COMPARISONS OF NUTRITION AND FOOD BUDGETING KNOWLEDGE OF FOOD SECURE AND FOOD INSECURE SOPHOMORES AT APPALACHIAN STATE UNIVERSITY

A Thesis
by
REBEKAH LAING LUNAN

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APPROVED BY:

Laura McArthur, PhD, RD
Chairperson, Thesis Committee

Melissa Gutschall, PhD, RD, LDN
Member, Thesis Committee

Alisha Farris, PhD, RDN
Member, Thesis Committee

Margaret Barth, PhD, MPH
Chairperson, Department of Nutrition and Health Care Management

Mike McKenzie, Ph.D.
Dean, Cratis D. Williams School of Graduate Studies

Abstract

COMPARISONS OF NUTRITION AND FOOD BUDGETING KNOWLEDGE OF FOOD SECURE AND FOOD INSECURE SOPHOMORES AT APPALACHIAN STATE UNIVERSITY

Rebekah Laing Lunan
B.S., Appalachian State University
M.S., Appalachian State University

Chairperson: Laura McArthur, PhD, RD

Introduction: Food insecurity means limited access to safe, nutritious food that supports an active, healthy life. This problem is widespread among US college students, with rates from 14% to 59%. In 2016 the rate at Appalachian State University (App State) was 46.2%. This descriptive, cross-sectional study measured the food security status, nutrition and budgeting knowledge, and budgeting behaviors of food secure (FS) and food insecure (FI) sophomores attending App State during the spring 2019 semester, and identified associations between these variables.

Materials and Methods: A random sample of 1,792 sophomores received electronic recruitment letters. Data were collected with an online questionnaire using Qualtrics survey software. Food security status was measured using the USDA ten-item Adult Food Security Survey Module (AFSSM), nutrition and budgeting knowledge were measured with multiple-choice tests, and budgeting behaviors were measured with a frequency table. Correlational analyses examined associations, and statistical significance was $p < 0.05$.

Results: Among the 222 sophomores, 119 (53.6%) were FS and 103 (46.4%) were FI. No significant correlations were found between AFSSM scores and nutrition knowledge (r= -0.071, p= 0.320), budgeting knowledge (r= -0.06, p= 0.404), or budgeting behaviors (r= -0.08, p= 0.297). A significant positive correlation emerged between budgeting behaviors and budgeting knowledge (r= 0.20, p= 0.010).

Discussion and Conclusions: Findings indicate a need for educational activities that teach these FS and FI sophomores how to recognize low-cost nutritious foods, construct a monthly budget that includes anticipated food costs, and use money-saving practices to purchase healthy foods.

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Chapter One Introduction

Background Information

Definition and Measurement of Food Security

"Food insecurity" is defined as having limited or uncertain access, in socially acceptable ways, to nutritionally adequate and safe foods that promote an active and healthy life (USDA Definitions, 2019). The term "hunger" refers to the physiological responses of the body to food insecurity (USDA Measurement, 2019). The food security status of U.S. adults is measured annually using the 10-item Adult Food Security Survey Module (AFSSM) sponsored by the United States Department of Agriculture Economic Research Service (USDA/ERS). This survey categorizes persons on a continuum of high, marginal, low, or very low food security. High food secure persons are those who had no problems accessing adequate food during the previous year. Marginally food secure persons experienced worry or anxiety about accessing adequate food, but the quality, variety, and quantity of their diet was not substantially reduced. Adults classified as low food secure reduced the quality, variety, and desirability of their diets, but the quantity of food consumed and usual eating patterns were not substantially disrupted. Lastly, very low food secure persons experienced disruption in their usual eating pattern and reduced the amount of food consumed due to a lack of money and other resources to acquire food. People are assigned to one of these categories based on the number of affirmative responses to the AFSSM questions as applied to the previous 12 months, i.e., "yes," "often," "sometimes," "almost every month," and "some months but not every month." The sum of affirmative responses is the raw food security score on a scale of 0 to 10. Accordingly, a score of 0 (zero) indicates high food security, scores of 1 and 2 reflect marginal food security, scores between 3 and 5 reflect low food security,

and scores between 6 and 10 are associated with very low food security (USDA Measurement, 2019).

Prevalence and Correlates of Food Insecurity among U.S. Adults

Every year the USDA/ERS reports the number and percentage of U.S. adults who are classified into each of the four levels of food security. Additionally, The number of persons in the high and marginally food secure groups are combined and classified as food secure, while the number of persons in the low or very low groups are combined and classified as food insecure (USDA Measurement, 2019). In 2018, 11.1% of all US households were food insecure with 4.3% being very food insecure. This is the first time that food insecurity rates have declined to pre-recession levels (Coleman-Jensen, 2019).

Households at a higher risk for food insecurity include those headed by Black, non-Hispanic, and Hispanic persons, and households with children or incomes at or below 185 percent of the federal poverty level (Morris et al., 2016). Additional demographic characteristics of households especially vulnerable to very low food security include single-parent households, persons living alone, households located in metropolitan areas, and households located in the southern United States (Coleman-Jensen et al., 2018).

Researchers have identified the following correlates of food insecurity among U.S. adults: homelessness, 65 years of age or older, disability, mental health disorders (including depression), presence of one or more chronic diseases (including type 2 diabetes), presence of inflammatory conditions and sleep disorders, and a diagnosis of HIV infection in women (Crews et al., 2014; Gowda et al., 2012; Grandner et al., 2016; Gregory & Coleman-Jensen, 2017; Spinelli et al., 2017). Other health characteristics reported for food insecure persons include smoking and dyslipidemias (Armour et al., 2008; Dong et al., 2018; Seligman et al., 2007; Shin

et al., 2015). Coping strategies used by food insecure families and individuals for food access include using public and private food assistance programs like the Supplemental Nutrition Assistance Program (SNAP) and food pantries, selling personal belongings, eating smaller portions, using credit cards or taking funds out of savings accounts to buy food, borrowing money from family or friends to buy food, and stealing money or food (Bartfeld & Collins, 2017). A familial strategy reported by Rosa et al. (2018) was for parents to serve dessert to keep their children from feeling food deprived.

Prevalence and Correlates of Food Insecurity among U.S. College Students

Researchers have identified college students as a vulnerable population for food insecurity (Bruening et al., 2017), with rates ranging from 14.1% at an urban university in Alabama (Gaines et al., 2014) to 59% at a rural university in Oregon (Patton-Lopez, 2014). The characteristics most frequently associated with food insecure college students include identifying with a race/ethnic minority group, perceived fair or poor physical health, poor class attendance, lower grade point average (GPA), on-campus residence, annual income less than $15,000, credit card debt, and higher body mass index (BMI) (Bennett et al., 2013; Bruening et al., 2016; Gaines et al., 2014; Knol et al., 2017; McArthur, Ball et al., 2018; Patton-López et al., 2014).

Students who are food insecure also show higher rates of depression, anxiety, obesity, and emotional eating compared to their food secure peers (Wall-Bassett et al., 2017; Martinez, Frongillo et al., 2018; Raskind et al., 2019). The coping strategies reported for this population include receiving financial aid, participating in food assistance programs, holding one or more part-time jobs, buying cheap, processed foods, planning menus before buying food, eating smaller portions, stretching food to make it last longer, and eating less healthy meals to eat more (Knol et al., 2017; McArthur, Ball et al., 2018; Watson et al., 2017).

Researchers speculate that college students may be vulnerable to food insecurity in part because they are challenged with increased financial responsibilities, including purchasing textbooks and school supplies, tuition, transportation, rent, utilities, unexpected expenses and personal items. These expenses are competing with the cost of food, forcing students to make decisions about how to allocate their money (Mukigi et al., 2018). Rates of college student food insecurity have increased in tandem with the accessibility of higher education (Bruening et al., 2017). As the population of college students increases in numbers and in diversity, these students and their families will need more assistance in navigating available supportive resources (Bruening et al., 2016). Current interventions on college campuses for facilitating greater food access to students in need include opening campus food pantries, providing financial coaching services, and developing an app for mobile phones that allows students to trade or share excess meal plan points with peers in need (Bruening et al., 2017; Hagedorn et al., 2020; McArthur, Ball et al., 2018; Novak & Johnson, 2017; Watson et al., 2017).

Despite these efforts, the problem of college student food insecurity has reached public health proportions, and more and different kinds of activities, programs, and policies are needed than are currently available to facilitate food access (Bruening et al., 2017). Future efforts should include greater financial aid, provide basic living stipends, and allow students to receive SNAP benefits (Larin & Office, 2018). However, before planning and implementing future interventions, research is needed that assesses student knowledge and behaviors on topics related to food security, including basic nutrition and budgeting knowledge, food selection, and budgeting practices. Findings from such studies could serve as the basis for directing activities toward education and skill-building in areas where gaps still exist.

Nutrition Knowledge of College Students

Research findings with college samples, while limited, have generated evidence that these young adults make more nutritionally dense food choices after exposure to basic nutrition concepts and public health nutrition guidelines. For example, Kolodinsky et al. (2007) found that students who consumed higher amounts of fruit, dairy, protein, and whole grains, also possessed more knowledge related to making healthful choices, and Yahia et al. (2016) reported that a higher saturated fat intake by college students was associated with a lower nutrition knowledge test score. Additionally, making better food choices may be based on a combination of a positive attitude toward and awareness of nutrition and healthy eating. Azizi et al. (2011) studied the nutrition knowledge, attitudes, and practices among university students in different academic disciplines and found that the main cause of low nutritional awareness was due to the students' lack of interest in nutrition, which accounted for 33.3% of responses, while lack of information accounted for 20% of student responses. The authors speculated that the students' attitudes toward nutrition may be grounded in a lack of knowledge about the impacts of nutrition on quality of life, however the study did not address or define why students were not interested in nutrition.

Budgeting Knowledge of College Students

Food insecure students have expressed the desire for interventions that teach monthly budget construction that includes purchasing healthy, affordable foods (McArthur, Ball et al., 2018). Current research on food insecure college students' food budgeting knowledge and behavior is scarce, however, there is research on the general budgeting knowledge and monetary behaviors in this population. Thobejane and Fatoki (2017) working with university students in South Africa, identified students' lack of budgeting skills as a barrier to food security. Although

the majority of students did not have a monthly budget, females were more likely than males to budget. In addition, students spent most of their funds on groceries and fast food, with their remaining money more likely spent on movies, music, and alcohol than on health care. Watson et al. (2017) conducted research with students attending the University of California, Los Angeles to examine the impacts of improved budgeting skills and food literacy on student food insecurity. Students reported feeling frustrated when attempting to shop for nutritious food due to monetary restraints, i.e., they reported being able to identify certain items as nutritious but could not purchase the items because of a lack of resources. Students identified wanting to strengthen their budgeting skills and receive training to better procure nutritious food while on a budget.

Cuy Castellanos and Holcomb (2018) also examined the relationship between budgeting priorities and food literacy among students at a university in the Midwestern United States. The food insecure students reported prioritizing their spending on alcohol and tuition costs over other expenses. With 80.8% of participants showing adequate nutrition literacy, the practice of poor budgeting behaviors may be a contributor to food insecurity.

In contrast, researchers who examined food insecurity and financial resources at a southeastern university found that students who budgeted were more likely to be food insecure than those that did not (Gaines et al., 2014). The authors speculated that students who did not budget may still be considered dependents and have financial help from home. Another finding from this study was that students were using credit cards to buy food, which was associated with a lower risk of experiencing food insecurity. The authors proposed that credit cards help students when financial resources are restricted to keep them from becoming food insecure. However, more research needs to be completed on budgeting behavior and knowledge, as many students

find themselves in debt after graduation from a combination of school-related expenses and credit card bills.

Study Objectives and Justification

Researchers have measured nutrition and budgeting knowledge, budgeting behaviors, and food choices separately among food secure and food insecure college students, but few studies have compared the relationships between these cognitive and behavioral variables between food secure and food insecure students. Studying the associations between these variables may help to identify other contributing factors to the food insecurity experienced by this population. Accordingly, the objectives of this descriptive, cross-sectional survey research were to 1) measure the food security status of sophomores attending App State during the spring, 2019 semester, 2) measure and compare the basic nutrition and budgeting knowledge and budgeting behaviors of food secure and food insecure sophomores, 3) identify correlations between the students' AFSSM scores and scores on basic nutrition and budgeting tests, Budgeting Behavior Scale (BBS) scores, and sociodemographic, health, academic, and dietary variables. The findings from this study will be used to design and evaluate a course focusing on skill-building for food security, with the long-term goal of decreasing the rate of food insecurity at Appalachian State University. Sample selection was limited to sophomores because for many of these students their second year of college represents a transition from campus to community living arrangements. This relocation requires these students to take on new responsibilities that, until their sophomore year, may have been performed for them by others. For example, those students who move off campus during their second year are challenged with learning how to balance their financial resources to afford rent, utilities, food, textbooks, tuition, personal items, and transportation while simultaneously meeting academic and extracurricular demands.

Study Hypotheses

The following sets of hypotheses were tested to address the study objectives.

Food Security Status

1) Approximately thirty percent of the sample of sophomores will be food insecure.

2) A significantly greater proportion of females than males will be food insecure.

3) A significantly greater proportion of food insecure than food secure students will have personal monthly incomes of $500 or less.

4) A significantly greater proportion of food insecure than food secure students will come from families with annual incomes of $49,999 or less.

5) A significantly greater proportion of food insecure than food secure students will identify with a minority race or ethnicity, e.g., Black (African American), Black (Hispanic or Latino), American Indian or Alaska Native, Asian, White (Hispanic or Latino), or Native Hawaiian or Pacific Islander.

6) A significantly greater proportion of food insecure than food secure students will live off-campus.

Food Security Status and Health-Related Variables

1) A significantly greater proportion of food insecure than food secure students will rate their physical health as poor/fair.

2) A significantly greater proportion of food insecure than food secure students will rate their mental/emotional health as poor/fair.

3) There will be a significant positive correlation between the students' AFSSM scores and their BMIs.

Food Security Status and Academic Variables

1) There will be a significant inverse correlation between the students' AFSSM scores and their GPA.

2) A significantly greater proportion of food insecure than food secure students will receive financial aid.

3) A significantly greater proportion of food secure than food insecure students will participate in a campus meal plan.

4) A significantly greater proportion of students with intended majors in the Beaver College of Health Sciences will be food secure compared to students in other schools/colleges.

Food Security Status and Dietary Patterns

1) Food insecure students will consume fruits and fruit juices fewer times per day than food secure students.

2) Food insecure students will consume vegetables and vegetable juices fewer times per day than food secure students.

3) Food insecure students will consume sweets more times per day than food secure students.

4) Food insecure students will consume grains more times per day than food secure students.

5) Food insecure students will consume meat, seafood, and poultry fewer times per day than food secure students.

6) Food insecure students will consume other protein foods such as eggs, nuts, and beans more times per day than food secure students.

7) Food insecure students will consume dairy foods fewer times per day than food secure students.

Food Security Status and Basic Nutrition Knowledge

1) There will be no significant difference between the mean scores on the Nutrition Knowledge Test (NKT) earned by food insecure and food secure students.

2) There will be no significant correlation between the students' AFSSM scores and their scores on the NKT.

Food Security Status and Basic Budgeting Knowledge

1) Food insecure students will earn a significantly higher mean score on the Budgeting Knowledge Test (BKT) than food secure students.

2) There will be a significant inverse correlation between the students' AFSSM scores and their BKT scores.

Food Security Status and Budgeting Behaviors

1) Food insecure students will earn a significantly higher mean score on the BBS than food secure students.

2) There will be a significant inverse correlation between the student's AFSSM scores and their BBS scores.

Relationships between Knowledge and Behavioral Variables

1) There will be a significant positive correlation between NKT scores and consumption of nutrient-dense diets among food secure and food insecure students.

2) There will be a significant positive correlation between the BKT scores and BBS scores among food secure and food insecure students.

Chapter Two Literature Review

Food Insecurity among U.S. College Students

Food insecurity exists when access to adequate and safe food is limited or uncertain, or when such food cannot be accessed in socially acceptable ways (USDA Measurement, 2019). Research conducted at App State in 2016 found a 46.2% prevalence of food insecurity among a random sample of 1,093 undergraduate and graduate students (21.9% low food secure and 24.3% very low food secure) (McArthur, Ball et al., 2018). The sociodemographic and behavioral correlates most frequently reported for food insecure college students include: lower GPA; poor or fair self-rated health status; being employed while in school, and having an annual income less than $15,000; older age; receiving food assistance; having lower self-efficacy for cooking cost-effective, nutritious meals; having less time to prepare food; having less money to buy food; on-campus residence; living off-campus with roommates; identifying with a minority race/ethnic group; and having an increased risk for depression and anxiety (Chaparro et al., 2009; Gaines et al., 2014; Lindsley & King, 2014; Morris et al., 2016; Patton-López et al., 2014; Snelling et al., 2014).

Basic Nutrition Knowledge of U.S. College Students

Key to the USDA/ERS definition of food security is regular access to a nutritionally adequate diet that supports an active and healthy lifestyle. Research findings with college samples have generated evidence that these young adults would make more nutritionally dense choices if they were better educated on the Dietary Guidelines for Americans (Kolodinsky et al., 2007). Kolodinsky et al. (2007) examined how college students make decisions on what to eat at the dining hall. A survey was administered to discover what students were consuming and to

draw correlations between an individual's knowledge of the Dietary Guidelines for Americans and whether their food choices were reflective of their basic food knowledge. Five overarching food categories were identified and frequency of consumption was measured for fruits, vegetables, dairy, grains, with other subcategories. These subcategories included the intake of whole grains, oils, dark green vegetables, orange vegetables, dry beans and peas, starchy vegetables, and other vegetables. Students were also scored on how well they could identify the more healthful food alternative. A statistically significant difference in knowledge was found in those who consumed more whole grains comparatively to any of the other subcategories of food. Overall, the authors found that students who consumed higher amounts of fruit, dairy, protein, and whole grains, also exhibited increased knowledge related to making more choices that were healthful. This example supports the importance of public education interventions on basic nutrition knowledge for students. Some of these nutritionally dense choices include students choosing items that are lower in saturated fat, *trans* fat, and cholesterol.

A study from 2016 analyzed university student's nutrition knowledge and fat intake (Yahia et al., 2016). Information on demographics, anthropometrics, nutrition knowledge, and daily fat consumption was collected. Women proved to have better nutrition knowledge than men and those who consumed more than 35% of their daily calories from fat or consumed over the daily recommended amount of cholesterol also scored lower for nutrition knowledge. When isolated for types of fat consumed, a higher saturated fat intake was indicative of a lower nutrition knowledge score, meaning that those who were better educated about nutrition consumed a diet lower in unhealthy fats.

Making better nutritional choices often also relies on the combination of an individual’s attitude and knowledge. Azizi et al. studied the relationship between nutrition knowledge,

attitudes, and practices among university students (Azizi et al., 2011). The researchers separated the students into their prospective majors to identify differences in attitude and knowledge between schools such as nursing, physical education and business management. The highest nutrition knowledge scores were obtained by nurses while the highest attitude scores were seen in physical education majors. Business management scored the lowest. They found that the main cause of low nutritional awareness was due to carelessness towards nutrition, which accounted for 33.3% of participants, the highest percent of the responses. Their results showed a positive and significant correlation between an individual's knowledge and attitude and between attitude and their dietary practices.

Food Budgeting Skills and Behaviors of U.S. College Students

Educational interventions for college students aimed at decreasing their risk for food insecurity need to consider student resources and to teach skill-building for creating monthly budgets that include purchasing healthy, affordable foods. If a student is unable to afford enough nutrient-dense, safe food, which is often the case among those with food insecurity, then their nutritional status becomes more difficult to improve. Thobejane and Fatoki (2017) in South Africa, isolated a barrier to food security: the lack of budgeting skills among university students. A self-administered questionnaire was used to collect data on spending habits and budgeting skills and to assess if there was a difference between genders. Most of the students did not have a budget, however women were more likely than males to have a monthly budget. In addition, students spent most of their funds on groceries and fast food; however, their remaining money was more likely to be spent on movies, music, and alcohol before being spent on health care. The authors took a call to action, asking that universities take responsibility for educating their students on financial literacy to improve their financial freedom.

A study from the University of California, Los Angeles, sought to find a relationship between improved financial and food literacy to better food security outcomes through eleven focus group interviews (Watson et al., 2017). The aim of the study was to better understand different coping mechanisms and perceptions of food insecurity and to identify areas in which they could alleviate the stress of food insecurity by improving food literacy among students. Low self-efficacy for creating a budget was accredited to receiving their financial reimbursement in a single payment, which was overwhelming according to students. With a lack of budgeting skills, students reported feeling frustrated when attempting to shop for nutritious food, a common thread throughout the results. They could identify certain items as nutritious but could not act on that knowledge because of a lack of resources. Lack of financial resources often led students to cope by buying less nutritious, cheap meals and skipping meals altogether. In conclusion, students desired more interventions focused on training and skills around food preparation and budgeting, which are feasible interventions for a university to provide.

Supporting these findings, another research study targeted a mid-sized private Catholic university and addressed financial priority and nutrition literacy among students (Cuy Castellanos & Holcomb, 2018). Cuy Castellanos and Holcomb (2018) used a six-item food security questionnaire modeled form the survey module developed by the Economic Research Service. Next, they used a financial prioritization questionnaire and a New Vital Signs for health literacy that identified student's basic nutrition knowledge. Of the students sampled, 35.8% identified as food insecure and those that prioritized buying alcohol or paying tuition had higher odds of experiencing food insecurity as well. However, money spent on alcohol had a negative correlation with food insecurity. There was also a significant correlation between food security and increased nutrition literacy. With 80.8% of participants exemplifying adequate nutrition

literacy, a gap in budgeting knowledge illuminates an intervention area to increase food security. An intervention that addresses poor budgeting skills, spending prioritization, and planning among college students may prove to be successful at alleviating food insecurity.

In contrast, researchers who examined food insecurity and financial resources at a southeastern university campus found that students who budgeted were more likely to be food insecure than those that didn't (Gaines et al., 2014). Research is controversial in this area and a few explanations remain. One such explanation from the study suggested that those who are not budgeting are often still considered dependents and have financial help from home. Another proposed reason is that those that are food insecure have better budgeting skills because they have had to. An apparent trend from the study was that the use of credit cards protected individuals from spells of food insecurity. The authors proposed that credit cards help individuals in times of financial need to keep them from entering into a period of food insecurity during the school year. However, more research needs to be completed, as many students find themselves in great financial debt after graduating and may only be exacerbating a future financial burden as they take on paying off student loans or credit card bills.

Chapter Three Methods

Protocol

Participants and Recruitment

A random, computer-generated sample of 1,792 sophomores enrolled at App State during the spring, 2019 semester were sent electronic recruitment letters using email addresses obtained from the Office of Institutional Research, Assessment and Planning at the university. Inclusion criteria were sophomore standing, any gender identity, at least 18 years of age, on or off-campus residence, and any race/ethnic or religious affiliation. The initial recruitment letters were sent through Qualtrics (Qualtrics, Provo, UT, 2019) as a single email blast during Mid-February, followed by four weekly reminder emails (reference Appendix A for recruitment email format). The exception was the second reminder that was sent two weeks after the first to avoid the week of spring break when fewer students were likely to complete a questionnaire. Therefore, data collection began in mid-February and concluded on April 1st, 2019. This timeframe was chosen to get a more accurate measure of the students' usual food security status when on-campus since it avoided the period between fall and spring semesters when students may have brought back resources such as food from family or money obtained from relatives or seasonal employment.

Students who wished to participate in the study clicked a link in the recruitment letter that displayed the informed consent screen. If they accepted the terms for participation, they clicked on a "next" button that displayed the first item in the questionnaire. Students who completed the questionnaire were offered the opportunity to click a link that displayed a screen where they could type their email address to enter a randomized drawing for one of two $50.00 gift cards to amazon.com. This link was detached from the students' questionnaire responses to deidentify

data collection. This study was deemed exempt by the Office of Research Protections at Appalachian State University.

Questionnaire

Data were collected using a three-part, anonymous online questionnaire consisting of 61 items administered using Qualtrics survey software (Qualtrics, Provo, UT, 2019) (reference Appendix B for examples of survey questions from each questionnaire section and Appendix C for the full survey questionnaire). Part one concerned the students' food security status, social support for food access, perceived health, usual dietary intake, and cooking frequency. Their on-campus food security status during their sophomore year was measured using a modification of the 10-item USDA/ERS Adult Food Security Survey (AFSSM) (USDA Measurement, 2019).

The next two items focused on social support for food access. The students indicated whether they could have used "some more," "a little more," or whether they did not need more help accessing food, and they checked, from a list, the sources of support they would have found most helpful.

These items were followed by two questions that asked the students to rate their current physical and mental/emotional health, respectively, by checking either "poor," "fair," "good," or "very good."

The students' usual dietary pattern was assessed by asking them to estimate the number of times per day they consumed items from six food groups and a sweets group by checking either 0 (zero), 1 to 2, 3 to 4, 5 to 6, or 7 or more. They also identified which group(s) they would eat more from given greater access.

Next the students estimated how often they prepared food for themselves and for others, respectively, by checking either "never," "less than once a week," "one time/day," "two

times/day," "three times/day," or "four or more times/day." Additionally, they checked either "yes" or "no" to indicate whether they participated in a campus meal plan.

Part two of the questionnaire consisted of a nine-item NKT and a fourteen-item BKT, both using a multiple-choice format. The NKT measured awareness of dietary guidelines (4 items), nutrient functions (3 items), and the association between nutrients and chronic disease (2 items).

The BKT included questions about budget construction (4 items), strategies for staying within a food budget (5 items), and identifying low-cost nutrient-dense products at the grocery store (5 items).

The BKT was followed by a checklist of 16 money saving behaviors assigned to categories based on themes as follows: food access (4 behaviors), saving (8 behaviors), and food selection (4 behaviors). The students estimated how often they adopted each behavior by checking either "never", "seldom", "sometimes", or "often".

Part three of the questionnaire collected data on sociodemographic, anthropometric, and academic variables. The sociodemographic variables were gender, age, race/ethnic background, employment status, personal monthly income, annual family income, marital status, and presence of dependent children. The students also self-reported their weight and height for calculating body mass index (BMI). The academic variables were GPA, financial aid status, year in school, international vs domestic student status, part-time vs full-time student, academic major, and on-campus vs. off-campus residence.

Pilot Test

The online questionnaire was pilot tested in January, 2019 with a computer-generated random sample of 50 sophomores to assess the clarity of the wording, the amount of text on each screen, and the ease of use of the buttons. Completed questionnaires were submitted by seven students (14%). Based on their input, 13 questions were discarded because they were not strongly linked to the study objectives, and the final version of the questionnaire was reduced from 74 to 61 items.

Statistical Analysis

Data were analyzed using SPSS statistical software (Version 25.0, SPSS Statistics for Macintosh,. IBM Corp. Armonk, NY: 2017). Only data from students who answered the ten USDA/ERS AFSSM questions were included in the analyses to permit comparisons of food secure and food insecure students. When scoring the AFSSM, each affirmative response, i.e., "often," "sometimes," "yes," "almost every month," and "some months, but not every month" was assigned one point, and the sum was tallied to classify students as either high, marginally, low, or very low food secure, in accord with the USDA/ERS scoring system. Scores of 0 (zero) indicated high, 1 to 2 marginal, 3 to 5 low, and 6 to 10 very low food secure. Students whose scores classified them as high or marginally food secure were combined to comprise the food secure group, and those whose scores classified them as low or very low food secure were combined to comprise the food insecure group for data analysis. Comparisons based on food security status were made for all variables. Descriptive statistics were obtained for sociodemographic, academic, dietary, health, knowledge, and behavioral variables. The items concerning perceived physical and mental health were scored by assigning 1 point to the "poor," 2 to the "fair," 3 to the "good," and 4 points to the "very good" responses. Usual food group

intake data were compressed such that "more often" was defined as three or more times per day, and "less often" as zero to two times per day. Chi-square tests compared proportions of food secure and food insecure students based on daily food group consumption, perceived physical and mental health status, social support, and frequency of cooking for self or others.

Scores on the NKT and BKT were obtained by assigning 1 point for each correct response. Therefore, scores on the NKT could range from 0 (zero) to 9 points, and scores on the BKT could range from 0 to 14 points. The checklist of 16 money saving behaviors was scored by assigning 4 points to the most budget-friendly temporal category and 1 point to the least budget-friendly temporal category. For example, 4 points was assigned to the “often” response for the behavior “use a shopping list and stick to it,” while 1 point was assigned to the “often” response for the “buy organic foods” behavior. Therefore, scores on this checklist could range from 16 points if a student selected the least budget-friendly temporal category for all 16 behaviors to 64 points if the most budget-friendly temporal category was selected for all behaviors.

Correlational analyses were performed to identify the strength of the associations between the students’ AFSSM scores and the following variables: BMI, GPAs, NKT scores, BKT scores, and scores on the checklist of money saving behaviors. Independent-t tests compared mean scores on the NKT, BKT, and checklist of money saving behaviors based on sociodemographic and academic variables. Statistical significance was $p< 0.05$.

Chapter Four Results

Characteristics of Overall Sophomores

Questionnaires were submitted by 222 of the 1,792 recruited sophomores (12.4%), of which 11 were discarded due to missing AFSSM data. This yielded a final sample of 222 students, of whom 119 (53.6%) were food secure and 103 (46.3%) were food insecure. The food secure students were those whose scores on the AFSSM ranged from 0 (zero) to 2 and classified them as either high or marginally food secure, while the food insecure students were those whose AFSSM scores ranged from 3 to 10 and classified them as either low or very low food secure (USDA Measurement, 2019).

Table 1 shows frequency counts and percentages for the sociodemographic, academic, and health characteristics and for the cooking behaviors of the overall sample of 222 sophomores. The following narrative summarizes these findings by reporting the percentages as approximations to avoid repeating tabular data and for ease of reading. The gender distribution was 18.5% male, 59.0% female, and 0.9% non-binary. The students' mean age was 19.59 years (±1.64, range 18 to 30), 67.1% self-classified as non-Hispanic white, 50% lived on-campus, and over 50% participated in a university meal plan.

Economic data revealed that about approximately 48% of students received financial aid and 43% held a full time job or one or more part-time jobs. Approximately 10% of the students reported having a personal monthly income between zero to $500, while 11.3% reported an income of $1001 or higher. Findings concerning academic variables revealed that 77.5% were full-time students, their mean GPA, based on self-reported data, was 3.41 (±0.46, range 1.6 to 4.0), and that 19.8% had intended academic majors in the health sciences.

Findings concerning health and cooking variables indicated that the students' mean BMI, calculated from self-reported height and weight data, was 24.18 kg/m^2 (± 5.14, range 16.64-46.91 kg/m^2). Based on BMI cut-off points, 51.8% of the students were underweight or normal weight and 21.6% were overweight or obese. Approximately 64% of the students rated their physical health as "good" or "very good," and 48% rated their mental and emotional health as "good" or "very good". About 60% of the students reported cooking for themselves "less often" and 90% reported cooking for others "less often."

Table 1.

Characteristics of Overall Sample of Sophomores (n= 222)

Characteristic	n	%
Food Security Status		
Food Secure	119	53.6
Food Insecure	103	46.4
Missing	0	0
Gender		
Males	41	18.5
Females	131	59.0
Non-binary	2	0.9
Missing	47	21.6
Race/Ethnicity		
White, Non-Hispanic	149	67.1
Non-white	26	11.7
Missing	47	21.2
Marital Status		
Married	6	2.7
Unmarried	168	78.4
Missing	48	21.6
Presence of Dependent Children		
Yes	2	0.9
No	173	77.9
Missing	47	21.2

Table 1.

Characteristics of Overall Sample of Sophomores (n= 222) (Continued)

Characteristic	n	%
Residency		
On-campus	92	41.1
Off-campus	83	37.4
Missing	47	21.2
Participation in On-campus Meal Plan		
Yes	121	54.5
No	90	40.5
Missing	11	5.0
Financial Aid Recipient		
Yes	106	47.7
No	69	31.1
Missing	47	21.2
Employment Status		
Employed	96	43.2
Unemployed	79	35.6
Missing	47	21.2
Personal Monthly Income		
<$500	22	9.9
$501-$1,000	5	2.3
$1,001+	25	11.3
Missing	170	76.6
Annual Family Income		
$0-$34,000	36	16.2
$35,000-$99,999	72	32.4
$100,000-$200,000+	60	27.0
Missing	54	24.3
Academic Status		
Part-time	2	0.9
Full-time	172	77.5
Missing	48	21.6

Table 1.

Characteristics of Overall Sample of Sophomores (n= 222) (Continued)

Characteristic	n	%
International Student Status		
Yes	2	0.9
No	172	77.5
Missing	48	21.6
Intended Major		
Health Sciences	44	19.8
Other Schools/Colleges	131	59.0
Missing	47	21.2
Weight Status by BMI		
Underweight/Normal Weight	115	51.8
Overweight/Obese	48	21.6
Missing	59	26.6
Perception of Current Physical Health		
Poor/Fair	72	32.4
Good/Very Good	142	64.0
Missing	8	3.6
Perception of Current Mental/Emotional Health		
Poor/Fair	108	48.6
Good/Very Good	106	47.7
Missing	8	3.6
Food Preparation for Self		
Less Often	131	59.0
More Often	80	36.0
Missing	11	5.0
Food Preparation for Others		
Less Often	198	89.2
More Often	13	5.9
Missing	11	5.0

Note. Responses of "yes," "often," "sometimes," "almost every month," and "some months but not every month" are coded as affirmative. The sum of affirmative responses to the 10 questions in the AFSSM data is the household's raw score on the scale. The food preparation categories:

"less often" means "never," "less than once per week," and "one time per day" vs. "more often" means "2 times per day," "3 times per day," and "4 or more times per day."

Comparisons of Characteristics of Food Secure and Food Insecure Sophomores

Tables 2 and 3 report frequency counts and percentages of food secure and food insecure sophomores based on sociodemographic, academic, and health characteristics and on cooking behaviors. The following narrative summarizes these findings by reporting the percentages as approximations to avoid repeating tabular data and for ease of reading.

There was a significant relationship between food security status and gender (p= 0.046). Among food secure students, males made up approximately a third of the population and females two thirds. Food insecure students were approximately 53% female. There was a significant association between food security status and their race/ethnic distribution, with non-whites making up a more significant portion of the food insecure population than the food secure population (p= 0.034). No significant association existed between the other variables analyzed in Table 2 and 3 and food security status.

The mean BMI of food secure students was 24.02 kg/m^2 (±4.76, range 17.99 to 46.91) and that of the food insecure students was sophomores who had an average BMI of 24.37 kg/m (±5.57, range 16.64 to 44.53). Food secure students' GPAs on average were 3.51 (±0.41, range 2.30 to 4.00) while food insecure students mean GPA was 3.28 (± 0.47, range 1.60 to 4.00). No significant association existed between students' AFSSM scores and students' BMI however, there was a significant difference between AFSSM scores and students' GPAs (p= 0.001). There was also a significant negative correlation between AFSSM scores and students' earned GPA (r= -0.291, p= 0.00), suggesting that as they scored higher on the AFSSM questionnaire their GPA decreased (reference Appendix D for a complete list of all

tested correlations). However, due to the small correlation coefficient this may be of no applicable importance because the small sample size.

Table 2.

Comparison of Characteristics of Food Secure (n= 119) and Food Insecure Students (n= 103)

	Food Secure Students		Food Insecure Students		
Characteristic	**n**	**%**	**n**	**%**	**p-value**
Gender					**0.046**
Males	17	14.3	24	23.3	
Females	77	64.7	54	52.4	
Non-binary	0	0.0	2	1.9	
Missing	25	21.0	23	22.3	
Race/Ethnicity					**0.034**
White, Non-Hispanic	85	71.4	64	62.1	
Non-white	9	7.6	17	16.5	
Missing	25	21.0	22	21.4	
Marital Status					**0.841**
Married	3	2.5	3	3.8	
Unmarried	91	76.5	77	74.8	
Missing	25	21.0	23	22.3	
Presence of Dependent Children					**0.916**
Yes	1	0.8	1	1.0	
No	118	78.2	80	77.7	
Missing	25	21.0	22	21.3	
Academic Status					**0.189**
Part-time	2	1.7	0	0	
Full-time	92	77.3	80	77.7	
Missing	25	21.0	23	22.3	
International Student Status					**0.922**
Yes	1	0.8	1	1	
No	92	77.3	80	77.7	
Missing	26	21.8	22	21.4	

Table 2.

Comparison of Characteristics of Food Secure (n= 119) and Food Insecure Students (n= 103)

(Continued)

	Food Secure Students		Food Insecure Students		
Characteristic	**n**	**%**	**n**	**%**	**p-value**
Intended Major					**0.127**
Health Sciences	28	23.5	16	15.5	
Other Schools/Colleges	66	55.5	65	63.1	
Missing	25	21.0	22	21.4	
Residency					**0.433**
On-campus	52	43.7	40	38.8	
Off-campus	42	35.3	41	39.8	
Missing	25	21.0	22	21.4	
Participation in On-campus Meal Plan					**0.650**
Yes	67	56.3	54	52.4	
No	47	39.5	43	41.7	
Missing	5	4.2	6	5.8	
Financial Aid Recipient					**0.065**
Yes	51	42.9	55	53.4	
No	43	36.1	26	25.2	
Missing	25	21.0	22	21.4	
Employment Status					**0.863**
Employed	51	42.9	45	43.7	
Unemployed	43	36.1	36	35.0	
Missing	25	21.0	22	21.4	
Personal Monthly Income					**0.740**
<$500	9	7.6	13	12.6	
$501-$1,000	3	2.5	2	1.9	
$1,001+	11	9.2	14	13.6	
Missing	96	80.7	74	71.8	

Table 2.

Comparison of Characteristics of Food Secure (n= 119) and Food Insecure Students (n= 103)

(Continued)

	Food Secure Students		Food Insecure Students		
Characteristic	**n**	**%**	**n**	**%**	**p-value**
Annual Family Income					**0.348**
$0-$34,000	15	12.6	21	20.4	
$35,000-$99,999	40	33.6	32	31.1	
$100,000-$200,000+	33	27.7	27	26.2	
Missing	31	26.1	23	22.3	
Weight Status by BMI					**0.971**
Underweight/Normal Weight	62	52.1	53	51.5	
Overweight/Obese	25	21.0	23	22.3	
Missing	32	26.9	27	26.2	
Perception of Current Physical Health					**0.000**
Poor/Fair	26	21.8	46	44.7	
Good/Very Good	91	76.5	51	49.5	
Missing	2	1.7	6	5.8	
Perception of Current Mental/Emotional Health					**0.000**
Poor/Fair	44	37.0	64	62.1	
Good/Very Good	73	61.3	33	32.0	
Missing	2	1.7	6	5.8	
Food Preparation for Self					**0.989**
Less often	68	57.1	63	61.2	
More Often	46	38.7	34	33.0	
Missing	5	4.2	6	5.8	

Table 2.

Comparison of Characteristics of Food Secure (n= 119) and Food Insecure Students (n= 103) (Continued)

	Food Secure Students		Food Insecure Students		
Characteristic	**n**	**%**	**n**	**%**	**p-value**
Food Preparation for Others					**0.045**
Less Often	107	89.9	91	88.3	
More Often	7	5.9	6	5.8	
Missing	5	4.2	6	5.8	

Note. In regards to food security status: "food secure" means "high food secure" and "marginal food secure" and "food insecure" means "low food secure" and "very low food secure."

The food preparation categories: "less often" means "never," "less than once per week," and "one time per day" vs. "more often" means "2 times per day," "3 times per day," and "4 or more times per day."

Table 3.

Chi-square Comparisons of Food Secure (n= 119) and Food Insecure (n= 103) Sophomores on Sociodemographic, Academic, and Health Characteristics and on Cooking Behaviors Based on Food Security Status

Characteristic		
Gender	χ^2	**p-value**
Male	6.147	0.046
Female		
Non-binary		
Race/Ethnicity	χ^2	**p-value**
White, Non-Hispanic	4.480	0.034
Non-White		

Table 3.

Chi-square Comparisons of Food Secure (n= 119) and Food Insecure (n= 103) Sophomores on Sociodemographic, Academic, and Health Characteristics and on Cooking Behaviors Based on Food Security Status (Continued)

Characteristic		
Academic Status	χ^2	**p-value**
Part-time Full-Time	1.722	0.189
Intended Major	χ^2	**p-value**
Health Sciences Other Schools/Colleges	2.327	0.127
Residency	χ^2	**p-value**
On-campus Off-campus	0.615	0.433
Participation in On-campus Meal Plan	χ^2	**p-value**
Yes No	0.206	0.650
Financial Aid Recipient	χ^2	**p-value**
Yes No	3.392	0.065
Employment Status	χ^2	**p-value**
Employed Unemployed	0.030	0.863
Personal Monthly Income	χ^2	**p-value**
Lower Middle Upper	0.603	0.740
Annual Family Income	χ^2	**p-value**
Lower Middle Upper	2.113	0.348

Table 3.

Chi-square Comparisons of Food Secure (n= 119) and Food Insecure (n= 103) Sophomores on Sociodemographic, Academic, and Health Characteristics and on Cooking Behaviors Based on Food Security Status (Continued)

Characteristic		
Need for Support Accessing Food	χ^2	**p-value**
A Lot More Some More A Little More Do Not Need Support Missing	90.832	0.000
Perception of Current Physical Health	χ^2	**p-value**
Poor/Fair Good/Very Good	15.086	0.000
Perception of Current Mental/Emotional Health	χ^2	**p-value**
Poor/Fair Good/Very Good	17.078	0.000
Food Preparation for Self	χ^2	**p-value**
Less Often More Often	0.625	0.429
Food Preparation for Others	χ^2	**p-value**
Less Often More Often	0.000	0.989

Note. In regards to food security status: "food secure" means "high food secure" and "marginal food secure" and "food insecure" means "low food secure" and "very low food secure." The food preparation categories: "less often" means "never," "less than once per week," and "one time per day" vs. "more often" means "2 times per day," "3 times per day," and "4 or more times per day."

Social Support for Food Access and Learning Interventions Requested by Food Secure and Food Insecure Sophomores

Tables 4 and 5 illustrates the need for support in accessing food for the overall sample and by food security status. There was also a significant association between food security status and their perceived need for support in accessing food, with greater proportions of food secure students expressing that they "do not need support" in accessing food (p= 0.000). Approximately 40% of food insecure students reported a desire for "a little more" support in accessing food.

Table 6 shows selected learning interventions ranked in descending order as selected by food insecure students. The majority of food insecure students selected interventions that would teach them how to "shop for affordable, healthy foods," "make a budget and stick to it," and "plan balanced meals." Other interventions such as "make a list before shopping for food," "grow food by container gardening," and "participate in a community garden to exchange work for produce" were selected less frequently among food insecure sophomores.

Table 4.

Need for Support in Accessing Food for the Overall Sample (n= 222)

Need for Support Accessing Food	n	%
A Lot More	6	2.7
Some More	36	16.2
A Little More	58	26.1
Do Not Need Support	117	52.7
Missing	5	2.3

Table 5.

Comparisons in the Need for Support in Accessing Food for Food Secure (n= 119) and Food Insecure (n= 103) Sophomores

	Food Secure		Food Insecure	
Need for Support Accessing Food	n	%	n	%
A Lot More	0	0	6	5.8
Some More	3	2.5	33	32.0
A Little More	17	14.3	41	39.8
Do Not Need Support	97	81.5	20	19.4
Missing	2	1.7	3	2.9

Table 6.

Learning Interventions Selected by Food Insecure Sophomores (n= 103) for Improving Their Food Access

	n	%
Interventions		
Shop for affordable, healthy foods	54	52.4
Make a budget and stick to it	52	50.5
Plan balanced meals	51	49.5
Make a list before shopping for food	40	38.8
Grow food by container gardening	18	17.5
Participate in a community garden to exchange work for produce	16	15.5

Food Group Consumption by Food Secure and Food Insecure Sophomores

Table 7 displays the number of students in the whole sample who eat from each of the food groups “more often” and “less often” every day. It appears that the overall group of students

primarily consumes “grains and cereals” more frequently per day than any other single food group. “Vegetables and juices” had the highest proportion of students that selected that they consume them “less often” with “fruits and juices” taking a close second. Table 8 ranks the food groups in descending order with students having a greater desire for access to more “fruits and juices” and “vegetables and juices” over any other food group.

Table 9 examines the frequency of current food group consumption between food secure and food insecure sophomores. “Grains and cereals” were consumed “more often” among food secure students, while food insecure students reported consuming “other protein foods” “more often” than any other food group. Food secure students reported consuming “sweets” the least often while food insecure students reported consuming “fruits and juices” least often. Table 10 ranks preferences of food that food insecure students wish they had more access to. Ranked in descending order, food insecure students desired more access to “fruits and juices” and “vegetables and juices”. Both the overall sample and food insecure students ranked the food groups in the same order.

As displayed in table 11, a significant association existed between consumption of “grains and cereals” (p= 0.045) or “fruit and juices” (p= 0.009) and food security status as determined by chi-square analysis.

Table 7.

Current Food Group Consumption of the Overall Sample (n= 222)

Current Food Group Consumption	n	%
Grains and Cereals		
More Often	86	38.7
Less Often	127	57.2
Missing	9	4.1

Table 7.

Current Food Group Consumption of the Overall Sample (n= 222) (Continued)

Current Food Group Consumption	n	%
Vegetables and Juices		
More Often	52	23.4
Less Often	161	72.5
Missing	9	4.1
Fruits and Juices		
More Often	58	26.1
Less Often	155	69.8
Missing	9	4.1
Meat, Seafood, and Poultry		
More Often	62	27.9
Less Often	150	67.6
Missing	10	4.5
Other Protein Foods		
More Often	69	31.1
Less Often	143	64.4
Missing	10	4.5
Dairy Foods		
More Often	60	27.0
Less Often	152	68.5
Missing	10	4.5
Sweets		
More Often	60	24.8
Less Often	152	70.7
Missing	10	4.5

Note. Responses for food group consumption: "more often" means "3 to 7 or more times per day" and "less often" means "zero to 2 times per day."

Table 8.

Food Groups from Which the Overall Sample Would Eat More Given Greater Access (n= 222)

Food Groups	n	%
Fruits and Juices	158	71.2
Vegetables and Juices	154	69.4
Other Protein Foods	83	37.4
Meat, Seafood, and Poultry	75	33.8
Dairy Foods	43	19.4
Grains and Cereals	37	16.7
Sweets	8	3.6

Table 9.

Comparisons in Current Food Group Consumption of Food Secure (n= 119) and Food Insecure (n= 103) Sophomores

	Food Secure		Food Insecure	
Current Food Group Consumption	**n**	**%**	**n**	**%**
Grains and Cereals				
More Often	54	45.5	32	31.1
Less Often	62	52.1	65	63.1
Missing	3	2.5	6	5.8
Vegetables and Juices				
More Often	32	26.9	20	19.4
Less Often	84	70.6	77	74.8
Missing	3	2.5	6	5.8
Fruits and Juices				
More Often	40	33.6	18	17.5
Less Often	76	63.9	79	76.7
Missing	3	2.5	6	5.8
Meat, Seafood, and Poultry				
More Often	32	26.9	30	29.1
Less Often	83	69.7	67	65.0
Missing	4	3.4	6	5.8

Table 9.

Comparisons in Current Food Group Consumption of Food Secure (n= 119) and Food Insecure (n= 103) Sophomores (Continued)

	Food Secure		Food Insecure	
Current Food Group Consumption	**n**	**%**	**n**	**%**
Other Protein Foods				
More Often	35	29.4	34	33.0
Less Often	80	67.2	63	61.2
Missing	4	3.4	6	5.8
Dairy Foods				
More Often	35	29.4	25	24.3
Less Often	80	67.2	72	69.9
Missing	4	3.4	6	5.8
Sweets				
More Often	26	21.8	29	28.2
Less Often	89	74.8	68	66.0
Missing	4	3.4	6	5.8

Note. The food group consumption categories: "more often" means "3 to 7 or more times per day" and "less often" means "zero to 2 times per day."

Table 10.

Food Groups from Which Food Insecure Sophomores Would Eat More Given Greater Access (n = 103)

	n	**%**
Strategies		
Fruits and Juices	80	77.7
Vegetables and Juices	80	77.7
Other Protein Foods	47	45.6
Meat, Seafood, and Poultry	36	35.0
Dairy Foods	23	22.3
Grains and Cereals	22	21.4
Sweets	2	1.9

Table 11.

Chi-square Comparisons of Food Secure (n= 119) and Food Insecure (n= 103) Students on Food Group Consumption

Food Groups		
Consumption of Grains and Cereals	χ^2	**p-value**
More Often	4.036	0.045
Less Often		
Consumption of Fruits and Juices	χ^2	**p-value**
More Often	6.762	0.009
Less Often		

Note. The food group consumption categories: "more often" means "3 to 7 or more times per day" and "less often" means "zero to 2 times per day."

Basic Nutrition Knowledge of Food Secure and Food Insecure Sophomores

Table 12 compares the mean scores and ranges of food secure and food insecure students on the basic Nutrition Knowledge Test (NKT). Food secure students scored an average of 4.90 points (±1.59, range 2 to 9) while food insecure students scored an average of 4.70 points (±1.51, range 1 to 8). An independent t-test revealed no significant differences in mean NKT scores between food secure and food insecure students (p= 0.367) and no correlations between the mean NKT scores and their AFSSM scores (r= -0.071, p= 0.320), GPA (r= 0.082, p= 0.289), or their BMIs (r= -0.116, p= 0.141). Independent t-tests indicated that no difference in mean scores within topic areas, such as "dietary guidelines (p= 0.226)," "nutrient functions (p= 0.917)," and "nutrients and chronic diseases (r= 0.487)," existed between food secure and food insecure students. This suggested that there was no significant difference between the subscale scores earned by the two groups on any of these topic areas. Additionally, scoring

higher in any one topic area on the NKT was not a predictor for improved food security status. An insignificant regression equation was found ($F(3,193)= 0.818$, $p= 0.485$), with an R^2 of 0.013.

Table 13 compares the mean scores of food secure and food insecure sophomores on their NKT based on sociodemographic, academic, and health characteristics, and on cooking behaviors. As determined by ANOVA, there were no statistically significant differences between food secure and food insecure students mean NKT scores, even when divided by sociodemographic, academic, health characteristic, and cooking behavior variables. The questions that were most often answered correctly by food secure and food insecure students were "Consuming too much _____ could increase your risk for high blood pressure. (salt)" and "Adults should eat wholegrain and cereal products every day because they are rich sources of _____ which exercises the muscles of the small and large intestines. (fiber)". The question that was most often answered incorrectly by food secure and food insecure students were "How many daily servings of fruits and vegetables should adults eat as a minimum? (5 or more)." The second question that was most often answered incorrectly by food secure students was "How many daily servings of low-fat, fat-free dairy foods should adults consume? (3)" while food insecure students most often incorrectly answered a question on grains, "What percent of grains and cereals should adults get from whole grain foods? (50%)."

Table 12.

Mean Scores of Nutrition Knowledge Test from Food Secure Students (n= 119) and Food Insecure Students (n= 103)

Nutrition Knowledge Test (9 items, possible range 0 to 9)	**Food Secure**		**Food Insecure**	
Subscale	**Mean±SD**	**Range**	**Mean±SD**	**Range**
Dietary Guidelines (4 items, possible range 0-4)	**1.43±0.92**	**0.00-4.00**	**1.29±0.69**	**0.00-3.00**
How many daily servings of fruits and vegetables should adults eat as a minimum?				
How many times per week should adults eat oily fish?				
How many daily servings of low-fat, fat-free dairy foods should adults consume?				
What percent of grains and cereals should adults get from whole grain foods?				
Nutrient Functions (3 items, possible range 0-3)	**2.11±0.84**	**0.00-3.00**	**2.12±0.84**	**1.00-3.00**
Adults should eat protein-rich foods every day because protein performs which function?				
Adults should eat wholegrain and cereal products every day because they are rich sources of _____ which exercises the muscles of the small and large intestines. (Fiber)				
Foods rich in _____ are the main fuel source used by the body. (Carbohydrates)				
Nutrients and Chronic Diseases (2 items, possible range 0-2)	**1.35±0.67**	**0.00-2.00**	**1.28±0.69**	**0.00-2.00**
Consuming too much _____ could increase your risk for high blood pressure. (Salt)				
Eating too much of _____ is most likely to increase your risk for heart disease. (Animal Fats)				

Table 13.

Comparisons of Mean Scores of Food Secure Students (n= 119) and Food Insecure Students (n= 103) on Nutrition Knowledge Test Based on Demographic, Health, and Cooking Characteristics

	Food Secure	Food Insecure	
Characteristic	**Mean±SD**	**Mean±SD**	**p-value**
Gender			
Males	5.65±1.37	5.13±1.39	0.616
Females	4.74±1.62	4.53±1.54	0.486
Non-binary	0.00±0.00	6.50±0.71	NA
Race/Ethnicity			
White, Non-Hispanic	4.92±1.64	4.88±1.44	0.345
Non-white	4.78±1.39	4.31±1.74	0.465
Intended Major			
Health Sciences	5.22±1.67	5.06±1.57	0.890
Other Schools/Colleges	4.77±1.58	4.69±1.50	0.762
Residency			
On-campus	5.06±1.49	4.88±1.56	0.320
Off-campus	4.71±1.74	4.65±1.48	0.180
Perception of Current Physical Health			
Poor/Fair	4.86±1.75	4.49±1.57	0.727
Good/Very Good	4.91±1.56	4.88±1.45	0.476
Perception of Current Mental/Emotional Health			
Poor/Fair	4.70±1.32	4.76±1.55	0.139
Good/Very Good	5.01±1.73	4.58±1.45	0.194
Food Preparation for Self			
Less often	5.11±1.60	4.84±1.39	0.672
More Often	4.33±1.63	3.40±1.82	0.667
Food Preparation for Others			
Less Often	4.93±1.59	4.77±1.47	0.672
More Often	4.33±1.63	3.40±1.82	0.667

Note. The food preparation categories: "less often" means "never," "less than once per week," and "one time per day" vs. "more often" means "2 times per day," "3 times per day," and "4 or more times per day."

Basic Budgeting Knowledge of Food Secure and Food Insecure Sophomores

Table 14 compares the mean scores and point ranges between the food secure and food insecure sophomores within each subscale of the BKT, i.e. "budget construction," "shopping behaviors," and "grocery shopping." The mean test score earned by the food secure students was 11.49 points (±1.78, range 6 to 14), and that of the food insecure students was 11.05 points (± 2.42, range 0 to 14) out of a possible 14 points. Food secure and food insecure students' scores within each subset of items were not significantly different, however significant differences did exist between food security status two individual questions from the budgeting test. The questions that exhibited a significant difference between food secure and food insecure students were "How can making a grocery list help you when you're shopping at the store? (prevents impulse buys)," (p= 0.032) and "How can you save money when shopping for snacks? (buy snack foods in larger packages and pre-portion them yourself)" (p= 0.003). There was no significant correlation between the students' test scores and their scores on the AFSSM (r= -0.063, p= 0.404). Additionally, there was a significant correlation between scores on the NKT and BKT (r= 0.170, p= 0.024), meaning that there is a positive relationship between students' scores on both tests. The two groups did differ markedly in their responses to two test questions. Significantly greater proportions of food secure than food insecure students gave correct answers to the questions concerning "buying in bulk" when purchasing snacks (p= 0.000) and "making a list before grocery shopping" (p= 0.030).

Table 15 compares the mean scores of food secure and food insecure sophomores on BKT scores based on sociodemographic and health characteristics and on cooking behaviors. There were no significant differences between the mean test scores of the two groups based on any of the variables examined.

Table 14.

Comparisons of Mean Scores of Food Secure Students (n= 113) and Food Insecure Students (n= 103) on Budgeting Knowledge Test

Budgeting Knowledge Test (14 items, possible range 0 to 14)	**Food Secure**		**Food Insecure**		
Subscale	**Mean±SD**	**Range**	**Mean±SD**	**Range**	**p-value**
Budget Construction (4 items, possible range 0-4)	**3.85±0.417**	**2.00-4.00**	**3.75±0.641**	**0.00-4.00**	**0.220**
What is budgeting?					
Which is the best strategy for creating and sticking to a budget?					
Which is an example of a "fixed expense"?					
When putting together a budget, which item should you include?					
Shopping Behaviors (5 items, possible range 0-5)	**4.06±0.689**	**2.00-5.00**	**3.85±0.970**	**0.00-5.00**	**0.100**
Which would be a way to help you save on your food bill?					
How can making a grocery list help you when you're shopping at the store?					
Which type of food vendor would provide you with the most budget-friendly food?					
Which is a budget-friendly grocery item?					
If you're craving a recipe for a food that requires expensive ingredients, which will help you make the recipe most affordable?					
Grocery Shopping (5 items, possible range 0-5)	**3.58±1.31**	**1.00-5.00**	**3.44±1.39**	**0.00-5.00**	**0.500**
Which is a budget-friendly way to shop for produce?					
Buying meat in which form would help you save money on your food bill?					
Which can help you save on grain and cereal products?					
Which is the most budget-friendly way to buy dairy foods? (e.g., milk, cheese, cottage cheese, ice cream)					
How can you save money when shopping for snacks?					

Table 15.

Comparisons of Mean Scores of Food Secure Students (n = 119) and Food Insecure Students (n = 103) on Budgeting Knowledge Test Based on Demographic, Health, and Cooking Characteristics

	Food Secure	Food Insecure	
Characteristic	**Mean±SD**	**Mean±SD**	**p-value**
Gender			
Males	11.25±1.65	10.29±2.37	0.256
Females	11.49±1.83	11.39±2.43	0.442
Non-binary	0.00±0.00	13.00±1.41	N/A
Race/Ethnicity			
White, Non-Hispanic	11.38±1.84	11.39±2.11	0.519
Non-white	12.11±1.17	9.81±3.21	0.088
Intended Major			
Health Sciences	11.82±1.81	11.06±2.46	0.246
Other Schools/Colleges	11.29±1.78	11.06±2.45	0.360
Residency			
On-campus	11.24±1.63	11.25±2.17	0.297
Off-campus	11.71±1.97	10.87±2.70	0.220
Perception of Current Physical Health			
Poor/Fair	11.67±1.28	10.89±2.67	0.114
Good/Very Good	11.45±1.88	11.18±2.21	0.360
Perception of Current Mental/Emotional Health			
Poor/Fair	11.58±1.57	10.92±2.61	0.114
Good/Very Good	11.43±1.91	11.29±2.03	0.592
Food Preparation for Self			
Less often	11.36±1.62	11.09±2.04	0.236
More Often	11.68±2.01	10.96±3.07	0.189
Food Preparation for Others			
Less Often	11.45±1.75	11.11±2.45	0.089
More Often	12.20±2.49	10.00±1.41	0.402

Note. The food preparation categories: "less often" means "never," "less than once per week," and "one time per day" vs. "more often" means "2 times per day," "3 times per day," and "4 or more times per day."

Budgeting Behaviors of Food Secure and Food Insecure Sophomores

Table 16 reports the frequency counts and percentages of food secure and food insecure students who used 16 budgeting behaviors based on temporal categories which was scored by assigning 4 points to the most budget-friendly temporal category and 1 point to the least budget-friendly temporal category. Therefore, budget-friendly behaviors that were scored as being performed "often" received 4 points while those that were performed "never" received 1 point. Behaviors that were not budget-friendly such as "buy fast food," were scored with "often" earning participants 1 point and "never" earning participants 4 points. Total scores ranged from 16 to 64 points. Categories measured included behaviors that were reflective of student's current "food access," "shopping behaviors," and "food selection." The subscore with the highest comparative mean scores for food secure and food insecure students was "food selection" with an average of 12.41 points (± 1.97, range 0 to 16) and 11.97 points (± 2.33, range 0 to 16) respectively. However, "food access" had the lowest mean scale scores for both groups with mean scores at 9.89 points (± 2.24, range 0 to 16) for food secure students and food insecure students on average earning 9.84 points (± 2.32, range 0 to 16). Food secure and food insecure students reported using behaviors such as "buy(ing) food items on sale" and "buy(ing) the store brand of a food over a brand name of food" as "sometimes/often" the most frequently. Additionally, "get(ting) free food from food pantries on or off campus" and "shop(ping) for food when you're not hungry" was reported as behaviors performed "never/seldom" the most frequently by both groups. Food secure students mean scores were 44.2 points

(±6.4, range 25 to 59) while food insecure students mean scores were 42.3 points (±6.6, range 22 to 55).

Table 17 compares the mean overall BBS scores earned by the food secure and food insecure sophomores based on sociodemographic and health characteristics and on cooking behaviors. A significant difference was found between the mean BBS scores of the food secure and food insecure non-white students, with the food secure non-white students earning significantly higher scores (p= 0.031). Additionally, food secure students who cooked for themselves (p= 0.042) or others (p= 0.048) "less often" scored significantly higher on the BBS than food insecure students who reported the same frequency of behavior.

Table 16.

Comparisons of Budgeting Behaviors of Food Secure Students (n= 119) and Food Insecure Students (n= 103)

Budgeting Behavior Scale (16 items, possible range 16 to 64)	**Food Secure**				**Food Insecure**			
Behavior	**Never/Seldom n**	**%**	**Sometimes/Often n**	**%**	**Never/Seldom n**	**%**	**Sometimes/Often n**	**%**
Food Access (4 items, possible range 4-16)								
Buy Fast Food	48	40.3	46	38.7	39	37.9	42	40.8
Prepare your own meals rather than eat out	16	13.4	79	66.4	20	19.4	60	58.3
Get free food at activities on or off campus	42	35.3	53	44.5	30	29.1	50	48.5
Get free food from food pantries on or off campus	79	66.4	16	13.4	60	58.3	19	18.4

Table 16.

Comparisons of Budgeting Behaviors of Food Secure Students (n= 119) and Food Insecure Students (n= 103) (Continued)

Budgeting Behavior Scale (16 items, possible range 16 to 64)	Food Secure				Food Insecure			
Behavior	Never/Seldom n	%	Sometimes/Often n	%	Never/Seldom n	%	Sometimes/Often n	%
Shopping Behaviors (8 items, possible range 8-32)								
Use a shopping list and stick to it	23	19.3	70	58.8	38	47.5	42	40.8
Use your shopper's card (e.g., Harris Teeter VIC card)	22	18.5	72	60.5	31	30.1	50	48.5
Use coupons	55	46.2	40	33.6	51	49.5	30	29.1
Shop for food when you're not hungry	77	64.7	18	15.1	54	52.4	27	26.2
Create a budget that includes food purchases	48	40.3	47	39.5	46	44.7	35	34.0
Buy foods in bulk that don't spoil quickly, (e.g., rice, canned beans, canned tuna, or chicken)	27	22.7	68	57.1	26	25.2	54	52.4
Buy food items on sale	11	9.2	84	70.6	15	14.6	65	63.1
Pay for your food or meal with cash rather than use your credit card	44	37.0	50	42.0	43	41.7	37	35.9

Table 16.

Comparisons of Budgeting Behaviors of Food Secure Students (n= 119) and Food Insecure Students (n= 103) (Continued)

Budgeting Behavior Scale (16 items, possible range 16 to 64)	Food Secure				Food Insecure			
	Never/Seldom		Sometimes/Often		Never/Seldom		Sometimes/Often	
Behavior	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Food Selection (4 items, possible range 4-16)								
Shop for produce in season	26	21.8	69	58.0	33	32.0	48	46.6
Compare unit prices for the same food across brands	22	18.5	72	60.5	19	18.4	62	60.2
Buy the store brand of a food over a brand name of food	11	9.2	84	70.6	15	14.6	65	63.1
Buy organic foods	38	31.9	57	47.9	28	27.2	51	49.5

Table 17.

Comparisons of Mean Scores of Food Secure Students (n= 119) and Food Insecure Students (n= 103) on Budgeting Behaviors Scale Based on Demographic, Health, and Cooking Characteristics

	Food Secure	Food Insecure	
Characteristic	**Mean±SD**	**Mean±SD**	**p-value**
Gender			
Males	44.82±8.43	41.48±7.29	0.187
Females	43.94±5.88	43.08±5.89	0.424
Non-binary	N/A	N/A	N/A
Race/Ethnicity			
White, Non-Hispanic	43.78±6.31	42.98±6.04	0.451
Non-white	47.00±6.82	39.82±7.93	0.031
Intended Major			
Health Sciences	43.00±6.22	42.69±4.33	0.862
Other Schools/Colleges	44.53±6.47	42.18±7.08	0.055
Residency			
On-campus	44.23±6.22	41.41±7.04	0.520
Off-campus	43.98±6.67	43.18±6.04	0.583
Perception of Current Physical Health			
Poor/Fair	43.06±6.62	41.25±7.13	0.382
Good/Very Good	44.52±5.70	42.63±6.07	0.188
Perception of Current Mental/Emotional Health			
Poor/Fair	43.69±7.43	42.13±6.85	0.317
Good/Very Good	44.52±5.70	42.63±6.07	0.188
Food Preparation for Self			
Less often	43.29±6.24	40.62±6.84	0.042
More Often	45.46±6.51	45.37±4.83	0.952
Food Preparation for Others			
Less Often	44.13±6.46	42.05±6.57	0.048
More Often	45.20±6.06	46.50±5.97	0.757

Note. The food group consumption categories: "more often" means "3 to 7 or more times per day" and "less often" means "zero to 2 times per day."

Chapter Five Discussion

Hypothesis Testing and Interpretation of Results

Food Security Status and Sociodemographic Characteristics

The prevalence of food insecurity among the 222 App State sophomores who participated in the present study was 46.4%, which was approximately the same as findings from research at the university during the spring 2016 semester (McArthur, Ball et al., 2018). It may be proposed that current campus interventions, such as the food pantry, are not affecting the rate of food insecurity on campus because it is not directly educating students on budgeting and nutrition or providing employment opportunities, but more so providing a temporary means by which to access food.

Previous research has reported particular demographic and lifestyle characteristics associated with college food insecurity such as female gender, higher BMI, identifying with a minority ethnic group, and lower GPA (Chaparro et al., 2009; Gaines et al., 2014; Martinez, Frongillo, et al., 2018; Patton-López et al., 2014). Gender-based comparisons within the present study reflect that there was a higher prevalence of food insecurity among females and a higher prevalence of non-white food insecure students than non-white food secure students. Chi-square tests supported the hypothesis that there was a significant difference in genders, with females making up the majority of food insecure students. It can be speculated that these results are related to an overrepresentation of female students. The present study also supported the hypothesis that a significantly greater proportion of food insecure than food secure students identified with a minority race or ethnicity.

Although food insecure students did have a greater proportion of students in the "overweight/obese" category, there were no a significant differences between food security

status groups based on BMI. Additionally, there was no correlation between AFSSM score and BMI category. This finding did not support the hypothesis that AFSSM scores and BMI would have a significant positive correlation. McArthur and Ball et al. (2018) found that a greater proportion of food insecure students were overweight or obese by BMI than those that were food secure. It can be proposed that perhaps with a larger sample size, our findings would mimic other research on this topic. Additionally researchers have identified correlates of food insecurity one of which was GPA (McArthur, Ball et al., 2018; Morris et al., 2016; Patton-López et al., 2014). Within these studies, GPA was negatively correlated with food security status. The findings from the present study supported the hypothesis that AFSSM scores and GPA would have a significant negative correlation. Perhaps food insecure students have a more difficult time with balancing the stressors associated with food insecurity and academics. Additionally, food insecure students may be experiencing hunger during class or while studying which may affect student's abilities to focus.

Previous research has associated food insecurity with incomes <$15,000 annually, on-campus residence, living off-campus with roommates, and being employed during school (Chaparro et al., 2009; Patton-López et al., 2014). The present study hypothesized food insecure students would have a significantly greater proportion of students with personal monthly incomes of $500 or less. This hypothesis was upheld in that 12.6% of food insecure students reported making less than $500 per month compared to 7.6% of food secure students. However, 13.6% of food insecure students when compared to only 9.2% of food secure students were making more than $1001+ dollars per month. Lastly, food secure and food insecure students had similar proportions of those employed and unemployed. Perhaps food insecure students have the greatest need for income when compared to food secure students, who may have more financial

support from home. Additionally, food insecure students' earned income may not be enough to support their food purchasing and consumption needs throughout the school year.

It was hypothesized that there would be a significantly greater proportion of food insecure students than food secure students that would report coming from a family with an income less than $34,999 per year; while a difference in proportions was found, it is not significant. Food insecure students did have the highest proportion of students with a lower family income of "<$34,999" when compared to food secure participants (20.4% vs. 12.6%). However, a greater proportion of food secure than food insecure students came from families with annual incomes of "$35,000-$99,999" and "$100,000-$200,000+". This suggests that food insecure students may have come from families with a lower income, which may mean that these students were unable to rely on financial support from home.

In terms of residency, individuals that reported food insecurity made up a greater proportion of students living off-campus than the food secure group (39.8% vs. 35.3%). While not significant, it can be proposed that the increased cost of living on campus may have sent students looking for more affordable housing situations in the surrounding community.

Additionally research has associated food insecure college students with fair or poor self-rated health status (Martinez, Frongillo, et al., 2018; Patton-López et al., 2014). The present research reported a significant difference between food secure and food insecure sophomores and mental/emotional and physical health status as hypothesized, with greater proportions of food insecure students rating their mental/emotional and physical health as "poor/fair". It can be speculated that food security status has an effect on both mental/emotional and physical health because of their relation to correlates such as increased BMI and depression as found in other studies (Knol et al., 2017; Patton-López et al., 2014; Stuff et al., 2004).

Previous research has observed associations between food insecurity and academic variables such as participation in financial aid, utilizing campus meal plans, and field of study. These findings were present with food insecure first-year students receiving financial aid at a university in South Africa (Gwacela et al., 2015). Additionally, research from a university in the southern United States also found an association between food insecurity and receiving financial aid (Gaines et al., 2014; Knol et al., 2018). Findings from the present study did support the hypothesis that food insecure students received more financial aid, however there was not a significant difference. It is possible that as more and more students from a variety of socioeconomic backgrounds attend higher education institutions, this association will continue to remain unless addressed by focused interventions. Additionally, previous research has assessed the relationship between food security status and meal plan participation. Findings from Bruening et al. (2016) indicated that there were no associations between food security status and meal plan usage, and the present study found no significant associations either. The data from the present study supported the hypothesis that more food secure students would participate in the campus meal plan than food insecure students, however there was no significant difference in participation between the two groups. While the university does a very good job at balancing quality of food with cost, it is still more cost effective for students to cook or prepare meals at home which may explain why more food insecure students would prefer to not participate in a campus meal plan.

While limited research has examined intended major of study and food security status, the current study compared students with a major in the Health Sciences with students in other fields of study. Previous research identified Nursing majors, a major within health sciences, as having a higher degree of nutrition knowledge than those in business management (Azizi et al.,

2011). Nutrition knowledge and attitudes may contribute to food buying habits, thereby potentially affecting food security status. Results from the present study did support the hypothesis that a greater proportion of food secure compared to food insecure students would have majors in the Beaver College of Health Sciences. Additionally, results showed that a greater proportion of food insecure students selected an intended program of study outside of Health Sciences. While there were no significant differences, this may mean that students who study the Health Sciences have more exposure to nutrition education and access to food security resources that help them to support their own health and dietary practices. All of the students who major in Health Sciences at App State attend classes within the same building and every semester, interdisciplinary events are held to encourage students to discuss their area of study with their peers. Perhaps these events paired with exposure to their learning environment, has helped to connect students to educational resources for better food security.

Food Security Status and Dietary Patterns

Dietary patterns are an important part of assessing food insecure students because it allows researchers to propose interventions that can affect current dietary habits of food insecure students. It also helps to assess food secure and food insecure sophomores' desire for more access to certain food groups compared to the current reported food group intakes. Previous research is limited but initial findings show that both food secure and food insecure students consume too much dietary fat and do not meet recommendations for fruits, vegetables, and fiber (Hiller et al., 2019; Yahia et al., 2016). The present research found significant differences in proportions between food secure and food insecure students and current "grains/cereal" and "fruit and juice" consumption, with food insecure students consuming servings of these foods "less often" than their food secure counterparts. The hypothesis that food insecure students

would consume “grains/cereals” more times per day than the food secure students was not supported. No significant differences existed between food security status groups and consumption of “vegetables and juices”, “meat, seafood and poultry”, “other protein foods”, “dairy foods”, and “sweets”. The hypothesis that food insecure students would consume more sources of “other protein foods” than their food secure peers was supported in that food insecure students had a higher proportion consuming those foods than food secure students. It may be proposed that food insecure students relied more on affordable protein sources such as peanut butter, beans, and lentils. Additionally, food insecure students had higher proportions than food secure students of “meat, seafood, and poultry” consumption within the “more often” category. Despite no significant differences between the aforementioned food groups, a smaller, but not significant proportion of food insecure students were typically consuming health promoting foods less often than food secure students, and a larger proportion of food insecure students were consuming less healthy foods, such as “sweets”, more often than their food secure peers. It may be proposed that consumption of foods such as “meat, seafood, and poultry,” “other protein foods,” and “sweets” are perceived by food insecure students as less expensive than fresh produce as well as more satiating. Additionally, these food categories may be some of the more available foods provided by food pantries, e.g., canned chicken, canned tuna, canned beans, cakes, cookies, or peanut butter.

Students ranked the food groups they would desire greater access to. The only differences between food secure and food insecure students was that food secure students desired greater access to “meat, seafood, and poultry” more than they desired access to “other protein foods,” whereas food insecure sophomores preferred greater access to “other protein foods” over “meat, seafood, and poultry”. All other food groups were ranked in the same order with desire for

greater access to fruits, vegetables, and their juices ranked first and greater access to "sweets" ranked last. This was comparable to findings from a study at App State by McArthur and Ball et al. (2018), which also found that students desired more access to fruits and vegetables.

Food Security Status and Basic Nutrition Knowledge

Assessing the student's nutrition knowledge carried great importance as other studies have aimed to examine this in the hopes of developing relevant well-focused interventions that would help students to identify low-cost nutritious foods for increased nutritional status and food security (Martinez, Webb, et al., 2018). This previous research has shown an association between greater nutrition knowledge and more nutritious food choices. A study in 2007, found that students with increased nutrition knowledge also consumed a diet more in alignment with the dietary guidelines (Kolodinsky et al., 2007). Those who consumed over the recommended amount of fruit scored significantly higher in nutrition knowledge. While little research is present measuring students' nutrition knowledge in relation to their food security status, educating individuals on ways to affordably purchase nutrient-dense foods is perhaps a great first step towards closing the gap in food access for food insecure students. As hypothesized there was no association between AFSSM score and students' scores on the NKT. It may be proposed that selection of answers on the NKT was slightly influenced by food security status in that food secure students did select the correct answer more frequently than food insecure students, however, these findings were not significant. In addition, students were not assessed on whether they had received prior nutrition education; therefore that could have contributed to differences in scores.

Food Security Status and Budgeting Knowledge

Past research has examined the impact of financial barriers to procuring food. While interventions may not be able to deeply impact an individual's access to financial resources, interventions can teach and develop budgeting knowledge, skills, and behaviors that can help students to better manage their money and improve their access to food. Previous research has discovered that students at higher risk of becoming food insecure are typically financially independent, which may mean that they work one or multiple part-time jobs or a full-time job (Gaines et al., 2014). Other studies have reported that effective budgeting skills and management behaviors resulted in better financial and food security (Knol et al., 2018). The present research did not support the hypothesis that there would be a significant positive correlation between the students AFSSM scores and their BKT score. While there were no significant differences between food secure and food insecure students and their scores on the BKT, a greater proportion of food secure students selected the correct answers on the test questions except for two questions. Additionally, food secure students had higher mean scores in all three subscales when compared to food insecure students. Perhaps food secure students who may be coming from food secure households have had exposure to food budgeting before, whether from observing their parents/guardians shop for food or perhaps they were familiar with budgeting knowledge after taking an accounting class. Additionally, food insecure students may not have been exposed to any budgeting concepts at this point. Perhaps many students are having to budget for the first time and have not developed the base knowledge yet to do so successfully. This could have led students to sacrifice food quality and quantity in order to pay for other expenses associated with higher education such as textbooks, tuition, and rent which may explain

why students are experiencing higher rates of food insecurity on campus than at home (Mcarthur, Fasczewski et al., 2018)

Food Security Status and Budgeting Behaviors

Budgeting knowledge, while important, does not always translate to better budgeting behaviors, therefore several studies have deeply examined budgeting behaviors and their relation to food security status (Cuy Castellanos & Holcomb, 2018; Gaines et al., 2014; Martinez, Webb, et al., 2018; Thobejane & Fatoki, 2017). Students who reported a degree of budgeting behavior were more likely to indicate food insecurity while other studies have indicated that students who budget are at a decreased risk of developing food insecurity (Alaimo, 2005; Gundersen & Garasky, 2012; Hughes et al., 2011).It may be proposed that exhibiting budgeting behaviors was related to food insecurity within these studies because students with poor access to safe, nutritious foods were more likely the ones who had budget to balance their expenses. The findings from these studies showed that while practiced budgeting habits may be a reflection of budgeting knowledge, measuring budgeting knowledge is not necessarily a good predictor of budgeting habits, because habits may be influenced by access to resources. While these two measurements are connected, it is also important to analyze them separately to best identify and design appropriate, effective interventions. In the present study, findings indicated that food secure students had higher mean scores on the BBS scale when compared to food insecure students, as hypothesized. This suggests that increased budgeting knowledge may translate into increased budgeting behaviors when an individual has the knowledge and resources to change habits. It can be argued that a lack of financial resources keeps students from purchasing and consuming more from certain food groups that are perceived as “expensive”, such as fruits, vegetables, and their juice. Additionally, it may be proposed that even with more budgeting

knowledge sophomores will still habitually choose to purchase certain foods over others. Data may have been affected if participants were choosing the behaviors that they identified as budget-friendly instead of answering the assessment tool based on their actual exhibited budgeting behaviors. Lastly, the present findings discovered a significant positive correlation between the BKT and BBS scores as hypothesized. It can be proposed that students with greater budgeting knowledge are more likely to make better budgeting choices when it comes to purchasing food.

Suggested Policies and Programs for Reducing Student Food Insecurity at Appalachian State University

App State has taken great lengths to advocate for sustainability on campus and has provided a platform for students to be a voice for change. Just like sustainability, food insecurity is a multi-faceted problem and requires further attention as evidenced by the similar rates of food insecurity found both in this research and identified by McArthur and Ball et al. (2018) in 2016. The university currently supports food security initiatives on campus such as the Food Resource Hub & Free Store through the Office of Sustainability by advertising their services. The Food Resource Hub, or food pantry, has grown in scale since 2016 and also offers a free store where students can pick up items such as toothbrushes and other toiletries. With locations in four different areas of campus, the pantry and free store has continued to expand and relies heavily on donations from local businesses, charities, clubs, and volunteers. Available to students, faculty, and staff, the pantry serves a variety of individuals by providing both nonperishable staples and fresh, local bread, fruits, and vegetables as available. Findings from the present study suggest that food insecure sophomores are desiring more access to fresh fruits, vegetables, and non-meat protein sources such as tofu and peanut butter. This finding offers pantry staff the opportunity to

identify more local farmers and businesses that would be willing to partner with them to increase the accessibility of these items. Additionally, App State has worked to provide food insecure students with donated meal plan money through a program called Mountaineer Meal Share. The purpose of this program is to provide temporary assistance to students who are experiencing food insecurity. Allocations are made to students' whose meal plan account balance drops below $25.00. This program is also designed for food insecure students who may not have a current meal plan. Students who submit a request form and qualify are eligible to receive up to $50.00. Once students are approved to use the money, it is deposited into their Appcard account so that the funds can be spent on food at the dining halls, coffee shops, or markets across campus. Case Management, under the Division of Student Affairs, the Student Government Association, Dining Services, and the Office of the Dean of Students have worked together to provide this valuable service to our students. While this program has adequate information online on how to get involved, perhaps it would be beneficial to advertise their services both at the beginning of the semester during orientation and at the end of the semester when students have less money on their App State meal plan account.

This 2020 spring semester, a course focused on addressing factors that can impact food insecurity was piloted to help educate students in budgeting, nutrition knowledge, food safety, and cooking self-efficacy as well as expose them to the resources available on and off campus to assist them. The course aimed to educate students on skills to decrease their risk of becoming food insecure and to collect data to measure the effectiveness of the participants via knowledge gain and shifts in behavior. Students participated in a three day SNAP challenge and wrote reflection papers. The course was interdisciplinary and classes were taught by professors from the nutrition, social work, public health, honors college, physics, and sustainability programs at

the university. Results of the effectiveness of this course are to come during the 2020-2021 school year.

Additionally, the dining halls currently offer a variety of fruits, vegetables, and non-meat protein sources at a price that is comparable to more unhealthy items such as pizza and burgers. Therefore, university administrators could intervene at the retail level at the campus grocery stores/markets. The prices for perishable items such as blueberries, baby carrots, and tofu are not currently comparable to the more shelf-stable or frozen items. Beginning a discussion with university administrators about the discrepancy between affordable dining hall offerings and the more expensive campus grocery store offerings may help to facilitate change at the administrative level. Researchers should be prepared with evidence-based presentations to establish rapport with administrators and draw attention to the gravity of the problem and its relation to sociodemographic, academic, and lifestyle factors.

The university could also participate in a national campaign to end college food insecurity called “Swipe Out Hunger”. “Swipe Out Hunger” advises colleges and universities on the design and implementation of innovative anti-hunger programs. They have seen great success with their flagship program, “The Swipe Drive,” which allows their peers to donate extra meal plan swipes. This campaign, currently implemented at UNC Charlotte, as well as at 110+ other colleges across the country, collects up to two meal plan swipes from donating students during donation drives. “Swipe Out Hunger” was then able to transfer the money from those swipes to qualified food insecure students who had contacted the Student Assistance and Support Services Office. The money was loaded onto their meal card for use and UNC Charlotte has seen multiple improvements in self-reported health and academic outcomes. They have provided over 1.8 million nutritious meals to date (Swipe Out Hunger, 2020). Currently at App State, the meal plan

operates on a declining balance model but there has been discussion on designing different meal plan options for students to promote better food security, however, no action has resulted from these discussions to date. Perhaps if the university were to offer a meal plan that operates on meal swipes, partnering with "Swipe Out Hunger" would be a great opportunity to provide additional aid to our food insecure students.

Study Limitations and Strengths

While the findings of this study are mostly in alignment with other research in the field, the present findings cannot be generalized to other US college students due to study limitations. These limitations include: nonprobability sample, data collection on a single campus, self-reporting of all measures, overrepresentation of female students, and limited race/ethnic diversity. Food security status is also measured over a period of a year and many students may not be able to clearly remember the status of their food accessibility during that timeframe. Both of these influences may have affected student responses to questions. Despite these limitations, this research adds to the literature on college food insecurity, particularly sophomores. One strength of the study is the response rate of 12.4%. Additionally, studying the sophomore population at App State provided another perspective from which to study college food insecurity. This research provides a deeper glimpse into food insecurity rates, correlates, and associations among college sophomores, an understudied population.

Areas for Future Research

The present study found that there were no significant differences in nutrition and budgeting knowledge or budgeting behaviors between the food secure and food insecure sophomores, however there was an association between budgeting knowledge and budgeting behaviors. Knowing this, future research conducted at Appalachian State University should be

focused on the effectiveness of nutrition and budgeting education programs for all students with the hopes of impacting and empowering those who are food insecure. The current pilot course will be a valuable resource for future research in determining which topics are effective in promoting behavior change in students and exposing them to university and community resources to alleviate food insecurity in higher education. Additionally nationwide studies that help to define reliable questionnaires to measure students' nutrition and budgeting knowledge and budgeting skills consistently would help to contribute to the validity of the data from the present study. Future research should look to capture a more diverse student body to effectively address food insecurity and its correlates. Lastly, studying the rate of food insecurity by class standing (i.e. freshman, sophomore, junior, or senior) may help to identify the optimal time to implement interventions and expose students to resources.

Conclusions

While there were no significant differences in nutrition and budgeting knowledge or budgeting behaviors between food secure and food insecure students, several findings from the present study confirm and add to the current literature on college food insecurity, specifically on sophomores. Transition to higher education brings its own financial, academic, and social challenges, especially for sophomores as they begin to move off-campus and gain additional competing responsibilities, such as paying for rent and utilities, extracurricular activities, and transportation to campus. Given that the food insecurity rate among sophomore participants was similar to the campus-wide rate reported in 2016, the university administrators need to identify additional potential interventions and resources to provide for students including support for academic, mental, and physical health (McArthur, Ball et al., 2018).

The present findings indicate a need to teach food insecure and food secure sophomores how to recognize low-cost nutritious foods, construct a monthly budget, and use money-saving practices to purchase healthy foods. With no significant differences in knowledge or behaviors between food secure and food insecure students, interventions may be helpful for all students no matter their food security status.

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Appendix A

Recruitment Email

Email heading: ATTENTION! Please help us fight hunger

Hello App State sophomore!

Welcome back to App State! You are invited to take part in a research study about reducing the hunger problem among App State students. This study is being conducted by three professors and a graduate student from the nutrition program at App State. If you agree to participate, we will ask for about 10 to 15 minutes of your time to complete an online questionnaire. **If you participate, you may enter a drawing to win a $50 gift card from Amazon.com.**

Your participation in this study is strictly voluntary, and you are free to stop answering questions at any time. We do not anticipate that you will experience any inconvenience from completing this questionnaire other than the time it takes to answer the questions. The answers you provide will help us to design activities about how to fight hunger at App State.

We assure you that the answers you give will not be connected to your email address and that only group answers, not individual answers, will be used to get our findings.

Thank you for considering this invitation. If you have any questions about this study, please contact any of the people listed below.

Respectfully,

Laura McArthur, PhD, RD, Associate Professor

Department of Nutrition and Health Care Management, Appalachian State University

Telephone: (828) 262-2971; Email: mcarthurlh@appstate.edu

Melissa Gutschall, PhD, RD, LDN, Associate Professor

Department of Nutrition and Health Care Management, Appalachian State University

Telephone: (828) 262-2698; Email: gutschallmd@appstate.edu

Alisha Farris, PhD, RD, Assistant Professor

Department of Nutrition and Health Care Management, Appalachian State University

Telephone: (828) 262-7863; Email: farrisar@appstate.edu

Rebekah Lunan, Graduate Student

Department of Nutrition and Health Care Management, Appalachian State University

Email: lunanrl@appstate.edu

Questions regarding the protection of human subjects may be addressed to the IRB Administrator, Research Protections, Appalachian State University, Boone, NC 28608 (828) 262-2692, irb@appstate.edu

Please click here to begin the survey.

Or follow the link provided below.

https://appstate.az1.qualtrics.com/jfe/form/SV_bqO3yHWZDnqeYGp

Appendix B

Examples of Survey Questions

Modified USDA/ERS Adult Food Security Survey Module

As a sophomore at App State there have been times when…

1. I have worried whether my food would run out before I got money to buy more.
   Often Sometimes Never

2. The food I have to eat just doesn't last, and I don't have money to get more.
   Often Sometimes Never

3. I can't afford to eat balanced meals.
   Often Sometimes Never

4. I have cut the size of my meals or skipped meals because I didn't have enough money for food.
   Yes No

If you answered "yes" to question 4, please answer question 5. Otherwise, skip to question 6.

5. How often did this happen?
_____ Almost every month
_____ Some months, but not every month
_____ In only one or two months

6. I have eaten less than I felt I should because I didn't have enough money for food.
   Yes No

7. I was hungry but didn't eat because I didn't have enough money for food.
   Yes No

8. I have lost weight because I didn't have enough money for food.
   Yes No

9. I have not eaten for a whole day because I didn't have enough money for food.
   Yes No

If you answered "yes" to question 9, please complete question 10. Otherwise, skip to question 11.

10. How often did you not eat for a whole day because you didn't have enough money for food?
_____ Almost every month
_____ Some months, but not every month
_____ In only one or two months

Sources of Social Support for Food Access

Learn how to...
Make a budget and stick to it
Grow food by container gardening
Participate in a community gardening project where you exchange work hours for produce
Plan balanced meals
Make a list before shopping for food
Identify and shop for affordable, healthy foods
Use different cooking skills to prepare and cook healthy meals
Shop for, store, prepare, and cook foods safely
If other, please describe

Listing of Food and Sweets Groups for Assessing Usual Dietary Pattern

Grains and Cereals (e.g. breads, rice, pastas)
Vegetables and Juices (e.g. potatoes, broccoli, V8 juice)
Fruits and Juices (e.g. apples, berries, orange juice)
Meat, Seafood, and Poultry (e.g. beef, chicken, salmon)
Other protein foods (e.g. eggs, nuts, beans-other than green beans)
Dairy Foods (e.g. milk, cheese, yogurt)
Sweets (e.g. candy, regular sodas, cookies)

Nutrition Knowledge Test

Dietary Guidelines Subscale (n= 4)
How many daily servings of fruits and vegetables should adults eat as a minimum? (e.g., One serving could be an apple or a handful of chopped carrots)

a. 2
b. 3
c. 4
d. 5 or more

How many times per week should adults eat oily fish (e.g., salmon, mackerel, or oily fish)? (click one)

a. 1-2 times/week
b. 2-3 times/week
c. 3-4 times/week
d. Every day

How many daily servings of low-fat, fat-free dairy foods (e.g., yogurt, milk, cheese, cottage cheese) should adults consume?

a. 2
b. 3
c. 4
d. 5

What percent of grains and cereals (e.g., oatmeal, whole wheat bread, brown rice, popcorn) should adults get from whole grain foods?

a. 10%
b. 25%
c. 50%
d. 75%

Nutrient Function Subscale (n= 3)

Adults should eat protein-rich foods every day because protein performs which function?

a. Stores energy
b. Cushions joints
c. Maintains normal blood sugar
d. Repairs tissues

Adults should eat wholegrain and cereal products every day because they are rich sources of _____ which exercises the muscles of the small and large intestines.

a. Protein
b. Fiber
c. Fat
d. Sugar

Foods rich in _____ are the main fuel source used by the body.

a. Protein
b. Vitamins
c. Carbohydrates
d. Fat

Nutrients and Chronic Diseases Subscale (n= 2)

Consuming too much _____ could increase your risk for high blood pressure.

a. Salt
b. Vinegar
c. Sugar
d. Pepper

Eating too much of _____ is most likely to increase your risk for heart disease.

a. Animal fats
b. Vegetable oils
c. Fiber
d. Sugar

Budgeting Knowledge Test

Budget Construction (n= 4)

What is budgeting?

a. Having money left over at the end of the month
b. Planning in advance how you will spend your money based on available income
c. Paying your bills on time
d. Having enough money to go out to eat

Which is the best strategy for creating and sticking to a budget?

a. Memorize the amounts you spend and keep your account balance in your head
b. Use a computer spreadsheet to plan expenses and track your balance
c. Put priority on expenses for recreational activities
d. Assume that you will have no unexpected expenses

Which is an example of a "fixed expense"?

a. Food
b. Rent payments
c. Charitable contributions
d. Gas for your car

When putting together a budget, which item should you include?

a. Money for food
b. Money for transportation
c. Money for savings
d. All of the above

Shopping Behaviors (n= 5)

Which would be a way to help you save on your food bill?

a. Use coupons
b. Plan meals around weekly sales at your grocery store
c. Use your shopper's card for store discounts
d. All of the above

How can making a grocery list help you when you're shopping at the store?

a. Prevents impulse buys
b. Encourages you to spend more
c. Takes more time
d. Leads you to make less nutritious food choices

Which type of food vendor would provide you with the most budget-friendly food?

a. Convenience store where you can buy gas and food
b. Local farmers market
c. Health food store
d. Discount grocery store

Which is a budget-friendly grocery item?

a. Frozen-prepared meals
b. Organic dairy foods
c. Fresh whole fruit in season
d. Shelled, chopped, or sliced nuts

If you're craving a recipe for a food that requires expensive ingredients, which will help you make the recipe most affordable?

a. Buy organic pre-portioned ingredients and prepare the food at home
b. Buy the exact ingredients from a health food store and prepare the food at home
c. Substitute less expensive ingredients and prepare the food at home
d. Buy ingredients at a specialty-grocery store and prepare the food at home

Grocery Shopping (n= 5)

Which is a budget-friendly way to shop for produce?

a. Buy produce out of season
b. Buy fresh unprocessed produce in season
c. Buy organic produce
d. Buy packaged produce that has been prepped in advance, like zucchini noodles

Buying meat in which form would help you save money on your food bill?

a. Buy pre-portioned frozen meat (e.g., chicken breasts and pre-formed hamburger patties)
b. Buy larger unprocessed cuts of meat (e.g., whole raw chicken and pork loin)
c. Buy sliced packaged meat (e.g., honey ham and salami)
d. Buy grass-fed or free-range meat (e.g., beef and chicken)

Which can help you save on grain and cereal products?

a. Buy organic grain and cereal products
b. Buy specialty loaves of bread
c. Buy single serving packets of oatmeal
d. Buy less processed grain and cereal products

Which is the most budget-friendly way to buy dairy foods? (e.g., milk, cheese, cottage cheese, ice cream)

a. Buy the store brand rather than a name brand
b. Buy organic dairy foods
c. Buy single-serving packages
d. Buy pre-prepared foods (e.g., shredded cheese, cheese sticks)

How can you save money when shopping for snacks?

a. Buy single-serving packages of snack foods
b. Buy snack foods from a vending machine
c. Buy snack foods in larger packages and pre-portion them for yourself
d. Buy snack foods at a convenience store where you can buy gas and food

L*isting of Money Saving Behaviors*

Food Access (n= 4)
Buy fast food
Prepare your own meals rather than eat out
Get free food at activities on or off campus
Get free food from food pantries on or off campus
Saving (n= 8)
Use a shopping list and stick to it
Use your shopper's card (e.g., Harris-Teeter VIC Card)
Use Coupons
Shop for food when you're not hungry
Buy foods in bulk that don’t spoil quickly, (e.g., rice, canned beans, canned tuna or chicken)
Buy food items on sale
Pay for your food or meal with cash rather than use your credit card
Food Selection (n= 4)
Buy produce in season
Compare unit prices for the same food across brands
Buy the store brand of a food over a brand name food
Buy organic foods

Appendix C

Full Survey Questionnaire

Food insecurity, basic nutrition knowledge, and budgeting skills and knowledge of college sophomores

---

Start of Block: Consent Letter

You are invited to participate in a research study about your usual access to food as a sophomore at ASU, and your awareness of healthy foods and food budgeting. If you agree to be part of the research study, you will be asked to complete an online questionnaire that should take about 10 to 15 minutes of your time. The anticipated benefits of this research will include offering on-campus educational interventions that would strengthen the knowledge and skills of ASU undergraduates about healthy eating and food budgeting to decrease their risk of becoming food insecure. It is anticipated that you will experience no risks or discomforts from participating in this study beyond the time it takes you to complete this questionnaire. Your responses will be kept confidential and only group answers will be reported in any publications resulting from this study. **Please understand that no compensation or academic credit is being offered for your participation, although you may enter a drawing to win a $50 gift card from Amazon.com.** Participating in this study is completely voluntary. Even if you decide to participate now, you may change your mind and stop at any time. You may choose not to continue answering any survey question for any reason. If you have questions about this research study, please contact Laura McArthur, Ph.D., RD at (828) 262-2971 or at mcarthurlh@appstate.edu. The Appalachian State University Institutional Review Board (IRB) has determined that this study is exempt from IRB oversight. By continuing to the research procedures, I acknowledge that I am at least 18 years old, have read the above information, and agree to participate.

End of Block: Consent Letter

Start of Block: Part One

Part One: These first questions ask about your usual access to food as a sophomore at Appalachian State University (ASU), whether you live on or off campus. Please click the button with the answer that BEST applies to you. Please do not leave any questions unanswered.

As a sophomore at ASU there have been times when …

---

1 I have worried whether my food would run out before I got money to buy more.

- ○ Often (1)
- ○ Sometimes (2)
- ○ Never (3)

---

2 The food I buy just doesn't last, and I don't have money to get more.

- ○ Often (1)
- ○ Sometimes (2)
- ○ Never (3)

---

3 I can't afford to eat balanced meals.

- ○ Often (1)
- ○ Sometimes (2)
- ○ Never (3)

---

4 I have cut the size of my meals or skipped meals because I didn't have enough money for food.

- ○ Yes (1)
- ○ No (2)

Display This Question:

If 4 = Yes

5 How often did this happen?

- ○ Almost every month (1)
- ○ Some months, but not every month (2)
- ○ In only one or two months (3)

---

6 I have eaten less than I felt I should because I didn't have enough money for food.

- ○ Yes (1)
- ○ No (2)

---

7 I was hungry but didn't eat because I didn't have enough money for food.

- ○ Yes (1)
- ○ No (2)

---

8 I have lost weight because I didn't have enough money for food.

- ○ Yes (1)
- ○ No (2)

---

9 I have not eaten for a whole day because I didn’t have enough money for food.

- Yes (1)
- No (2)

Display This Question:
If 9 = Yes

10 How often did you not eat for a whole day because you didn't have enough money for food?

- Almost every month (1)
- Some months but not every month (2)
- In only one or two months (3)

---

11 I could use ____ support to help me access food.

- A lot more (1)
- Some more (2)
- A little more (3)
- I do not need more help accessing food (4)

Display This Question:
If 11 != I do not need more help accessing food

12 Which would help you improve your current access to food? Click all that apply. Learn how to:

- [ ] Make a budget and stick to it (1)
- [ ] Grow food by container gardening (2)
- [ ] Participate in a community gardening project where you exchange work hours for produce (3)
- [ ] Plan balanced meals (4)
- [ ] Make a list before shopping for food (5)
- [ ] Identify and shop for affordable, healthy foods (6)
- [ ] Use different cooking skills to prepare and cook healthy meals (7)
- [ ] Shop for, store, prepare, and cook foods safely (8)
- [ ] If other, please describe (9) _____

---

13 I would rate my current physical health as:

- ○ Poor (1)
- ○ Fair (2)
- ○ Good (3)
- ○ Very Good (4)

---

14 I would rate my current mental/emotional health as:

- ○ Poor (1)
- ○ Fair (2)
- ○ Good (3)
- ○ Very Good (4)

Page Break

15 Please estimate the **number of times per day** that you eat from each of the following food groups by checking the button that best applies to you.

	0 times/day (1)	1-2 times/day (2)	3-4 times/day (3)	5-6 times/day (4)	7 or more times/day (5)
Grains and Cereals (e.g. breads, rice, pastas) (1)	○	○	○	○	○
Vegetables and Juices (e.g. potatoes, broccoli, V8 juice.) (2)	○	○	○	○	○
Fruits and Juices (e.g. apples, berries, orange juice) (3)	○	○	○	○	○
Meat, Seafood, and Poultry (e.g. beef, chicken, salmon) (4)	○	○	○	○	○
Other protein foods (e.g. eggs, nuts, beans - other than green beans) (5)	○	○	○	○	○
Dairy Foods (e.g. milk, cheese, yogurt) (6)	○	○	○	○	○
Sweets (e.g. candy, regular sodas, cookies) (7)	○	○	○	○	○

Page Break

16 Please click the food group(s) that you would eat more from if you had greater access

- [ ] Grains/cereals (e.g. bread, rice, pastas, etc.) (1)
- [ ] Vegetables and Juices (e.g. potatoes, broccoli, V8 juice.) (2)
- [ ] Fruits and Juices (e.g. apples, berries, orange juice) (3)
- [ ] Meat, Seafood, and Poultry (e.g. beef, chicken, salmon) (4)
- [ ] Other protein foods (e.g. eggs, nuts, beans - other than green beans) (5)
- [ ] Dairy Foods (e.g. milk, cheese, yogurt) (6)
- [ ] Sweets (e.g. candy, regular sodas, cookies) (7)

Page Break

17 I prepare or cook food for myself:

- Never (1)
- Less than once a week (5)
- One time/day (6)
- Two times/day (7)
- Three times/day (8)
- Four or more times/day (9)

---

18 I prepare or cook food for others:

- Never (1)
- Less than once a week (2)
- One time/day (3)
- Two times/day (4)
- Three times/day (5)
- Four or more times/day (6)

---

19 I currently participate in an on-campus meal plan

- Yes (1)
- No (2)

End of Block: Part One

Start of Block: Part Two

Part Two: These next questions are about eating healthy and how to budget for food. Please click the button that you think best answers each question.

---

20 How many daily servings of fruits and vegetables should adults eat as a minimum? (e.g., One serving could be an apple or a handful of chopped carrots)

- ○ 2 (1)
- ○ 3 (2)
- ○ 4 (3)
- ○ 5 or more (4)

---

21 How many times per week should adults eat oily fish (e.g., salmon, mackerel, or oily fish)? (click one)

- ○ 1-2 times/week (1)
- ○ 2-3 times/week (2)
- ○ 3-4 times/week (3)
- ○ Every day (4)

---

22 How many daily servings of low-fat, fat-free dairy foods (e.g., yogurt, milk, cheese, cottage cheese) should adults consume?

- 2 (1)
- 3 (2)
- 4 (3)
- 5 (4)

---

23 What percent of grains and cereals (e.g., oatmeal, whole wheat bread, brown rice, popcorn) should adults get from whole grain foods?

- 10% (1)
- 25% (2)
- 50% (3)
- 75% (4)

---

24 Adults should eat protein-rich foods every day because protein performs which function?

- Stores energy (1)
- Cushions Joints (2)
- Maintains normal blood sugar (3)
- Repairs tissues (4)

---

25 Consuming too much _____ could increase your risk for high blood pressure.

- Salt (1)
- Sugar (2)
- Vinegar (3)
- Pepper (4)

---

26 Adults should eat wholegrain and cereal products every day because they are rich sources of _____ which exercises the muscles of the small and large intestines.

- Protein (1)
- Fat (2)
- Fiber (3)
- Sugar (4)

---

27 Foods rich in _____ are the main fuel source used by the body.

- Protein (1)
- Carbohydrates (2)
- Vitamins (3)
- Fat (4)

---

28 Eating too much of _____ is most likely to increase your risk for heart disease.

- ○ Animal fats (1)
- ○ Fiber (2)
- ○ Vegetable oils (3)
- ○ Sugar (4)

Page Break

These next few questions are about how to prepare a budget and save money when shopping for food. Please click the button that you think best answers each question.

---

29 What is budgeting?

- ○ Having money left over at the end of the month (1)
- ○ Planning in advance how you will spend your money based on available income (2)
- ○ Paying your bills on time (3)
- ○ Having enough money to go out to eat (4)

---

30 Which is the best strategy for creating and sticking to a budget?

- ○ Memorize the amounts you spend and keep your account balance in your head (1)
- ○ Use a computer spreadsheet to plan expenses and track your balance (2)
- ○ Put priority on expenses for recreational activities (3)
- ○ Assume that you will have no unexpected expenses (4)

---

31 Which is an example of a “fixed expense”?

- ○ Food (1)
- ○ Rent payments (2)
- ○ Charitable contributions (3)
- ○ Gas for your car (4)

---

32 When putting together a budget, which item should you include?

- ○ Money for food (1)
- ○ Money for transportation (2)
- ○ Money for savings (3)
- ○ All of the above (4)

---

33 Which would be a way to help you save on your food bill?

- ○ Use coupons (1)
- ○ Plan meals around weekly sales at your grocery store (2)
- ○ Use your shopper’s card for store discounts (3)
- ○ All of the above (4)

---

34 How can making a grocery list help you when you're shopping at the store?

- ○ Prevents impulse buys (1)
- ○ Encourages you to spend more (2)
- ○ Takes more time (3)
- ○ Leads you to make less nutritious food choices (4)

---

35 Which type of food vendor would provide you with the most budget-friendly food?

- ○ Convenience store where you can buy gas and food (1)
- ○ Local farmers market (2)
- ○ Health food store (3)
- ○ Discount grocery store (4)

---

36 Which is a budget-friendly grocery item?

- ○ Frozen prepared meals (1)
- ○ Organic dairy foods (2)
- ○ Fresh whole fruit in season (3)
- ○ Shelled, chopped, or sliced nuts (4)

---

37 If you're craving a recipe for a food that requires expensive ingredients, which will help you make the recipe most affordable?

- Buy organic pre-portioned ingredients and prepare the food at home (1)
- Buy the exact ingredients from a health food store and prepare the food at home (2)
- Substitute less expensive ingredients and prepare the food at home (3)
- Buy ingredients at a specialty-grocery store and prepare the food at home (4)

---

38 Which is a budget-friendly way to shop for produce?

- Buy produce out of season (1)
- Buy fresh unprocessed produce in season (2)
- Buy organic produce (3)
- Buy packaged produce that has been prepped in advance, like zucchini noodles (4)

---

39 Buying meat in which form would help you save money on your food bill?

- Buy pre-portioned frozen meat (e.g., chicken breasts and pre-formed hamburger patties) (1)
- Buy larger unprocessed cuts of meat (e.g., whole raw chicken and pork loin) (2)
- Buy Sliced packaged meat (e.g., honey ham and salami) (3)
- Buy grass-fed or free-range meat (e.g., beef and chicken) (4)

---

40 Which can help you save on grain and cereal products?

- Buy organic grain and cereal products (1)
- Buy specialty loaves of bread (2)
- Buy single serving packets of oatmeal (3)
- Buy less processed grain and cereal products (4)

---

41 Which is the most budget-friendly way to buy dairy foods? (e.g., milk, cheese, cottage cheese, ice cream)

- Buy the store brand rather than a name brand (1)
- Buy organic dairy foods (2)
- Buy single-serving packages (3)
- Buy pre-prepared foods (e.g., shredded cheese, cheese sticks) (4)

---

42 How can you save money when shopping for snacks?

- Buy single-serving packages of snack foods (1)
- Buy snack foods from a vending machine (2)
- Buy snack foods in larger packages and pre-portion them yourself (3)
- Buy snack foods at a convenience store where you can buy gas and food (4)

Page Break

43 Click the answer choice that BEST shows how often you use the following strategies to try to save money on your food budget. Please do not leave any strategy unanswered.

	Never (1)	Seldom (2)	Sometimes (3)	Often (4)
Buy fast food (1)	○	○	○	○
Use a shopping list and stick to it (2)	○	○	○	○
Use your shopper's card (e.g., Harris-Teeter VIC card) (3)	○	○	○	○
Use coupons (4)	○	○	○	○
Shop for food when you're not hungry (5)	○	○	○	○
Create a budget that includes food purchases (6)	○	○	○	○
Shop for produce in season (7)	○	○	○	○
Compare unit prices for the same food across brands (8)	○	○	○	○
Buy the store brand of a food over a brand name food (9)	○	○	○	○
Prepare your own meals rather than eat out (10)	○	○	○	○
Get free food at activities on or off campus (11)	○	○	○	○

Get free food from food pantries on or off campus (12)	○	○	○	○
Buy foods in bulk that don't spoil quickly, (e.g., rice, canned beans, canned tuna or chicken) (13)	○	○	○	○
Buy food items on sale (14)	○	○	○	○
Pay for your food or meal with cash rather than use your credit card (15)	○	○	○	○
Buy organic foods (16)	○	○	○	○
If other, please describe (17)	○	○	○	○

Page Break

End of Block: Part Two

Start of Block: Part Three

Part Three: These final questions ask for information about you and your lifestyle. All of your answers will be kept confidential. Please click the answers that best apply to you, or write the answer in the text box provided.

44 The gender I identify with is _____.

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary (3)
- ○ If none of the above apply to you, please describe (4)

_____

45 My age is _____years.

▼ 18 (1) ... 99 (82)

46 My race/ethnic background is _____.

- White (1)
- White, Hispanic or Latino (2)
- Black, African American (3)
- Black, Hispanic or Latino (4)
- American Indian or Alaska Native (5)
- Asian (6)
- Native Hawaiian or Pacific Islander (7)
- If none of the above apply to you, please describe (8)

_____

---

47 I currently weigh about _____ pounds.

▼ 75 (1) ... 399 (325)

---

48 My current height is:

▼ 3 ft, 0 in (6) ... 7 ft, 11 in (70)

---

49 I live _____.

- On-campus (1)
- Off-campus by myself (2)
- Off-campus with a roommate(s) (3)
- Off-campus with my family (4)
- I am homeless (5)

---

50 My year in school is _____.

- Freshman (1)
- Sophomore (2)
- Junior (3)
- Senior (4)
- Graduate Student (5)
- If other, please identify (6) _____

---

51 My student status at ASU is _____.

- Part-time student (1)
- Full-time student (2)

---

52 My intended major at ASU is in _____.

- Beaver College of Health Sciences (1)
- College of Arts and Sciences (2)
- College of Fine and Applied Arts (3)
- Hayes School of Music (4)
- Reich College of Education (5)
- Walker College of Business (6)
- I am undecided about my major (7)

---

53 My current GPA is _____.

▼ 1 (1) ... 4 (31)

---

54 My employment status is _____.

- Unemployed (1)
- One or more part-time jobs (2)
- One full-time job (3)
- If other, please identify (4) _____

---

55 I currently receive income from some type of financial aid like a scholarship, grant, private or federal loan.

- ○ Yes (1)
- ○ No (2)

---

56 My personal (not family) monthly income falls between _____ and _____.

- ○ $0-$500 (1)
- ○ $501-$1000 (2)
- ○ $1001-$1500 (3)
- ○ $1501+ (4)

---

57 My family (not personal) annual income falls between _____ and _____.

- $0-$15,000 (1)
- $15,001-$24,999 (2)
- $25,000-$34,999 (3)
- $35,000-$49,999 (4)
- $50,000-$74,999 (5)
- $75,000-$99,999 (6)
- $100,000-$149,999 (7)
- $150,000-$199,999 (8)
- $200,000+ (9)

---

58 My marital status is _____.

- Not married (1)
- Married (2)

---

59 I have dependent children living with me.

- Yes (1)
- No (2)

Display This Question:

If 59 = Yes

60 How many dependent children live with you?

▼ 1 (1) ... 10 (10)

61 I am an international student.

- ○ Yes (1)
- ○ No (2)

End of Block: Part Three

Appendix D

Table of All Tested Correlations

Correlation Coefficients for Hypothesis Testing

Associations	r	p-value
AFSSM Score and BMI	0.058	0.459
AFSSM Scores and GPAs	-0.291	0.001
AFSSM Scores and NKT Scores	-0.071	0.320
NKT Scores and GPA	0.082	0.289
NKT Scores and BMI	-0.116	0.141
NKT Scores and BKT Scores	0.170	0.024
AFSSM Scores and BKT Scores	-0.063	0.404
AFSSM Scores and BBS Scores	-0.081	0.297
BBS Score and BKT Scores	0.200	0.010
BBS Score and NKT	0.071	0.363

Vita

Rebekah Laing Lunan was born in Boca Raton, Florida, to Charlie and Deena Lunan. She graduated from Appalachian State University in May of 2018 with a bachelor's degree in Nutrition and Foods. The following autumn, she entered into the combined Master of Science in Nutrition and Dietetic Internship Program at Appalachian State University in pursuit of becoming a Registered Dietitian. She is currently pursuing completion of this degree and registration with the Academy of Nutrition and Dietetics.

Rebekah heavily enjoys all forms of physical activity, especially weightlifting and loves to connect with others through nutrition by cooking a variety of cuisines, scoping out the most decadent desserts, and caffeinating. She currently resides in Charlotte, N.C. and hopes to pursue a career in sports or performance nutrition while obtaining her CSSD.