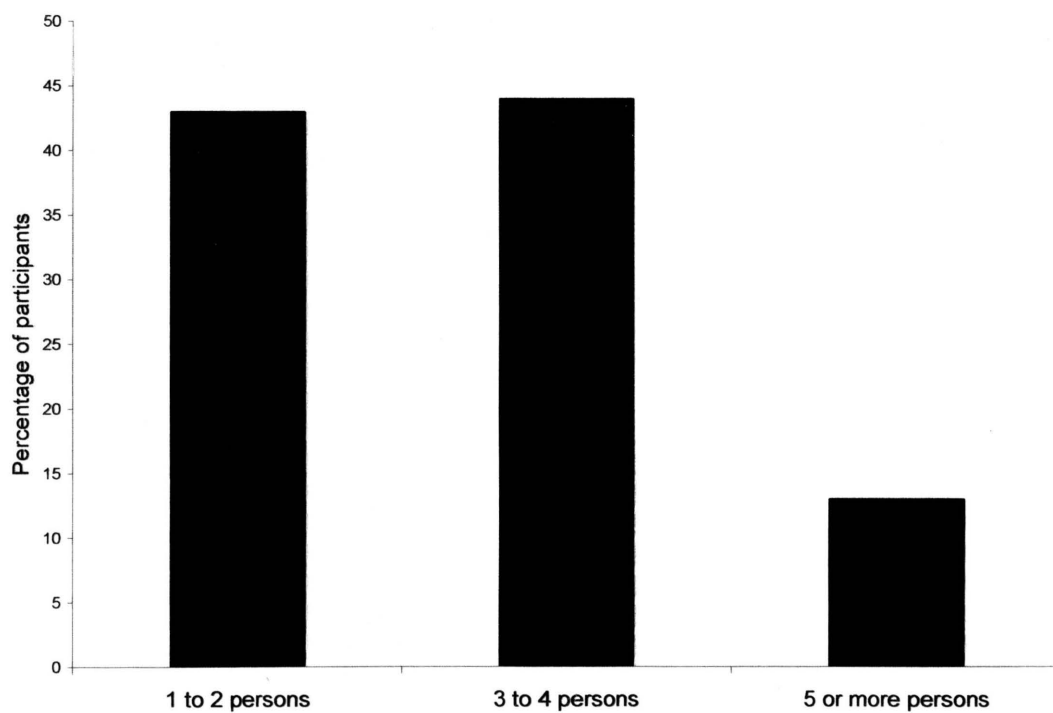
*Note.* Chi Square analysis reflect a significant difference in snack choice between males and females  $p = 0.017$ .



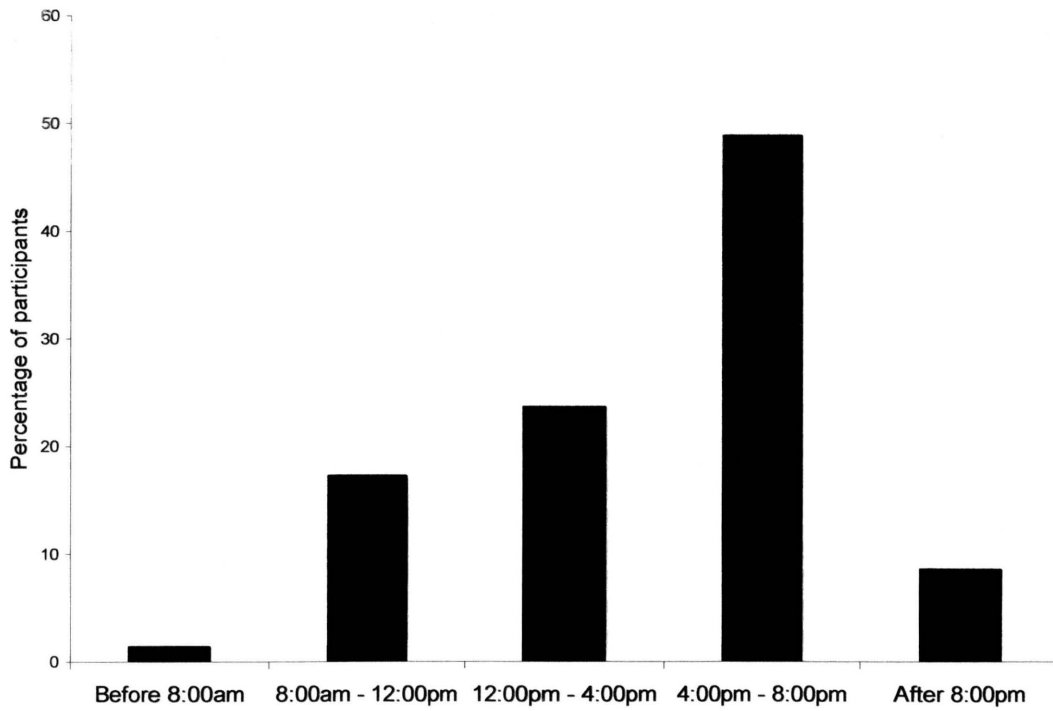
*Figure 1.* Percentage of males and females choosing low and high energy dense snacks



*Figure 2.* Shopping trips per month.



*Figure 3.* Household size.



*Figure 4.* Most often time of day participants reported they shop for groceries.

store. More than three quarters (87%) of the participants surveyed were part of a family of four or less, as depicted in Figure 2. Figure 3 shows that the majority (49%) of participants reported shopping between the hours of 4:00pm and 8:00pm. Finally, the most often checked reason for shopping at the research grocery store was good location.

## CHAPTER V

### DISCUSSION

Based on the results of this study the hypothesis was accepted. The research conducted in this study showed that there is a relationship between snack choice and gender. The data illustrates that women chose the low energy dense snack more often than men. With a  $p$  value of  $p = 0.017$ , there is only a 1.7% chance that these results are due to chance alone, which suggests that these results would be easily reproduced if the study was performed again. One study, conducted with men and women aged 18 years to 24 years, found that men have more barriers than women do about eating fruits and vegetables (Doong, Hoerr, and Okeafor, 2005). Men reported being too busy or too lazy, unavailability, and poor taste/smell as barriers to eating fruits and vegetables. Whereas, women only stated lack of time and availability as reasons they do not eat fruits and vegetables (Doong, Hoerr, and Okeafor, 2005). The present study demonstrated that the most common choice among all participants was the low energy dense fruits and vegetables, which is a positive finding. These findings could be due to the fact that the fruits and vegetable were cut and ready to eat, so there was no preparation needed to eat them. Also, the participants may not have liked the selection of high energy dense snacks that was available, therefore choosing the low energy dense snack for lack of a better high-calorie option (different potato chips or different cookies).



The results of the current study can be compared to findings in previous research about dietary habits. One study examined the fruit and vegetable intake of adolescent girls over a six year period. Striegel-Moore and colleges (2006) found that fruit and vegetable intake increased as the girls got older. This may continue into adulthood which would lead to the results of the current study; women choosing the low energy dense snack more often than the high energy dense snack. Haire-Joshu and colleagues (2004) found this to be true in their study of African-American woman. They found that estimates of one's own intake of fruits and vegetables as a child were significantly related to dietary habits of fruits and vegetables in adulthood (Haire-Joshu, Kreuter, Holt, and Streger-May, 2004). Finally, research shows that women snack more often than men (Forslund, Torgerson, Sjostrom, and Lindroos, 2005). This leads to them eating more fruits and vegetables, as seen in a study by Liebman et al. (2003) with residents in rural cities, given that they will choose a low energy snack more often than a high energy dense snack, as seen in the current study.

The results obtained from the distracter survey can be compared with previous research. The current research indicates that more women than men shopped for groceries. One study comparing adolescents showed that more females participated in grocery shopping and meal preparation (Larson, Story, Eisenberg, and Neumark-Sztainer, 2006). It is possible that this continues into adulthood and the women continue to take on a traditional role in the household, such as shopping

and preparing meals. Yoo et al. (2006) performed a study regarding food-purchasing frequencies. In their study, 78.5% of the participant shoppers were female (Yoo et al., 2006). This is higher than the 62% female participation in this study. The data obtained by Yoo et al. (2006) showed that, on a monthly basis, 56.8% of consumers shopped at grocery and convenience stores more than once a week. This can be compared to the data gathered in this study. The percentage of shoppers who reported grocery shopping five or more times per month was 54.4%.

### *Limitations*

First, the study was performed solely on the weekend. This could be a time when more people do not adhere to the same healthy practices they may observe during weekdays. Therefore, participants that chose the high energy dense food during the study may have chosen the low energy dense food on a different day.

Second, there were more women participating in the study than men. The researcher attempted to avoid this situation by conducting research on the weekends when it is likely both genders do their grocery shopping. This may be of interest to the store owner, product advertisers, and health educators. The store owner and product advertisers may want to gear the information published in sale ads and commercials to women. Health educators may better understand the populations that shop for the families. If it is the mother or woman that makes the food choices for the family, nutrition education should be targeted toward women. Therefore, the

men that typically do not grocery shop were not evaluated. These possible participants may have had an affect on the results had they been evaluated.

Also, the size of the snack choice may have affected the data. Knowing that they were only going to be eating one cookie or a very small amount of chips may have lead participants to choose the high energy dense option. Otherwise at home, given a bigger portion, they may have chosen the low energy dense snack. They may not have any high energy dense snacks at home or may also never buy cookies and chips, therefore deciding that eating only a little sample of a high energy dense food would be acceptable.

Finally, the results of the study can not be generalized to the entire population. Although the income status of participants was not evaluated, as stated previously, income has an affect on food choice. This study was performed in middle class neighborhood grocery stores. This may have had an affect on the results.

## CHAPTER VI

### CONCLUSION AND IMPLICATIONS FOR FUTURE RESEARCH

This study investigated if there was a difference in snack choices among the genders. The data gathered here conclude that a relationship exists between snack choice and gender.

This study could be used as a platform to continue the study of snack choices. One option may be to compare locations as well as gender. There may be a difference in snack choices of people that live far north versus in the south. There also may be a difference in the ages (minors versus adults), and ethnicity. The results of these studies would help professionals to develop better nutrition education programs for different communities and different age groups when they know what the usual snack choice of each will be.

To better understand snack choice it may be more reliable to go to the homes of Americans and actually see what snacks are in their pantries. Then, determine the amount of high energy dense snacks and low energy dense snacks. This would give health educators a better idea of what people are actually eating for snacks.

This study did identify a significant relationship between snack choice and the genders. Women, more often than men, chose the low energy dense fruits and vegetables. The author believes that more research is necessary because other

aspects that affect snack choice, such as age, education level, ethnicity, and geographical location may play a significant role.

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## APPENDICES

**APPENDIX A**  
**IRB Approval Form**



**TEXAS WOMAN'S UNIVERSITY**

DENTON DALLAS HOUSTON

**INSTITUTIONAL REVIEW BOARD**

1130 John Freeman Blvd., Houston, Texas 77030 713/794-2074

**MEMORANDUM**

TO: Karen Moreland  
Jessica Burditt

FROM: IRB

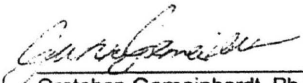
DATE: November 14, 2005

SUBJECT: IRB Exempt Application

TITLE: Gender and snack choices

This application is **approved**. This approval lasts for 1 year. The study may not continue after the approval period without additional IRB review and approval for continuation. It is your responsibility to assure that this study is not conducted beyond the expiration date.

Any changes in the study must receive review and approval prior to implementation unless the change is necessary for the safety of subjects. In addition, you must inform the IRB of adverse events encountered during the study or of any new and significant information that may impact a research participant's safety or willingness to continue in your study.



Gretchen Gemeinhardt, Ph.D.  
Chairperson

**APPENDIX B**  
Participant Survey

Thank you for participating in this survey for Texas Woman's University. Your responses are very helpful and valuable! By completing this survey you are giving your consent to participate in the study.

1. Please identify your gender

☐ Male ☐ Female

2. How many times per month do you shop at this store?

☐ 1-2 ☐ 3-4 ☐ 5 or more

3. How many people live in your household?

☐ 1-2 ☐ 3-4 ☐ 5 or more

4. What is the most common time of day you shop at this store?

☐ before 8:00am ☐ 8:00am-12:00pm ☐ 12:00pm-4:00pm  
☐ 4:00pm-8:00pm ☐ after 8:00pm

5. Why do you shop at this store? Please check all that apply.

☐ Good location  
☐ Low prices  
☐ Product variety  
☐ Customer service

Thanks again for your participation. Please enjoy one of the snacks on the table as a token of my appreciation in helping me complete this study.

**APPENDIX C**

**Grocery Store Approval Forms**



TEXAS WOMAN'S  
UNIVERSITY

1901 - 2001 CENTENNIAL

Department of Nutrition and Food Sciences  
1130 John Freeman Blvd.  
Houston, TX 77030-2897  
T 713-794-2371 F 713-794-2374

### AGENCY PERMISSION FOR CONDUCTING STUDY

The Kroger Food Store #311  
Grants to Jessica Burditt  
A student enrolled in the Department of Nutrition and Food Science at Texas Woman's University, the privilege of its facilities in order to study the following problem:

The conditions mutually agreed upon are as follows: (to be completed by the Agency Representative)

1. The agency may/may not be identified in the final report.
2. The names of consultative or administrative personnel in the agency may/may not be identified in the final report.
3. The agency wants/does not want a conference with the student when the report is completed. yes
4. Other \_\_\_\_\_

3/28/05  
Date:

[Signature]  
Signature of Agency Representative

[Signature]  
Signature of Research Committee Chair

[Signature]  
Signature of Student

Distribution: One copy each to student (original – to be included in the final paper), Agency, Dean of Graduate School (to accompany prospectus); Department of NFWS, TWU-Houston Center.



Jessica Burditt  
832-545-5107  
TEXAS WOMAN'S  
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Houston, TX 77030-2897  
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### AGENCY PERMISSION FOR CONDUCTING STUDY

The Lager Store #739

Grants to Jessica Burditt

A student enrolled in the Department of Nutrition and Food Science at Texas Woman's University, the privilege of its facilities in order to study the following problem:

The conditions mutually agreed upon are as follows: (to be completed by the Agency Representative)

1. The agency ~~may~~ may not be identified in the final report.
2. The names of consultative or administrative personnel in the agency ~~may~~ may not be identified in the final report.
3. The agency ~~wants~~ does not want a conference with the student when the report is completed.
4. Other \_\_\_\_\_

3-22-05  
Date:

[Signature]  
Signature of Agency Representative

[Signature]  
Signature of Research Committee Chair

[Signature]  
Signature of Student

Distribution: One copy each to student (original - to be included in the final paper), Agency, Dean of Graduate School (to accompany prospectus); Department of NFWS, TWU-Houston Center.

**APPENDIX D**  
**Data Collection Forms**

**Data Collection Form**  
**Store #1**

<b>Gender</b>	<b>Low Energy Density</b>	<b>High Energy Density</b>	<b>Both</b>
<b>Male</b>			
<b>Female</b>			

**Observations:**



**Data Collection Form**  
**Store #2**

<b>Gender</b>	<b>Low Energy Density</b>	<b>High Energy Density</b>	<b>Both</b>
<b>Male</b>			
<b>Female</b>			

**Observations:**