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A Menu Analysis of Sorority Meals at the University of Mississippi

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A MENU ANALYSIS OF SORORITY MEALS AT THE UNIVERSITY OF MISSISSIPPI

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ABSTRACT

Students transitioning to university life face numerous challenges including the problem of making healthy dietary choices. Sorority members are uniquely suited to examining dietary habits because of their access to regular planned meals and because of the social stresses they experience in regards to body image. Menus are not required to follow nutrient specific guidelines and the nutrient content of sorority meals has not been evaluated at the University of Mississippi. The purpose of this study is to analyze nutrient content of sorority meals and determine if members are able to obtain adequate amounts of nutrients from the foods offered.

A menu analysis was performed in three representative sorority houses at the University of Mississippi. All meals offered during one week (14 meals per house, 42 meals total) were analyzed for nutrient content using the Nutrition Data Systems for Research (NDSR) software. Descriptive statistics were used to express results and percent differences were calculated. Non-parametric statistics were used to compare means of nutrient values. The study protocol was approved by the University Institutional Review Board.

The menu analysis showed that each meal offered amounts of nutrients that exceeded daily nutrient recommendations for members. Averaged totals and percent difference calculations revealed no nutritional deficiencies. Averages calculated according to meals showed breakfast as the highest calorie meal and the salad bar offering the greatest fat content. Dinner was shown to be the most nutritionally balanced meal. Beverages were also shown to be a large contributor of calories and carbohydrates in sorority meals.

The amounts of all nutrients of each sorority meal exceeded the recommended daily allowances (RDA) for members. The numerous food items offered at each meal inflated results of nutrient analysis. The considerable amount and variety of food items reveals that members have the opportunity to make healthy choices from sorority meals. Training on menu planning and quantity food production for house directors and nutrition education for members may help promote healthier sorority meals.

LIST OF ABBREVIATIONS AND SYMBOLS

AHA	American Heart Association
AI	Adequate Intake
DFE	Dietary Folate Equivalent
FNB	Food and Nutrition Board
g/d	grams per deciliter
IOM	Institute of Medicine
mg/d	milligrams per deciliter
ND	Not Determined
RAE	Retinol Activity Equivalent
RDA	Recommended Daily Allowance
µg	Microgram
WHO	World Health Organization
SFA	Saturated Fatty Acids
MUFA	Monounsaturated Fatty Acids

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CHAPTER 1. INTRODUCTION

College students face many challenges upon enrolling at a university. These challenges go beyond academics and include the student's ability to maintain a healthy lifestyle. Making the transition is pivotal to a successful college experience, and it is sometimes difficult for incoming freshman to adapt (Malinauskas, Raedeke, Aeby, Smith, & Dallas, 2006). The lack of supervision, new freedoms, and a youth oriented environment allow new students to have more control over their lives for the first time (Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004).

Unfortunately, conflicting expectations and the loss of support systems from home can negatively impact the student's college experience. While in college the different lifestyle can influence the student's diet, behavior, and physical well-being. Heavy alcohol consumption, smoking, risky sexual behaviors, poor dieting patterns, and lack of physical activity are common behaviors exhibited by college students (Buckworth & Nigg, 2006). Students engaging in these activities within the first two years increase their risk of leading unhealthy lifestyles throughout college and later in life (Deshpande, Basil, & Basil, 2009).

One factor that can impact students' lifestyles is whether they join a Greek social organization. Greek social organizations provide opportunities for students to socialize and provide community service. The largest student community in many colleges and universities is a social organization that combines males and females into single-sex groups known as the "Greek System" or fraternities and sororities (Park, A., Sher, & Krull, 2009a).

These organizations espouse one main objective: to prepare members for life after college by encouraging leadership, character building, social skills, academic achievements, and

philanthropy. The groups present themselves as societies and often reside in a chapter house. This social organization provides members with social activities, regular meals, comfort, and the support of a like-minded community (Sidanius, Van Laar, Levin, & Sinclair, 2004).

The majority of Greek members consume all their nutrients from meals served in their designated house. The planning and execution of these meals is the responsibility of the director of each Greek chapter house. House directors come from a wide variety of backgrounds and usually have little training or experience in food service and menu planning which creates a need for the Greek meal system to be examined. There are few guidelines or manuals available for house directors to aid them in menu planning making this an even more difficult process for house directors who have little background in food service.

Meals in Greek chapter houses are served in a scrambled service style similar to campus dining at many universities, but on a smaller scale. Greek members select foods on a buffet line in the portions they desire. Most chapter houses offer breakfast, lunch, and dinner to their members from breakfast on Monday through Friday's lunch; meals are not available from Friday dinner through Sunday. Meal costs are included in membership fees which further encourages members' participation.

Female Greek organizations are known as sororities. Sorority members (members), in particular are interesting study subjects in terms of eating habits because these students exhibit skewed attitudes related to weight-gain causing them to be more diet conscious than males (Cluskey & Grobe, 2009). Sororities have unique social dynamics. Social pressures and challenges encountered within the sorority system have the ability to impact members' behaviors (Turrisi, Mallett, Mastroleo, & Larimer, 2007), including food selection.

Members experience additional stressors that may hinder their ability to meet nutrient needs. Peer pressure and emphasis on body image can easily influence their eating patterns. Binge eating, food restrictions, and unhealthy dieting practices are frequently seen in sorority members (Basow, Foran, & Bookwala, 2007). College females are already at higher risk for developing disordered eating behaviors n (Larson, Nuemark-Sztainer, & Story, 2009). The potential for adopting unhealthy eating behaviors creates a need to examine what nutrients are being offered in meals provided by sororities.

The social environment of Greek organizations can have a great impact on behaviors of their members, including eating behaviors. Previous studies have determined that members are at higher risk for developing behaviors such as excessive alcohol consumption, nicotine use, unusual sleep patterns, disordered eating, and risky sexual behaviors (Nelson, Lust, Story, M., & Ehlinger, 2009). From this research, more studies have been conducted comparing the differences of health behaviors in Greek-affiliated and non-Greek affiliated students. Very few of these studies have focused on the diet patterns of Greek members (Scott-Sheldon, Carey, K.B., & Carey, M., 2008).

The purposes of this study was to analyze the nutrient content of menus offered in sorority houses to determine if members are able to meet their nutritional needs. There are two main objectives of this study: 1) to identify preparation methods and ingredients used in individual meals, and 2) to compare results of the menu analyses with the recommended nutrients for members. No current research could be found to identify if proper dietary choices can be made from the foods provided in sororities, and whether these offerings are capable of meeting the nutrient needs of the members. Because of the lack of previous literature assessing

nutrient content of meals provided to sorority members, baseline data on sorority meals is needed.

CHAPTER 2. LITERATURE REVIEW

College Students' Lifestyle

Transition. For many college students, the transition from living at home to college is the most dramatic change of environment in their lives (Levitsky, Halbmaier, & Mrdjenovic, 2004). Students must learn to adapt to the numerous environmental changes and shifts from family to more peer based support systems (Cluskey & Grobe, 2009). They are faced with challenges such as academic workloads, social networks, greater freedom, and new responsibilities (Von Ah et al., 2004). Along with these challenges, college students are known to engage in a variety of unhealthy behaviors that may result in long-term health consequences (Scott-Sheldon et al., 2008). Some of these recognized behaviors include; poor dietary habits, heavy alcohol consumption, lack of physical activity, and tobacco smoking (Von Ah et al., 2004). Participation in these common behaviors may affect students' nutrient needs and intake.

Changes in dietary intakes and eating behaviors are also greatest during this significant period and can be harmful to students' overall health (Edwards & Meiselman, 2003). The dietary habits students establish in college are most likely carried into adulthood (Brown, Dresen, & Egget, 2005).

Alcohol consumption and behavior. Studies from all over the world have shown that many college students engage in risky health behaviors including; alcohol use, tobacco use, unhealthy diet, physical inactivity, and risky sexual behavior (Jackson, Berry, & Kennedy, 2009). Recent US studies found the prevalence of binge drinking to be between 37.5% and 44%. Binge drinking can be defined as drinking five or more alcoholic drinks in one sitting (Park,

Sher, Wood, & Krull, 2009b). This drinking behavior has several negative effects on overall health and may influence nutrient intake. The irregular meal patterns associated with the excessive sleep of binge drinkers may lead to infrequent breakfast consumption and skipping meals (Nelson et al., 2009).

A 2008 study (Lloyd-Richardson, Lucero, DiBello, Jacobson, & Wing, 2008) measured the relationship between eating and alcohol consumption. The results showed that out of 200 participants, 65.7% were unaware of the caloric content of alcoholic beverages. About 32.5% reported that drinking increased their appetite and 36.1% admitted large intakes following alcohol consumption. Alcohol use results in consuming large quantities of high-fat foods (Lloyd-Richardson et al., 2008). When under the influence, students are more likely to consume unhealthy, caloric dense foods resulting in frequent overconsumption (Anding, Suminiski, & Boss, 2001). Fast food restaurants are a large contributor to these poor dietary choices because of their availability late at night (Kasparek, Corwin, Valois, Sargent, & Morris, 2008). The combination of calories consumed from binge drinking and "late night snacking" leads to weight gain in students.

Irregular meal patterns, infrequent breakfast consumption and skipping meals are common the day after binge drinking. Results from a previous alcohol study found that only a fifth of the 1,595 students who participated reported to eating three meals a day (Scott-Sheldon et al., 2008). Students reported to sleep for about 7-8 hours following alcohol use. Current research is limited in assessing sleep as an important health behavior, but is important to consider in college students because of their unusual sleep habits (Scott-Sheldon et al., 2008).

Greek organizations have been found to greatly influence students towards heavy drinking practices (Park et al., 2009b). Fraternities and sororities associate heavy alcohol use

with an increased ability to socialize and interact with friends. It has been shown that students increase their alcohol consumption after being accepted into the Greek system (Scott-Sheldon et al., 2008). Greeks use alcohol as a way to bond with their new members and initiate social activity. New members want to feel accepted by their Greek organization which is why this alcohol influence is strongest during the first year (Turrisi et al., 2006).

Obesity in college students. Weight gain is caused by an imbalance of energy and occurs when caloric input exceeds caloric output. Numerous studies focus on overweight and obesity of college students caused by high alcohol intake and lack of physical activity. However, research is limited in other weight-related health indicators such as dietary patterns, meal sources, and the effect nutrition has on weight gain (Nelson et al., 2009). Low levels of physical activity and high prevalence of unhealthy diet patterns commonly exist among college students (Huang, Harris, Lee, Nazir, Born, & Kaur, 2003) and can result in weight gain. This has been a major issue for college students and concern for health educators because these behaviors contribute to overweight and obesity (Center for Disease Control and Prevention [CDC], 2011).

Overweight and obesity is a serious concern for college students aged 18-24 because they are transitioning into adulthood. Developing weight gain problems at this age increases the likelihood that these students will become obese in the future. Obesity is a difficult condition to reverse especially when adulthood is reached and harmful lifestyle behaviors become routine (Desai, Miller, Staples, & Bravender, 2008).

Prevention methods for overweight and obesity are usually implemented in childhood and early adolescence. This helps establish healthy lifestyles at younger ages and increases the ability to maintain these lifestyles into adulthood (Lowry, Galuska, Fulton, Wechsler, Kann, & Collings, 2000). Obesity in childhood and adolescence is often used as the leading predictor of

obesity in adulthood (Brunt, Rhee, & Zhong, 2008). Data from studies conducted by the CDC showed that approximately 80% of children who were overweight in adolescence (10-15 years) were obese at age 25, and 25% of obese adults were overweight as children. These results indicate the difficultly of improving lifestyle behaviors once adulthood is reached (Ogden, Carroll, Curtin, McDowell, Tabak & Flegal, 2006).

A study conducted by Levitsky et al. (2004) examined the weight gain of 60 freshmen following their first semester at Cornell University. Students were weighed at the beginning of the semester and again 12 weeks later. They were asked to complete questionnaires at both weigh-ins providing information about lifestyles in high school and college (sleeping, eating, exercising). Results showed that the freshmen gained an average of 4.2 pounds; twice the amount of weight gain seen in a similar previous study (Matvienko & Lewis, 2001). The variables shown to have the most influence on weight gain included; evening snacks, meals consumed on weekends (restaurants), fast food consumption, empty calories, and recent dieting (Levitsky et al., 2004). To have recent, dieting-influenced weight gain shows that weight loss dieting can be ineffective for student weight maintenance or loss. Although sleeping patterns and decreased physical activity have previously been found to cause weight gain, they were not significant explanatory variables for weight change in this study. The amount of weight gain experienced by students in this study (4.2 lbs.) is equivalent to consuming an additional 174 kcal per day. This amount does not seem large, but can play a large role in weight change. This study concludes that if small changes can cause an increase in weight, then small behavioral or environmental changes should prevent or reverse the weight gain (Levitsky et al., 2004).

Overweight and obesity increases the risk for coronary heart disease, hypertension, type II diabetes, dyslipidemia, gall bladder disease, stroke, hepatic steatosis, some forms of cancer,

asthma, and sleep apnea. Researchers have found that weight gain in college students may further increase an individual's risk for developing some of these chronic diseases (National Center for Health Statistics[NCHS], 2011).

Prevalence of obesity in US college-aged students was estimated at approximately 36% of the college population in 2004. This percentage is a large increase from 1991 when only 12% of the college population was found to be obese (Ogden, Carroll, National Health and Nutrition Examination Surveys [NHANES], 2010). Prevalence rates showed increasing trends of obesity during the years 2007-2008. Results from the NHANES study indicated an estimated 34.2% adults were overweight, 33.8% obese, and 5.7% were morbidly obese. Percentages in prevalence rates not only increased in number, but also in severity of the overweight condition. The increases in obesity rates coupled with the higher prevalence among college students enforce the importance of promoting healthier lifestyles in college students (Ogden, Carroll, NHANES, 2010).

Students' Intake and Nutritional Requirements

College student nutrient intake. Consuming adequate amounts of nutrients is especially important to support growth and body changes as adulthood is approached. Many students lack the knowledge of the nutrient needs of their bodies at these ages. This may lead them to make dietary choices that often lack nutrient variety and density (Kolodinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007). Researchers have found that college students consume diets high in total fat, saturated fat, cholesterol and sodium. Students' diets often lack fruits and vegetables, further increasing their intake of high-fat foods (Haberman & Luffey, 1998). In a study involving 2,489 college students; 4% reported obtaining 30% or less of their energy from fat and 10% or less from sugar per day (Huang et al., 2003).

The CDC conducted a national college-based survey in 1995 to assess the health risk behaviors of college students. The *National College Health Risk Behavior* (NCHRB) found that students aged 18-24 make up 7.1 million or 57% of the college population. Results from this survey were taken from 4,609 eligible participants. The NCHRB found that 20.5% of this sample was considered to be overweight; with males making up 32.4% and females 48.8% of this group. The dieting practices of college students showed that slightly more than one fourth (26.3%) ate five or more fruits and vegetables the previous day before the survey. Seventy-eight percent admitted to consuming at least two servings of foods high in fat content. Females (84.9%) were significantly more likely to consume high fat foods than males (69.6%), (CDC, 2000).

Female student intake. There are several determinants of eating behaviors in college students such as living on campus, dietary habits established within the first two years, and gender. High protein intakes are more prevalent in males, and females have a higher ratio of total cholesterol. The fruit and vegetable consumption seems to be poor in both genders. A 2004 study confirmed that only 7.3% students had eaten the recommended servings of five or more fruits and vegetables per week (Despanche et al., 2009). This is far lower than the national average of women's fruit and vegetable consumption. National US surveys have estimated that 40% of women eat the recommended servings of fruit, and 43% for vegetables (Chung & Hoerr, 2005).

Fruits and vegetables are important to the diet and provide health benefits such as reducing the risk of chronic disease and providing antioxidants and key vitamins and minerals. The inadequate intake of fruits and vegetables seen in college students can affect their current and future health because of their bodies' inability to meet nutrient needs provided by these food groups, and the increases in likelihood that this dietary behavior will be practiced in adulthood (Chung & Hoerr, 2005).

A study conducted by Anding et al. (2001), measured the compliance with *Dietary Guidelines for Americans* (DGA) in college women. Out of the 103 participants; 15% consumed five or more fruit and vegetable servings per day, 66% exceeded saturated fat recommendations, 20% exceeded desired cholesterol levels, 8% received less than 10% of total calories from sugar, and 57% exceeded daily sodium intakes (2,400 mg/day). The high fat intake results correlated with inadequate fruit and vegetable consumption. High sodium intakes were related to the consumption of vending-machine snacks. These sodium-rich snacks are commonly consumed by college students because of the convenience provided by vending machines in dorms and around campus (Anding et al., 2001).

Establishing healthy eating patterns can be very difficult for students living on-campus or in residence halls. Freshmen are normally required to live in the dorms for their first year. This limits their food options and leads to greater consumption of processed and convenience foods. The dramatic weight gain caused by these eating habits is commonly known as "the freshman fifteen", (Jung, Bray, & Ginis, 2008).

Dieting practices in females. Female students are more likely to go to extreme lengths to prevent this predicted weight gain and resort to dangerous weight loss behaviors. A study examined the different diet practices of college females and found that while most exercised to stay in shape, others took a different route (Malinauskas et al., 2006). Alternative diet methods consisted of skipping meals, eating less, and smoking cigarettes to curb hunger. Moradi, Dirks, and Matteson (2005) examined a population of college and high school females to show the percentage of students participating in these numerous diet techniques. They found that 59% of the population skipped meals, 37% consumed less than 1,200 calories per day, 30% eliminated fats from diet, 26.5% eliminated carbohydrates, and 26% fasted for greater than twenty-four

hours (Moradi et al., 2005). This shows that even in a stable home environment, high school females still struggle with body dissatisfaction issues and develop poor diet habits that may be carried into college life.

Nutrient requirements for college women. Dietary reference intakes (DRIs) published by *Institute of Medicine* provide values for recommended daily allowances (RDA), adequate intakes (AI), and tolerable upper intake levels (UL) for nutrients (IOM, 2005). These DRIs are used by many health and food service professionals to aid in meal planning, goal setting for nutrition programs, and personal dietary counseling to reduce the number of nutrient deficiencies or diseases. The DRIs provide recommendations for males and females in different life span groups. Most college women fall into the life category for ages 19-30 years. Examining the nutritional needs of this group is crucial in determining sorority women's ability to meet their nutritional needs from nutrients offered in sorority meals (Institute of Medicine[IOM], 2005). Key recommendations based on support from scientific evidence and nutritional factors linked to disease prevention make up the *Dietary Guidelines for Americans* (USDA,[DGA] 2005). The guidelines are re-examined every five years and recommendations established in 2005 were used to further assess the nutrient needs of sorority women.

The average caloric intake needed for women aged 18-24 ranges from 1800-2000kcals and the healthy BMI for normal weights are 18.5-24.9. The recommended daily allowances (RDA) for all the nutrients examined in this study are as follows: vitamin A (700µg/d), vitamin C (75mg/d), vitamin D (5µg/d), vitamin B6 (1.3 mg/d), folate (400µg/d), vitamin B12 (2.4µg/d), calcium (1,000mg/d), iron (18mg/d), magnesium (310mg/d), potassium (4.7g/d), carbohydrates (130g/d), proteins (46g/d), total fiber (25g/d). However, fat intake is marked ND for not determined (IOM, 2005). Fat intake when following a 2,000 calorie diet should not exceed 30%

(66gm/d) of total caloric intake; 20% (44gm/d) from unsaturated fats and no more than 10% (22gm/d) from saturated fats. Increased intakes from unsaturated fats and lower intakes of saturated fats are recommended when following weight loss or lower caloric diets (IOM, 2005).

Iron deficiencies are very common among young women of childbearing ages and can cause anemia. This is related to the amount of iron lost during menstrual cycles. Foods such as red meats and spinach are recommended along with vitamin C to help meet the RDA for iron (18mg), (USDA, 2005).

Several key vitamins and minerals play an important role for college women and insufficient amounts can lead to future health risks. Researchers have shown significant interest in assessing college women's' intake of vitamins B-12 and folate because of the vital roles these vitamins play in supporting reproductive health and metabolic pathway reactions. Deficient intake of vitamin B-12 and folate can increase college womens' risk for developing neural tube defects. Folic acid supplementation has been shown to reduce risks of birth defects and intakes should be increased to 600µg/d when pregnant (USDA, 2005). Aside from reproductive health risks, studies have found folate deficiencies to be associated with increased risk for cardiovascular disease, intestinal villious atrophy, and depression (Shuaibi, Sevenhuysen, House, 2008). Adequate intake of folate (400µg/day) can be consumed from foods rich in folate, dark leafy green vegetables.

Another key nutrient in maintaining reproductive health is vitamin B-12. Vitamin B-12 is responsible for maintaining proper red blood cell formation, gastrointestinal absorption, neurological function, and DNA synthesis. Insufficient vitamin B-12 intake can cause megaloblastic anemia, fatigue, weakness, malabsorption, constipation, weight loss, and numbness in the hands and feet. Deficiency may also cause developmental delays and failure to

thrive during infancy. Vegetarians are at risk for developing vitamin B-12 deficiency because this vitamin is mainly found in animal products. Vegetarians must rely on foods fortified with vitamin B-12 or oral supplementation to avoid problems associated with this deficiency. This is a cause for concern in college women as the percentage of vegetarians continues to increase. Vitamin B-12 deficiency has also been used as a marker for identifying disordered eating behaviors which is prevalently seen in sorority women (USDA, 2005).

Calcium and vitamin D intakes are also significant nutrients because of their roles in bone development. Women are already at higher risk for developing osteoporosis later in life due to bone mass lost during menopause. Although bone loss is common after age 30, bone thinning can be delayed by achieving peak bone mass by ages 25-30. By maximizing bone density before thinning occurs, young women can help prevent risks for osteoporosis and bone fragility (Kalkwarf, Khoury, & Lanphear, 2003). Many adolescent females do not meet dietary needs for calcium and vitamin D, and have decreased intakes of milk and milk products. At this stage in their lives receiving adequate amounts of both nutrients is crucial and may provide long-term health benefits. The RDA for calcium is 1,000mg/d and vitamin D is 5µg/d and can be received through dairy products, green leafy vegetables, and sunlight (vitamin D). Magnesium, potassium, and phosphorus are also used in bone development and aid these nutrients in bone mineralization (Jung et al., 2008).

Vegetarianism. Public awareness and the availability of more fruits and vegetables have supported a growing dietary trend, vegetarianism. College students contribute to this rising trend as they expand their nutritional knowledge through college courses and demonstrate a greater concern for food choices made away from the home (Craig & Mengels, 2009). In 2004 a university food service provider, ARAMARK, surveyed over 100,000 college students and found

that 25% of students requested more vegetarian options in their school dining. Universities are slowly responding to the students' perception of this healthier lifestyle, making it difficult for students striving to commit to vegetarian diets.

Vegetarian, or vegan, is a term used to describe a person who does not consume any meat or meat products. Dietary exclusion includes fowl, seafood, and other food sources of animal origin such as dairy and egg products (Craig & Mengels, 2009). This diet forces individuals to obtain their protein needs from a variety of grains, legumes, seeds, nuts, fruits, and vegetables. There are several different classifications, or levels of vegetarianism. The lacto-ovo vegetarians will allow themselves to consume dairy and egg products, and the lacto-vegetarians exclude egg products but will allow intakes from dairy products (Craig & Mengels, 2009).

Vegan college students' are most likely categorized as semi-vegetarians'. This term is used to describe students who follow a vegetarian diet with the exception of occasionally consuming meat products such as seafood and chicken. Protein sources of non-animal origin are limited in university dining venues that offer little variety in legumes, grains, and vegetables (Stein, 2004). Although vegan diets do not require large amounts of protein, college students find it difficult to meet their nutrient needs when following a strict vegan diet. Students find themselves relying on combining protein intake from animal and plant-based foods when necessary (Craig & Mengels, 2009).

Several newly designed cafeterias have incorporated more vegan items in universities, but this transition has moved slowly among universities nationwide (ARAMARK, 2005). Introducing more vegan items may require universities to re-evaluate the entire dining process.

Adopting a vegetarian diet in college may not necessarily lead to a healthier lifestyle. Studies have shown correlations between vegetarianism and disordered eating behaviors or

weight preoccupations. Vegetarians in college were found to have greater dietary restraint than non-vegetarians, and were more susceptible to meal skipping, and reliance on dietary supplements. These behaviors may lead to disordered eating behaviors (Kloop, Heiss, & Smith, 2003).

College Students' Food Consumption

Food choices. Guidelines for individuals wanting to make healthy dietary choices have been established by several authoritative bodies such as the World Health Organization (WHO) and the American Heart Association (AHA). According to the WHO, making healthy dietary choices includes: 1) limiting energy intake from total fats, 2) shifting consumption from saturated to unsaturated fats, 3) increasing consumption of fruits, vegetables, whole grains, legumes and nuts, 4) limit sugar intake to less than 10% simple sugars, 5) limit salt consumption from all sources, and 6) maintain sufficient protein intake (WHO, 2011). The AHA recommendations are similar but also suggesting the elimination of trans fatty acids from the diet (Gidding et al., 2009).

A 2007 study conducted by Kolodinsky and colleagues measured the effect nutrient knowledge had on college students' food choices and ability to meet dietary guidelines (Kolodinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007). A self survey was completed by 200 college students (136 females and 64 males) who followed a university meal plan during their first two years. Students reported eating less than the recommended amounts of all food groups except grains. In the protein category, 56% of females reported eating less than the recommended amount compared to 22% men; 39% reported eating more than recommended amounts. Students who consumed the recommended amounts of whole grains showed greater nutritional knowledge than those who did not meet recommendations. Approximately 67% of

students chose 1% milk over 2%, or whole milk compared to 33% who rarely make this choice. Student percentages were higher in making healthy choices such as eating lower-fat luncheon meats, low-energy salad dressing, and frozen yogurt, reflecting higher nutrient knowledge in these areas, and suggesting that knowledge affects college student food choices (Kolodinsky et al., 2007).

A 2003 United Kingdom study focused on changes in nutrient intakes during the first year at college (Edwards & Meiselman, 2003). Three cohorts of first year students were studied over three consecutive years. Data was collected in the form of surveys and food frequency questionnaires. Data was measured from September to January, and January to May. The results showed energy declines in both male (13.5%) and females (15.8%) during the January to May period. Protein, fat and carbohydrate intakes significantly declined from September to January. Protein intakes in females increased from January to May while fat intake declined. Food frequency of items decreased during the September to January period, and increased for certain food items in females from January to May. The decline in energy intake suggests decreased consumption of food. This may have been caused by economic reasons, dislike of food choices, or unwillingness to pay for food items (Edwards & Meiselman, 2003).

Increasing the availability of fruits and vegetables is always a challenge in high school and elementary school cafeterias. Schools try to address this issue by incorporating salad bars in cafeteria meals. Similarly, self-service salad bars are often offered in Greek houses with a wide range of fresh fruits and vegetables.

A study conducted by Adams, Pelletier, Zive, and Sallis (2005) assessed fruit and vegetable intake using two different types of salad bars. Pre-portioned salads and self-service salad bars were offered in two separate elementary school districts. There were five different

items offered on the pre-portioned salad. There were four items offered in one school and seven items offered in the other school's self-service salad bar. The results showed a trend in the self-service salad bar; consumption increased when variety increased (Adams et al., 2005). The trend of increased consumption with increased variety helps provide insight to members' approach to food choices from the salad bar.

A self-service or buffet style meal environment influences an individual's food choice, portion size, and amount of intake. Results from a 2003 study (Marshall & Bell), determined that food choice is more dependent on meal situation than food and taste preferences. Meal situation can be described as place of meal, social environment, occasion, and convenience (Ahlgren, Gustafsson, & Gunnar, 2005). This finding can be related to the environment of sorority meals, and how the meal situation in sorority houses impacts members' food choices.

College food service. The nutritional status of college students has been a concern for researchers. Common diet behaviors that affect nutrient intake among students include large consumption of fast foods or energy-dense foods, alcohol consumption, skipping meals, consumption of high-caloric snacks, avoidance of nutrient-dense foods, and the large portion sizes in dining halls (Driskell, Schake, & Detter, 2008). College students may adopt dieting practices such as overeating due to the self-service buffet atmosphere. University dining settings allows students the freedom of determining their portion sizes and amounts of servings of available food items. This is different from the previous dining experience students had in school lunch programs. School lunch programs follow nutrient regulations established by USDA and are required to serve students portions derived from standardized recipes. Because universities are not required to follow similar regulations, nutrient intake varies among college students making individual intake difficult to assess in university dining settings (Driskell et al., 2008).

Residence halls and campus dining areas are environments that may lead students to consume excess calories (Kasparek et al., 2008). Convenience stores and vending machines located in residence halls are appealing meal sources to students and convenient substitutes when meals are skipped (Brunt et al., 2008). However, the foods offered by these sources are high in sodium, fat, and added sugars. The availability of these foods further increases caloric intake and can lead to poor dietary habits (Jung et al., 2008). In campus dining, healthy food options are limited and great amounts of processed food items are offered. Processed foods are high in sodium, further contributing to students' sodium intake (Edwards & Meiselman, 2003).

Food availability, price, convenience, taste preferences, meal plans, portion sizes, and attitude and behavior of peers all play a role in the development of student's dietary habits (Craigie, Mathers, Rugg-Gunn, & Adamson, 2004). These dietary changes are most evident during the first college year. First year students are usually required to live on campus and participate in university meal plans. The University of Mississippi does require first year students to follow a meal plan, but several different plans are available. A temporary meal plan option is also offered for students planning to join a Greek organization and participate in Greek meal plans.

Brown et al. (2005) conducted a study to determine the nutritional benefits of students who participate in meal plans with those who do not. Nutrient intakes were evaluated using the Food Guide Pyramid recommendations for servings in each food group. Results showed that students who participated in a meal plan had significantly greater intakes in meat, vegetable, and fruit food groups. However very few students were able to meet the recommendations for each food group. Gender differences showed that males had greater vegetable intakes than females, but researchers suggested this increase was related to larger French fry consumption and not

from other vegetables. Low intakes of fruit and vegetables are commonly seen in college students, but students who participated in meal plans still had greater intakes than those without a meal plan. The results found very few students were able to meet all their recommended servings regardless of meal plan participation. However, students participating in meal plans had slightly greater intake of recommended servings showing that there are nutritional benefits to participating in meal plans (Brown et al., 2005).

Disordered eating behaviors. The development of disordered eating patterns and body dissatisfaction is a problem frequently seen among female college students. Body consciousness begins in adolescence due to pressures from media, family, and peers (Malinauskas et al., 2006). Regular conversations about dieting techniques, comments on appearance, and the need to lose weight occur almost daily among college students (Ousley, Cordero, & White, 2008). The emphasis on thinness and beauty has stemmed from media influences and has created an ideal body image in students' minds. This emphasis is so prevalent that even discussions about another individual's appearance, positive or negative, can increase levels of body-shape concerns and give rise to eating disorder behavior (Ousely et al., 2008).

Anorexia nervosa and bulimia nervosa are the two eating disorders most prominent among college and sorority women. Individuals with these eating disorders are characterized by an excessive concern with body shape and weight, and application of extreme behaviors to control their weight (Phillips & Pratt, 2005). Anorexia is manifested by self-starvation methods and results in a body weight less than 85% of normal weight for height and age. In individuals suffering from this eating disorder, their thinness contributes to their levels of self-esteem. Inappropriate dieting behaviors include caloric restrictions between 300-500 calories per day, binging one small amounts of high-calorie food, misuse of laxatives and diuretics, and obsession

with weight loss and exercise. The physiological effects of starvation may include vitamin and mineral deficiencies, weakened immune system, irregular cardiac rhythm, and amenorrhea (Miranda & Karlis, 2007).

In bulimia nervosa, individuals may be underweight, normal weight, or overweight. They are unable to discipline themselves and often overindulge during binge episodes. To prevent further weight gain, many engage in purging or self-induced vomiting following a binge. Others go through fasting periods or participate in excessive exercise to control weight after a binge. It is estimated that 20-30% of college women participate in bulimic activity (Phillips & Pratt, 2005). Both anorexia and bulimia are caused by psychological factors that may be easily influenced by the sociocultural factors present within the sorority environment.

Greek organizations. As previously mentioned, joining a Greek social organization can impact students' lifestyles. Greek organizations provide opportunities for students to socialize based on culture, ethnicity, academic honors, and community service. The groups present themselves as societies and often reside in a chapter house. This social organization provides members with social activities, regular meals, comfort and the support of a like-minded community.

Although all college students are influenced by the social pressures leading to eating pathology, these traits have been found to be stronger in members than non-members. The incidences of eating disorders remain highest in members (Allison & Park, 2004). This is best explained by Crandall's research (1988) on disordered eating in sororities. Crandall found that the intense social pressures present in sororities contributed to a pattern of disordered eating, or an adoption of binge-eating habits over time. A member's binge-eating can be predicted by the extent of binge-eating behaviors in their friendship circle. This research also supports the idea

that women most vulnerable to conformity are largely affected by sorority pressures of appearance (Basow et al., 2007).

Researchers Basow et al. (2007) examined the relationship between perceived social pressure, disordered eating attitudes, and body objectification in members living in the house for 2-15 months. Time spent living in the house was not significant to perceived pressures from sisters, but was significantly correlated ($p>0.5$) to bulimia and body dissatisfaction levels. Sorority women living off-campus but with other members were at higher risk for developing disordered eating than those living with non-members (Basow et al., 2007). Women who intended to join a sorority showed higher levels of perceived pressures toward body objectification and thinness than individuals with no intent to join. In contrast to results from the study previously described (Allison & Park, 2004), individuals intending to join a sorority displayed similar disordered eating attitudes as current members. These same attitudes were also exhibited by other individuals intending to join, but not among non-joining individuals (Basow et al., 2007).

In a longitudinal study conducted by Allison and Park (2004), disordered eating patterns were measured in sorority and non-members over a three year period. Surveys were given once each year to both groups and measured females' drive for thinness, bulimia, and body dissatisfaction. The results showed that women belonging to a sorority gained significantly more weight over the three year period than non-sorority women. It was also found that freshman who participated in sororities and those who did not had the same scores for disordered eating patterns. Depression and self-esteem measures were also similar for these two groups. After two years, non-sorority women scored lower than members in their drive for thinness, but not in bulimia and body dissatisfaction. The results concluded that membership was found to further

encourage thinness, diet and weight issues over time (Allison & Park, 2004). Although, there was no significant difference in the prevalence of bulimia and body dissatisfaction between members and non-members, the results still show that disordered eating patterns are challenges all college women face regardless of Greek membership.

All college students participate in some type of judgment regarding physical appearance, weight, or diet habits. Sororities place high pressures on how they are perceived as a whole because they want positive recognition throughout campus (Malinauskas et al., 2006). Women with heightened body consciousness and disordered eating attitudes join social groups that reinforce their attitudes and behavior. Future research is needed to help dispose of these preexisting behaviors and attitudes adapted in sororities (Basow et al., 2007).

Sorority House Meals

House directors. House directors of sorority organizations have numerous responsibilities but their main job description is to provide administrative oversight to the sorority chapter, and act as an advisor to all members of that chapter house. The women who seek these job positions are typically middle-aged or older, live by themselves, and are looking for part-time employment with job flexibility. House directors come from a variety of educational backgrounds although experience in restaurant management, food catering, property management, event planning, and previous house director experience are preferred. Excellent house director candidates include airline retirees, educators, Peace Corps and social workers, and business owners or managers. Public relations and parenting skills are desirable traits. It is ideal for sorority house directors to have food service experience, but many do not. The process of placing house directors in the appropriate chapter house is completed by assessing the needs and requirements of both the chapter house and the house director applicant. The *Greek House*

Resource is a placement service for house directors' and aims to create the best possible match between Greek house and director.

Sorority house directors are provided a private room and bath, and have a time commitment to work 10 hours a week. Time spent carrying out their administrative responsibilities varies and their busiest periods occur during the beginning and end of school semesters. There is an initial two-week training prior to starting the house director position. There are few complete references to assist new house directors with their new responsibilities. There are online sources available in the form of E-books. These resources were written by current house directors as a means to provide outside resources to those who are new to the house director position.

Sorority members. Members are of particular interest because of the challenges and social pressures encountered within the sorority system. Sororities have the ability to impact member behaviors (Turrisi et al., 2006). The behaviors encountered among members differ than fraternities and require different approaches toward addressing these issues. An increased interest in sorority dynamics and eating behaviors is the reason why this group was chosen to study.

Sorority meals are included in membership fees, and the majority of members consume all their nutrients from meals served at the sorority house. There are many food options offered at each meal; sometimes making it difficult for members to choose what to eat. This can encourage overconsumption of certain foods and discourage members from making healthy choices with what is available (Adams et al., 2005).

Sorority participants who consume the majority of their meals from sorority houses narrow down their sources of dietary intake. However, if a sorority member is paying for her own membership fees, the pressure to participate in every meal and gain the full benefits of the

membership may be felt. Meals do not always appeal to the member's taste preferences and the planned cycle menus can be monotonous with daily meal participation. The taste preferences and eating habits of the members influences participation rates and therefore, influence the types of foods that are purchased and offered.

Menu planning. There is almost no research literature specific to sorority food service. Sorority house directors have the responsibility of planning meals and establishing menus. As a time-saver, many house directors pull previous menus, including some that may have been designed by past house directors. House directors combine new and old menus and rotate them as cycle menus.

A previous unpublished study by the author analyzed menus from seven of the nine houses sorority houses located on the Oxford campus. Results from this study further indicated great similarities among sorority menus and suggested similar results could be represented using a sample size of three sorority houses (Moosa, J. *A Menu Analysis of Ole Miss Sororities*, unpublished study, 2008).

CHAPTER III. METHODOLOGY

To determine if sorority house directors' provide meals with adequate nutrients for members to meet their dietary recommendations, menus and recipes were collected from house directors and their food service staff. In order to conduct an accurate menu analysis, menus and recipes from a one-week cycle menu 14 meals (5 breakfast, 5 lunches, and 4 dinners) were collected. Collected menus were not derived from the same week, but were offered in the months of August or September. Approval from the Institutional Review Board (IRB) was secured which granted approval for all menus and recipes to be given to the primary investigator. The investigator collected data from all three houses and no other data collectors were used. Informed consent was waived because there was no direct contact between the primary investigator and members. The only contact made was between the house directors and the primary investigator. All house directors were assured of confidentiality and anonymity of data collected from their houses.

Participants

Three of the nine sorority houses located on the University of Mississippi campus were chosen as a sample of convenience because their house directors were willing to participate. The menus offered in the three participating sorority houses have been used for many years and shared among the house directors. All three sorority houses served approximately 200 female members that were between the ages of 18-24.

Interview Process

A survey instrument was designed for the interview process prior to visiting with house directors (See Appendix A). This survey was developed following guidelines set by the USDA Nutrient Analysis Protocols (USDA, 2010). House directors were to provide recipes for all meals featured in their one-week cycle menu. However, none of the three house directors were able to provide written documentation for these recipes. In order to gather all the necessary information needed for an accurate menu analysis, the food service workers of sorority houses were also interviewed about food preparation methods.

Food preparation methods used by food service workers were recalled from memory and the ingredients were recorded by the investigator. All ingredients added to each recipe were recorded, and the ingredient amounts were estimated. Food service workers noted which utensils they used for the menu items listed and the approximate size of each standard serving utensil. The three participating house directors ordered food items from the same food distributors. Some of the menu items ordered were pre-packaged and no recipes were used. Name brands were provided by the house directors for well known products. For these foods, information regarding food preparation methods was obtained and recorded during the interview. The same questions were asked to each director to maintain consistency of data collection.

Information gathered during the interviews included how each food item was cooked (steamed, fried, grilled, boiled), seasoned (added salt and fat, type of fat used), and served (diameter and height of items, approximate size or weight) were also asked. Questions regarding menus and each food item were based on the USDA Nutrient Analysis Protocols (USDA, 2011). Additionally, information was needed for food items that were offered to members but not litsted on the one-week cycle menus.

Questions regarding what beverages were offered throughout the day were asked along with the ounce sizes of cups used for the beverages. Additional data collected from the house directors' included their process of planning menus, problems they have experienced during menu planning, average meal participation rates, and taste preferences.

Once data on the menus, recipes, and food items was collected, a menu analysis was performed. Menus and recipes were analyzed using the *Nutrition Data Systems for Research* (*NDSR*) software (NDSR, 2010), (Schakel, 1997). An electronic menu analysis folder was developed for each sorority house and labeled Sorority A, B, or C

Data was entered using one serving size of each food item offered. For food items that did not require serving utensils such as scoops or spoons, standard serving sizes established by the USDA were used for data entry (USDA, 2011).

Menus, recipes, and food items for the five days were entered under the following headings; breakfast, hot lunch, salad and deli bar, dinner, and beverages. Food items were entered under the appropriate meal heading and under the established software categories (e.g. coffee, bagel, milk). Specific details for the food items were identified (e.g. low-fat, two percent, or chocolate milk) strengthening the accuracy of data entry. Combination food items (e.g. salad, sandwich) were entered under "assembled food". When a food item was not found within the software, NDSR would search for a food item that most closely resembles the "missing food item" (NDSR User Manual, 2010).

The menus were analyzed for carbohydrates, protein, fat (total, saturated, and unsaturated); vitamins A, B_6, B_{12}, C, D, and K and folate; the minerals calcium, iron, magnesium, potassium, and sodium; and dietary fiber. Total kilocalories of energy provided was also determined.

Weekly averages were calculated for each meal. The averaged amounts of nutrients offered were then compared to Dietary Reference Intakes for the age group of females 19-30.

Total weekly averages (5 days) were calculated for each menu collected from the participating houses. The results of weekly averages from each house were then averaged together (3 houses) to represent a total average for the sorority menus.

Results were described using descriptive statistics and calculated weekly means of nutrient amounts in menus. Results of data were compared with the established nutrient recommendations in the form of RDAs. In addition to the total averages of the nutrients, individual nutrient levels were calculated for each meal: breakfast, lunch and dinner, the salad and deli bars, and beverages offered throughout one day. The results of each meal were displayed in six tables representing each sorority house; a seventh table compared total averages of sorority houses according to meals.

Statistical Analysis

A non-parametric test was chosen for statistical analysis. The RDAs were compared to corresponding nutrient values from the menu analysis. Because of the wide range of values and the fact that the nutrients were measured in different units each nutrient was converted to a percentage so that relative correlations of each nutrient could be compared. These percentages were then inverse sine transformed so that the data could be subjected to a paired t-test to measure over all relative differences between the RDA and observed values from the menus. Percent difference calculations were made between the observed values of each sorority with the expected RDAs. The critical value of *t* was found with 16 degrees of freedom and a probability of *0.05* (p-value $\geq$ 0.05) to test for significance. The degrees of freedom were calculated from the sample of nutrients included in the non-parametric test; nutrients related to fat content were not

included because RDAs were not available. Calculations were made to adjust the observed values in order to match a similar distribution of the expected values from RDAs. Potassium made the most impact on the distribution of data, and contributed to 39% of RDA values. In order to show the same distribution, potassium was increased to represent 39% of the menu values and match the data distribution of expected values.

CHAPTER IV. RESULTS

The results of the study show that all three sorority houses offer a wide variety of foods that provide adequate amounts of all nutrients examined (Table 1, Figure 1) Sorority houses offer numerous additional food items, or a la carte items, at each meal in order to appeal to all members' tastes and preferences. All a la carte menu items were included in the menu analysis and may help explain why nutrients were offered in such high amounts. These large nutrient amounts support the hypothesis that sorority members' are able to meet their nutrient needs from sorority menus. However, these results only show what is being offered and do not reflect amounts of nutrients consumed by sorority members.' Because nutrient consumption was not measured, it can be inferred that the ability to meet appropriate individual nutrient needs is based on the choices sorority members make during meals. The abundance of available food choices may also influence patterns of overconsumption and sorority members' ability to make healthy food choices.

As seen in Table 1, sorority C's menu offered the least amount of calories. This is mainly because sorority C offered the least amount of additional items. Although sorority C does not have as extensive a menu as sororities A and B, sorority C offered a wider variety of healthier food items (See Appendix B, C, D). This included the incorporation of vegetarian items in sorority C's menu with at least one vegetarian entrée offered every day.

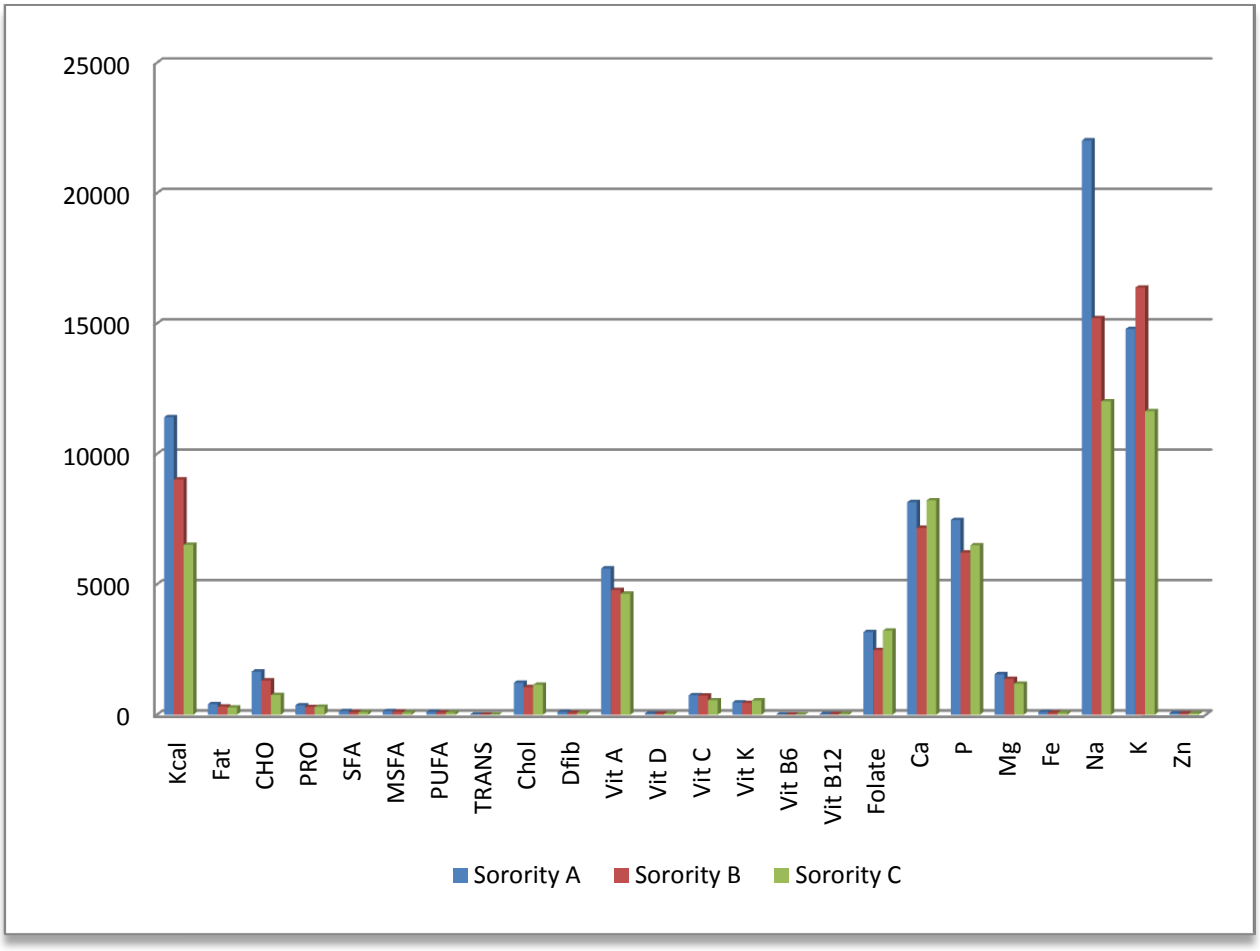
Sorority A offered the most calories compared to sorority B and C (Table 1, Figure 1), primarily because sorority A offered a much larger breakfast than the other two sororities. All three sorority houses have a standard hot breakfast pattern and offer the same foods every day.

TABLE 1.
Average of Five Day Menu in Sorority Houses

Nutrients	RDA/AI	Sorority A	Sorority B	Sorority C	Total Average
Kilocalories (kcal/d)	**2000**	**11,405+**[1]	9022	**6515 –**[2]	**8981**
Fat (g/d)	ND	403	309	274 **–**	329
Carbohydrates (g/d)	**130**	**1652+**	1312	**752 –**	1239
Protein (g/d)	46	357	294	301	317
Saturated Fatty Acids (g/d)	ND	135	93	93	107
Monounsaturated Fatty Acids (g/d)	ND	134	114	83	110
Polyunsaturated Fatty Acids (g/d)	ND	103	79	78	87
Trans-Fatty Acids (g/d)	ND	9	9	5	8
Cholesterol [3]* (mg/d)	≤300	1226	1059	1147	1144
Dietary Fiber (g/d)	25 (AI)	102	73	75	83
Vitamin A* (µg/d)	**700**	**5605+**	**4779+**	**4639+**	**5008+**
Vitamin D (µg/d)	5	46	46	42	45
Vitamin C (µg/d)	75	743	731	**553+**	676
Vitamin K (µg/d)	90 (AI)	467	447	546	487
Vitamin B6 (µg/d)	1.3	9.5	9.3	9.7	10
Vitamin B12 (µg/d)	2.4	25.9	27.6	33.3**+**	29
Folate (µg/d)*	**400** (AI)	**3168+**	2478	**3222+**	**2956+**
Calcium (mg/d)*	**1000**	**8149+**	**7164+**	**8220+**	**7844+**
Phosphorus (mg/d)	**700**	**7464+**	**6220+**	**6496+**	**6727+**
Magnesium (mg/d)	**310**	**1551+**	1373	1184	1369
Iron (mg/d)	18	97	76	73	82
Sodium (md/g)	**1500 (AI)**	**22021+**	**15202+**	**12015+**	**16413+**
Potassium (mg/d)	**4700 (AI)**	**14791+**	**16377+**	**11639+**	**14269+**
Zinc (mg/d)	8	54	49	53	52

[1] (+)Values that are above average
[2] (-)Values that are below average
[3] (*)Tolerable Upper Nutrients

FIGURE 1.
Total Average of Nutrient Amounts for a Five Day Menu



This pattern includes food items such as eggs (prepared upon request), sausage or bacon, toast, and biscuits. In addition, several a la carte items were provided. Several different hot and cold cereals, fresh fruit, different types of milk, and yogurt were available in each house.

Total weekly averages offered from each meal (breakfast, hot lunch, salad/deli bar, dinner, and beverages) are displayed in Tables 2-6. These tables allow for comparison of each meal between the three sorority menus.

The amounts of nutrients were averaged over the five breakfast meals. Table 2 shows the large number of food offerings among all sorority houses when compared to other meals. Sorority A offered the most food items during breakfast. The reason for this is that Sorority A offered a wider variety of a la carte items every day. This is reflected in the higher amounts Sorority A has in each nutrient component when compared to the other two sororities. Unlike sorority A, sororities B and C offer fewer a la carte items, but serve one different hot option everyday such as pancakes, omelets, blueberry muffins, or French toast.

The lunch meal (hot lunch, salad and deli bars) is the second largest food meal offered after breakfast. The hot lunch meal options are offered on a buffet line and change each day (Table 3). The results for this meal reflect the average amounts of nutrients offered for the five lunch meals in each sorority. Amounts of the eight nutrients shown on nutrition labels offered per meal were averaged across all three sorority houses (Table 4, Figure 2).

The hot lunch foods offered are the lowest in the nutrients measured when compared to nutrients offered in the salad and deli bars (Table 5). Calories offered in the hot lunch range from a high of 947 kcal/d in sorority A to a low of 765 kcal/d in sorority C compared to a range of 2,717 kcal/d in sorority B to 1,931 kcal/d in sorority C for the salad and deli bars.

TABLE 2.

Average of Total Nutrient Values for the Breakfast Meal for Five Days

Nutrients	Sorority A	Sorority B	Sorority C
Kilocalories (kcal/d)	**5,567**	3,725	3,268
Fat (g/d)	156	112	97
Carbohydrates (g/d)	**907**	722	501
Protein (g/d)	171	134	128
Saturated Fatty Acids (g/d)	61	40	31
Monounsaturated Fatty Acids	47	40	35
Polyunsaturated Fatty Acids	33	22	22
Trans-Fatty Acids	4	4	3
Cholesterol (mg/d)	824	**1114**	626
Dietary Fiber (g/d)	61	32	43
Vitamin A (µg/d)	**3054**	2766	2275
Vitamin D (µg/d)	25	23	21
Vitamin C (µg/d)	125	183	185
Vitamin K (µg/d)	70	57	46
Vitamin B6 (µg/d)	5.7	5.3	7.3
Vitamin B12 (µg/d)	17.3	18.5	24.3
Folate (µg/d)	505	1205	**1554**
Calcium (mg/d)	3,226	2,840	**3,555**
Phosphorus (mg/d)	**4068**	3189	3509
Magnesium (mg/d)	802	506	616
Iron (mg/d)	68	53	58
Sodium (mg/d)	**11,904**	4,967	5,240
Potassium (mg/d)	**6,371**	5,000	4,846
Zinc (mg/d)	33	26	35

TABLE 3.

Average of Total Nutrient Values for the Hot Lunch for Five Days

Nutrients	Sorority A	Sorority B	Sorority C
Kilocalories (kcal/d)	947	914	765
Fat (g/d)	47	40	34
Carbohydrates (g/d)	90	99	86
Protein (g/d)	43	42	31
Saturated Fatty Acids (g/d)	17	15	11
Monounsaturated Fatty Acids (g/d)	17	14	12
Polyunsaturated Fatty Acids (g/d)	10	7	8
Trans-Fatty Acids (g/d)	1	2	2
Cholesterol (mg/d)	97	155	56
Dietary Fiber (g/d)	7	9	5
Vitamin A (µg/d)	245	268	171
Vitamin D (µg/d)	1	1	1
Vitamin C (µg/d)	25	24	25
Vitamin K (µg/d)	40	34	25
Vitamin B6 (µg/d)	0.7	0.7	0.4
Vitamin B12 (µg/d)	1.3	1.7	0.9
Folate (µg/d)	160	148	147
Calcium (mg/d)	390	319	434
Phosphorus (mg/d)	638	549	424
Magnesium (mg/d)	101	120	81
Iron (mg/d)	6	7	5
Sodium (mg/d)	2,037	2,090	2,021
Potassium (mg/d)	951	1,318	748
Zinc (mg/d)	5	5	3

TABLE 4.
Average Nutrient Values per Meal

Meals	Breakfast	Salad/Deli bar	Hot Lunch	Dinner	Beverages
Kilocalories (kcal/d)	4187	2276	875	1415	1849
Fat (g/d)	121	147	40	55	19
Carbohydrates (g/d)	708	173	92	176	331
Protein (g/d)	144	73	39	60	46
Cholesterol (mg/d)	855	258	103	325	64
Fiber (g/d)	45	20	7	14	7
Sodium (mg/d)	7370	5709	2049	2720	827
Potassium (mg/d)	5406	2267	1006	1710	4928
Total	**18836**	**10923**	**4211**	**6475**	**8071**

Shading indicates above average values.

Each sorority house offered a wide variety of salad dressings (Table 5). Although low fat or fat free dressings are offered, all three house directors indicated that members more often select the higher fat dressings. Also, the large amounts of toppings offered on the salad bar such as: croutons, bacon bits, and cheeses all contribute to the high fat content of (147g/d) of this meal across all sororities (Table 4). Sodium is also high in this category with a range of 4,577 mg/d to 6,593 mg/d (Table 5). Calcium amounts were adequate to meet daily needs with a range of 891 mg/d to 1,363 mg/d.

FIGURE 2.
Total Average of Nutrient Amounts per Sorority Meal

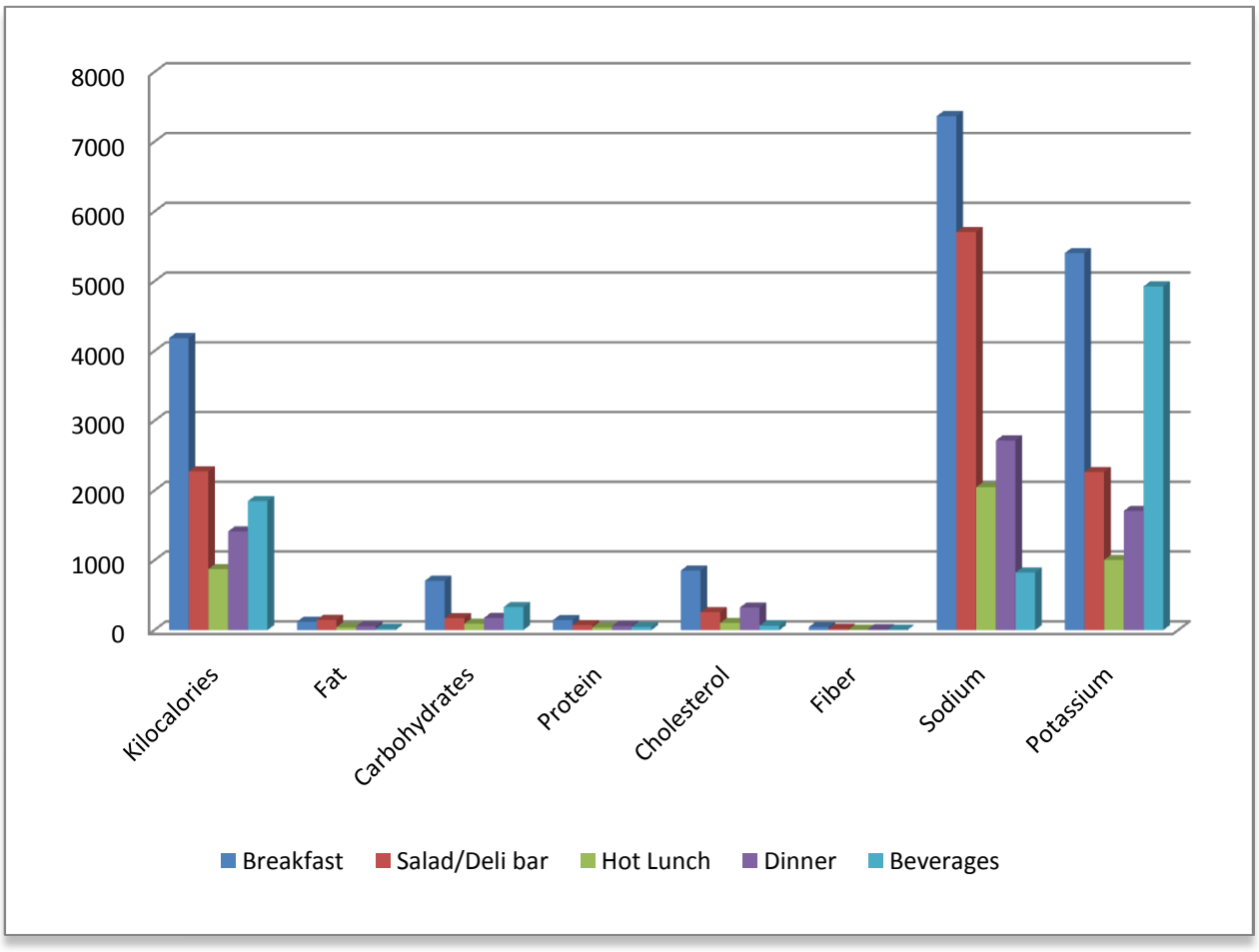


TABLE 5.

Total Amounts of Nutrients from Salad and Deli Bars for a Typical Day

Nutrients	Sorority A	Sorority B	Sorority C
Kilocalories (kcal/d)	2,179	2,717	1,931
Fat (g/d)	137	174	130
Carbohydrates (g/d)	178	209	132
Protein (g/d)	68	87	65
Saturated Fatty Acids	31	40	31
Monounsaturated Fatty Acids	50	61	39
Polyunsaturated Fatty Acids	49	63	52
Trans-Fatty Acids	2	3	2
Cholesterol (mg/d)	127	308	339
Fiber (g/d)	20	23	16
Vitamin A (µg/d)	741	1059	1086
Vitamin D (µg/d)	0.4	3	1
Vitamin C (µg/d)	75	103	80
Vitamin K (µg/d)	254	394	388
Vitamin B6 (µg/d)	1.2	2.0	0.9
Vitamin B12 (µg/d)	1.6	3.2	2.8
Folate (µg/d)	361	408	386
Calcium (mg/d)	1,363	891	1,171
Phosphorus (mg/d)	1332	1533	1396
Magnesium (mg/d)	238	320	182
Iron (mg/d)	11	13	10
Sodium (mg/d)	5,957	6,593	4,577
Potassium (mg/d)	1,777	3,264	1759
Zinc (mg/d)	9	10	8

Dinner is offered four nights a week and is the only meals where additional options are not available. The average of total nutrient values for dinner is shown in Table 6. Of all meals, dinner was lowest in calories with a range of 909 kcal/d for sorority C to 1,216 kcal/d for sorority A. Total fat was also low with a range of 36 g/d for sorority C to 54 for sorority A.

Beverages were not included in the food analysis but were analyzed separately. A large amount of kilocalories are offered from beverages and totals from analysis show they are high in carbohydrates, vitamin A, C, and potassium. As seen in Table 6, the amounts of these nutrients are higher for sororities A and B because they have beverage machines that offer cranberry, apple, and orange juices. All three sororities offered self-serve tap water and ice.

Results of the statistical analysis showed that the relative amounts of nutrients were the same in the RDA and menu values (Figures 3 and 4). The calculated mean value *1.589*, did not exceed the critical value $\alpha = 2.120$ (calculations made using df= 16; p=.05) supporting the hypothesis that the relative proportions are the same. Percent difference calculations showed that the menu values were approximately 18% more than the RDA values. This shows that sorority members can consume the recommended amounts of nutrients from meals at the sorority house.

TABLE 6.
Average of Total Nutrient Values for Dinner for Four Days

Nutrients	Sorority A	Sorority B	Sorority C
Kilocalories (kcal/d)	1,216	1,032	909
Fat (g/d)	54	50	36
Carbohydrates (g/d)	127	111	96
Protein (g/d)	60	43	51
Saturated Fatty Acids	21	19	13
Monounsaturated Fatty Acids	18	14	11
Polyunsaturated Fatty Acids	10	13	9
Trans-Fatty Acids	2	1	2
Cholesterol (mg/d)	176	181	118
Dietary Fiber (g/d)	9	11	10
Vitamin A (µg/d)	695	702	413
Vitamin D (µg/d)	2	1	3
Vitamin C (µg/d)	32	32	46
Vitamin K (µg/d)	65	123	116
Vitamin B6 (µg/d)	1.0	0.9	1.0
Vitamin B12 (µg/d)	1.5	1.3	2.2
Folate (µg/d)	192	272	240
Calcium (mg/d)	315	337	489
Phosphorus (mg/d)	650	561	708
Magnesium (mg/d)	98	126	136
Iron (mg/d)	9	8	7
Sodium (mg/d)	1897	1683	2079
Potassium (mg/d)	1446	1236	1,217
Zinc (mg/d)	6	4	5

TABLE 7.
Total Amounts of Nutrients from Beverages for Typical Day

Nutrients	Sorority A	Sorority B	Sorority C
Kilocalories (kcal/d)	1,828	2,466	1,254
Fat (g/d)	10	24	22
Carbohydrates (g/d)	392	369	232
Protein (g/d)	43	53	42
Saturated Fatty Acids	11	12	12
Monounsaturated Fatty Acids	4	6	6
Polyunsaturated Fatty Acids	2	3	2
Trans-Fatty Acids	0	1	1
Cholesterol (mg/d)	46	76	70
Dietary Fiber (g/d)	8	10	5
Vitamin A (µg/d)	479	718	550
Vitamin D (µg/d)	20	24	23
Vitamin C (µg/d)	416	433	308
Vitamin K (µg/d)	6	9	3
Vitamin B6 (µg/d)	1.0	1.3	0.9
Vitamin B12 (µg/d)	3.6	5.6	4.5
Folate (µg/d)	220	288	294
Calcium (mg/d)	2888	3520	3204
Phosphorus (mg/d)	1103	1614	1199
Magnesium (mg/d)	347	475	312
Iron (mg/d)	5	7	3
Sodium (mg/d)	710	1,028	744
Potassium (mg/d)	4,710	5,921	4,153
Zinc (mg/d)	5	12	5

FIGURE 3.
Nutrient Values from Menus

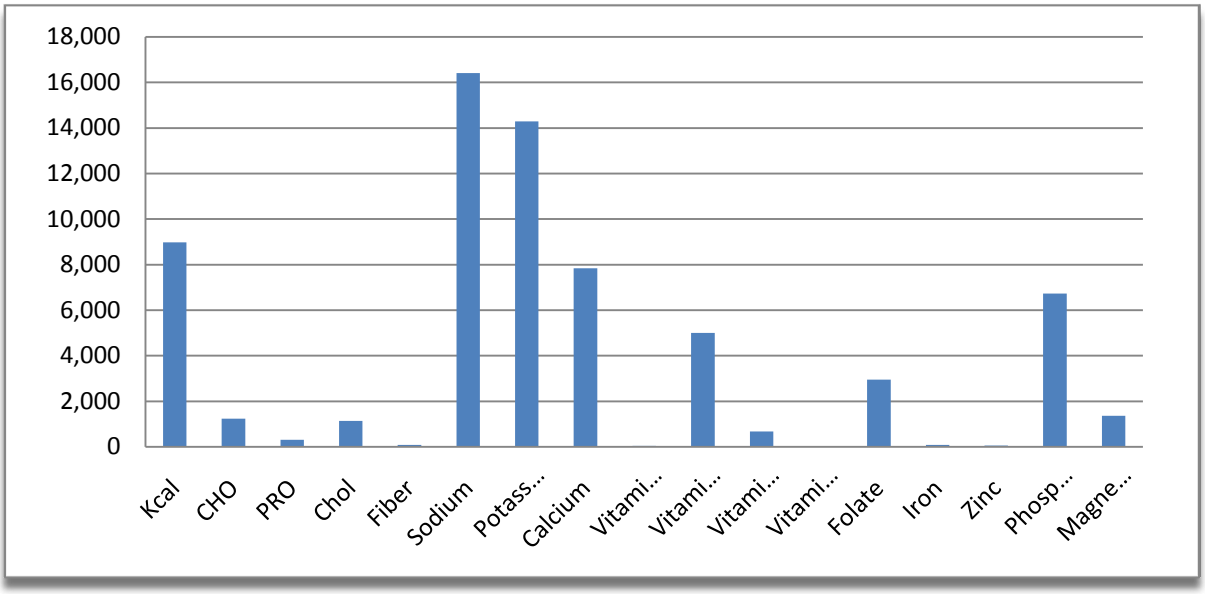
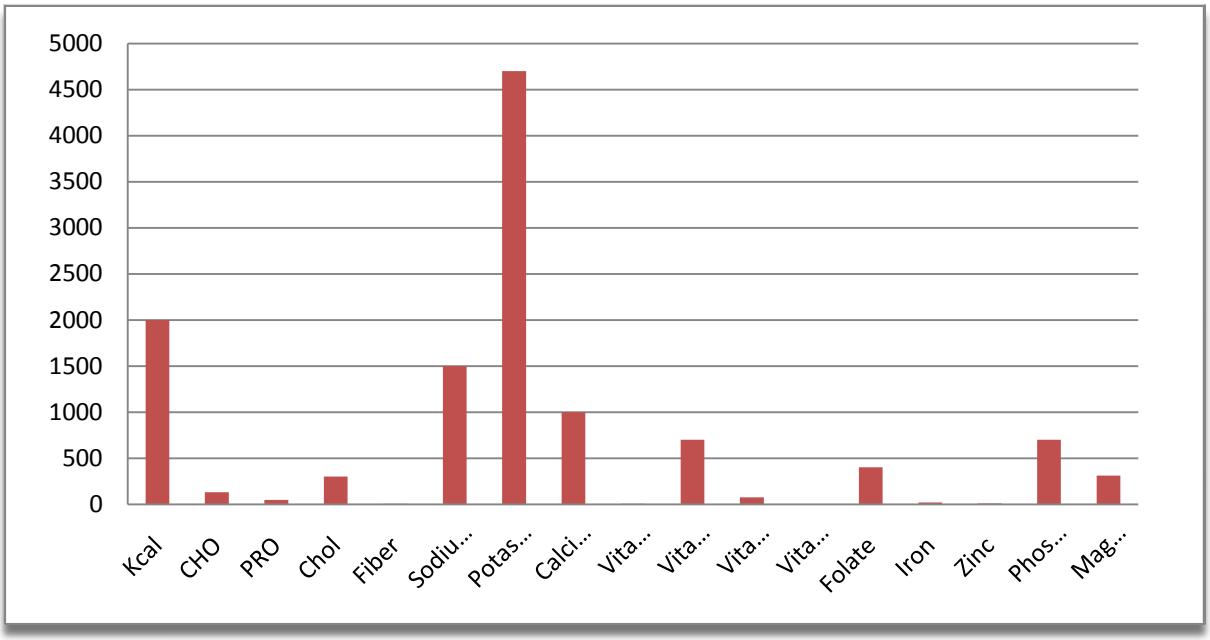


FIGURE 4.
RDA Values from Menus



House Director Interview Responses

Interviews conducted with house directors provided substantial information about meal planning and preparation, recipes and ingredients, and members' menu preferences. The following summarizes the interview responses provided by house directors.

One of the greatest challenges described by house directors is creating the menus and implementing them. Providing members with a variety of healthy meals that satisfy their taste preferences and keeping menus cost-effective is perceived to be a difficult task. However, there is no evidence-based literature, protocols, or guidelines available to assist house directors with these responsibilities. In their interviews, the house directors in this study stated that prior to working in the sorority houses they did not have previous knowledge about quantity menu planning and meeting nutritional requirements of their members.

None of the house directors had ever conducted a nutrient analysis on their cycle menus, and they did not know if their menus supported the nutritional needs of their members. House directors are not required to follow any dietary regulations or federal guidelines regarding meal composition. Members' taste preferences, meal participation rates, and scheduled social events assist house directors with determining what meals to offer and when to offer them.

In this study, house directors reported giving surveys to members during their weekly meetings and asking members to list their favorite items and the items they do not like. The majority of responses from members are requests for healthier menu items, such as take away the "fried Fridays". However, there were complaints when these menu items were discontinued.

House directors' also shared their concerns and difficulties when implementing healthier items. When menu items such as tilapia, salmon, broccoli, and sweet potatoes were offered, meal participation decreased during those meals. House directors feel that members may request

healthier food options, but still prefer the unhealthier options such as fried foods and high fat pasta entrees.

Weekly meals are available during the following times: breakfast (7:30 a.m. -9:00 a.m.), lunch (11:00 a.m. - 1:00 p.m.), and dinner (5:00 p.m. -6:00 p.m.). According to the house directors, the breakfast meal generates the least amount of participation because of the early time when breakfast is offered. Many students do not wake up early enough to participate in the breakfast meal.

Aside from members' requests and preferences, house directors plan their menus by forecasting meal participation on certain weekdays. Lunch tends to be the most consistently well attended meal. Lunch is the longest meal period offered and generates greater participation than any other meal offered. Lunch gives the majority of members' time to sit down and socialize with one another. There is also a greater number of food choices available during the lunch meal which may appeal to more members' tastes and preferences.

Unlike breakfast and lunch; dinner does not offer numerous additional options. Dinner menus include only one choice of meat, vegetable, starch, and dessert. The dinner meal changes every evening to increase variety in members' diet. If a sorority member does not like the dinner meal offered, she does not have alternative choices.

Participation in dinner meals is greatest on Monday and Thursday evenings. Every Monday evening, the sorority houses have sit down dinners followed by a meeting. Thursday evening is the last dinner meal available for the week. One house mother has used Thursday evenings to try new menu items, because the participation is so high. This provides her with more feedback and allows her to observe the acceptance of new menu items. Low dinner

participation occurs on evenings that sorority social events take place such as formal parties and other social gatherings referred to as “swaps” or “mixers”.

Interview data revealed that meals served in sorority houses are taken from cycle menus that have been circulating for many years. Past menus were designed by previous house directors and filed for new house directors to use.

CHAPTER V. DISCUSSION

Consuming all meals at the sorority house is convenient for members especially when they reside in the chapter house or on campus. Sorority houses offer 14 meals (5 breakfats, 5 lunches, and 4 suppers), five days a week and are paid for through membership fees.

Menus for the 14 meals were collected for nutrient analyses. Breakfast food items were no listed on any of the collected menus. House director for sorority A stated that she offered the same standard breakfast items every day of the week. House directors of sororities B and C offered that same breakfast items every day along with one new featured item.

Overall, the breakfast meals have the largest number of food offerings among all sorority houses when compared to other meals. Sorority A offered the most food items during breakfast with a wider variety of a la carte items every day. This wide variety contributed to the higher amounts of each nutrient component found in sorority A's menu compared to sorority B and C's breakfast menus. Sororities B and C offer the standard hot breakfast items, fewer a la carte items, but serve a different hot option everyday such as pancakes, omelets, blueberry muffins, or French toast. These items are not available every day like eggs, bacon, and cereal, but still allow the houses to vary their breakfast menus.

Adequate amounts of calcium and vitamin D can be consumed with breakfast food items. Healthy choices during this meal would include: dry cereals, oatmeal, whole wheat toast, fresh fruits, yogurt, and skim milk. Members need to be careful during this meal with respect to kilocalorie, fat, carbohydrate, and cholesterol intake. The amount of biscuits, bacon, sausage, and eggs consumed per day should be limited. It is recommended that whole egg consumption

should be limited to two or three times per week. Reducing cholesterol and saturated fat intake can also be achieved by requesting egg whites instead of whole eggs.

The nutrient values for each meal were averaged for easier comparison as seen in Table 4 and Figure 2. The breakfast meal offers the highest amount of calories, carbohydrates, protein, cholesterol, folate, saturated fat, calcium, sodium, potassium, and dietary fiber. College women commonly do not meet their fiber needs and breakfast offers an excellent opportunity for them to fulfill those needs.

Lunch involves several daily meal components; a hot lunch, salad bar, and deli bar. The hot lunch is offered in the buffet line and change each day (Table 3). The results for this meal reflect an average taken over the five days lunch is served. Hot lunch appears to be the healthier option for lunch and is the lowest meal in far, carbohydrates, and cholesterol. This is surprising when considering all the fried food that is offered over the course of the week. Sororities B and C both offer a "fried Friday" where they offer nothing but fried foods.

A salad bar is also available in every sorority house during this meal. Salad bars include a variety of toppings and dressings, both healthy and unhealthy. The salad bar may seem like a healthier option to some members, but the wide range of toppings and high-fat dressings may hinder the health benefits salads provide.

The deli bar provides a variety of luncheon meats, sandwich breads, cheeses, and sandwich toppings. Cold sandwiches may be made or toasted on a hot plate. With so many options, it is hard for members to dislike the lunch menus.

Results from the anlaysis of the salad and deli bars showed these categories to be the highest in fat (Table 5). Choosing the salad bar over the hot lunch items may seem healthier, but this can be deceiving. Each sorority house offers a wide variety of salad dressings, including low

fat or fat free dressings. Although healthier dressings are offered, they are not the popular choices among members. Also, the large amounts of toppings offered on the salad bar such as: croutons, bacon bits, cheeses, and high fat salad dressings all contribute to the high fat content in this category (147g/d average of all sororities) (Table 4).

The hot lunch meal is is lower in saturated fat than breakfast and offers more poly and monounsaturated fats. It is recommended to consume more of these "good fats" and try to stay away from the trans and saturated fats. The RDA for fat is not determined (ND) but total fat intake should be between 20-35% of an individual's diet. Intake of saturated and trans fats should be 15% or less (IOM, 2005).

Another nutrient offered in excess is sodium. The sodium content is approximately the same in all three houses. The high sodium seen in breakfast, salad and deli bars, and hot lunch put members at risk for consuming more sodium than needed. Adding table salt to a meal already high in sodium is unnecessary and is not recommended.

Sororities A and B offered one or two vegetarian entrees throughout the week. This forces vegan members' to rely on side items and the salad bar to support their nutrient needs on days when vegetarian entrées aren't offered. The salad bar is only offered during the lunch meal further limiting members' ability to follow strict vegetarian diets throughout the week. Also the majority of side items offered in sororities A and B such as potatoes, peas, lima beans, corn, black eye-peas, and are not rich sources of folate and vitamin B_{12}. These are two very important nutrients in vegan diets. This can be seen in the high nutrient amounts for folate and vitamin B_{12} offered by sorority C's menu (Table 1, Appendix D).

Previous literature suggests that more food options leads to greater consumption. This can be seen in the salad bar because there are fifteen or more items offered, and there are no

serving amounts established. Members may create a large salad with variety, and think they are making the healthier choices. In fact, this may account for half of their daily calories. However, the toppings and food items offered on the salad bar may provide more nutrient dense food items, allowing members to consume a larger amount and expose them to an increased variety of their recommended nutrients (Appendix E).

Dinner is offered four nights a week and represented as the only meal where additional options were not available (Table 6). Dinner was the only meal that resembled a typical family-style dinner pattern (meat, starch, vegetable). If members do not like what is being served for dinner they are not able to chose a salad or deli bar in place of that meal. There is usually a tossed salad offered during dinner and salad dressing options are limited. Similar to the hot lunch, dinner is one of the healthier meals offered in sorority houses and members should take advantage of this meal. The data show that they are able to meet nutrient need from multiple food components and unhealthy food options are limited. In the dinner meal there are no food items offered in excess. This decreases members' ability to make poor food choices.

Overconsumption of foods is less likely to occur during the dinner meal because the food options are more limited than lunch and breakfast. However, due to the buffet-style environment members can still chose food portions that are greater than what is recommended. Data from Tables 3, 4, and 6 demonstrate that hot lunch and dinner meals are closely related and appear to be the healthiest meals offered in sorority houses.

These menu items offered in the hot lunch and dinner meals are different on each day. These menu items may be repetitive in the cycle menus, but because there was only a one-week menu collected from each house the frequency these food items are offered over a span of weeks was not measured.

A large amount of kilocalories are offered from beverages and totals from analysis show they are very high in carbohydrates, vitamin A, C, and potassium (Table 7). This is mainly because sororities A and B have a beverage machines that offer cranberry, apple, and orange juice. This beverage machine is available to all members throughout the entire day. Sorority C provided lesser amounts of calories and sugars available from beverages than seen in sororities A and B. This is due to the fact that sorority C did not have a beverage machine.

House Director Survey

The training that house directors receive is minimal in regards to their job description and expectations. None of the participating house directors indicated having any previous foodservice experience or management of a foodservice operation. The two-week training required of all house directors is not sufficient for learning how to manage a household, and most importantly foodservice operations. Providing adequate and healthy nutrition to college students is very important in their academic success and growth into adulthood. There are a large percentage of Greek members who rely on meals from their chapter houses. This further creates a need for proper training in the house director position.

House directors can improve menus in the lunch and dinner meals by following members' suggestions and comments. A problem house directors identified was members' requesting healthier menu items, but complaining when their favorite "less healthy" choices were not offered. House directors should try to balance the amount of popular fried and processed items they offer with the amount of fresh fruits and vegetables and whole grain foods. This will help keep members interested and more likely to participate in meals when they have an active voice in creating their menus.

House directors can help members make healthier choices at the salad bar by establishing serving sizes for each topping offered. Nutrition facts of the serving amount could be displayed above each food item (e.g. 1 tbsp ladle for salad dressing, 1 tbp = 70 kcal, 25gm fat). The food items offered on the salad bar do not change, saving time spent on a further nutrient analysis.

Sororities should consider labeling the nutritional content of all foods at each meal in order to help in choosing lower fat and sodium menu items. This would serve to educate the members as to the nutritional value of the foods being served and would assist the house directors in selecting menus that contain healthier choice

CHAPTER VI. CONCLUSIONS

An evaluation and analysis of sorority menus has never been completed at the University of Mississippi. The purposes of this study was to analyze the nutrient content of menus offered in sorority houses to determine if members are able to meet their nutritional needs. One goal of this study was to provide house directors with a framework of guidelines that can be used for planning healthier menus and suggestions for future menu planning.

The results of the study show that all three sorority houses offer a wide variety of foods that provide adequate amounts of all nutrients examined. These data show that members are provided with ample food offerings to ensure their nutritional health during the college years. Further research is needed to investigate whether they are, in fact, meeting their nutritional needs. If they are not, nutrition education for members would help them choose more nutrient dense foods. The addition of nutrition labeling on buffet lines would also help members make healthier food and beverages choices. Limiting the amounts of energy dense food options might also help members to make healthier food choices. Without food labeling, or changes the number and quality menu items offered, individual sorority members must take personal responsibility for making the appropriate food choices.

Currently there is little research literature or evidence-based training for Greek house directors. Future research in this area and development of job specific training for these professionals would greatly assist them in providing healthy, high quality meals to their members.

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List of Appendices

Appendix: A

Interview Tool for House Directors

BREAKFAST

1.) Do you offer any additional breakfast items that aren't listed on your menu? Please list.

2.) Do you offer any whole grain items?

3.) What spreads do you offer for toast or muffins?

4.) Do you set out any kinds of bagels?

5.) Is the oatmeal offered in individual packets or on the buffet line?

6.) Do you offer the same breakfast items every day, if not what other items do you offer?

7.) What brands of cereals do you offer? Are offered as individual servings?

8.) Do you offer any fruits or yogurt during breakfast?

9.) What types of milk do you offer: skim, 2%, chocolate?

10.) Do you offer coffee or hot chocolate during breakfast?

11.) What are the beverages offered in your drink room (are they 100% juice?) If lemonade, fruit punch, and sweet tea are offered (or other beverages in addition to the drink machine) are they available all day or just during lunch and dinner?

12.) What is the time period for your breakfast meal?

13.) What are the time periods for lunch and hot dinner meals?

LUNCH

Salad bar

14.) What are ALL the items are offered on the salad bar?

15.) What salad dressings do you offer?

16.) Do you offer any fat free dressings?

17.) Do you set out individual packets of dressings including the ones provided in the salad bar?

Deli bar

18.) What type of deli meats do you offer on your deli bar?

19.) What is the fat content of the turkey you offer? (lean, very lean- 60% fat, 80% fat?)

20.) Do you set out tomato slices, lettuce, mayo, and mustard to dress the sandwiches? What type of mayo do you offer (regular and low fat?)

21.) What is the type of bread set out for the sandwiches? White, wheat, whole grain?

Hot Lunches in Buffet Line

22.) Do you have the recipes for the meal items prepared for the hot lunch?

23.) If no recipes, do you know all the ingredients used in the hot lunch meals?

24.) How were these meals prepared? (fried, baked, breaded, steamed)

25.) What items are prepackaged and homemade?

26.) What type of milk do you use in the hot lunch preparation? (skim, 2%, whole)

27.) What type of butter do you use in food preparation? (salted, unsalted, butter, margarine?

28.) What is your estimated size of pizza/pie (6-8”). If not can you give an estimated size of the slice? (square or wedge? If square is it 4X4”)

30.) What is the estimated serving size of the chicken? (3-4oz is similar to a deck of cards)Do you leave the skin on chicken or is it skinless?

31.) What type of bread is offered with the BBQ sandwiches? (hoagie? Bun? Size of bread?)

32.) What is the type of brand of chips offered with this meal?

33.) Do you offer grilled and fried chicken tenders or just fried?

34.) What type of oil do you use to fry these foods?

35.) Do you ever offer any desserts during lunch? Such as cookies, brownies?

36.) If you offer lunch desserts about how many times a week do you offer them?

DINNER

37.) What are the recipes for all dinner meals? (Mon-Thurs)

38.) How was the meat/entrée prepared?

39.) Do you use white meat only or a mixture of white and dark?

40.) How were the vegetables prepared? (steamed, added salt, butter?)

41.) If offering a side salad, what is on the salad? Does the side salad include any salad toppings such as; croutons, cheese, tomatoes?

42.) What type of salad dressing is offered with this salad?

43.) What is the size of the dinner rolls? (small, med or large dinner roll?)

44.) What is the est. size of pie slices? (4", 6", 8")?

45.) If not prepared in the sorority house, what is the brand item? (Sister Shubert etc..)

46.) Were there any additional ingredients used in preparation for any of the dinner items in this menu? (that have not been previously mentioned)

ADDITIONAL QUESTIONS

47.) What type of butter do you use in your recipes? Is it salted or unsalted?

48.) How do you go about planning the menus?

49.) Do you have any problems with menu planning, member meal participation, or trying to offer healthy menu items?

50.) Do members often request more fried food items or healthier options? What are some of these requests?

51.) It there any additional information you would like me to give you regarding these results?

52.) What is the most difficult part of your menu planning process?

Appendix: B

Sorority A Menu

	Monday	Tuesday	Wednesday	Thursday	Friday
Breakfast	Eggs to order Sausage Patty Bacon Waffles Cereal Bagels Grits Yogurt Biscuits	*The same breakfast is offered every day. This sorority's breakfast offers more everyday items than the other sorority breakfast meals.	*	*	*
Lunch	Hamburgers/ Cheeseburgers French Fries Salad bar Deli bar	Chicken Salad croissants Chips Brownies Salad/deli bar	Taco bar Beef & chicken Hard & soft shells Toppings Queso dip w/ chips Salad/deli bar	Grilled & fried chicken strips Mac' n Cheese Oatmeal cookie Salad/deli bar	Cheese & veggie pizza Chocolate chip cookie Salad/deli bar
Dinner	Poppyseed Chicken White rice Broccoli Baby carrots Wheat Rolls Oreo Delight	Spaghetti with meat marinara Caesar salad French bread Watermelon	Rotisserie chicken Scallop potatoes Green beans Wheat rolls Frozen peach yogurt	Breakfast for dinner **b/c so many items are offered for breakfast this meal was left out of results calculations to avoid limitation errors.	*Dinner not served on Friday because food service workers are off from the weekend. Meals resume Monday morning.

Appendix: C

Sorority B Menu

	Monday	Tuesday	Wednesday	Thursday	Friday
Breakfast	Eggs Sausage Bacon Biscuits Grits Oatmeal Cereal Fruit Yogurt Pop Tarts	Pancakes Bacon Biscuits Grits Oatmeal Cereal Fruit Yogurt Pop Tarts	Omelets Biscuits Grits Oatmeal Cereal Fruit Yogurt Pop Tarts	French toast Bacon Biscuits Grits Oatmeal Cereal Fruit Yogurt Pop Tarts	Eggs Sausage Biscuits Grits Oatmeal Cereal Fruit Yogurt Pop Tarts
Lunch	Hamburgers Waffle fries Baked beans Jalapeno pops Chocolate chip cookie Salad/deli bar	Tacos Beef & chicken Hard & soft shells Toppings Refried beans Mexican rice Potato bar Salad/deli bar	Fried okra Corn casserole Mac' n Cheese Cornbread Black eyed peas Brownies Salad/deli bar Chicken/tuna salad	Homemade vegetable soup Brownies Salad/deli bar Potato bar	Fish sticks Grilled & fried chicken tenders Cheese sticks Onion rings Chocolate chip cookies Salad/deli bar Chicken/tuna salad
Dinner	Chicken pot pie Corn on cob Broccoli florets Biscuits Yellow Confetti cake	Spaghetti w/ meat marinara Spaghetti w/ pesto Rolls Caesar salad Oreo Surprise	Baked chicken Lima beans Squash casserole Rolls Caesar salad Chocolate chip cookie	Shrimp & chicken kabobs Black eyed peas Garden salad w/ dressings Dinner Roll	*Food service staff off for weekend.

Appendix: D

Sorority C Menu

	Monday	Tuesday	Wednesday	Thursday	Friday
Breakfast	Eggs made to order Bacon English muffins Toast Oatmeal Cereal Milk & Juice	*same breakfast offered everyday	*	*	*
Lunch	Quiches-cheese, veggie w/ spinach Salad/deli bar	Homemade pimento cheese sandwiches Salad/deli bar	BLT Tomato basil soup Salad/deli bar	BBQ sandwiches Chips Oriental coleslaw Salad/deli bar	Fried chicken tenders French fries Fried okra Mac 'n Cheese
Dinner	Chicken artichoke casserole Lou's green beans Romaine salad Sister Shubert rolls Fresh strawberries	Lasagna-meat & vegetable French bread Mixed salad w/ Caesar dressing Lemon icebox pie	Baked salmon Creamed potatoes English peas Small salad bar Strawberry cake	Sub sandwiches Turkey, club, garden On white/wheat hoagie Chips	*Food service staff off for weekend. No meal.

Appendix: E

Sample Menu Offerings as Nutrient Sources

Nutrient	Meal/Category	Food Sources
Vitamin A	**Breakfast-**	**Fortified cereals and oatmeal, egg yolks, blueberry muffins, apples**
	Lunch: Hot lunch	**Peas, tomato basil soup**
	Salad/Deli bar	**Tuna salad, cheddar cheese, pecans, carrots, turkey, oriental coleslaw**
	Dinner	**Chicken menu items, baby carrots, Broccoli, butternut squash casserole,**
	Beverages	**Fortified milk and apple juice**
Vitamin D	**Breakfast**	**Eggs, yogurt, bacon, sausage patty**
	Lunch: Hot lunch	**Taco meat, sour cream, hamburgers/cheeseburgers, pimento cheese sandwiches**
	Salad/Deli bar	**mushrooms**
	Dinner	**Baked salmon, shrimp kabobs, poppy seed chicken**
	Beverages	**Fortified milk and orange juice**
Vitamin C	**Breakfast**	**Oranges, low-fat yogurt**
	Lunch: Hot lunch	
	Salad/Deli bar	**Green pepper**
	Dinner	**Fresh strawberries, strawberry cake, broccoli, butternut squash, strawberries,**
	Beverages	**Orange juice**
Vitamin K	**Breakfast**	**Eggs, cheddar cheese, grapes**
	Lunch: Hot lunch	**Beef(Hamburgers/Cheeseburgers), okra (fried), vegetable soup**
	Salad/Deli bar	**Romaine lettuce, tomatoes, Chinese cabbage, cucumber, cranberries, pine nuts, cashews, cole slaw**
	Dinner	**Green beans, broccoli, artichoke, peas, vegetable lasagna, squash, spinach, mustard greens, collard greens**
	Beverages	

Vitamin B_6	**Breakfast**	**Sausage patty, bacon, whole grain breads and cereals**
	Lunch: Hot lunch	**Taco meat, hamburgers, fish sticks, quiche with spinach**
	Salad/Deli bar	**Hummus, red bell peppers, tomato, sunflower seeds, tuna/chicken salad, celery, peanuts, turkey, broccoli, corn on the cob, peas, creamed potatoes, lima beans**
	Dinner	**Chicken pot pie, Creamed potatoes, corn on the cob, peas, creamed potatoes, lima beans, English peas, broccoli florets, vegetable lasagna, green beans, watermelon**
	Beverages	
Vitamin B_{12}	**Breakfast**	**Eggs, sausage patty, bacon, yogurt**
	Lunch: Hot lunch	**Hamburger, fried fish sticks, BBQ**
	Salad/Deli bar	**Tuna/chicken salad, cheddar cheese, cottage cheese**
	Dinner	**Shrimp kabobs, fish sticks**
	Beverages	**Milk**
Folate	**Breakfast**	**Wheat products, fortified cereals, oranges, bananas**
	Lunch: Hot lunch	
	Salad/Deli bar	**Sunflower seeds, soy beans, hummus, avocado, lettuce**
	Dinner	**Spinach, turnip greens, collard greens, black eyed peas, asparagus, broccoli**
	Beverages	
Calcium	**Breakfast**	**Cream cheese, yogurt, oatmeal, eggs, cheddar cheese, orange**
	Lunch: Hot lunch	**Okra**
	Salad/Deli bar	**Cottage cheese, sour cream, cheddar cheese, almonds, wheat bread**
	Dinner	**Squash**
	Beverages	**Grapefruit juice, orange juice**
Phosphorous	**Breakfast**	**Yogurt, cheddar cheese**
	Lunch: Hot lunch	**Wheat products**
	Salad/Deli bar	**Tuna salad**
	Dinner	**Artichoke, potatoes, lima beans, corn, rolls, salmon**
	Beverages	**Milk**

Magnesium	**Breakfast**	**Yogurt, oatmeal, banana**
	Lunch: Hot lunch	**Okra, wheat bread, tacos**
	Salad/Deli bar	**Almonds, pine nuts, peanuts cheddar cheese**
	Dinner	**Artichoke, peas, butternut squash**
	Beverages	**Milk**
Iron	**Breakfast**	**Wheat bread products, fortified cereals**
	Lunch: Hot lunch	**Lima beans, butternut squash, potatoes, hamburger**
	Salad/Deli bar	**Cashews, pine nuts, raisins**
	Dinner	**Peas, beef, chicken, watermelon**
	Beverages	
Sodium	**Breakfast**	**Eggs, cheddar cheese, yogurt, sausage patty, bacon**
	Lunch: Hot lunch	***Sodium occurs naturally in almost all fresh whole fruits, vegetables and seeds/nuts,**
	Salad/Deli bar	***Additional sodium during cooking and before eating should also be accounted for- risk of excessive sodium intake greater than low intake.**
	Dinner	**Sweet potatoes, broccoli, artichoke**
	Beverages	**Milk**
Potassium	**Breakfast**	**Bananas, yogurt, watermelon, wheat products, bacon**
	Lunch: Hot lunch	**Bread, French fries, BBQ, ground chicken**
	Salad/Deli bar	**Almonds, avocado**
	Dinner	**Lima beans, sweet potatoes, butternut squash, salmon**
	Beverages	**Grapefruit juice**
Zinc	**Breakfast**	**Yogurt, cheddar cheese, eggs, bacon, wheat**
	Lunch: Hot lunch	**Hamburger, fried okra, potatoes**
	Salad/Deli bar	**Sunflower seeds, avocado**
	Dinner	**Corn, lima beans, chicken breast, corn lima beans**
	Beverages	

VITA

Jessica Lauren Moosa was born to parents Hans and Doreen Moosa on June 4, 1986, in Pittsburgh, Pennsylvania. She grew up in Belleville, Illinois and graduated from Althoff Catholic High School in May, 2004. She then attended The University of Mississippi in University, Mississippi and graduated in May 2008 with a Bachelor of Family Consumer Science with an Emphasis in Nutrition and Dietetics.

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