THE RELATIONSHIP BETWEEN MEAL PLANS AND NUTRITIONAL INTAKE OF COLLEGE STUDENTS

A Thesis

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By

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ABSTRACT

With the innovations that have been made in many areas of college residence life, dining options are no exception. Many universities no longer require students who live in residence halls to purchase meal plans. Additionally, many universities provide a combination microwave/refrigerator for the students' use in each room. With these changes, it is expected that eating patterns and food choices would vary. The purpose of this study was to determine if any nutritional intake differences exist between those who have university meal plans and those who do not.

The sample consisted of 230 students living in an upper-class residence hall at The Ohio State University Autumn 1997 and Winter 1998 quarters. Respondents provided three consecutive weekday food intake records as well as information regarding where they consumed food and the type of meal plan purchased, if any. Non-respondents were also contacted to provide demographic information and information regarding their meal plan purchasing decision to determine if there was a difference between the groups using differing plans.

Of the 230 eligible residents, 31 completed and returned the food records for a total response rate of 13.5%. There were no statistical differences between respondents and non-respondents. The results indicated that the vast majority of students

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(N = 29; 94%) participated in a meal plan through the university. The majority of the respondents were female (N = 17;55%) with a mean age of 20 years (range = 19-25).

Results indicated that overall, college students’ diets are high in fat and low in fruits and vegetables, however, the consumption of fruit juice is high. The consumption of dairy products varied according to each individual but average consumption was low overall. The students also had a low fiber intake. The number of meals consumed in university dining halls was low compared to the number of meals that students picked up to-go at fast food restaurants and ate in their rooms. Additionally, most students snacked until they went to bed.

The results also indicated that students who participated in university meal plans and consumed two or more meals per day in the commons had the best nutritional intake compared to those who ate less than two meals in the commons per day or did not participate in the university meal plan (zero meals per day in the dining halls).

The results of this study are that: typical nutritional intake of upper-class college students is compromised due to high caloric and fat intake and low fiber, fruit, vegetable, and milk intake. Results also indicate that nutrition educators may best focus their efforts in providing guidance in how to evaluate diets and in turn, modify behavior.
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CHAPTER 1

INTRODUCTION

Background and Setting

College campuses are rapidly changing the dining options available to their students (1-3). In the 1960’s, a student entering a residence hall would have three meals per day included in the housing fee. Today, the discriminating students may not only decide if they want to buy any meals, but where the meals will be consumed.

Today’s college students are documented to be independent consumers (4-27). These young adults are estimated to skip at least one meal per day, consume 25-33% of their energy from snacks, and eat high fat convenience foods (4, 5, 6). College campus administrators recognize their customers as these independent persons who will not be accustomed to cafeteria style foods, are brand loyal, and who are very comfortable purchasing several meals per week in fast food chains (1-3).

The dining options which exist on campuses include the traditional meal plans where a student selects the number of meals per week, pays for that number in their housing fee, and consumes these meals only in the university dining center. Many universities offer a take-out option for meals to be consumed somewhere other than the dining hall. Universities also contract with other food establishments to offer the students
a variety of dining options. For example, at The Ohio State University, students receive a small card that is their university identification and a debit card. This card, called the Buck ID, can be used to purchase meals from the dining halls or from neighboring establishments such as fast food chains and pizza establishments (1, 2). In addition, this card can be used to purchase other items such as books and clothes.

Although so many dining selections may enhance consumer satisfaction, nutrient intake may be compromised. College students are documented to have low intakes of iron, calcium, Vitamin A, and other nutrients (6-11). Fast foods are documented sources of fat, sodium and excess calories (12). By consuming these foods on a regular basis, students may be putting themselves at risk for unbalanced, unhealthy nutritional intake. The varied dining opportunities of the contemporary college student may further decrease the recommended nutrient intake while increasing nutrients such as fat.

College students’ smoking, sexual and alcohol habits have been documented widely. The eating habits of college students have also been researched in the past. However, since the evolution of the new meal plan options, no new research has been conducted to determine if the additional options available to the students are having an effect on their food choices and nutritional status. This information can be used to educate the college students, parents and university administration. The knowledge gained will allow more informed options and selections.
Statement of the Problem

Colleges are offering a variety of meal plans to students in residence halls, one of which is no meals provided. While the administration of these academic institutions are meeting the wishes of the consumer, the nutrient intake of the consumer may be compromised. These consumers are known to have poor intake and consume foods that are not nutrient dense. These food choices may be compromising the wellness today and in the future of this population. If the universities are going to continue to offer many different meal plans, more must be known about the nutrient intake of the student who selects each plan.

Objectives of the Study

The objectives of the study are as follows:

1. To determine the eating patterns of upper-classmen residing in a college dormitory.

2. To analyze the nutritional values of the diets of upper-class students that eat at least two meals per day in the university dining halls.

3. To analyze the nutritional values of the diets of upper-classmen that do not consume any meals in the university dining halls.

4. To determine if there is a difference between upper-class students’ nutritional intake who dine in a university dining hall at least twice a day and those who choose not to eat in the dining halls.
**Definition of Terms**

**EATING PATTERN**: The decisions that are made and the way that students eat. Includes what and when they eat.

**MEAL PLAN**: The university-offered meal service which includes a certain number of meals per week. It is paid for at the same time as the residence fee.

**BUCK ID**: The university provides one of these cards to each student. It serves many purposes including acting as their student identification. Money can be deposited on their student account for use in area locations, and the student’s meal plan is kept track of through an electrical strip that is on the back of the card.

**19 MEALS PLUS PLAN**: The Ohio State University’s meal plan available through the Office of Residence and Dining that provides up to 19 meals per week in the university dining commons plus $100 is deposited on the student’s Buck ID.

**10 MEALS PLUS PLAN**: The meal plan that allows the student up to 10 meals per week in the dining commons plus $100 is deposited on their Buck ID.

**8 MEALS PLUS PLAN**: The meal plan that allows the student up to 8 meals per week in the dining commons plus $100 is deposited on the student’s Buck ID.

**ALL PLUS PLAN**: The student receives a $500 deposit on their Buck ID and no meals are contracted for through the university.

**BUCKEYE EXPRESS**: The carry-out service that is provided by The Ohio State University. Items available include sandwiches, pizza, yogurt, desserts, fruits, bagels and beverages. This service is available for breakfast, lunch, and dinner. Service (until 8:00 p.m.) Monday through Friday.
Limitations and Assumptions of the Study

This study concerning the eating habits of students who live in the dormitories has some limitations. The dormitory that was used to conduct the research is an upper-class dormitory. Therefore, the results are limited to upper-class students. The decision to use only an upper-class establishment was made under the assumption that upper-class students have more control over whether or not they participate in the meal plans whereas first year students may have the decision made for them by parents or guardians.

An additional limitation of this study involves the randomization. Since the investigator asked for volunteers and did not use a random sample, the results are only applicable to those who participated and can not be applied to all upper-class students.

Finally, the study only involved students living in on-campus dormitories. The results are not transferable to the wide array of upper-class students that live in apartments or other forms of off-campus housing.

Significance of the Problem

The problem described involving the choices that students make in relation to their eating habits when living in a university upper-class dormitory is of significance to the dietetics profession as a whole. The results of the study show some areas of concern to dietitians and allows identification of areas where nutrition education might improve nutrient intake. The university community strives to serve their customers. A better understanding of eating patterns also assists the establishment in better serving the needs of the students who attend these universities.
CHAPTER 2

REVIEW OF LITERATURE

INTRODUCTION

This section provides an overview of the information that is currently found in the literature related to the nutritional status and food choices that college students make. It also gives a brief discussion on the evolution of new food service plans in the academic institution food service scene as well as some trends and reasons why students in this stage of their lives make a variety of food choices.

Food Service in Academic Institutions

Formerly, when a student entered a university setting and resided in a university residence hall, the available meal plans were neither complex nor optional. The student selected from a definite number of meals per week and those meals were only consumed in the university dining halls. Due to the changing demands by students, university food service directors and staff, universities now offer a variety of meal plans.

Currently in many institutions, and at The Ohio State University (OSU), meal plans are available on an optional basis to students that live in residence halls (1). Ohio State is a strong leader among the universities to incorporate this new optional meal plan system into their food service. Many universities model their food plans after this system. Currently, Ohio State offers the Buck ID. This is a small card that double as the students’
university identification and a debit card. The card is accepted at many surrounding stores, both retail and food establishments, as well as in the university dining halls (1, 2). The revenue generated from the Buck ID demonstrates the success of the program. For example:

$100,000/month in January by the bookstores,

$20,000/month by Wendy’s,

$40,000/month by Catfish Biffs (a local pizza establishment), and

$30,000/month by university dining halls.

While sales are increased in non-residential establishments, the sales are stable in the university food service establishments. In spite of the optional food plans at Ohio State, over 7,000 of the 60,000 students still choose to participate and purchase a university food plan (2).

**Trends Among College Food Service**

The food service operations in university sectors have been changing quite drastically and rapidly in the recent past. The mandatory food plans appear to be a part of the past for many institutions. With the development of new food choices and optional food plans, the college food service departments have been faced with the challenge of keeping up with the demand and maintaining a strong presence in the university food service arena.

One trend that appears to be evolving is contracting and/or food branding. Universities are contracting with outside food service establishments to help increase and maximize their revenue (3). As the previous example regarding The Ohio State University noted, universities are contracting with other establishments such as fast food and pizza restaurants to give students more choices and also to help with their business.
(2). By making other such establishments an alliance, profits increase in all food service areas. In addition to contracting with other establishments, universities also include branding and changing their menus to offer vegetarian dishes and lower fat dishes to those who are interested to help maximize profits.

Also, in addition to contracting, universities such as Ohio State are now providing a device that is a combination microwave and refrigerator to the students that live in on-campus dormitories. The addition of the “micro-fridge” helps to give students that choose not to participate in the university meal service an alternate method of preparing food.

As the literature has previously suggested, many students are now eating at restaurants more often and they are also taking their food “to go”. The days of college students gathering in the dining halls together appears to be on the down side. Students are dining at restaurants more frequently and getting their food and taking it to their rooms to study or socialize (1, 13). Many universities are now offering meals to go in order to keep up with the demand that the students want and also to keep up with the service that fast food restaurants already offer (1). With this changing situation, the university food service operations are challenged to maintain both a dining room for those who wish to eat there and also a carry out service for students who choose to eat in their dormitory rooms or somewhere else.

**College Students Eating Habits**

College students’ eating habits are a popular area of research (4-27). Eating patterns such as snacking, skipping meals, and consuming larger amounts of high fat foods than other populations are among the trends that have been identified and studied among this population. Other areas such as nutrient deficiencies and energy consumption of college students have also been an area of study (4-27).
Perhaps one of the most widely identified and studied habit of college students is snacking. J. Marrale reports that young adults may consume 25-33% of their calories from snacks (5). Driskell conducted a study and included snacking habits as a component (10). Driskell’s study had 150 volunteers, men and women, to complete a 24 hour recall with the assistance of trained, dietary professionals. Also, consecutive two day food records were obtained from the students. Results showed that slightly over 66% of college students snack 1-2 times per day (10).

With the known practice of snacking among this population, it is interesting to observe what the students buy. The most common snack is reported to be carbonated beverages and the most common time of day to snack is reported to be after dinner (6). However, increases in consumption of pizza, hamburgers, french fries and potato chips are also reported (4, 14). The apparently high incidence of snacking that happens among college students is likely to have an affect on the overall nutritional status of these students.

Another behavior identified in the population of college students is their tendency to skip meals. There is some controversy in the literature as to which meal college students most often skip. In one study, researchers studied the data collected from 250 students, both nutrition and non-nutrition majors. The students filled out a 15-page questionnaire and kept 24-hour recalls. The researchers found that 25% of college students did not consume breakfast (6). An additional study used 1912 one day food records that were kept by students in an introductory nutrition class as an assignment. These researchers found that 1 student in every 4-5 students skipped breakfast, which is also about 20-25% of students (4). In contrast, C. Jakobivits et al reported that lunch was the most often skipped meal of the day (9) while J. Marrale reports that college students skip meals in general (5). Regardless of which meal is most often skipped, the
tendency of students to skip meals is apparent. If wise choices are not made, skipping meals will also have an effect on college students overall nutritional status.

In addition to snacking and skipping meals, many college students are consuming more fat and calories than recommended. It is documented that as young adults leave home, their eating habits tend to become worse due to the meals that they choose as well as the snack foods that they choose (15). A major point of focus in relation to the eating habits of college students is their consumption of “fast food”. As previously mentioned, the consumption of pizza, hamburgers, french fries and potato chips are high in this population (4). These are all foods that are found in fast food restaurants. One study conducted by A. Hertzler et al reported that 45% of college students eat fast food at least once per week (12). The researcher P. Brevard et al found students who live on campus are more likely to eat higher amounts of fried/fast food than those who live off-campus, primarily due to the increased costs of living off-campus prohibits the purchase of fast food (13).

Researchers also find college students consuming inadequate calories (9). Persons consuming less than 1,200 kcal/day are defined as deficient in nutrient intake (7). The most prone group of students to consume less than 1,200 kilocalories per day are women (7). Women are generally more weight conscious than men and usually take more drastic measures to regulate their weight. The dieting behaviors of college students will be discussed later in the literature review. However, generally, reports tend to state that college students may consume too few calories and too much fat (16). Many students, especially women, report to follow a low calorie diet on a regular basis and below recommended energy intakes are reported (7). This is evidence that the nutritional status of college students may not only be affected by consuming too much fat or too many calories but also by too few calories.
The use of supplements among college students is also an area of investigation. The literature demonstrates that supplement use is definitely apparent among college students. A study conducted by C. Jakobovits reported that 34% of the 195 respondents of college women took some form of a supplement (9). An additional study revealed that 7% of college men and 16% of college women used supplements (8). The supplements used most often were multivitamins fortified with iron (8).

Reports have been made that college students' diets are considered to be inadequate in vegetables (16, 17). This is interesting because this is in contrast with other reports that have been made saying that vegetarianism is becoming more popular among this population and that the demand for vegetarian dishes is increasing (1). However, in general, it appears that vegetables are not very popular among college students and this may cause their diets to be considered unbalanced and inadequate.

**The Nutritional Status of College Students**

As previously discussed, the importance of practicing good, healthy nutritional habits of college-age students can have very positive effects on them later in life. Eating a variety of nutritious foods is an important factor in disease prevention and good health. There are numerous reports of college students having various nutritional deficiencies throughout the literature.

The nutrient that receives most of the attention throughout the literature is iron. Anemia is a condition that is reported to be widespread throughout the college student population (10). It has been reported extensively that college students, especially women, consume below the recommended amount of iron (6, 7, 9-11, 12, 18). One study revealed that women who consumed over 1,200 calories per day were able to meet the RDA's for all nutrients except for iron (7). It has also been reported that the only way to
meet the iron needs of college age women may be throughout supplementation (8). One study conducted by J. Driskell et al revealed less dramatic results than others as far as the extent of iron deficiency in this population (10). Low hemoglobin values were observed in 2-4% of the 150 college students and low hematocrit values were seen in 8-17% of college students that participated in Driskell’s study (10). These results show a lower incidence of iron deficiency than other studies that revealed most students were not consuming adequate iron. One study revealed 79% of the 300 students who kept three day food records for the study were eating below the recommended amounts of iron (11). Iron deficiency appears to be one of the prevalent nutritional deficiencies found among the college student population.

Another nutrient that appears to be deficient in many college students is calcium. Like iron, inadequate intakes of calcium are found primarily among the female students. In a study conducted by J. Hernon et al, it was found that women who consumed less than 1,200 calories per day did not consume adequate amounts of calcium. However, women consuming more than 1,200 calories per day met the RDA for calcium (14). Other studies concluded that college students, especially women, consume below the RDA for calcium (7, 8, 11, 12, 14, 17). C. Hoffman et al found that 59% of college women consumed below the RDA for calcium and one-third of all college students, both male and female, did not meet the RDA for this nutrient (11). In general, it appears from the literature that the average college student’s diet is low in calcium.
In addition to iron and calcium, several vitamins and minerals appear to be deficient in the diets of college students, including thiamin (B1), pyridoxine (B6), riboflavin, and niacin (7, 8, 9). In the study conducted by J. Hernon, college women who consumed less than 1,200 calories daily were not only low in iron and calcium but also the B vitamins (7). It does appear, however, that both men and women have inadequate intakes of pyridoxine (8). The literature reveals that the B vitamins may also be a concern of the average college student’s diet.

In addition to the “B” vitamins, two other vitamins may be lacking in the diets of college students, vitamins A and C. A study conducted by A. Hertzler used three-day diet record to study the nutritional status of college students. This study revealed that, in general, college students ate below the RDA for both vitamin A and C (12). However, in contrast, an additional study revealed that college women did consume the RDA for vitamins A and C, regardless of their caloric intake (7). These studies once again reveal inconsistencies in the literature but may raise an area of nutritional concern regarding college students.

Minerals are also an area to consider. When analyzing college students’ diets, many female college students do not consume the RDA for magnesium, zinc and copper and male college students do not consume the RDA for copper (8). The intakes of minerals of college students is also an area of nutritional consideration.

A popular nutritional interest is fiber. In the college student population, it appears that men are generally consuming adequate amounts of fiber. As expected and as the trend appears, female college students appear to be low in their fiber intake (8). With the overwhelming amount of attention that is focused on fiber, the intake amounts of this nutrient in college students should receive some focus.
Dieting Among College Students

It has been shown thus far from the literature that the female college students have more nutritional inadequacies in their diets than the male students. It is also known that women tend to be more weight-conscious and diet more than men. The dieting patterns of college students is a focus of many research studies.

C. Jakobovits reports that up to 60% of college women have dieted to lose weight (9). It has also been reported that many college students consume below recommended caloric intakes and that many students follow a low calorie diet on a regular basis for the reason of weight regulation (7). These students may not be consuming adequate calories, vitamins and minerals which maintain good, healthy nutritional status.

The accepted caloric level for “low calorie” is 1,200 calories per day (7). As shown in the previous section of this report, many essential nutrients were considered to be below the RDA when less than 1,200 calories were consumed daily (7). These dieting behaviors, in addition to the many “fad” diets that are available on the market, have been identified with contributing to the poor dietary intake of young adults (9).

The population as a whole is becoming more weight conscious and the literature shows that the college students are not an exception. With extremely low caloric intakes, special attention must be paid to ensuring adequate nutrition and vitamin/mineral intakes in the general population and also in the population of college students.

The Reasons Behind Many Food Choices

Many theories have been considered regarding college students’ food choices and rationale for these choices. There is controversy in the literature as to whether or not food prices have an affect on the nutritional decisions that college students make. P. Brevard reported that college students who live in off-campus apartments or sites other than the
university dormitories eat lower amounts of fried and fast foods than students who live in
on-campus dormitories. It has been suggested that students who live off-campus have less
money to eat out and this drives their decision to not consume fast foods or go to
restaurants very often (13). An additional author, J. Marrale, reports that economic
factors play a role in the food choices that college students make (5). In contrast to these
reports, C. Jakobovits reported there is no relation between diet adequacy and food cost
(9). The literature appears to be varying on the topic of whether financial factors play a
role in the nutritional decisions made by college students.

In addition to economic factors, there are other factors which may play a role in
college students’ food choices. J. Marrale reported food is often used by college students
as a substitute for affection, attention and/or emotional gratification (5). These factors
also must be considered when studying the nutritional decisions made by college students.

A final factor that may influence the food choices made by college students is the
issue of peer acceptance. When asked why they eat out, the reason most often stated was
to socialize with friends (12). The literature reveals peer socialization and/or acceptance
is an important factor in the food choices that college students make (5). Since eating
usually takes place within one's immediate social environment, some feel social factors
influence food choices more than individual factors (15). People tend to be most
influenced by what their partner does and says, rather than other social factors (15).

The issues of peer acceptance, financial situation and the overall emotional state of
college students are large parts of the lives of college students everyday. It is important to
consider these areas when studying their eating habits and the reasons driving their
nutritional decisions.
The Effect That the Living Environment has on Nutritional Adequacy

There is controversy in the literature as to whether or not the college students’ living environment has an effect on their nutritional status (13). With the many possible influences a college student faces, it is conceivable that living environment may play a part in food choices and the literature has shown just that. However, not all researchers agree.

The study conducted by C. Jakobivits revealed whether a student lives in a university dormitory or in an independent apartment, their nutritional choices were independent. In other words, residence hall versus apartment living did not appear to influence diet adequacy (9). In this study, the author studied the seven-day food records of 208 college students. A computer nutrient analysis program was then developed and used to determine the percent of the RDA’s that the students met. This study suggests where students live does not influence their food choices. C. Jakobivits reported these results are in conflict to findings in other studies (20-22). On the other side of the debate, a study conducted by M.F. Hovell found women are by far more likely to gain weight during their first year of college if they ate in the university cafeterias under a mandatory feeding plan than if they neither lived in dormitories nor ate in dining halls (23). The literature demonstrates mixed results on this subject.

SUMMARY

Research regarding the eating habits of college students is for the most part in agreement that their eating habits are not optimal. These young adults have a tendency to skip meals, snack often and go on low calorie diets. In addition, there appear to be many nutrients which are not consumed at adequate levels. Dieting appears to be prevalent among this population. The reasons behind the food choices the students make appear to be more on an individual basis and the literature is mixed on this topic. Whether or not
residence plays a role on eating patterns is also mixed and no agreeing conclusion on the topic was found in the literature. Overall, it appears the diets of college students are not nutritionally adequate nor desirable.
CHAPTER 3
METHODOLOGY

INTRODUCTION

There are many studies which examine the nutritional status and food choices which college students make. However, with the changing system of the university food service, especially with the abolition of mandatory meal plans and the addition of the new microwave-refrigerator combination, it is important to reevaluate the nutritional status of the students. Few, if any studies exist which examine students’ nutritional status and food choices being made under these conditions.

At The Ohio State University, there are a wide variety of meal plans available to meet the needs of diverse students. The Office of Residence and Dining offers meal plans that provide nineteen, ten and eight meals per week. In addition to these plans, students can use their Buck ID to eat in the university dining halls without having a meal plan and pay for each meal individually. Also, whereas in the past students living in a university residence hall had to purchase a meal plan as part of their housing contract, students at Ohio State now have the option of not having a meal plan and providing meals for themselves outside of the university dining halls.

Students use their Buck ID to deduct the meals from their meal plan. Students who have a meal plan save money on meals eaten in the dining halls compared to students who choose to pay on a per meal basis. However, once a meal plan is purchased, if a student does not utilize it completely and eat all of their meals in the dining commons, the
remaining meals are forfeited. Additionally, when a meal plan is purchased, some money is automatically deposited on the students' Buck ID for their use elsewhere on and around campus.

Students who select not to purchase a meal plan have several options. These include paying cash for meals in university dining areas, fast food establishments and preparing meals using the university-provided microwave/refrigerator appliance.

Therefore, due to the wide variety of meal service options for today's college students, it is likely that their nutrient intake may vary due to the meal plan they select, if they utilize their meal plan, or if they opt not to participate in a university meal plan. The purpose of this study was to determine and analyze the differences in nutrient intake among students on these varying meal plans.

This chapter will describe the methodology of the study including: the design of the research project, the selection of subjects, the instrumentation and development of the study, the conditions of the study and, finally, the methods of data collection and analysis.

**Research Design**

This study was a descriptive study designed to determine if there is a difference in the relationships between the following variables:

**Dependent Variables:**

a. Nutritional Intake

**Independent Variables:**

a. Decision to purchase a university meal plan

b. Decision not to purchase a university meal plan

**Other Variables:**

a. Food Choices made by students
Research Objectives

The objectives of the study are as follows:

1. To determine the eating patterns of upper-class students residing in a college dormitory.

2. To analyze the nutritional values of the diets of upper-class students that eat at least two meals per day in the university dining halls.

3. To analyze the nutritional values of the diets of upper-classmen that do not consume any meals in the university dining commons.

4. To determine if there is a difference between upper-class students’ nutritional intake who dine in a university dining hall at least twice a day and those who choose not to eat in the dining halls.

The method of data collection was the three-day food diary. Three-day food diaries are considered to be an acceptable method to collect accurate data by the dietetics profession (7, 8, 11, 12, 24). The three-day food records consisted of three weekdays of the students’ choice (Monday through Thursday).

Population and Sample

The target population for this study consisted of upper-class students who resided in the dormitories (N = 1,900) at The Ohio State University. The accessible population included all students (N = 230) living in Drackett Tower at The Ohio State University in Autumn Quarter of 1998.
**Instrumentation**

A three day food record was used to collect nutritional intakes for this study. The participant self-recorded intake for three days selected from Monday, Tuesday, Wednesday and Thursday. The food diary form was developed and tested by Ross Products which is a division of Abbott Labs. The three-day food records are widely used in the dietetics profession to gather data relating to what a population consumes. Three day food diaries are considered to be more accurate and reflective of actual food intakes than 24 hour recalls and food frequency questionnaires (4, 7-8, 11-12, 24).

The three-day food diary is an instrument that is used to keep accurate records of the foods that one consumes over a three day period. Subjects provided information including what was eaten, the amount that was eaten, the time it was consumed and where it was consumed. To increase accuracy, the instructions included examples of portion sizing and an explanation of the importance of including food and beverages. Additional information was collected on age, gender, if the student purchased a meal plan and if so which meal plan, the number of meals that the student consumed in the dining commons, and whether the student took any food supplements. A copy of the distributed instrument can be found in Appendix E.

**Data Collection and Analysis**

Permission to conduct this study was obtained from The Ohio State University’s Office of Residence and Dining and Human Subjects Committee (Appendix A and B). The student leader and the staff leader of the participating dormitory provided complete support of this project.

Data collection was conducted during Autumn Quarter 1997 and Winter Quarter 1998 at The Ohio State University. The author attended a dormitory meeting at Drackett
Tower, an upper-class dormitory at OSU, and requested that the floor leaders encourage the students to participate in the study. Surveys were then distributed to each student’s mailbox. The surveys included a cover letter, food diary form, a demographics sheet (Appendix C and D) and a pre-addressed return envelope. The cover letter explained that participation was voluntary and confidential.

To encourage participation, the author offered to provide a nutrient analysis print-out of each participant’s intake. If a volunteer chose to receive a nutrient analysis, the volunteer was requested to include a self-addressed campus envelope. The researcher then sent the analysis in this envelope. This kept the volunteer anonymous for the research purposes. This information was also included in the cover letter.

Data collection was conducted during Autumn Quarter 1997 and Winter Quarter 1998 at The Ohio State University. Ten days after initial survey distribution, a postcard was placed in each potential participant’s mailbox reminding them to complete the food records and to express appreciation for their participation in the study (Appendix F). Six weeks later, a pizza party in conjunction with a dormitory function was held to encourage food record completion. Six weeks after the pizza party, new surveys were placed in all of the students’ mailboxes to request participation again (Appendix D).

To increase participation, the student leader of Drackett Tower donated a gift certificate to a local restaurant to be given away in a drawing for all participants. The information regarding this additional incentive was included in the cover letter with the second and third food diary distributions.
To address the possibility of response error, an attempt was made to compare respondents to non-respondents. Non-respondents were requested to complete a postcard survey for demographic data (Appendix G). The demographic data that was collected for non-respondents included information regarding age, gender, if they purchased a food plan, if so, which food plan they purchased, and on average, how many meals they ate in the dining commons.

Data analysis for this study included nutrient intakes in the form of average intakes for the three days of calorie, protein, carbohydrate, fiber, saturated fat, total fat, vitamin A, vitamin C, iron and calcium. The author used the Food Processor Version 7.01 program to do the nutrient analysis. This program is distributed by ESHA Research, Salem, Oregon and is complete with over 300 food items in its database.

A qualitative analysis was conducted to describe the differences of intakes in milk, fruits and vegetables between the students that have university food plans and those who do not.
CHAPTER 4
RESULTS AND DISCUSSION

INTRODUCTION

The options available today for college students residing in university residence halls are numerous. Among these choices is the decision to participate or not participate in the university meal plan. The freedom to make this decision regarding a university meal plan has raised some concerns. If a student chooses not to participate, what is the student eating? What food choices are being made? Are nutritional needs being compromised?

RESULTS

The accessible population of this study included upper-class students who resided in the Drackett Tower dormitory at The Ohio State University in Columbus, Ohio during Autumn quarter 1997 and Winter quarter 1998. A total of 230 food diaries were distributed to the eligible residents. Of the 230 potential respondents, 31 food diaries were returned for a total response rate of 13.5%. Eighteen food diaries were returned after the first distribution, five after the second and eight after the final distribution.

The respondents had a mean age of 20 years (range = 19-25) and the vast majority (N = 29; 94%) participated in a meal plan through Ohio State University’s Office of Residence and Dining during the quarters that this study took place. The majority of the respondents were female (N = 17; 55%). (See Tables 1 and 2)
<table>
<thead>
<tr>
<th>Gender</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>14</td>
<td>45%</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>55%</td>
</tr>
</tbody>
</table>

Table 1  
**DEMOGRAPHIC DATA OF RESPONDENTS-GENDER**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>15</td>
<td>48%</td>
</tr>
<tr>
<td>20</td>
<td>8</td>
<td>26%</td>
</tr>
<tr>
<td>21</td>
<td>5</td>
<td>16%</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table 2  
**DEMOGRAPHIC DATA OF RESPONDENTS-AGE**

Of the respondents who purchased university meal plans, 7% (N = 2) purchased the 19 Meals Plus plan, 72% (N = 21) purchased the 10 Meals Plus plan, 17% (N = 5) purchased the 8 Meals Plus plan and 3% (N = 1) purchased the All Meals Plus plan. The average number of meals reportedly consumed in the university dining halls was 7.8 meals per week (range = 1-14). See Table 3.
<table>
<thead>
<tr>
<th>Meal Plan</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 Meals Plus</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>10 Meals Plus</td>
<td>21</td>
<td>68%</td>
</tr>
<tr>
<td>8 Meals Plus</td>
<td>5</td>
<td>16%</td>
</tr>
<tr>
<td>All Meals Plus</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>No meal plan purchased</td>
<td>2</td>
<td>7%</td>
</tr>
</tbody>
</table>

**Table 3**
MEAL PLAN PURCHASING CHOICES OF RESPONDENTS

The students were also requested to report on their use of dietary supplements. Results showed that 39% (N = 12) of respondents consumed a food supplement. Of those who used supplements, 73% (N = 8) took a multivitamin, 18% (N = 2) took vitamin C, 9% (N = 1) took vitamin E, 9% (N = 1) took calcium and 9% (N = 1) took creatine monohydrate. These results are shown in Table 4.

<table>
<thead>
<tr>
<th>Supplement</th>
<th>Number (total = 12)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multivitamin</td>
<td>8</td>
<td>73%</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>1</td>
<td>9%</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>1</td>
<td>9%</td>
</tr>
<tr>
<td>Calcium</td>
<td>1</td>
<td>9%</td>
</tr>
<tr>
<td>Creatine Monohydrate</td>
<td>1</td>
<td>9%</td>
</tr>
</tbody>
</table>

**Table 4**
SUPPLEMENT USE OF UNDERGRADUATE STUDENTS
Average nutrient intakes for major nutrients categories for males and females are shown in Table 5. Overall, the daily average energy intake for three days for males was 2918 calories. The average for females was 1913 calories per day. The three day average nutrient intake for each individual is included in Appendix H.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories (kcal)</td>
<td>2919</td>
<td>1913</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>105</td>
<td>63</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>406</td>
<td>266</td>
</tr>
<tr>
<td>Fiber (g)</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>103</td>
<td>68</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>34</td>
<td>23</td>
</tr>
<tr>
<td>Vitamin A (RE)</td>
<td>1096</td>
<td>740</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>214</td>
<td>89</td>
</tr>
<tr>
<td>iron (mg)</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1129</td>
<td>709</td>
</tr>
</tbody>
</table>

Table 5
AVERAGE DAILY INTAKE BY GENDER FOR MAJOR NUTRIENT CATEGORIES
**Handling of Non-respondents**

To control for response error, postcards were sent to all non-respondents. These postcards were used to assess the demographic differences between respondents and non-respondents. Of the 199 students who did not participate, 18% (N = 36) returned the postcard. The average age of non-respondents was 20 years old (range = 19-25) and the majority were male, (N=20; 56%). Demographic data are shown in Tables 6 and 7.

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>10</td>
<td>28%</td>
</tr>
<tr>
<td>20</td>
<td>16</td>
<td>44%</td>
</tr>
<tr>
<td>21</td>
<td>6</td>
<td>17%</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>25</td>
<td>2</td>
<td>6%</td>
</tr>
</tbody>
</table>

Table 6  
**DEMOGRAPHICS OF NON-RESPONDENTS-AGE**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>20</td>
<td>56%</td>
</tr>
<tr>
<td>Female</td>
<td>16</td>
<td>44%</td>
</tr>
</tbody>
</table>

Table 7  
**DEMOGRAPHICS OF NON-RESPONDENTS-GENDER**

The majority of these students, (N = 20; 56%) purchased the 10 Plus plan, while 22% (N = 8) purchased the 8 Plus plan, 13% (N = 4) purchased the 19 Plus plan and 6% (N = 2) purchased the All Plus plan. Six percent (N = 2) of the non-respondents chose...
not to purchase a university meal plan. Of those who did purchase a meal plan, the average number of meals eaten in the university dining halls was 8.4 meals per week.

<table>
<thead>
<tr>
<th>Meal Plan</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 Meals Plus</td>
<td>4</td>
<td>13%</td>
</tr>
<tr>
<td>10 Meals Plus</td>
<td>20</td>
<td>56%</td>
</tr>
<tr>
<td>8 Meals Plus</td>
<td>8</td>
<td>22%</td>
</tr>
<tr>
<td>All Meals Plus</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>No Meal Plan Purchased</td>
<td>2</td>
<td>6%</td>
</tr>
</tbody>
</table>

Table 8
MEAL PLAN PURCHASING CHOICES OF NON-RESPONDENTS

T-test and chi square analysis indicate that there are no significant demographic differences of age or gender between respondents and non-respondents in this study (p ≤ .05). Additionally, there are no significant differences between the decision to purchase a meal plan or the number of meals eaten in the dining halls per week between respondents and non-respondents. These results are summarized in Table 9.
<table>
<thead>
<tr>
<th>Response</th>
<th>Number</th>
<th>Average Age (years)</th>
<th># that purchased a Meal Plan</th>
<th># of Meals Eaten in Dining Halls per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents</td>
<td>31</td>
<td>20</td>
<td>29 (94%)</td>
<td>7.8</td>
</tr>
<tr>
<td>Non-Respondents</td>
<td>36</td>
<td>20</td>
<td>34 (94%)</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Table 9
COMPARISON OF RESPONDENTS AND NON-RESPONDENTS

Research Objectives

The first research objective for this study was to determine the eating patterns of upper-class students residing in a college dormitory. The results of this study indicate that the majority (94%) of respondents living in campus dormitories opted to purchase university meal plans. However, the participants reported eating an average of only 7.8 (range: 0-19) meals per week in the dining halls. Specifically, the three day food records revealed that a total of 93 meals were eaten over the three days. Forty-seven percent (N = 15) of the respondents ate three meals per day, 44% (N = 13) of the respondents ate two meals per day, six percent (N = 2) ate one meal per day, and two percent (N = 1) ate four meals per day. These results indicate that the majority of the meals of students living in campus dormitories are consumed in establishments other than university dining halls and that meal skipping is also prevalent.

The second research objective for this study was to analyze the nutritional values of the diets of upper-class students who eat at least two meals per day in the university
dining halls. The results show that 28% (N = 8) of those students who purchased meal plans consume 14 or more meals per week (two meals per day) in the university dining halls. The average nutrient intakes for these participants are shown in Table 10. The meals that were consumed in places other than the dining halls were commonly eaten in student rooms, in restaurants or at friends’ houses. Examples of foods consumed in places other than the dining halls include pizza, chicken wings and fast food items such as hamburgers and french fries.

<table>
<thead>
<tr>
<th># Meals in Dining Halls</th>
<th>&gt;2 (N = 8)</th>
<th>&lt;2 (N = 21)</th>
<th>0 (N = 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>2820</td>
<td>2152</td>
<td>2324</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>115</td>
<td>68</td>
<td>88</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>336</td>
<td>311</td>
<td>283</td>
</tr>
<tr>
<td>Fiber (g)</td>
<td>16</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>110</td>
<td>72</td>
<td>92</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>29</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td>Vitamin A (RE)</td>
<td>1426</td>
<td>695</td>
<td>750</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>186</td>
<td>124</td>
<td>58</td>
</tr>
<tr>
<td>iron (mg)</td>
<td>17</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1578</td>
<td>677</td>
<td>507</td>
</tr>
</tbody>
</table>

Table 10
NUTRIENT INTAKES OF STUDENTS ON VARYING MEAL PLANS

In addition to analyzing the average nutrient intakes for these students who consume more than two meals per day in the dining commons, a comparison of their diet was made against the food guide pyramid. This analysis revealed that, on average, they
ate four servings from the milk, yogurt, and cheese group, three servings from the meat, poultry, fish, etc. group, two servings from the fruit group, three servings from the vegetable group, and eight servings from the bread, cereal, rice, and pasta group. Also, this comparison revealed that they ate 23 servings from the fats, oils, and sweets group. These results are summarized in Table 11.

<table>
<thead>
<tr>
<th># Meals in Dining Hall</th>
<th>Milk, Cheese, &amp; Yogurt Group</th>
<th>Meat, Fish, and Poultry Group</th>
<th>Fruit Group</th>
<th>Vegetable Group</th>
<th>Bread, Rice, Pasta, and Grain Group</th>
<th>Fats, Oils, &amp; Sweets Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;2 (N = 8)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>&lt;2 (N = 21)</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>0 (N = 2)</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>28</td>
</tr>
<tr>
<td># Servings Recommended</td>
<td>2-3</td>
<td>2-3</td>
<td>2-4</td>
<td>3-5</td>
<td>6-11</td>
<td>Use Sparingly</td>
</tr>
</tbody>
</table>

Table 11
FOOD GUIDE PYRAMID COMPARISONS FOR STUDENTS ON VARYING MEAL PLANS

The third research objective for this study was to analyze the nutritional values of the diets of upper-class students who live in university residence halls but do not consume any meals in university dining halls. Of those students who participated in this study, six
percent did not purchase a university meal plan. The average nutrient intakes for these students are shown in Table 10. These students consumed their meals in their rooms or in fast food restaurants. They prepared food items such as ramen noodles, cereal, and sandwiches, however, most of their meals were sandwiches and french fries from fast food establishments and consumed in their rooms.

The diets of students who do not consume any meals in the university dining halls were also compared to the food guide pyramid. These results showed that, on average, they ate one serving from the milk, yogurt, and cheese group, three servings from the meat, fish and poultry group, zero servings from the fruit group, two servings from the vegetable group, and six servings from the bread, rice, grain, and pasta group. This analysis also revealed that this group ate 28 servings from the fats, oils, and sweets group.

The final objective of this study was to determine if there were differences between upper-class students’ nutritional intake who dine in university dining halls at least twice a day and those who choose not to eat in the dining halls. The researcher was not able to make an accurate determination on this matter due to non-response and the small sample size. From the response that was obtained, the nutrient intakes in all areas were lower for those students who do not eat in the dining halls at least twice a day and those who do dine in the commons on a regular basis. These results are shown in Table 10.

A nutrient analysis of the students’ diets who purchased a university meal plan but ate less than two meals per day in the commons was also performed. Their nutrient intakes were calculated and are shown in Table 10. A further analysis was also done to compare their intakes against the food guide pyramid recommendations. These results
show that this population ate, on average, one serving from the milk, cheese, and yogurt group, two servings from the meat, fish, and poultry group, one serving from the fruit group, two servings from the vegetable group, and seven servings from the bread, pasta, rice, and grain group. The results also showed that these students ate 25 servings from the fats, oils, and sweets group. These results are summarized in Table 11.

Nutrient Intake

Due to only two participants who did not participate in Ohio State’s meal plan, a comparison between those who have a meal plan and those who do not was not possible. Based on the results of the completed food diaries, the students’ diets are high in calories and fat and low in fruits and vegetables. Many students prepare and eat their meals in their dormitory rooms. They also frequently purchase their meals on their way home and eat in their rooms. Frequent operations which provide food are Buckeye Express, fast food restaurants, and pizza establishments.

The students snack until they go to bed. The results show that 77% (N = 24) of participating students reported eating snack foods such as pretzels, tortilla chips and salsa, and candy bars, after 9:00 p.m. This may suggest that they are eating as they study or watch television.

Many of the students’ diets were low in milk and dairy. Some students would eat cereal with milk in the morning or as a snack and that would be their sole source of calcium. Other students would drink milk with their meals. It appears that the students either drink large amounts of milk or hardly any at all. Cheese, yogurt and other dairy products were also not highly consumed. This could be because of the students’ limited space for the storage of such perishables.
The consumption of fruits and vegetables also appears to be low in this population. The consumption of fruit juices is high, however. Many students reported drinking fruit juice and punch with their meals. There was very limited reporting of eating fresh fruits or vegetables. These foods are widely available at the dining commons and at the other eateries on campus. With the low consumption of fresh fruits and vegetables, the values for fiber are low.

The majority of meals reported were eaten in the students' dormitory rooms. Results show that 46% of the meals reported were prepared and/or eaten in their rooms. Approximately 75% of the meals eaten in dormitory rooms were either picked up at an outside establishment such as Buckeye Express, the fast-food-type establishment run by Ohio State, or were left-over portions of previous meals. Buckeye Express offers such choices as sandwiches, pizza, yogurt, desserts, fruits, bagels and beverages. Buckeye Express offers carry-out services for breakfast, lunch and dinner Monday through Friday.

The consumption of fast foods and restaurant foods was high. Results show that 13% (N = 32) of the reported meals were consumed at restaurants and fast food establishments. The consumption of foods from Buckeye Express is high. The food diaries showed that 16% (N = 40) of meals reported were consumed at Buckeye Express but an additional 34% of meals were reported to be picked up at Buckeye Express and eaten in students' dormitory rooms.

The results showed that the consumption of meals in the dining commons is low. The students reported eating approximately 23% (N = 56) of their meals in the university dining commons. The frequency the students eat in the commons is much lower than the frequency that they eat in their rooms.

Additional foods that appear to be high in college students' lives are snack cakes such as Twinkies and Ho Hos, and other snack foods. Many students consumed potato
chips, tortilla chips and salsa and pretzels throughout the three days. These foods were commonly consumed at night after dinner. The results showed that most of the respondents (N = 14; 45%) reported eating snack foods at least once a day. The study also showed that 35% (n = 11) snacked at least twice during the three day food record, 13% (N = 4) reported snacking once during the three days and 6% (N = 2) reported no snacking during the three day period.

DISCUSSION

The results of this study suggest that college students who reside in university dormitories are not eating at optimal nutritional levels. Their diets tend to be low in fiber, and high in calories and fat.

These results are not surprising. The diets of college students have previously been reported as being low in fiber, calcium, fruits and vegetables and high in fat and calories (4-14). With the many meal options available to students and the addition of the microwave/refrigerator in all dormitory rooms, it is of interest to nutrition professionals to see what these students are eating and the nutritional choices they are making.

With the low number of meals that are being consumed in university dining commons and the large number of students who purchase meal plans, it is apparent that the students are not using their meal plans to their full potential and are choosing to purchase other foods such as fast food and Buckeye Express meal items. This is a likely contributor to the high fat and low fiber intakes of the college student.
The information presented is not meant to be representative of all upper-class, undergraduate students who live in university dormitories. It is meant to describe a small sample of such students who attended The Ohio State University during Autumn 1997 and Winter 1998 Quarters. A discussion of each analysis performed is presented below.

The Eating Habits and Food Choices of College Students

The first objective of this study was to determine the eating patterns of upperclassmen residing in a college dormitory. The demographic information that was collected for both respondents and non-respondents show that there are no significant differences between the two groups.

The results indicate that 94% of the participants who lived in Drackett Tower on The Ohio State University campus for Autumn 1997 and Winter 1998 quarters purchased a meal plan through the Office of Residence and Dining. The respondents consumed a mean of 7.8 meals per week in the dining halls, thus eating a majority of meals outside of the university dining commons.

Most students ate at a fast food establishment at least once during the time they kept the food diary. They also ate frequently in their rooms after picking up their food at either a major fast food restaurant or Buckeye Express, a take-out service provided by Ohio State.

The description of the eating patterns/habits of college students are consistent with those found in the literature pertaining to the amounts of fast food eaten by college students (1, 3, 4, 12, 13, 17). For example, Brevard et al reported that students who live in on-campus housing tend to eat more fast food than students who live off campus, primarily due to economic reasons (13). Brevard’s findings are similar to the findings of this study due to the ability of students to use the Buck ID in many fast food restaurants.
They do not have to pay cash for the fast food because they can use the deposit that their parents or guardians put on their account. Additionally, it has been reported by many universities that more students are eating take-out food in their rooms and less are eating in the university dining halls as was also shown in this study (1).

Supplements were used by 39% (N = 12) of the respondents. A multivitamin was the most often consumed supplement (73%; N = 8). C. Jakobivits also found that 34% of college students use supplements and the most often consumed supplement in that study was a multivitamin (9).

Analysis of Nutrients Consumed Compared to the Recommended Daily Allowance's and Dietary Guidelines

An analysis was performed comparing the intakes of the students to the dietary guidelines and the Recommended Daily Allowances (RDAs) for micronutrients. The results showed that students who ate two or more meals in the university dining commons (28%; N = 8) consumed on average 2820 calories, 115 grams of protein, 336 grams of carbohydrate, 16 grams of fiber, 110 grams of fat (total), 39 grams of saturated fat, 1426 RE of vitamin A, 186 mg of vitamin C, 17 mg of iron, and 1578 mg of calcium. The results of this study show that students who ate less than two meals per day in the dining halls (46%; N = 21) ate an average of 2152 calories, 68 grams of protein, 311 grams of carbohydrate, 13 grams of fiber, 72 grams of fat, 24 grams of saturated fat, 695 RE of vitamin A, 124 mg of vitamin C, 14 mg of iron, and 677 mg of calcium. Finally, the nutrient intakes for students who ate zero meals in the dining commons (6%; N = 2) were as follows: 2324 calories, 88 grams of protein, 283 grams of carbohydrate, 11 grams of fiber, 92 grams of fat, 31 grams of saturated fat, 750 RE of vitamin A, 58 mg of vitamin C, 11 mg of iron, and 507 mg of calcium.
Although data such as height, weight, and activity level were not obtained, these results would suggest that the students as a whole are consuming, on average, an excess amount of calories. Consuming excess amounts of calories without balancing the consumption with an equal amount of exercise will lead to obesity later in life. If these students are in fact consuming more calories than they are utilizing, they run the risk of developing health conditions such as Diabetes Mellitus, heart disease and some cancers such as breast cancer, later in life.

The United States Department of Agriculture and the Department of Health and Human Services publishes dietary guidelines for healthy eating. These guidelines are used to help the general public make healthy food choices and promote wellness in the area of nutrition. These guidelines recommend that the amount of fat consumed be limited to 30% of the calories consumed. All three groups of students in this study consumed greater than 30% of their calories in fat. The students ate approximately 35% of their calories from a fat source. Again, to promote healthy eating and wellness later in life, the students need to choose foods lower in fat. By decreasing the amount of fast food and increasing their lean meat, fruit, vegetable, and grain consumption, the students will increase their micronutrient intake and decrease the risk of developing obesity and heart disease later in life. These results are consistent with the literature findings. Horwath found that fat contributed 34% of calories in college students’ diets.

An additional area of concern is fiber. The reference range for fiber intake is 25 to 30 grams per day. Participants who ate at least two meals per day in the commons had an average daily intake of 16 grams of fiber while those who ate less than two meals per day in the commons ate 13 grams per day and those who ate zero meals per day in the commons ate only 11 grams of fiber per day. All of these groups of students are consuming lower amounts of fiber than recommended. This is due to the students’
choices to eat foods that are lower in fiber or to the unavailability of high fiber foods in establishments other than the dining commons. The low fiber intake is also related to the low fruit and vegetable intake that is typical of this population which is consistent with the literature (4, 8, 13, 16-17). Brevard et al had similar findings. Brevard found that students who live on-campus have an average fiber intake of 14 to 17 grams of fiber per day (13). Brevard’s results are consistent with the findings of this study. By increasing their fiber intake, students could decrease their risk for developing heart disease, elevated blood cholesterol levels and colon cancer later in life.

An additional nutrient that was analyzed in this study was vitamin A. Results indicate that the adequacies of the students’ diets were related to the number of meals they consumed in the dining halls. The RDA for vitamin A is 1000 RE for men and 800 RE for women. The students who ate more than two meals per day in the dining commons consumed 1426 RE of vitamin A, thus were meeting the RDA. The students who ate less than two or zero meals in the dining commons were not meeting their vitamin A needs. These students consumed 695 and 750 RE of vitamin A respectively. The students’ major sources for vitamin A were cheese and enriched cereals. Previous research results found inconsistent intakes of vitamin A. Herron, et al found that students are often deficient in other nutrients, such as iron, but were adequate in vitamin A intake (7). The results, however, are inconsistent with other studies found in the literature. The study conducted by A. Hertzler showed that, in general, college students ate below the recommended amounts of vitamin A (12). The literature is inconsistent in this area, however, this study showed that students who ate more than two meals per day in the commons met the RDA for vitamin A.

Similar results were found for vitamin C. The RDA for vitamin C is 60 mg per day. The students who ate two or more meals per day in the dining halls consumed an
average of 186 mg/day which is meeting the RDA for vitamin C. The students who ate one to two meals per day also met the RDA with 124 mg of vitamin C. Those who ate zero meals in the commons were slightly low in their intake with 58 mg. The major source of vitamin C was orange juice. Orange juice is available in the dining commons at every meal and was frequently consumed by those students who ate in the dining commons. Additionally, potatoes are highly consumed among this population and also contributed to their vitamin C intake. These results are inconsistent with Hertzler’s study which reported that college students’ diets are inadequate in vitamin C (12). However, the results are in agreement with Hernon et al’s findings that college students’ diets are adequate in vitamin C (7).

The results of this study regarding iron intake among college students are in agreement with the literature. Biochemical data was not available so iron deficiency can not be diagnosed, however, the average intakes among the students was low. The RDA for iron is 15 mg per day for females and 10 mg per day for males. The males met the recommended amount with an average of 16 mg per day. The females, however, were low. They consumed an average of 13 mg per day. The literature reports many studies that showed inadequate iron intake, especially among women (6-12). The results of this study came to the same conclusion. When analyzed according to meal plan choice, all groups fell between 10 to 15 mg per day (range = 11-17).

The students’ intake of calcium was also inadequate. The only group to meet the RDA of 1200 mg per day were those who ate more than two meals per day in the dining halls. They consumed, on average, 1578 mg per day. Those who ate less than two or zero meals per day in the dining halls were consuming below recommended levels for this nutrient. Additionally, when analyzed according to gender, neither males nor females met the requirement. Again, these findings are in agreement with the literature. C. Hoffman, et
al found that 59% of college women consume inadequate amounts of calcium (11). This is a concern, especially for women, to prevent the development of osteoporosis later in life.

**Analysis of Intakes Compared to the Food Guide Pyramid**

In addition to comparing the intakes of the respondents to the RDAs and dietary guidelines, a comparison was done between their intakes and the Food Guide Pyramid. The food guide pyramid is another method used to promote healthy eating by giving general guidelines and numbers of servings recommended for the average person. The Food Guide Pyramid recommends that people use fats, oils and sweets sparingly. The pyramid also recommends that Americans consume two to three servings per day from both the milk and meat groups, two to four servings from the fruit group, three to five servings from the vegetable group, and six to eleven servings from the bread, cereal and grain group.

The results of this study show that all of the participants were exceeding the recommended amounts of fats, oils and sweets according to the Food Guide Pyramid. The students ate approximately 25 servings from this group. This amount is in agreement with the findings in the previous discussion comparing fat as a component of the caloric intake. This study concludes that the participants' diets were higher in fat than is recommended by the dietary guidelines and the Food Guide Pyramid. By decreasing their fat intake, the students could prevent life long health problems.

The students' intake of milk and dairy products varied with the number of meals that were consumed in the university dining halls. The students who ate two or more meals per day in the commons exceeded the recommendations by one serving (consuming four servings per day). The students who consumed less than two or zero meals per day
in the commons were low in their dairy consumption with an average of one serving per day. These results show that most students were low in their milk and dairy consumption. With the prevalence of osteoporosis in today’s older adults, it is vital that students, especially females, consume adequate calcium. Students who do not eat in the commons regularly are not consuming adequate amounts of dairy products. These students do not choose adequate amounts of foods from this category and these decisions could lead to health problems later in life.

The intake of meat, poultry and fish was relatively consistent among the students. The students in all groups met this recommendation. The students who ate two or more or zero meals per day in the dining halls consumed an average of three servings per day and those who ate less than two meals per day in the dining halls consumed two servings from the meat group. This is an encouraging factor. Although many of the students chose high fat meats such as hamburger, the students are meeting the recommendation. Meats are a good source of protein and iron. Many studies have documented the iron deficiencies found among the college student population (6-12).

The participants intakes of fruits also varied according to the frequency that they ate in the commons. Those who ate two or more meals per day were the only participants who met the recommendation with two servings. Those who ate zero meals per day in the dining halls, on average, did not have any fruits in their diets. Those who ate less than two meals per day in the commons ate, on average, one serving per day. The low intake of fruits may contribute to the low intake of vitamin C among some students. Additionally, the low fiber values may also be reflected by the inadequate consumption of fruits. The low intake of fruits among college students may be due to the unavailability of these foods or the students simply choose not to eat fruits.
The consumption of vegetables also varied but was, on average, low compared to the recommendations of the Food Guide Pyramid. Those who ate two or more meals per day in the commons barely met the recommendations with three servings per day. Those who ate less than two or zero meals per day in the dining halls consumed only two servings per day from the vegetable group. Again, vegetables are a source of micronutrients and fiber. They also contain phytochemicals and antioxidants which may reduce the risk of cardiovascular disease and some cancers. It is vital that these students incorporate vegetables into their diet to promote healthy eating habits and to help ensure health throughout their lives.

The last food group in the Food Guide Pyramid is the bread, cereal, and grain group. All of the students were adequate in this category, however, those who ate zero meals in the commons were at the low end of the recommended range with only six servings per day from this group. The students appear to choose enriched white bread products for their sandwiches and also for their hamburger buns. By choosing whole grain products, they would increase their fiber intake which may help prevent some diseases later in life.

**General Observations and Recommendations**

Overall, the diets of college students who reside in Drackett Tower at The Ohio State University appear to be adequate in calories (excessive in some cases), low in fruits and vegetables, calcium, iron, and fiber, and high in fat. The students choose fast, convenient foods and eat in their rooms often, even though they have a university meal plan and could eat in the dining commons.

The students who consume two or more meals per day in the university commons met all of the dietary guidelines, RDAs, and recommendations of the Food Guide Pyramid.
Recommendations for college students would be to purchase and utilize a university meal plan. Additionally, a wide variety of foods from all food groups are available in the dining halls. By choosing a wide variety of low fat, nutrient dense foods, students will be able to obtain nutritious, well balanced dietary habits that will be carried on throughout life.
CHAPTER 5
CONCLUSIONS

INTRODUCTION

This chapter will summarize the results of the study. Implications for further research and limitations of the study will also be discussed.

Summary

The study was designed to compare the nutritional adequacies of the diets of upper-class college students who reside in university dormitories based on their decision to participate in university meal plans or not to participate. Thirty-one students responded to the request to keep three day food diaries.

The participants of this study consume few meals in the university dining halls. Many students chose to eat their meals at fast food restaurants or purchase their meals at these establishments and eat the meals in their dormitory rooms. With the addition of the microwave/refrigerator combination in the students’ rooms, preparing and eating meals in their rooms has also been shown to happen frequently.

The diets of college students vary according to their decision to purchase a meal plan with the university and also the number of meals they choose to eat in the university dining halls. The students who ate more than two meals per day were shown to be adequate in all areas analyzed including calories, food groups and micronutrients. The students who purchased a meal plan but usually ate less than two meals per day in the
dining commons were shown to have diets that were adequate in calories but inadequate when broken down by food groups and micronutrient intakes. These students' nutrient intakes were low in milk, fruits, and vegetables while excessive in fats, oils, and sweets. They also consumed inadequate amounts of vitamin A and calcium. The students who did not purchase a university meal plan and did not eat any meals in the dining commons were shown to have inadequate intakes in many areas including milk, fruits, vegetables, vitamins A and C, calcium, iron, and they were on the very low end of the recommended range for breads and grains. Their diets were also excessive in calories and fat. These students' diets are not nutritionally adequate and may compromise their nutritional status.

The three research objectives were answered within the constraints of response percentage. The findings were consistent with the literature in relation to the diets, eating habits and nutritional adequacy of food choices made by this population. These results generate thought and interest among nutrition professionals and also among members of the general collegic atmosphere. Future research would benefit these organizations to determine if the growth of nutrition knowledge is impacting the eating habits and nutritional status of college students.
Implications and Future Research

The findings of this study are of importance and interest to many people in different areas of these students' lives. One group of people that may find interest in the results of this study are the students' parents. Many parents may be under the impression that their children are eating in the dining commons on a regular basis. This study's participants are not. Most students eat at fast food restaurants on a regular basis. When the food is purchased at Buckeye Express, it is deducted from their meal plan, however, they can also go to traditional fast food establishments and use the money that is on their account to purchase food. Parents might be interested in learning more about how the meal service operates and what students are actually consuming as their meals.

Another group of people that may be interested in the results of this study are the students themselves. Students may not realize the amount of calories and fat that they are consuming and how low their diets are in fruits, vegetables, and milk. Students may benefit from the realization of the nutritional inadequacies of their diets and may be willing to make lifelong dietary changes when faced with these realities.

Dietitians and health care professionals who are involved with the university student population may also be interested in the results of the study. These professionals may be able to use these results when trying to educate the students on wellness and disease prevention. By showing the students what they are eating and what is recommended that they eat, the students may realize the need for dietary change and these health professionals will be able to better assist them.

These results indicate that college students who reside in university residence halls could improve their nutritional intake and make healthier food choices. This population may benefit from nutrition education. Future research questions include: What are these students eating? Why do they make the food choices they make? What could nutrition
educators do to help improve their nutritional choices? Study replication involving a larger, more representative sample to provide a measure of validity and generalizability of previous research would be beneficial to the dietetics and collegic communities. Enlarging the study to include areas such as activity and biochemical measurements may also be advantageous to incorporate a larger, broader look at the lives of these students. Additional comparative studies may also be beneficial. Comparing upper-classmen to freshmen or those who live on-campus to those who live off-campus may prove to be helpful in educating the students and also helping to improve their food choices and nutritional status.

**Limitations**

The major limitation of the study was response rate. Although descriptive research is designed to obtain information concerning the nature of a situation as it exists at the time of study, the limited response rate makes this not feasible. Response error was controlled by comparing non-respondents to respondents but this too resulted in a low response rate. Therefore, these results may not be generalized to others.


APPENDIX A
Permission From OSU’s Office of Residence and Dining
APPLICATION FOR EXEMPTION FROM HUMAN SUBJECTS COMMITTEE REVIEW

All research activities that will involve human beings as research subjects must be reviewed and approved by the appropriate human subjects review committee, or receive exemption status, prior to implementation of the research.

Principal Investigator: Wolf, Kay N. .................................................. (Signature)
Academic Title: Asst. Professor ..................................................
Department: Medical Dietetics ..................................................
Campus Address: 916 BAMP Building ............ 1583 Perry Street (building)
Suite Number: Building ..................................................
Co-Investigator(s): Meckle, Ellen D. ................ (Signature)
(First name) ..................................................
(First name) ..................................................
(First name) ..................................................
PROTOCOL TITLE: The Relationship Between Meal Plans and Nutritional Intake of College Students

THE ONLY INVOLVEMENT OF HUMAN SUBJECTS IN THE PROPOSED RESEARCH ACTIVITY WILL BE IN ONE OR MORE OF THE EXEMPTION CATEGORIES LISTED ON THE BACK OF THIS APPLICATION.

CATEGORY: [Check one or more] #1  #2 X  #3  #4  #5  #6

SOURCE OF FUNDING FOR PROPOSED RESEARCH: (Check A or B)
A. OSU: Sponsor ..................................................
RF Proposal/Project No. ..................................................
B. Other (Identify) ..................................................

Office Use: EXEMPTION STATUS: ✓ APPROVED ___ DISAPPROVED**

OCT 31 1997

** Principal Investigator must submit a protocol to the appropriate Human Subjects Review Committee.

IMPORTANT NOTICE TO INVESTIGATORS: Exempting an activity from review DOES NOT absolve the investigators of the activity from ensuring that the welfare of human subjects in the activity is protected and that methods used, and information provided, to gain subject consent are appropriate to the activity.
APPENDIX B
Permission From OSU's Human Subjects Committee
TO: HUMAN SUBJECTS COMMITTEE  
FROM: JEFF REDFIELD, DRACKETT TOWER HALL DIRECTOR  
SUBJECT: ELLEN MERKLE STUDY  
DATE: OCTOBER 27, 1997  
CC: ELLEN MERKLE

This memo is in support of Ellen Merkle’s study on “The Relationship Between Meal Plans and Nutritional Intake of College Students”. Ms. Merkle notified me about her study. She also discussed what the study would be about with the general assembly of the Drackett Tower Community Council. They voted to support her study and had no concerns. They are excited about the opportunity to learn the caloric and nutritional information about their diets that the study can provide.

If you should need further information or have additional questions, please contact me at (614) 292-8611. Thank you.
APPENDIX C
Cover Letter With First Mailing
Dear Fellow Student:

Hello. My name is Ellen Merkle and I am a graduate student in the Medical Dietetics Division of the School of Allied Medical Professions. As a component of my research thesis required for graduation, I am studying the different food choices that upper-class students make.

I am asking people to please keep three day food diaries for me so I may accurately complete this study. By returning a completed food record, you will be providing implied informed consent to participate.

This is a completely anonymous and confidential. However, if you desire, I would be more than willing to sent you a printout of a nutrient analysis of your diet. This would show how many calories, fat grams, grams of protein, nutrients, etc....that are in your diet.

Please complete the attached food diary for three weekdays of your choice (Monday-Thursday) within the next three weeks. The completed food records can simply be dropped in campus mail in the enclosed return envelope or any addressed envelope to the address shown below, by November 21, 1997:

Ellen Merkle
Medical Dietetics Division
School of Allied Medical Professions
1583 Perry Street
Columbus, Ohio 43210

If you want a printout of your nutrient analysis, please include a self-addressed campus envelope with the completed food diary and I will sent this to you.

Thank you for your participation. Your input will greatly help my study!!
APPENDIX D
Cover Letter with Third Mailing
Dear Fellow Student:

Hello. I hope you all had a good holiday and a relaxing break from school. As you may remember from last quarter, my name is Ellen Merkle and I am a graduate student in the Medical Dietetics Division of the School of Allied Medical Professions.

Last quarter, many of you kept three-day food records for my study concerning the eating habits of college students. I want to thank all of you that completed this for me. Unfortunately, I did not get enough responses to continue with my thesis at this point. So, I am asking again that if you did not previously complete a three-day food record for me, please do so at this time. If you already completed one, there is no need for you to complete another and again, thank you for your participation.

Again, this is completely anonymous and confidential. However, if you desire, I would be more than willing to send you a printout of a nutrient analysis of your diet. This would show you how many calories, fat grams, grams of protein, etc. that are in your diet.

Also, at the completion of my study, I will be having a drawing for a $25 gift certificate to Cookers. When you return your food diary, please enclose a piece of paper with your name and phone number on it so that I may contact you if your name is chosen for the gift certificate.

Please complete the attached food diary for three weekdays of your choice (Monday-Thursday) within the next two weeks. The completed food records can simply be dropped in campus mail in the enclosed envelope or any envelope addressed to the address shown below by Friday, January 16, 1998:

Ellen Merkle  
Medical Dietetics Division  
School of Allied Medical Professions  
1583 Perry Street  
Columbus, Ohio 43210

If you want a printout of your nutrient analysis, please include a self-addressed campus envelope with the completed food diary and I will send this to you.

Again, thank you for participating. I really appreciate your help. Your input will greatly help my study.
APPENDIX E
Instrument
THREE DAY

FOOD DIARY
KEEPING YOUR FOOD RECORD

Over the any three WEEKDAYS (Monday-Thursday) in the next three weeks, please record all the food and liquid that you eat and drink. Please use this packet to record your intake.

Keep this record as completely and accurately as possible for three days.

The following tips may be useful in keeping the record:

1. Record immediately after eating.

2. List every food on a different line.

3. Give the amount of food or drink eaten in cups, teaspoons, tablespoons or in a common unit amount for that food. For example:
   - 1 slice of bread
   - 1 small, medium or large size apple.

4. Give method of preparation, that is: broiled, roasted or fried, etc.

5. Give brand names if applicable, for example:
   - 1 Tbsp Miracle Whip Salad Dressing, not sandwich spread.
   - 1 McDonalds Quarter Pounder Sandwich

6. Specify anything added to foods or beverages, for example:
   - 1 cup coffee with 1 oz whole milk.

7. For foods made at home such as casseroles or sandwiches, record the main ingredients and approximate amounts for each, for example:
   - 2 slices of bread, 2 tsp. butter, 1 egg, 1 tsp. mayonnaise

8. Include all meals, snacks and beverages, including alcohol.
9. Record any food supplements such as vitamins, protein supplements, etc.

GENERAL INFORMATION

AGE

MALE/FEMALE (Please circle)

Do you have a meal plan through the Office of Housing? __________
If yes, which meal plan? (Please circle)
19 Meals Plus
10 Meals Plus
8 Meals Plus
All Plus Plan

How many meals per week do you usually eat in the OSU dining commons? __________

Do you take any food supplement? __________
If yes, what is it? ________________
DAY 1

Date: ________________ (m/d/y)

Day of the Week: ________________
DAY 2

Date: ____________________________

(m/d/y)

Day of the Week: _____________________
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**Date:**

**Day of the Week:**
DAY 3

Date: ____________________________
(m/d/y)

Day of the Week: ________________________

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Date:
Day of the Week:
FOR INFORMATION, CONTACT

Ellen Merkle
Medical Dietetics Division
School of Allied Medical Professions
1583 Perry Street
Columbus, Ohio 43210
292-1706

Thank you for participating in this study.
We appreciate the time you spend in filling out this booklet.
APPENDIX F
Reminder Postcard
Just a Reminder....
Please do not forget to complete your three day food diaries for my research project by Nov. 21. Also, don’t forget to include a self addressed envelope so I can get a nutrient analysis on your diet to you! If you need a new packet, please contact me at:
Ellen Merkle
School of Allied Medical Professions Student Affairs
292-1706
APPENDIX G
Non-Respondent Postcard
Hello. As you may remember, I put Food Records in each of your boxes at the beginning of Winter Quarter. If you DID NOT complete the Food Record, please take a minute to complete this postcard and drop it in Campus Mail. PLEASE HELP ME GRADUATE! Thank you for your participation.

Ellen Merkle
Medical Dietetics Graduate Student

How many meals per week do you usually eat in the OSU Dining Commons? ______

Do you have a meal plan through the Office of Housing? ______
If so, which meal plan (please circle)
  19 Meals Plus       10 Meals Plus       8 Meals Plus       All Plus Plan

Male/Female (please circle)

Age: ______
APPENDIX H
Nutrient Averages for all Respondents
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<th>Fiber (g)</th>
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<th>Sat. Fat (g)</th>
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<th>Vitamin C (mg)</th>
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**NUTRIENT INTAKES OF PARTICIPANTS**