

COMPARISONS OF COOKING SELF-EFFICACY AND FOOD SAFETY KNOWLEDGE OF FOOD
SECURE AND FOOD INSECURE SOPHOMORES AT APPALACHIAN STATE UNIVERSITY

A Thesis
by
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Abstract

COMPARISONS OF COOKING SELF-EFFICACY AND FOOD SAFETY KNOWLEDGE OF FOOD SECURE AND FOOD INSECURE SOPHOMORES AT APPALACHIAN STATE UNIVERSITY

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Introduction: Food insecurity exists when access to nutritionally adequate and safe foods is limited or uncertain. Research indicates that food insecurity is a serious problem among college students, with rates from 14% to 59%. The food insecurity rate among students at Appalachian State University (App State) was 46.2% in 2016. The purpose of this descriptive, cross-sectional research was to measure the food security status of sophomores attending App State during the spring, 2019 semester, compare the food safety knowledge and cooking competency of food secure and food insecure sophomores, and identify correlations between these variables based on sociodemographic characteristics.

Methods: A random sample of 1794 App State sophomores received electronic recruitment letters. Data were collected with an anonymous online questionnaire administered using Qualtrics survey software. Food security was measured using the USDA 10-item Adult Food Security Survey Module (AFSSM). A four-point scale measured cooking self-efficacy, and a multiple-choice test measured food safety knowledge. Data were analyzed using SPSS. Comparisons were made using chi-square analyses and associations were identified using correlational analyses. Statistical significance was $p < .05$.

Results: Questionnaires were completed by 226 sophomores, of whom 46% were found to be food insecure. A significant, but small correlation was found between AFSSM scores and food safety knowledge ($r = .008, p = .037$). No significant correlation was found between AFSSM scores and cooking self-efficacy ($r = 0.126, p = .068$) or between food safety knowledge and cooking self-efficacy ($r = .067, p = .343$).

Conclusions: Findings suggest a need for educational activities that teach food safety and cooking techniques to food secure and food insecure sophomores to help reduce their high rate of food insecurity.

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Chapter One Introduction

Background Information

Definition and Measurement of Food Insecurity

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 ERS - Measurement, 2019*), whereas the term hunger refers to the physiological responses of the body to food insecurity, i.e., pain, discomfort, weakness, or illness (*USDA ERS - Definitions of Food Security, 2019*). The United States Department of Agriculture Economic Research Service (USDAERS) 18-item Household Food Security Survey Module (HFSSM) is administered annually to quantify the food security status of U.S. households with children, and a subset of this survey, the 10-item Adult Food Security Survey Module (AFSSM) is used to measure the food security status of adults, or households with no children present (*US Adult Food Security Survey Module: Three-Stage Design, With Screeners 2012.Pdf, n.d.*). The sum of affirmative responses to the ten AFSSM questions, i.e., “often,” “sometimes,” “yes,” “almost every month,” and “some months, but not every month”, is used to determine the food security status of the respondents, which can range from high food secure to very low food secure (*US Adult Food Security Survey Module: Three-Stage Design, With Screeners 2012.Pdf, n.d.*). More specifically, the food security spectrum consists of four categories, high, marginally, low, and very low food secure. USDAERS classifies high and marginally food secure adults as food secure and low and very low food secure adults as food insecure. These food security data pertain to the 12 months prior to the administration of the AFSSM, and the time frame assessed refers to sometime during the previous 12 months, not necessarily to the entire 12-month period. Therefore, high food secure adults experienced

no problems or anxiety about consistently accessing adequate food during the previous year. Marginally food secure adults experienced problems or anxiety about accessing adequate food, but the quality, variety, and quantity of food consumed was not significantly reduced. Low food secure adults reduced the quality, variety, and desirability of their diets, but the amount of food consumed, and typical eating patterns were not substantially altered. Finally, very low food secure adults experienced disrupted eating patterns, reduced food intake, or weight loss due to a lack of food or resources to access food.

Prevalence and Correlates of Food Insecurity Among U.S. Households

Food insecurity affected 14.3 million households, equivalent to 11.1% of U.S. households in 2018 (Coleman-Jensen et al., 2019). Among these 14.3 million households, 6.8% were low food secure and 4.3% were very low food secure. Populations with rates of food insecurity higher than the national average in 2018 included: households with children (especially one-parent households headed by women or men), women and men living alone, African-American and Hispanic-headed households, households in major cities and nonmetropolitan areas, and households with incomes near or below the national poverty level (Coleman-Jensen et al., 2019).

Health Outcomes of Food Insecurity Throughout the Life Cycle

Food insecurity is associated with negative health outcomes throughout the lifecycle, from pregnancy to the older adult years (Garner, 2016). Among pregnant women food insecurity is significantly associated with an increased risk for preeclampsia (Hoseini et al., 2018). Food insecurity is also associated with increased gestational weight gain and increased risk for gestational diabetes (Garner, 2016). During childhood, food insecurity can lead to impaired growth and development, compromised physical and mental health, obesity, aggression, anxiety, impaired cognition reflected in poor academic performance, and decreased immune function (Chung et al., 2016; Garner, 2016). Researchers have reported that children

and adolescents from marginally food secure households have higher odds of having a mental disorder with impairment, and that those from very low food secure households have higher odds of having a mental disorder with severe impairment (Burke et al., 2016). Children from food insecure households have also been found to be at higher risk for stunted growth, underweight, and wasting compared to those who live in food secure households (Wolde et al., 2015).

Among adults, food insecurity increases the odds for developing diabetes, coronary artery disease, heart disease, hypertension, inflammatory diseases, stroke, and functional limitations (Venci & Lee, 2018). Adults in food-insecure households have also been found to have a higher risk of obesity (Moradi et al., 2019). Food insecurity has also been found to be strongly associated with poor diet quality and may influence diabetes control and the risk of developing type 2 diabetes mellitus (Essien et al., 2016). Additionally, among the adult population, food insecurity has been found to be associated with poorer mental health, and to be consistently associated with higher odds of negative psychological conditions such as sadness, worry, stress, and anger (Jones, 2017). Among older adults, food insecurity is significantly associated with reduced health-related quality of life (Russell et al., 2016). These authors reported that food insecure older adults had significantly lower scores across all eight domains of the 36-Item Short Form Health Survey (36-SF). These domains included physical functioning, role limitations due to physical problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and mental health. Lower income older adults experiencing more severe food insecurity were found to have increased depressive symptoms (Jung et al., 2019). In addition, food insecure older adults are more likely to live alone, not have a partner, and more frequently had poorer scores for social support and wellbeing (Park et al., 2019). Furthermore, food insecure older adults have been found to be at an increased risk for malnutrition (Grammatikopoulou et al., 2019).

Prevalence, Health Outcomes, and Correlates of Food Insecurity Among College Students

Ample evidence indicates that college students are among the populations vulnerable to food insecurity (Bruening et al., 2017). Findings from studies that measured the food security status of these young adults indicate that there is a higher prevalence of food insecurity among this population compared to the general population (Patton-López et al., 2014). Rates range from 14.1% at a large, public university in Alabama (Gaines et al., 2014) to 58.8% at a rural university in Oregon (Patton-López et al., 2014). The health outcomes associated with food insecurity reported for college students include: perceived fair, poor, or very poor health (Hagedorn & Olfert, 2018; McArthur et al., 2018a; Patton-López et al., 2014; Payne-Sturges et al., 2018), higher incidence of poor mental health indicators (Martinez et al., 2018a), lower energy levels (Payne-Sturges et al., 2018; Watson et al., 2017), fewer days of sleep sufficiency (Martinez et al., 2019), higher body mass index (BMI) (Martinez et al., 2019; McArthur et al., 2018a), depression symptoms (Martinez et al., 2018a; Payne-Sturges et al., 2018; Watson et al., 2017), and higher stress levels (Wall-Bassett et al., 2017; Watson et al., 2017).

The correlates associated with college student food insecurity include: having a childhood history of food insecurity (Martinez et al., 2018a), having a lower self-efficacy for preparing cost-effective nutritious meals, lower cooking self-efficacy (Gaines et al., 2012), never cooking for self or others (McArthur et al., 2018a), on-campus residence (Chaparro et al., 2009), living off-campus (Martinez et al., 2018b; Payne-Sturges et al., 2018), living off-campus with unknown arrangements (Chaparro et al., 2009), living off-campus with roommates (Chaparro et al., 2009), living off-campus without family (Morris et al., 2016), engaging in some degree of budgeting behavior such as tracking expenses (Gaines et al., 2014), receiving financial support through student loans or other types of funding requiring repayment (Morris et al., 2016), receiving financial aid from their college or university (Gaines et al., 2014; Martinez et al., 2018b; Payne-Sturges et al., 2018), being financially independent (Gaines et al., 2014), being

employed (Patton-López et al., 2014), receiving food assistance (Gaines et al., 2012; Patton-López et al., 2014), having an annual income <\$15,000 (Patton-López et al., 2014), greater incidence of failing or withdrawing from courses (Silva et al., 2017), and poor academic performance, including lower grade point average (GPA) (Hagedorn & Olfert, 2018; Martinez et al., 2018a; Martinez et al., 2018b; McArthur et al., 2018a; Morris et al., 2016; Patton-López et al., 2014; Payne-Sturges et al., 2018; Watson et al., 2017).

Researchers have also reported that college students who use more coping strategies for accessing food tend to be those with higher scores on the USDAERS AFSSM (Hagedorn & Olfert, 2018; McArthur et al., 2018a). The coping strategies used most often are purchasing cheap, processed foods (Martinez et al., 2018b; McArthur et al., 2018a), choosing cheaper, less nutritious foods and skipping meals (Watson et al., 2017), eating less healthy meals to eat more food, i.e., stretching food to make it last longer (McArthur et al., 2018a), borrowing money from friends or relatives (Farahbakhsh et al., 2015; Martinez et al., 2018b; McArthur et al., 2018a), receiving food from a friend or relative (Farahbakhsh et al., 2015; Watson et al., 2017), deciding whether to spend money for food or medicine, housing/utilities, and educational expenses (Martinez et al., 2018b), delaying the purchase or not purchasing university supplies (Farahbakhsh et al., 2015), attending events on and near campus to get free food (McArthur et al., 2018a; Watson et al., 2017), working part-time jobs, being employed, seeking employment or working more hours (Farahbakhsh et al., 2015; McArthur et al., 2018a; Patton-López et al., 2014; Watson et al., 2017), purchasing food using a credit card (Farahbakhsh et al., 2015; McArthur et al., 2018a), delaying bill payments, discontinuing services such as telephone or TV, selling or pawning possessions, and accessing food from a food bank or pantry (other than the campus food bank) or emergency food service (Farahbakhsh et al., 2015).

Cooking Self-Efficacy Among College Students

The USDAERS definition of food security also refers to an “adequate” diet. Thus cooking self-efficacy, or one’s confidence to perform food preparation tasks and cooking abilities, may also influence food security status in terms of the foods prepared (i.e., energy-dense vs. nutrient-dense food choices) and the preparation methods used (less healthy methods using more fats and sugars vs. healthier methods using less of these ingredients). Several authors have reported that college-aged populations have inadequate cooking skills and little involvement in food preparation (Larson et al., 2006; Wilson et al., 2017). Aside from these few studies, little research has been conducted to evaluate the impact of cooking skills or self-efficacy on the food security status of college students.

Food Safety Knowledge of College Students

The USDAERS definition of food security cited above refers to “safe” foods, thus indicating that safe food access and handling practices play an essential role in determining food security status (*USDA ERS - Measurement*, 2019). Several investigators have identified the information sources about food safety used by college students and have found that students tend to obtain this information from food labels, newspapers/magazines, television/radio, internet, university studies, family or friends, and mass media (Lazou et al., 2012; McArthur et al., 2007). Another study that examined college students’ compliance with food safety recommendations found that over three-quarters of the sample read or paid attention to news stories about food safety, almost half of the students had taken a college course with food-safety information, and over 60% were interested in learning more about food safety (McArthur et al., 2006). Studies that have assessed food safety knowledge among college students have revealed that this population tends to have limited knowledge of food safety practices and poor adherence to food safety recommendations (Green & Knechtges, 2015; Lazou et al., 2012; McArthur et al., 2007; McNeilly & Raming, 2018). In addition, the USDA Center for Nutrition

Policy and Promotion identified college students as a vulnerable group for foodborne illness due to frequent unsafe food handling and consumption behaviors (Green & Knechtges, 2015). However, very few studies have examined the relationship between food safety knowledge and food security status among college students.

Study Objectives

The objectives of this descriptive, cross-sectional survey research were to 1) measure the food security status of sophomores enrolled at Appalachian State University (App State) during the spring 2019 semester, 2) compare the food safety knowledge, food handling practices, dietary choices, cooking self-efficacy, and need for social support of food secure and food insecure sophomores, overall and based on sociodemographic, academic, and health-related variables, and 3) identify the strength of the correlations between the students' AFSSM scores and their scores on the food safety test and food handling and cooking self-efficacy scales. To date, most of the research conducted on food insecurity among college students has focused on measuring prevalence rates and identifying correlates and health outcomes, with little research examining the food safety knowledge, food handling practices, dietary choices, and cooking self-efficacy that may be impacting the food security status of this population. This study was conducted to contribute preliminary data on this topic at App State, with the aim of identifying areas in need of skill-building to improve the food access and nutritional status of food insecure students. Research conducted during the spring 2016 semester indicated that 46.2% of a randomized sample of 1093 App State students were food insecure (McArthur et al., 2018a). The current study focused specifically on sophomores because this is often a transitional year when students are moving off-campus from residence halls, becoming more independent, and taking on new responsibilities and expenses. These lifestyle changes have been associated with an increased financial burden that could predispose students to food insecurity (Knol et al., 2017). The findings from this study will guide future intervention

research for App State freshmen intended to reduce their risk for food insecurity during their subsequent sophomore transition year and throughout their college career.

Study Hypotheses

The following sets of hypotheses were tested in this thesis.

Food Security Status and Sociodemographic Variables

- Over one-third of the sophomores will be food insecure.
- A significantly greater proportion of females will be food insecure compared to males.
- A significantly greater proportion of food insecure students will report a personal monthly income less than \$500 compared to food secure students.
- A significantly greater proportion of food insecure students will report a family yearly income of less than \$25,000 compared to food secure students.
- A significantly greater proportion of food secure students will identify with the “White” race/ethnic group compared to food insecure students.
- A significantly greater proportion of food insecure students will live off-campus compared to food secure students.
- A significantly greater proportion of food insecure students will be employed compared to food secure students.

Food Security Status and Perceived Health

- A significantly greater proportion of food insecure students will rate their physical health as “fair/poor” compared to food secure students, and a significantly greater proportion of food secure students will rate their current physical health as “good/very good” compared to food insecure students.
- A significantly greater proportion of food insecure students will rate their current mental/emotional health as “fair/poor” compared to food secure students, and a

- significantly greater proportion of food secure students will rate their current mental/emotional health as “good/very good” compared to food insecure students.
- There will be a significant positive correlation between the students’ AFSSM scores and their BMIs.

Food Security Status and Academic Variables

- A significantly greater proportion of part-time than full-time students will be food insecure.
- There will be no significant difference in the proportions of food insecure and food secure students who receive some form of financial aid.
- A significantly greater proportion of students who did not purchase a campus meal plan will be food insecure compared to students who purchased a plan.
- 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 Social Support for Accessing Food

- A significantly greater proportion of food insecure students will report that they could have used “a lot more” or “some more” support compared to food secure students.
- The three sources of social support selected most often by food secure and food insecure students will be “make a budget and stick to it,” “plan balanced meals,” and “shop for affordable, healthy foods.”

Food Security Status and Dietary Patterns

- Food secure and food insecure students will consume grains and cereals more times per day compared to other food groups.
- A significantly greater proportion of food secure students will consume vegetables and vegetable juices more times per day compared to food insecure students.

- A significantly greater proportion of food secure students will consume fruits and fruit juices more times per day compared to food insecure students.
- A significantly greater proportion of food secure students will consume meat, seafood, and poultry more times per day compared to food insecure students.
- A significantly greater proportion of food secure students will consume “other protein foods” (e.g., eggs, peanut butter, legumes, nuts) more times per day compared to food insecure students.
- A significantly greater proportion of food secure students will consume dairy foods more times per day compared to food insecure students.
- A significantly greater proportion of food insecure students will consume sweets more times per day compared to food secure students.
- The food groups selected most often by food secure and food insecure students as those they would eat more from if they had greater access will be vegetables and juices, fruits and juices, and meat/fish/poultry.

Food Security Status and Cooking Self-Efficacy

- Food secure students will earn a significantly higher mean score on the cooking self-efficacy scale compared to food insecure students.
- Food secure and food insecure females will earn a significantly higher mean score on the cooking self-efficacy scale compared to food secure and food insecure males.
- There will be a significant inverse correlation between the student’s AFSSM scores and their scores on the cooking self-efficacy scale.
- Food secure students will earn significantly higher mean scores compared to food insecure students for the following activities from the cooking self-efficacy scale:
 - making safe food purchases;
 - preparing foods safely;

- storing cold and frozen foods safely;
 - cooking new foods;
 - using knives to slice, chop, dice, or mince;
 - accurately using measuring cups and spoons; and
 - using leftovers to make different foods.
- A significantly greater proportion of food secure students will prepare or cook food for themselves “more often” compared to food insecure students.
 - A significantly greater proportion of food secure students will prepare or cook food for others “more often” compared to food insecure students.
 - A significantly greater proportion of food secure compared to food insecure students will have regular access to kitchen appliances, cooking equipment, and eating utensils, as defined below:
 - Kitchen appliances (i.e., refrigerator; freezer; oven; stove top or hot plate; microwave; blender)
 - Cooking Equipment (i.e., knives; cutting boards; mixing bowls, measuring cups and spoons, baking sheets; pots and pans)
 - Eating utensils (i.e., silverware, cups, glasses, plates, and bowls)

Food Security Status and Food Safety Knowledge

- Food secure students will earn a significantly higher mean score on the food safety knowledge test compared to food insecure students.
- There will be a significant inverse correlation between the student’s AFSSM scores and their scores on the food safety knowledge test.
- Food secure and food insecure females will earn a significantly higher mean score on the food safety knowledge test compared to food secure and food insecure males.

Chapter Two Literature Review

Food Insecurity Among U.S. College Students

Food insecurity is defined as having limited or uncertain access to nutritionally adequate and safe foods in socially acceptable ways (*USDA ERS - Measurement*, n.d.). Food security status of each household falls somewhere along a continuum that ranges from high food security to very low food security. The food security continuum is divided into four categories, high food security, marginal food security, low food security, and very low food security. High food security indicates that the household had no problems, or anxiety about, consistently accessing adequate food. Marginal food security is when households had problems at times, or anxiety about accessing adequate food, but the quality, variety, and quantity of the diet was not substantially reduced. To be categorized with low food security, a household reduced the quality, variety, and desirability of their diets, but the quantity of food intake and normal eating patterns were not substantially disrupted. Households are considered to have very low food security when at times during the year, eating patterns of one or more household members were disrupted and food intake was reduced because the household lacked money and other resources to acquire food. The terms low food security and very low food security reflect food insecurity (*USDA ERS - Definitions of Food Security*, 2019). The USDA employs the 10-item Adult Food Security Survey Module (AFSSM) to assess the food security status of adults. The survey captures an individual's food security status over the previous 12 months. It is important to note that although an individual classified as food insecure may have experienced food insecurity in the past year, the individual could have also experienced periods of food security during the same year (*USDA ERS - Frequency of Food Insecurity*, 2019). The

AFSSM responses are scored by coding the responses “yes,” “often,” “sometimes,” “almost every month,” and “some months but not every month” as affirmative. The sum of affirmative responses is the household’s raw score, on a scale of 0 to 10. These scores categorize the respondents’ food security status as follows: a score of zero indicates high food security, a score of 1-2 represents marginal food security, 3-5 reflects low food security, and a score of 6-10 is associated with very low food security (*US Adult Food Security Survey Module: Three-Stage Design, With Screeners 2012.Pdf*, n.d.).

Food insecurity affected 14.3 million households (11.1 percent of U.S. households) in 2018 (Coleman-Jensen et al., 2019). Populations that have been found to be at a higher risk for food insecurity include households with children, households headed by black, non-Hispanic, and Hispanic people, and households with incomes at or below 185% the poverty line (Morris et al., 2016). Furthermore, groups who have been identified with having a higher prevalence of very low food insecurity include single-parent households; individuals who live alone; black, non-Hispanic households; Hispanic households; households with an income below 185% of the poverty line; metropolitan areas; and households in the southern U.S.

Additionally, studies assessing food security status among college students indicate that a higher prevalence of food insecurity exists in this population compared to the general population (Patton-López et al., 2014). Furthermore, survey results from several U.S. campuses have indicated that college students are also a population subgroup at increased risk for food insecurity (McArthur et al., 2018a). The reported rates of food insecurity ranged from 14.1% among students at an urban university in Alabama to 59% among students at a rural Oregon university. Another study conducted by Chaparro et al. (2009) found the prevalence of food insecurity to be 21% among students at the University of Hawai’i at Mānoa.

Furthermore, beginning college is a major transitional period for many students. The transition to college life is often associated with increased independence and various kinds of

stress, such as shifts in financial burdens, which can result in increased rates of food insecurity (Bruening et al., 2016). Many college students may experience financial hardships due to the new costs and expenditures incurred, including textbooks, tuition, housing, utilities, etc. These financial strains can cause budget demands that compete with money for food (Patton-López et al., 2014). Additionally, post-secondary education is becoming more accessible to all populations, even those from low-income households. Students from low-income households are more likely to need student loans. The use of financial support, such as student loans has also been significantly associated with increased prevalence of food insecurity ($p < 0.001$) (Morris et al., 2016).

A study among college freshman attending a large, urban southwestern university aimed to examine the prevalence of food insecurity and associations with health outcomes (Bruening et al., 2016). The authors found that among the college freshman studied ($n = 209$), 37 percent were food insecure. Other findings were that students who rarely consumed breakfast, students who rarely ate home-cooked meals, and students with higher levels of depression had a significantly greater probability of reporting food insecurity in the past three months ($p < .05$). The authors concluded that the students who were more likely to report food insecurity in the last three months were also those who often consumed fast food ($p = .09$), reported unhealthy eating habits off campus ($p = .07$), and students whose parents did not regularly send/purchase food for them ($p = .10$). There is a chance that a significant number of college freshman living in residence halls may experience food insecurity. Considerations regarding the limited resources available should be taken into account when addressing healthy eating in college students. Although further research is needed to better understand the prevalence of food insecurity among college students, interventions are necessary to help those students who have inconsistent access to healthy foods.

McArthur et al. (2018a) examined the problem of college student food insecurity among students attending a university in Appalachia. The objectives of this study were to: (1) measure the prevalence of food insecurity and identify associated correlates in a nonprobability sample of college students, (2) compare food-insecure and food-secure students on correlates, and (3) identify predictors of food insecurity. The sample consisted of 1,093 sophomores, juniors, seniors, and graduate students. College freshman were excluded since one of the primary objectives was to determine the prevalence of food insecurity over the previous 12 months, and freshman would not have been enrolled in college during that time. The authors found that 46.2% ($n = 505$) of the students had experienced food insecurity over the past 12 months ($n = 239$, 21.9% were low food secure and $n = 266$, 24.3% were very low food secure). It was also found that approximately 60% of the students who were food insecure held at least one or more part-time jobs, 75% had personal incomes of less than \$500 per month, 70% were financial aid recipients, and approximately 75% did not purchase a meal plan. The health-related variables found to be associated with food insecurity included self-perceived ratings of health status as "fair/poor" (27%), and having a BMI classification of overweight or obese, based on self-reported weight and height (38%). Additionally, about half of the food insecure students (53.1%) reported that they "often" cooked for themselves or others, and 80% rated their cooking skills as "good/excellent." When comparing food-insecure to food-secure students, it was found that the number of food-insecure students who rated their health as "fair/poor" was 3 times greater than the number of food-secure students, and that a larger proportion of food insecure students were overweight or obese by BMI than food secure students. It was also found that a greater proportion of food secure students "often" cooked for themselves or others compared to food insecure students, and that approximately 80% of students in both groups considered their cooking skills to be "good/excellent." Overall, the predictor variables of food insecurity were determined to be higher money expenditure and

coping strategy scale scores, lower grade point averages, being male, receiving financial aid, “fair/poor” self-perceived health status, and “never” cooking for self or others. The most frequent coping strategies used by these students included the purchase of cheap, processed food (57.4%), stretching food (40.5%), and eating less healthy meals to eat more (35.4%). The results from this study show an immediate need for interventions among the food-insecure students that involve teaching how to create a budget and how to purchase and prepare healthy foods, as well as policies that enable increased access to food resource assistance.

A study conducted by Morris et al. (2016) examined the prevalence of food insecurity among undergraduate students from four Illinois universities. The aim of the study was to measure the students’ food security status and to determine whether sociodemographic characteristics were associated with their food security status. The inclusion criteria were: (1) enrollment in any of the undergraduate programs of the 4 state institutions, (2) access to university email, (3) the ability to read and respond in English, and (4) being 18 years of age or older. A total of 1,882 undergraduate students were included in this study. The number of students from each university who responded to the survey included 350 Eastern Illinois University students, 484 Northern Illinois University students, 812 Southern Illinois University students, and 236 Western Illinois students. The prevalence of food insecurity in the overall sample was 35%, and all four universities had similar percentages in each of the four food security levels (i.e., high food security, marginal food security, low food security, and very low food security). The results indicated that there was a significant association between food security status and race, GPA, living situation, and student loan use ($p < .001$ in each case). The study found that a large number of African Americans had a higher rate of very low food security and had lower rates of high food security whereas a larger number of Caucasian students were associated with having greater high food security. Additionally, students with the lowest GPA range (0-1.99) had a lower probability of being high food secure. When compared

to students in other GPA ranges, a high number of students in the GPA range of 2.00-2.99 had higher rates of food insecurity. Students with the highest GPA range (≥ 3.00) were associated with having more high food security and less very low food security. The authors also found that many students who lived off-campus with their parents or guardians were found to have more high food security and less food insecurity. Comparatively, students living off-campus without their parents or guardians were associated with having less high food security and more very low food security. Lastly, a large number of students who did not receive financial support requiring repayment, such as student loans, had greater rates of high food security and lower rates of food insecurity. On the other hand, many students who did receive financial support requiring repayment had less high food security and more very low food security. The significant association between food security status and race, GPA, loan use, and living situation is necessary to consider and may be helpful in the development of interventions and services for those in need.

Hagedorn and Olfert (2018) conducted a study to investigate the impact of food insecurity on college students attending an Appalachian university. The primary objectives of this study were to (1) assess the prevalence of food insecurity among college students at a large, rural university in Appalachia, and (2) examine the relationship between food insecurity and behavioral characteristics, academic performance, coping strategies, and money expenditure. Students from all academic disciplines and academic years were eligible to take part in the study. The final study sample included 692 participants. The authors found that 63.4% ($n = 439$) students were food secure, of which 34.1% ($n = 236$) were considered to be high food secure and 29.3% ($n = 203$) were marginally food secure. The remaining 36.6% of respondents ($n = 253$) were classified as being food insecure with 16.6% of these students ($n = 115$) having low food security and 20.0% ($n = 138$) were very low food secure.

Cooking Competence of U.S. College Students

Food preparation and cooking skills may be a predictor of food security. Additionally, sufficient food skills may help to improve diet quality and decrease the risk of chronic disease (Wilson et al., 2017). A study conducted by Wilson et al. (2017) evaluated the self-perceived food skills of students attending a large, Canadian university. The objective of this study was to determine whether the students' self-reported food skills and food-related behaviors varied by sex, having completed a Food and Nutrition (FN) course, and living arrangements. The sample population was comprised of 6,638 students. The major findings from this study included that (1) women were reported to have higher total food skill scores than males ($p < .001$), (2) students who reported having taken a FN course had higher total food skill scores than those who had not ($p < .001$), and (3) students who had lived away from their parental home for over one year were associated with having significantly higher total food skill scores than those who had lived away from home for one year or less ($p < .001$). The results of this study indicate that students self-reported food skills differed by sex, FN education, living situation, and years living away from their parental home. Students reported having significantly greater abilities for basic mechanical food skills (such as combining ingredients) than for conceptual skills (such as deciding the final yield). From the results, the authors concluded that it is of utmost importance for nutrition education interventions to focus on improving the food skills of university students, especially those in their first year and/or within the first year away from home.

Murray et al. (2016) from Montclair State University conducted a study observing culinary self-efficacy among university students. The objective of this study was to determine whether a group of students attending a public New Jersey college had the necessary skills, knowledge, and self-efficacy to take control of their personal meal planning and preparation. To be eligible to participate in the study, the students had to meet the following criteria: (1) live off campus and not participate in the campus dining system and (2) not live with family (parental

home) but living with other students was permissible. The study design consisted of focus groups, in which responses were recorded, transcribed, and coded into themes (described below). The total sample consisted of 24 students attending the New Jersey university, both undergraduate and graduate students were included. The results from the Health Perceptions theme included that “there appeared to be an understanding that cooking for themselves provided the surest means of controlling their diet and health” (p. 148) and that the students’ actual food choices and behaviors may be very different than their responses to how they think eating habits should be. The students’ eating habits were similar to the practices they previously considered to be unhealthy, such as overreliance on processed and prepared foods (restaurant and takeout), inadequate fruit and vegetable intake, and excessive carbohydrate intake. Regarding the Life Influences theme, mealtime behaviors appeared to mirror the meal experiences they had with their family. Students who came from a family who cooked and ate together tried to replicate that practice with roommates, friends, and significant others, whereas students who did not share the experience of preparing and consuming meals with their family, tended to be more inclined to eating pre-prepared meals. The results from the Barriers to Cooking and Eating Healthy theme indicate that financial constraints, transportation, and availability of seasonal items or traditional ingredients were the primary issues experienced among the students. The authors found “several of them remarked that they would eat healthfully if they had the knowledge and information to choose and prepare more nutritious foods.” The authors concluded that future program planners and policymakers need to take into consideration the trends and student perspectives presented in this study to develop better interventions to meet the culinary needs of college students.

Food Safety Knowledge of U.S. College Students

Food safety is also encompassed in the definition of food security as it involves having access to nutritionally adequate and safe foods. Therefore, just as the food security status of

college students is an important area of research, their safe food-handling practices are an associated concern. A study conducted by McArthur et al. (2007) examined college students' awareness of food safety. The primary objectives of this study were to assess college students' compliance with food safety recommendations, measure their food safety knowledge, identify their sources of food safety information, and determine what food safety education activities would interest them. Participation in the study was restricted to off-campus residents to increase the probability that the students involved would have food-handling responsibilities. The sample included 460 university students who completed questionnaires. The study found that students' overall compliance for food purchasing, storage, and preparation recommendations on an often/always basis was reported to be 72.4%, 67.6%, and 75.0%, respectively. Compliance with food safety was most clearly discerned by the variable of whether students paid attention to news stories in print or electronic media regarding food safety. The students who utilized the media for news on food safety had higher scores on the Purchasing ($p = .004$) and Storage ($p = .013$) compliance indices. Of the 460 students who completed questionnaires, 440 students had complete data for the Knowledge about Food Safety Test (KFST). The mean score on the KFST was found to be 39% (SD 16%, range 0 to 87%). The majority of the questions missed were related to time and temperature recommendations. Significantly higher scores on the KFST were associated with the following factors: male ($p = .006$), third/fourth year academic status ($p = .006$), White or other race ($p = .004$), previous diagnosis of a foodborne illness ($p < .001$), reading or paying attention to news stories about food safety ($p = .002$), previously taking a college course that included information about food safety ($p < .001$), and having interest in learning more about food safety ($p = .010$). McArthur et al., (2007) found that the majority of students relied on the following sources for food safety information: food labels (76%), newspapers/magazines (74%), television/radio (70%), family (70%), and internet (69%). Students had increased

interest in three types of food safety education activities: classroom presentations (72%), internet information (70%), and access to flyers/brochures at the student recreation center (66%). The results from the compliance and knowledge of food safety indicate that college students should be included as a group at increased risk of foodborne illness identified by the FDA.

A similar study conducted by Green and Knechtges (2015) focused on the food safety knowledge and practices of college students. The objective of this study was to establish the food safety knowledge and practices of undergraduate students at a major American university. The population of this survey primarily consisted of freshman college students who currently lived on campus. The total sample included 786 undergraduate students who completed the survey. The authors found “The vast majority of students (72%) feel that they are “very unlikely” (27%) or “unlikely” (45%) to be at risk of foodborne disease” (p. 21). Additionally, the study indicated that the students perceived the two most important food safety topics to teach young adults to be “cross contamination and disinfection procedures” and “safe times/temperatures for cooking/storing food.” The scores of the food safety knowledge portion of the survey ranged from 0-19 points (0-79%), with the mean of the scores determined to be 10.23 (43%). On the food safety knowledge test, the students scored the best on the question regarding who should not prepare food for others. Collectively, the students were found to score the lowest on common sources of foodborne pathogens. Overall, the food safety knowledge scores were very poor. The results from this study indicate that students and young adults have limited knowledge of food safety practices. As previously stated, students thought the most important food safety topics were cross contamination and disinfection procedures and safe time/temperatures for cooking/storing food. These topics should be given precedence when developing food safety interventions, considering approximately half of the students in the study performed poorly on the questions regarding these topics. From this study it can be

gathered that it is of particular importance to develop educational interventions on food safety for young adults.

Byrd-Bredbenner et al. (2008) conducted a study regarding risky eating behaviors among young adults. The primary objectives of this study were to assess risky eating behaviors, self-efficacy for safe food-handling, and the stage of readiness for behavior change among college students. The stage of readiness for behavior change was measured by the Transtheoretical Model, which assumes that individuals move through six stages of readiness to change. For the purpose of this study, the Transtheoretical Model was modified to develop the food safety stage of change. Students included in this study were required to be between the ages of 17 and 26 years. A total of 4,343 students were included in the study population. The authors found that male students consumed a significantly greater amount of risky foods compared to female students ($p < .0001$). Nonwhite students had significantly less risky food eating behaviors than did white students. Additionally, students with higher self-efficacy for safe food-handling behaviors had fewer risky eating behaviors ($p < .001$). Furthermore, related to stage of change, measured by the adapted Transtheoretical Model, the authors found that students who were categorized in the lower stages of change (have no intention of changing the way they prepare food in the next 6 months or are aware that the way food is prepared may need to change to make it safer and are seriously thinking about changing food preparation methods in the next 6 months) ate a significantly greater number of risky foods than those in the higher stages of change (have changed the way food is prepared to make it safer and have been doing so for more than 6 months or have changed the way food is prepared to make it safer but have been doing so for less than 6 months) ($p < .001$). Students who thought that food poisoning was a personal threat were more likely to eat less risky foods ($p < .001$). The results also indicated a significant correlation between food safety knowledge and risky eating score ($p = .03$), however this was very weak (Spearman's $\rho = -.031$). The strongest predictor of risky

eating score was self-efficacy score, and stage of change was the second strongest predictor. Neither food safety knowledge nor enrollment in a college course in nutrition, food safety, and/or microbiology course were significant predictors of risky eating behaviors. The authors concluded that to help protect the health of the young adult population and the health of their future families, health professionals should place emphasis on creative measures for adoption of safe food consumption behaviors.

Chapter Three Protocol

Participants and Recruitment

A random computer-generated sample of 1,794 sophomores attending App State during the spring 2019 semester were sent electronic recruitment letters through Qualtrics survey software (Qualtrics, Provo, UT. August 2019) (Qualtrics, 2019) using email addresses provided by the Office of Institutional Research, Assessment and Planning at the university. These letters were sent as a single email blast in mid-February, followed by four reminder emails sent one, three, four, and five weeks later (Dillman et al., 2014), and data collection concluded on April 3, 2019. Inclusion criteria were sophomore standing, at least 18 years of age, any gender identity, on or off-campus residence, and any race/ethnic affiliation. Recruitment was limited to sophomores because many second-year students transition from on-campus residence halls to off-campus living arrangements, and this relocation features greater independence and financial responsibilities that they may not have previously encountered and that could influence their food access. The desired number of responses for the final sample was at least 180 or 10% of the initial sample to set the p-value of statistical significance for hypothesis testing at 0.05. The time frame for data collection was intentional to obtain a more accurate measure of the students' usual on-campus food security status by avoiding the first four weeks of the semester when students may have had access to food and money acquired over the winter break.

The students who wanted to learn more about this research clicked a link in the recruitment letter that directed them to a screen displaying the elements of informed consent, and those wishing to participate clicked a "next" button that showed the first questionnaire

item. At the end of the questionnaire a notice offered the opportunity to enter a drawing for a \$50 gift card from Amazon.com. Those who wished to be entered in this drawing clicked a link which redirected them to a separate screen where they could enter their App State email address. This link was detached from the questionnaire to deidentify the students' responses. Approval to conduct this study was granted by the Office of Research Protections at App State.

Questionnaire

Data were collected using an anonymous four-part online questionnaire administered using Qualtrics survey software (Qualtrics, Provo, UT. August 2019) (Appendix D). The first ten items consisted of the USDAERS Adult Food Security Survey Module (AFSSM) (*US Adult Food Security Survey Module: Three-Stage Design, With Screeners 2012.Pdf*, n.d.), with the language modified to reflect the students' usual access to food during their sophomore year, i.e., "As a sophomore at App State there have been times when..." Based on the number of affirmative responses, i.e., "often," "sometimes," "yes," "almost every month," and "some months, but not every month" the students were classified as either high, marginal, low, or very low food secure (*US Adult Food Security Survey Module: Three-Stage Design, With Screeners 2012.Pdf*, n.d.) (Appendix B).

Part two of the questionnaire focused on food preparation. 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." The students next checked, from a list of 11 items developed by the research team, the types of food preparation equipment they had access to on a regular basis. What follows is a list of the types of food preparation equipment from which students could report having regular access:

- Refrigerator
- Stove top or hot plate

- Oven
- Microwave
- Knives for chopping, slicing, dicing, etc.
- Cutting board
- Mixing bowls, measuring cups and spoons, baking sheets
- Pots and pans
- Freezer
- Blender
- Silverware, cups, glasses, plates, and bowls

The list of cooking equipment was followed by a cooking self-efficacy scale developed by the research team consisting of 13 kitchen activities. The students indicated how confident they felt about performing each activity by checking either “not at all confident,” “a little confident,” “confident,” or “very confident.” The following is a list of the types of cooking activities included in the cooking self-efficacy scale:

- Cooking foods using the microwave
- Using a cutting board
- Making safe food purchases
- Following a simple recipe
- Cooking new foods
- Using knives to slice, chop, dice, or mince
- Accurately using measuring cups and spoons
- Accurately setting temperatures on the stove and oven
- Using a blender
- Storing cold and frozen foods safely
- Using leftovers to make different foods

- Preparing meals that include vegetables
- Preparing foods safely

Part three of the questionnaire consisted of an 11-item multiple-choice food safety knowledge test developed by the research team (Appendix C). These questions were categorized into four subscales based on their themes as follows: Food Characteristics (2 items), Food Storage (3 items), Food Preparation (3 items), and Other (3 items).

The final section of the questionnaire asked for information concerning sociodemographics (i.e., gender identity, age, race/ethnic background, employment status, personal monthly income, family yearly income, marital status, and the presence and number of dependent children in the residence); academic variables (i.e., living arrangement, year in school, part-time vs full-time student status, intended academic major, financial aid status, meal plan participation, and international vs domestic student status); health-related variables (i.e., perceived physical and mental/emotional health and self-reported weight and height [for calculating BMI]). Next the students completed a frequency table indicating approximately how many times per day they consumed foods from the food groups and from the sweets group by checking either “0 (zero),” “1 to 2,” “3 to 4,” “5 to 6,” or “7 or more.” Serving sizes were not provided in this table. They then identified the food group(s) they would consume from more often if they had greater access. The following is the list of food groups included in this table:

- 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)

The final two items concerned social support for accessing food. The students indicated how much support they needed by checking either “a lot more,” “some more,” “a little more,” and “I do not need more help accessing food.” The students who indicated some level of need for support checked, from a list of eight types of educational interventions compiled by the research team, those that they regarded as most helpful for improving their food access. These sources were followed by an “Other” option to allow the students to identify a source not included among the interventions. The following is a list of the methods students could select from that would help improve their current access to food, “learn how to:”

- Make a budget and stick to it
- Grow food by container gardening
- Participate in a community garden to exchange work for produce
- Plan balanced meals
- Make a list before shopping for food
- Shop for affordable, healthy foods
- Use different cooking skills to prepare healthy meals
- Shop for, store, and prepare foods safely
- Other, please describe

Pilot Test

The questionnaire was pilot tested in January 2019 with a random, computer-generated sample of 50 students whose email addresses were obtained from the Office of Institutional Research, Assessment, and Planning at the university. Recruitment and questionnaire administration followed the same procedures that were later used during the final study. The five students who pilot tested the questionnaire were able to complete all items and made no suggestions for changes. These students did not participate in the final study. The research

team, nevertheless, made revisions to increase clarity of wording and number of items that were displayed per screen.

Statistical Analysis

Data were analyzed using SPSS statistical software (*SPSS Statistics for Macintosh*, 2017). Only responses from the students who completed the AFSSM were used for analysis, in accord with the study objectives. The students' food security status was measured using the USDAERS scoring system for the 10-item AFSSM, where one point is allotted to each affirmative response, with higher scores reflecting more severe food insecurity. Accordingly, scores of 0 (zero) indicated high, 1 and 2 marginal, 3 to 5 low, and 6 to 10 very low food security (*USDA ERS - Measurement*, 2019). Also, in compliance with the USDAERS scoring scheme, students with scores from 0 (zero) to 2 were classified as food secure, while those with scores from 3 to 10 were classified as food insecure.

Descriptive statistics were obtained for all sociodemographic, health, knowledge, and behavioral variables, and chi-square analyses were performed to compare proportions of food secure and food insecure sophomores on these variables. Since several variables had multiple levels, these levels were compressed for data analysis as shown below (Table 1):

Table 1

Compression of Variables for Data Analysis

Variable	Compressed Levels for Data Analysis
Race/ethnicity	White, non-Hispanic and non-white
Weight status based on BMI	Underweight/normal and overweight/obese
Perception of physical and mental health	Poor/fair and good/very good
Cooking for self and others	Less often (never, less than once per week, or one time per day) and more often (two or more times per day)
Daily consumption of food groups	Most often (3 to 7 or more times/day) and least often (zero to 2 times/day)
Intended academic major	Health sciences and other schools/colleges
Employment status	Employed and unemployed

Variable	Compressed Levels for Data Analysis
Personal monthly income	Lower (\$0-\$500), moderate (\$501-\$1000), and upper (\$1000+)
Annual family income	Lower (\$0-\$34,999), middle (\$35,000-\$99,000), and upper (\$100,000-\$200,000+)

When scoring the 13-item cooking Self-Efficacy Scale, 1 point was allotted to the “Not at all confident,” 2 points to the “A little confident,” 3 points to the “Confident,” and 4 points to the “Very confident” response, with possible scores ranging from 13 to 52 points, and higher scores reflecting greater confidence in performing the activities. An independent-samples t-test compared the mean scale scores of the food secure and food insecure students, and correlational analysis assessed the strength of the relationship between the students’ AFSSM and cooking self-efficacy scores. Regression analysis through a general linear model and individual t-tests compared the mean scores of food secure and food insecure students on each cooking activity and analysis of variance (ANOVA) compared the mean overall scale scores of the two groups based on sociodemographic variables and perceived physical and mental health status.

The 11-item Food Safety Knowledge Test was scored by allotting 1 point to each correct answer and 0 (zero) points to each incorrect answer, with possible scores ranging from 0 to 11 points and higher scores reflecting greater food safety knowledge. Mean overall test scores and subscale scores were calculated. Independent-samples t-tests compared the overall and subscale scores of the food secure and food insecure students. Correlational analyses assessed the strength of the relationships between the students’ AFSSM and overall test scores and between the students’ test scores and their scores on the cooking Self-Efficacy Scale. ANOVA compared the mean scores of food secure and food insecure students on the four food safety test subscales, and compared the overall mean test scores of the two groups based on sociodemographic and perceived health variables. Statistical significance was $p < .05$ for hypothesis testing.

Chapter Four Results

Characteristics of Food Secure and Food Insecure Sophomores

Questionnaires were submitted by 242 of the 1794 sophomores recruited (13.5%), of which 16 questionnaires were discarded due to incomplete AFSSM data. This resulted in a final sample of 226 students and a 12.5% return rate of usable questionnaires. Among these students, 122 (54%) were food secure and 104 (46%) were food insecure based on their AFSSM scores. Table 2 reports frequency counts and percentages for the sociodemographic and health characteristics of the overall sample of 226 sophomores. The following narrative summarizes these findings by reporting percentages as approximations to avoid repeating the tabular data and for ease of reading. Accordingly, about 25% of the participants were male, 60% female, and less than 5% nonbinary, with a mean age of 19.52 years (± 1.21 , range 18 to 29). Approximately 75% of the students identified as white, non-Hispanic, 90% were full-time students, and 25% had intended majors in the Beaver College of Health Sciences while 70% had majors in other schools and colleges. About 40% of the students lived on-campus and almost 50% lived off-campus. Financial data indicated that about 50% of the students were unemployed and received financial aid, 75% had a personal monthly income of $\leq \$500$, 25% reported an annual family income between \$0-\$34,999, and 50% participated in an on-campus meal plan.

Findings concerning health and social support variables indicated that the students' mean BMI (calculated from self-reported heights and weights) was 24.17 kg/m² (± 5.14 , range 16.77 to 47.08); about 60% of the students were underweight or normal weight and 25% were overweight or obese. Almost 65% perceived their current physical health as "good" or "very good," while 33% regarded their physical health as "fair" or "poor." In addition, approximately

50% considered their mental/emotional health to be “good” or “very good,” while 45% regarded their mental/emotional health as either “fair” or “poor.” Regarding the need for social support for greater food access, less than 5% needed “a lot more,” 10% needed “some more,” 25% needed “a little more” support, and 60% selected “I do not need more help accessing food.”

Table 2

Characteristics of Overall Sample of Sophomores (n = 226)

Characteristic	n	%
Food security status		
High food secure	66	29.2
Marginally food secure	56	24.8
Low food secure	57	25.2
Very low food secure	47	20.8
Gender		
Males	55	24.3
Females	147	65.0
Nonbinary	5	2.2
Missing	19	8.4
Ethnicity		
White, Non-Hispanic	172	76.1
Non-White	35	15.5
Missing	19	8.4
Marital status		
Married	2	0.9
Unmarried	205	90.7
Missing	19	8.4
Presence of dependent children		
Yes	1	0.4
No	206	91.2
Missing	19	8.4
Academic status		
Part-time	3	1.3
Full-time	204	90.3
Missing	19	8.4
International student status		
Yes	2	0.9
No	204	90.3
Missing	20	8.8
Intended Major		
Health sciences	55	24.3
Other schools/colleges	152	67.3
Missing	19	8.4

Characteristic	n	%
Residency		
On-campus	96	42.5
Off-campus	110	48.7
Homeless	0	0.0
Missing	20	8.8
On-campus meal plan participant		
Yes	117	51.8
No	101	44.7
Missing	8	3.5
Financial aid recipient		
Yes	111	49.1
No	95	42.0
Missing	20	8.8
Employment status		
Employed	96	42.5
Unemployed	111	49.1
Missing	19	8.4
Personal monthly income		
Lower (\$0 - \$500)	175	77.4
Moderate (\$501 - \$1000)	20	8.8
Upper (\$1000+)	11	4.9
Missing	19	8.4
Annual family income		
Lower (\$0 - \$34,999)	51	22.6
Middle (\$35,000 - \$99,999)	78	34.5
Upper (\$100,000 - \$200,000+)	72	31.9
Missing	25	11.1
Weight category by BMI		
Underweight/Normal weight	138	61.1
Overweight/Obese	62	27.4
Missing	26	11.5
Need for support accessing food		
A lot more	9	4.0
Some more	28	12.4
A little more	58	25.7
Do not need more help accessing food	131	58.0
Missing	0	0.0

Characteristic	n	%
Perception of physical health		
Fair/Poor	73	32.2
Good/Very good	145	64.2
Missing	8	3.5
Perception of mental/emotional health		
Fair/Poor	99	43.8
Good/Very good	119	52.7
Missing	8	3.5

Note. Food secure is defined as having either high or marginal food security and food insecure is defined as having either low or very low food security based on scores on USDAERS AFSSM.

Comparisons of Characteristics of Food Secure and Food Insecure Sophomores

Table 3 compares the frequency counts and percentages of food secure and food insecure sophomores based on sociodemographic and health characteristics. The following narrative summarizes these findings by reporting percentages as approximations to avoid repeating tabular data and for ease of reading. Accordingly, approximately 25% of food secure students identified as male and 20% of food insecure students were males, while about 65% of food secure and food insecure students identified as female. Additionally, the students who identified as nonbinary were all food insecure, which made up about 5% of the food insecure sophomores. The mean age of food secure and food insecure students, respectively, was 19.41 years (± 1.24 , range 18 to 29) and 19.65 years (± 1.17 , range 18 to 25). About 10% of food secure and 20% of food insecure students identified as non-white. Only two students were married, and both were food insecure. Approximately 90% of food secure and food insecure students were full time students, and the only two international students were food insecure. Additionally, about 25% of food secure and food insecure students had intended majors in the Beaver College of Health Sciences while about 65% of both groups had intended majors in other

colleges or schools. A greater proportion of food insecure students (55%) lived off-campus compared to food secure students (45%).

Findings concerning financial variables revealed that a greater proportion of food insecure students (50%) than food secure students (40%) did not participate in an on-campus meal plan. Additionally, approximately 55% of food insecure students compared to 45% food secure students were financial aid recipients. The proportion of food secure students who were unemployed (50%) was greater than the proportion of food insecure students (45%). Findings concerning the students' personal monthly incomes revealed that the proportions of students who selected each income category were similar for both groups. However, about 40% of the food secure students and 20% of the food insecure students indicated that their annual family income was in the "upper" category. Regarding the need for social support for food access, 80% of the food secure and 30% of the food insecure students indicated that they did not need more help accessing food.

Health-related findings revealed that 33% of the food insecure students were overweight or obese by BMI compared to 25% of the food secure students. The mean BMI of the food secure and food insecure students, respectively, was 23.42 kg/m² (± 3.85 , range 17.04 to 39.56) and 25.09 kg/m² (± 6.27 , range 16.77 to 47.08). A significant, although small, positive correlation was found between the students' AFSSM scores and their BMIs ($r = .160, p < .05$), possibly attributable to the sample size. Additionally, a greater proportion of food insecure than food secure students (45% vs. 20%) perceived their physical health as "fair" or "poor." Likewise, a greater proportion of food insecure than food secure students (55% vs. 33%) regarded their mental/emotional health as "fair" or "poor."

Table 3*Comparisons of Characteristics of Food Secure (n = 122) and Food Insecure Students (n = 104)*

Characteristic	Food Secure Students		Food Insecure Students		p-value
	n	%	n	%	
Gender					
Males	33	27	22	21.2	0.036
Females	80	65.6	67	64.4	
Nonbinary	0	0.0	5	4.8	
Missing	9	7.4	10	9.6	
Ethnicity					
White, Non-Hispanic	99	81.1	73	70.2	0.057
Non-White	14	11.5	21	20.2	
Missing	9	7.4	10	9.6	
Marital status					
Married	0	0.0	2	1.9	0.119
Unmarried	113	92.6	92	88.5	
Missing	9	7.4	10	9.6	
Presence of dependent children					
Yes	0	0.0	1	1.0	0.272
No	113	92.6	93	89.4	
Missing	9	7.4	10	9.6	
Academic status					
Part-time	1	0.8	2	1.9	0.456
Full-time	112	91.8	92	88.5	
Missing	9	7.4	10	9.6	
International student status					
Yes	0	0.0	2	1.9	0.117
No	113	92.6	91	87.5	
Missing	9	7.4	11	10.6	
Intended Major					
Health sciences	31	25.4	24	23.1	0.758
Other schools/colleges	82	67.2	70	67.3	
Missing	9	7.4	10	9.6	
Residency					
On-campus	58	47.5	38	36.5	0.134
Off-campus	55	45.1	55	52.9	
Homeless	0	0.0	0	0.0	
Missing	9	7.4	11	10.6	
On-campus meal plan participant					
Yes	70	57.4	47	45.2	0.127
No	50	41.0	51	49.0	
Missing	2	1.6	6	5.8	

Characteristic	Food Secure Students		Food Insecure Students		p-value
	n	%	n	%	
Financial aid recipient					
Yes	52	42.6	59	56.7	0.013
No	61	50.0	34	32.7	
Missing	9	7.4	11	10.6	
Employment status					
Employed	50	41.0	46	44.2	0.501
Unemployed	63	51.6	48	46.2	
Missing	9	7.4	10	9.6	
Personal monthly income					
Lower (\$0 - \$500)	96	78.7	79	76.0	1.000
Moderate (\$501 - \$1000)	11	9.0	9	8.7	
Upper (\$1000+)	6	4.9	5	4.8	
Missing	9	7.4	11	10.6	
Annual family income					
Lower (\$0 - \$34,999)	19	15.6	32	30.8	0.003
Middle (\$35,000 - \$99,999)	41	33.6	37	35.6	
Upper (\$100,000 - \$200,000+)	49	40.2	23	22.1	
Missing	13	10.7	12	11.5	
Weight category by BMI					
Underweight/Normal weight	83	68.0	55	52.9	0.029
Overweight/Obese	27	22.1	35	33.7	
Missing	12	8.8	14	13.5	
Need for support accessing food					
A lot more	0	0.0	9	8.7	0.000
Some more	5	4.1	23	22.1	
A little more	16	13.1	42	40.4	
Do not need help	101	82.8	30	28.8	
Missing	0	0.0	0	0.0	
Perception of physical health					
Fair/Poor	25	20.5	48	46.2	0.000
Good/Very good	95	77.9	50	48.1	
Missing	2	1.6	6	5.8	

Characteristic	Food Secure Students		Food Insecure Students		p-value
	n	%	n	%	
Perception of mental/emotional health					
Fair/Poor	42	34.4	57	54.8	0.000
Good/Very good	78	63.9	41	39.4	
Missing	2	1.6	6	5.8	

Note. Food secure is defined as having either marginal or high food security and food insecure is defined as having either low or very low food security based on the USDAERS AFSSM.

Table 4 shows the results of chi-square analyses comparing proportions of food secure and food insecure students based on the sociodemographic and health variables listed in Table 3. Findings revealed that a significantly greater proportion of students who identify as nonbinary were food insecure. However, there were only five students who identified as nonbinary, all of whom were food insecure. When the chi-square analysis was performed with the nonbinary students removed, there was no significance between gender and food security status. Additionally, there was a significant association between food security status and reception of financial aid, in which a much greater proportion of food insecure students received financial aid compared to food secure students ($p = .013$). Furthermore, a significantly greater proportion of food secure students had an annual family income of \$100,000-\$200,000+ compared to food insecure students ($p = .003$). In addition, findings indicated that a significantly greater proportion of food secure students were underweight or normal weight compared to food insecure students ($p = .029$). Regarding the need for social support accessing food, a significantly greater proportion of food secure students reported that they “do not need help accessing food” compared to food insecure students, and a significantly greater proportion of food insecure students reported needing “some more” help accessing food compared to food secure students ($p = .000$). Additionally, the proportion of food secure students who perceived their physical health as “good” or “very good” was significantly greater than the proportion of

food insecure students ($p = .000$). Similarly, a significantly greater proportion of food secure students perceived their mental/emotional health as “good” or “very good” compared to the proportion of food insecure students ($p = 0.001$). There were no significant differences between food security status and ethnicity, marital status, presence of dependent children, academic status, international student status, intended major, residency, meal plan participation, employment status, or personal monthly income.

Table 4

Chi-Square Comparisons of Characteristics of Food Secure ($n = 122$) and Food Insecure ($n = 104$)

Sophomores

Characteristic	Food Security Classification	χ^2	p-value
Gender			
Males	Food Secure	6.62	0.036*
Females	Food Insecure		
Nonbinary			
Ethnicity			
White, Non-Hispanic	Food Secure	3.617	0.057
Non-White	Food Insecure		
Marital status			
Married	Food Secure	2.428	0.119
Unmarried	Food Insecure		
Presence of dependent children			
Yes	Food Secure	1.208	0.272
No	Food Insecure		
Academic status			
Part-time	Food Secure	0.555	0.456
Full-time	Food Insecure		
International student status			
Yes	Food Secure	2.454	0.117
No	Food Insecure		
Intended Major			
Health sciences	Food Secure	0.095	0.758
Other schools/colleges	Food Insecure		
Residency			
On-campus	Food Secure	2.246	0.134
Off-campus	Food Insecure		
Homeless			

Characteristic	Food Security Classification	χ^2	p-value
On-campus meal plan participant			
Yes	Food Secure	2.335	0.127
No	Food Insecure		
Financial aid recipient			
Yes	Food Secure	6.232	0.013*
No	Food Insecure		
Employment status			
Employed	Food Secure	0.454	0.501
Unemployed	Food Insecure		
Personal monthly income			
Lower (\$0 - \$500)	Food Secure	0.001	1.000
Moderate (\$501 - \$1000)	Food Insecure		
Upper (\$1000+)			
Annual family income			
Lower (\$0 - \$34,999)	Food Secure	11.553	0.003*
Middle (\$35,000 - \$99,999)	Food Insecure		
Upper (\$100,000 - \$200,000+)			
Weight category by BMI			
Underweight/Normal weight	Food Secure	4.761	0.029*
Overweight/Obese	Food Insecure		
Need for support accessing food			
A lot more	Food Secure	69.716	0.000*
Some more	Food Insecure		
A little more			
Do not need support			
Perception of physical health			
Fair/Poor	Food Secure	19.187	0.000*
Good/Very good	Food Insecure		
Perception of mental/emotional health			
Fair/Poor	Food Secure	11.676	0.001*
Good/Very good	Food Insecure		

Note. Food secure is defined as having either marginal or high food security and food insecure is defined as having either low or very low food security based on the USDAERS AFSSM.

Learning Interventions Requested by Food Secure and Food Insecure Sophomores for Improving their Access to Food

Table 5 shows frequency counts and percentages in descending order for the learning interventions that the food secure and food insecure students believed would help them improve their access to food. Only data from the students who indicated that they could have used “a lot more,” “some more,” or “a little more” support accessing food were included in this analysis. The three interventions selected most often by the food secure and food insecure students were learn how to shop for affordable, healthy foods, plan balanced meals, and make a budget and stick to it. However, differences emerged between the proportions of food secure and food insecure students who selected these three interventions, i.e., the proportion of food insecure students who responded to this question was more than three times greater than that of the food secure students.

Table 5

Learning Interventions Selected by Food Secure (n = 21) and Food Insecure (n = 74)

Sophomores for Improving Food Access

Intervention	Food Secure Students		Food Insecure students		p-value
	n	%	n	%	
Shop for affordable, healthy foods	16	13.1	52	50.0	<0.001*
Plan balanced meals	16	13.1	48	46.2	<0.001*
Make a budget and stick to it	14	11.5	41	39.4	<0.001*
Make a list before shopping for food	14	11.5	30	28.8	<0.01*
Shop for, store, and prepare foods safely	8	6.6	25	24.0	<0.001*
Use different cooking skills to prepare healthy meals	7	5.7	32	30.8	<0.001*
Grow food by container gardening	6	4.9	21	20.2	<0.001*
Participate in a community garden to exchange work for produce	5	4.1	27	26.0	<0.001*

Note. The n's do not add up to the n's comprising each sample because students were able to select multiple interventions.

Table 6 shows the results of chi-square analyses comparing proportions of food secure and food insecure students based on their selections of the learning interventions for improving their food access listed in Table 4. Only data from the students who reported that they could have used “a lot more,” “some more,” or “a little more” support accessing food were included in this analysis. A significantly greater proportion of food insecure students selected each intervention.

Table 6

Chi-Square Comparisons of Learning Interventions Selected by Food Secure (n = 21) and Food Insecure (n = 74) Sophomores for Improving Food Access

Strategy	Food Security Status	χ^2	p-value
Shop for affordable, healthy foods	Food Secure	36.311	<0.001*
	Food Insecure		
Plan balanced meals	Food Secure	30.190	<0.001*
	Food Insecure		
Make a budget and stick to it	Food Secure	23.814	<0.001*
	Food Insecure		
Make a list before shopping for food	Food Secure	10.805	<0.01*
	Food Insecure		
Shop for, store, and prepare foods safely	Food Secure	13.758	<0.001*
	Food Insecure		
Use different cooking skills to prepare healthy meals	Food Secure	24.636	<0.001*
	Food Insecure		
Grow food by container gardening	Food Secure	12.451	<0.001*
	Food Insecure		
Participate in a community garden to exchange work for produce	Food Secure	22.079	<0.001*
	Food Insecure		

Food Group Consumption of Food Secure and Food Insecure Sophomores

Table 7 shows the frequency counts and percentages of food secure and food insecure students who consume foods from each of the food groups “more often” and “least often.” The food group consumed “most often” was grains and cereals, selected by about 40% of the food

secure and food insecure students. More specifically, the food groups consumed “most often” by the food insecure students, in descending order, were grains and cereals, dairy foods, and other protein foods, while the three food groups that food secure students reported consuming “most often”, in descending order, were grains and cereals, other protein foods, and fruits and juices. However, the food groups consumed “least often” by food secure and food insecure students varied. About 70% of the food insecure students consumed vegetables and vegetable juices “least often,” while 75% of the food secure students consumed sweets “least often.”

Table 7

Food Group Consumption by Food Secure (n = 122) and Food Insecure (n = 104) Sophomores

Food Group	Food Secure Students				Food Insecure Students			
	Most Often		Least Often		Most Often		Least Often	
	n	%	n	%	n	%	n	%
Grains/cereals	52	42.6	67	54.9	45	43.3	51	49.0
Vegetables and juices	31	25.4	88	72.1	21	20.2	75	72.1
Fruits and juices	42	34.4	77	63.1	23	22.1	73	70.2
Meat, seafood, and poultry	41	33.6	78	63.9	35	33.7	61	58.7
Other protein foods	51	41.8	67	54.9	36	34.6	58	55.8
Dairy foods	39	32.0	80	65.6	40	38.5	56	53.8
Sweets	26	21.3	93	76.2	24	23.1	72	69.2

Table 8 shows the frequency counts and percentages of food secure and food insecure students who would consume more foods from each food group given greater access. Over 60% of the students from both groups selected the fruits and fruit juices group and less than 10% chose the sweets group.

Table 8

Food Groups from which More would be Consumed Given Greater Access by Food Secure (n = 122) and Food Insecure (n = 104) Sophomores

Food Group	Food Secure Students		Food Insecure Students		p-value
	n	%	n	%	
Fruits and juices	75	61.5	83	79.8	<0.01*
Vegetables and juices	74	60.7	76	73.1	<0.05*
Food Group	n	%	n	%	p-value
Meat, seafood, and poultry	47	38.5	45	43.3	0.469
Other protein foods	42	34.4	55	52.9	<0.01*
Grains and cereals	23	18.9	21	20.2	0.800
Dairy foods	16	13.1	26	25.0	<0.05*
Sweets	5	4.1	10	9.6	0.097

Table 9 shows the results of chi-square analyses comparing proportions of food secure and food insecure students based on the food groups they would eat more from given greater access. Findings revealed that, compared to food secure students, a significantly greater proportion of food insecure students indicated that they would eat more fruits and juices, vegetables and juices, other protein foods, and dairy foods if given greater access. There were no significant differences between the food secure and food insecure students for any other food group.

Table 9

Chi-Square Comparisons of Food Secure (n = 122) and Food Insecure (n = 104) Sophomores who would Consume More from Different Food Groups Given Greater Access

Food Group	Food Security Status	χ^2	p-value
Fruits and juices	Food Secure	8.970	<0.01*
	Food Insecure		
Vegetables and juices	Food Secure	3.881	<0.05*
	Food Insecure		
Meat, seafood, and poultry	Food Secure	0.524	0.469
	Food Insecure		

Food Group	Food Security Status	χ^2	p-value
Other protein foods	Food Secure	7.808	<0.01*
	Food Insecure		
Grains and cereals	Food Secure	0.064	0.800
	Food Insecure		
Dairy foods	Food Secure	5.241	<0.05*
	Food Insecure		
Sweets	Food Secure	2.758	0.097
	Food Insecure		

Food Preparation and Cooking Self-Efficacy

Food Preparation

Table 10 reports the results of chi-square analyses comparing proportions of food secure and food insecure students based on how often they prepared food for themselves and for others. Both groups showed similarities in how often they prepared food for themselves, with about 33% preparing food for themselves “more often.” Additionally, over 90% of food secure and about 85% of food insecure students prepared food for others “less often.”

Table 10

Chi-square Comparisons of Food Secure (n = 122) and Food Insecure (n = 104) Sophomores

Based on Food Preparation for Self and Others

Food Preparation	Food Security Classification	χ^2	p-value
Prepare food for self			
Less often	Food secure	0.141	0.707
More often	Food insecure		
Prepare food for others			
Less often	Food secure	2.740	0.098
More often	Food insecure		

Note. “Less often” was defined as never, less than once per week, and one time per day and “More often” was defined as two times per day, three times per day, and four or more times per day.

Access to Kitchen Equipment

Table 11 shows frequency counts and percentages of food secure and food insecure students having regular access to different types of kitchen appliances and cooking equipment. The findings indicated that, although both groups had access to similar types of cooking equipment, greater proportions of food secure students had access to each type of kitchen appliance listed in Table 8. The blender was the appliance that was least accessible to both groups. Among the food insecure students, a greater proportion had access to a microwave than to a refrigerator. Additionally, a much greater proportion of food secure students had access to a refrigerator and a freezer than did food insecure students.

Table 11

Frequency Counts and Percentages of Food Secure (n = 122) and Food Insecure (n = 104)

Sophomores with Regular Access to Kitchen Appliances and Cooking Equipment

Appliance	Food Secure Students		Food Insecure Students	
	n	%	n	%
Refrigerator	115	94.3	91	87.5
Microwave	112	91.8	93	89.4
Silverware, cups, glasses, plates, and bowls	103	84.4	87	83.7
Freezer	101	82.8	77	74.0
Oven	99	81.1	80	76.9
Stove top or hot plate	97	79.5	76	73.1
Pots and pans	82	67.2	69	66.3
Mixing bowls, measuring cups and spoons, baking sheets	76	62.3	59	56.7
Knives	75	61.5	63	60.6
Cutting board	71	58.2	55	52.9
Blender	53	43.4	36	34.6

Cooking Self-Efficacy

The mean scores on the 13-item cooking self-efficacy scale earned by the food secure and food insecure students, respectively were 44.87 points (± 7.17 , range 26 to 52) and 43.38 points (± 7.07 , range 21 to 52) out of a possible 52 points. Overall, both food secure and food insecure

students had relatively high scores on the cooking self-efficacy scale. However, no significant difference was found between the mean scores of food secure and food insecure students on this scale. Nor was there a significant correlation between the students' AFSSM scores and their scores on this scale ($r = -.126, p = .068$). In addition, no significant correlation emerged between students' BMIs and their scores on the cooking self-efficacy scale ($r = -.086, p = .229$). Although no differences were significant, food secure students had higher self-efficacy scores for performing all cooking activities included in the scale.

Table 12 shows the results of T-test analyses of the mean self-efficacy scale scores of the food secure and food insecure students for performing each kitchen activity. The score for each activity ranged from 1 to 4 points, with 1 meaning not at all confident and 4 meaning very confident. The independent t-test analysis revealed that significant differences existed between food secure and food insecure students on the following activities: cooking foods using the microwave ($p = .000$) and accurately using measuring cups and spoons ($p = .001$), with food insecure students scoring lower on both activities. However, a general linear model revealed that no individual significances exist between food secure and food insecure students' mean scores on each of the individual activities included in the cooking self-efficacy scale. Additionally, both food secure and food insecure students had the least self-confidence in performing the following kitchen activities: "using leftovers to make different foods" and "cooking new foods."

Table 12

Mean Self-Efficacy Scores Earned by Food Secure ($n = 122$) and Food Insecure ($n = 104$) Sophomores for Performing Kitchen Activities

	Food Secure Students	Food Insecure Students	p-value
Activity	Mean (\pm SD)	Mean (\pm SD)	
Cooking foods using the microwave	3.80 (\pm 0.45)	3.66 (\pm 0.56)	0.000

	Food Secure Students	Food Insecure Students	p-value
Activity	Mean (\pm SD)	Mean (\pm SD)	
Accurately using measuring cups and spoons	3.74 (\pm 0.53)	3.55 (\pm 0.73)	0.001
Accurately setting temperatures on the stove and oven	3.73 (\pm 0.53)	3.70 (\pm 0.48)	0.873
Using a cutting board	3.67 (\pm 0.63)	3.64 (\pm 0.60)	0.931
Following a simple recipe	3.61 (\pm 0.64)	3.56 (\pm 0.66)	0.420
Storing cold and frozen foods safely	3.45 (\pm 0.76)	3.40 (\pm 0.72)	0.406
Using a blender	3.43 (\pm 0.83)	3.36 (\pm 0.82)	0.742
Using knives to slice, chop, dice, or mince	3.43 (\pm 0.80)	3.35 (\pm 0.85)	0.438
Preparing foods safely	3.40 (\pm 0.74)	3.27 (\pm 0.72)	0.694
Making safe food purchases	3.33 (\pm 0.85)	3.11 (\pm 0.89)	0.954
Activity	Mean (\pm SD)	Mean (\pm SD)	
Preparing meals that include vegetables	3.27 (\pm 0.91)	3.12 (\pm 0.90)	0.224
Using leftovers to make different foods	3.10 (\pm 1.02)	2.86 (\pm 1.06)	0.455
Cooking new foods	2.96 (\pm 0.95)	2.86 (\pm 0.99)	0.324

Table 13 compares the mean scores of the food secure and food insecure students on the cooking self-efficacy scale based on sociodemographic and health characteristics. Results of one-way ANOVA indicated that there were no significant differences between the mean scores of the two groups for any of the characteristics examined.

Table 13

Mean Scores of Food Secure (n = 122) and Food Insecure (n = 104) Sophomores on the Cooking Self-Efficacy Scale Based on Sociodemographic and Health Characteristics

	Food Secure Students	Food Insecure Students	p-value
Characteristic	Mean Score (SD)	Mean Score (SD)	
Gender			
Males	45.19 (6.76)	44.77 (5.81)	0.940
Females	45.33 (7.07)	43.32 (7.05)	0.966
Nonbinary	N/A	36.40 (9.63)	N/A

	Food Secure Students	Food Insecure Students	
Characteristic	Mean Score (SD)	Mean Score (SD)	p-value
Ethnicity			
White, Non-Hispanic	45.28 (6.95)	43.24 (7.27)	0.502
Non-White	45.36 (7.21)	43.48 (6.49)	0.907
Marital status			
Married	N/A	40.00 (1.41)	N/A
Unmarried	45.29 (6.95)	43.37 (7.13)	0.470
Presence of dependent children			
Yes	N/A	41.00 (N/A)	N/A
No	45.29 (6.95)	43.32 (7.10)	0.485
Academic status			
Part-time	52.00 (N/A)	39.50 (2.12)	N/A
Full-time	45.23 (6.95)	43.38 (7.12)	0.480
International student status			
Yes	N/A	38.50 (6.36)	N/A
No	45.29	43.43 (7.11)	0.466
Intended major			
Health sciences	44.10 (7.12)	43.61 (7.95)	0.501
Other schools/colleges	45.73 (6.88)	43.19 (6.81)	0.726
Residency			
On-campus	44.96 (7.44)	42.86 (7.30)	0.970
Off-campus	45.63 (6.45)	43.61 (7.02)	0.200
Homeless	N/A	N/A	N/A
On-campus meal plan participant			
Yes	44.29 (7.47)	42.44 (6.90)	0.661
No	45.69 (6.73)	44.18 (7.19)	0.338
Financial aid recipient			
Yes	45.57 (7.49)	43.16 (7.16)	0.913
No	45.05 (6.51)	43.88 (6.80)	0.663
Employment status			
Employed	45.94 (6.99)	45.22 (6.64)	0.986
Unemployed	44.77 (6.94)	41.45 (7.03)	0.925
Personal monthly income			
Lower (\$0 - \$500)	45.08 (7.03)	42.84 (7.09)	0.705
Moderate (\$501 - \$1000)	45.45 (6.89)	47.78 (5.47)	0.712
Upper (\$1000+)	49.75 (4.50)	44.40 (6.31)	0.751

	Food Secure Students	Food Insecure Students	
Characteristic	Mean Score (SD)	Mean Score (SD)	p-value
Annual family income			
Lower (\$0 - \$34,999)	43.00 (9.09)	42.81 (6.27)	0.066
Middle (\$35,000 - \$99,999)	45.10 (6.91)	43.36 (7.63)	0.397
Upper (\$100,000 - \$200,000+)	46.13 (6.08)	44.35 (7.29)	0.220
Weight category by BMI			
Underweight/Normal weight	46.36 (5.92)	43.49 (6.51)	0.363
Overweight/Obese	42.81 (8.50)	43.69 (7.93)	0.859
Perception of physical health			
Fair/Poor	42.83 (8.27)	42.98 (7.66)	0.712
Good/Very good	45.40 (6.81)	43.77 (6.51)	0.843
Perception of mental/emotional health			
Fair/Poor	44.45 (7.79)	42.33 (7.92)	0.733
Good/Very good	45.11 (6.84)	44.82 (5.47)	0.289

Food Safety Knowledge of Food Secure and Food Insecure Sophomores

The mean scores on the food safety knowledge test earned by the food secure and food insecure students, respectively were 6.18 (± 1.60) and 6.60 (± 1.52) out of a possible 11 points. There were no significant differences between the mean scores earned by the two groups. Nor was there a significant correlation between the students' scores on this test and their scores on the cooking self-efficacy scale ($r = .067, p = .343$). There was also no significant correlation between the students' scores on the food safety knowledge test and their BMIs ($r = .008, p = .909$). However, there was a significant, although small, positive correlation between the students' AFSSM scores and their scores on the food safety knowledge test ($r = .146, p < .05$), possibly attributable to the sample size.

The 11-item food safety knowledge questions were categorized into four topics based on common themes. Table 14 shows the frequency counts and percentages of the food secure and food insecure students who correctly answered the test questions. The proportions of

students from both groups who correctly answered each question were similar. Additionally, food secure students scored higher on each individual topic area. However, the proportion of food secure and food insecure students who correctly answered each individual question varied. The question most frequently answered correctly by the food secure and food insecure students was in the food characteristic topic. The question most often answered incorrectly by the food secure and food insecure students was under the safe storage topic.

Table 14

Frequencies and Percentages of Food Secure (n = 122) and Food Insecure (n = 104) Sophomores who Answered Questions Correctly on the Food Safety Knowledge Test Based on Topic Areas

Topic	Food Secure		Food Insecure	
	n	%	n	%
Food Characteristic				
Which food is most likely to become contaminated with bacteria that cause foodborne illness?	111	91.0	93	89.4
Which characteristic of food is associated with an increased risk of foodborne illness?	54	44.3	53	51.0
Safe Storage				
What is the longest time leftover turkey can be safely left on the table before refrigerating it to reduce the risk of bacterial contamination?	36	29.5	36	34.6
At what temperature should you keep your freezer to store food safely?	20	16.4	20	19.2
Where should fresh meats be placed in your refrigerator to prevent them from contaminating other foods?	85	69.7	70	67.3
Safe Food Preparation				
Which is the safe temperature for reheating meat and poultry to reduce your risk of foodborne illness?	66	54.1	54	51.9
Which food is being thawed improperly?	37	30.3	31	29.8
Which best describes the appearance of a hamburger when it is safely cooked?	59	48.4	56	43.8

Topic	Food Secure		Food Insecure	
	n	%	n	%
Other				
Which is an important strategy for reducing your risk to foodborne illness?	111	91.0	92	88.5
How long should you spend washing your hands with soap and warm water before and after preparing food?	34	27.9	34	32.7
Which product would be safe to buy?	91	74.6	83	79.8

Table 15 shows the results of t-test analyses comparing the mean scores of the food secure and food insecure students for each individual question on the food safety knowledge test based on topic areas. There were no significant differences between the mean scores earned by the two groups on any of the questions.

Table 15

Mean Scores of Food Secure (n = 122) and Food Insecure (n = 104) Sophomores on Food Safety Knowledge Questions Based on Topic Areas

Topic	Food Secure		Food Insecure	
	Mean (SD)	Mean (SD)	p-value	
Food Characteristic				
Which food is most likely to become contaminated with bacteria that cause foodborne illness?	0.97 (0.16)	0.98 (0.14)	0.805	
Which characteristic of food is associated with an increased risk of foodborne illness?	0.48 (0.50)	0.56 (0.50)	0.252	
Safe Storage				
What is the longest time leftover turkey can be safely left on the table before refrigerating it to reduce the risk of bacterial contamination?	0.32 (0.47)	0.38 (0.49)	0.335	
At what temperature should you keep your freezer to store food safely?	0.18 (0.38)	0.21 (0.41)	0.523	
Where should fresh meats be placed in your refrigerator to prevent them from contaminating other foods?	0.75 (0.43)	0.75 (0.44)	0.902	

Topic	Food Secure	Food Insecure	p-value
	Mean (SD)	Mean (SD)	
Safe Food Preparation			
Which is the safe temperature for reheating meat and poultry to reduce your risk of foodborne illness?	0.58 (0.50)	0.57 (0.50)	0.821
Which food is being thawed improperly?	0.32 (0.47)	0.33 (0.47)	0.979
Which best describes the appearance of a hamburger when it is safely cooked?	0.52 (0.50)	0.60 (0.49)	0.261
Other			
Which is an important strategy for reducing your risk to foodborne illness?	0.97 (0.16)	0.97 (0.18)	0.822
How long should you spend washing your hands with soap and warm water before and after preparing food?	0.30 (0.46)	0.36 (0.48)	0.362
Which product would be safe to buy?	0.80 (0.40)	0.87 (0.33)	0.147

Table 16 compares the mean scores earned by the food secure and food insecure students on the topic areas of the food safety knowledge test. There were no significant differences between the mean scores earned by the two groups on any of the topic areas. Food secure and food insecure students earned the highest mean score on the food characteristic topic (1.45 ± 0.53 and 1.54 ± 0.54 points, respectively) and the lowest score on the safe storage topic area (1.24 ± 0.79 and 1.33 ± 0.74 points, respectively).

Table 16

Mean Scores of Food Secure (n = 122) and Food Insecure (n = 104) Sophomores on Topic Areas of Food Safety Knowledge Test

Topic	Food Secure	Food Insecure	p-value
	Mean (SD)	Mean (SD)	
Food Characteristic Range (0-2)	1.45 (0.53)	1.54 (0.54)	0.255
Safe Storage Range (0-3)	1.24 (0.79)	1.33 (0.74)	0.383
Safe Food Preparation Range (0-3)	1.43 (0.89)	1.49 (0.85)	0.647
Other (Range 0-3)	2.07 (0.59)	2.20 (0.59)	0.116

Table 17 compares food secure and food insecure students' mean scores on the food safety knowledge test based on sociodemographic and health characteristics. One-way ANOVA revealed that no significant differences emerged between the mean test scores of the two groups based on any of the characteristics examined.

Table 17

Mean Scores of Food Secure (n = 122) and Food Insecure (n = 104) Sophomores on the Food Safety Knowledge Test Based on Sociodemographic and Health Characteristics

	Food Secure Students	Food Insecure Students	
Characteristic	Mean Score (SD)	Mean Score (SD)	p-value
Gender			
Males	6.27 (1.44)	6.55 (1.74)	0.136
Females	6.13 (1.67)	6.59 (1.49)	0.320
Nonbinary	N/A	6.60 (1.14)	
Ethnicity			
White, Non-Hispanic	6.15 (1.60)	6.63 (1.53)	0.786
Non-White	6.01 (1.65)	6.40 (1.50)	0.743
Marital status			
Married	N/A	5.50	N/A
Unmarried	6.17 (1.60)	6.61 (1.51)	0.665
Presence of dependent children			
Yes	N/A	7.00	N/A
No	6.17 (1.60)	6.58 (1.53)	0.757
Academic status			
Part-time	5.00 (N/A)	7.50 (0.71)	N/A
Full-time	6.18 (1.60)	6.56 (1.53)	0.737
International student status			
Yes	N/A	6.00 (1.41)	N/A
No	6.17 (1.60)	6.60 (1.53)	0.769
Intended Major			
Health sciences	6.10 (1.66)	6.59 (1.56)	0.958
Other schools/colleges	6.20 (1.59)	6.58 (1.52)	0.618
Residency			
On-campus	6.21 (1.52)	6.76 (1.71)	0.525
Off-campus	6.13 (1.70)	6.45 (1.39)	0.318
Homeless	N/A	N/A	N/A

	Food Secure Students	Food Insecure Students	
Characteristic	Mean Score (SD)	Mean Score (SD)	p-value
On-campus meal plan participant			
Yes	6.26 (1.44)	6.65 (1.74)	0.180
No	6.07 (1.81)	6.55 (1.31)	0.060
Financial aid recipient			
Yes	6.25 (1.76)	6.56 (1.54)	0.278
No	6.10 (1.46)	6.67 (1.51)	0.623
Employment status			
Employed	6.26 (1.80)	6.60 (1.47)	0.163
Unemployed	6.10 (1.42)	6.57 (1.59)	0.377
Personal monthly income			
Lower (\$0 - \$500)	6.15 (1.59)	6.62 (1.52)	0.627
Moderate (\$501 - \$1000)	6.80 (1.93)	6.44 (1.67)	0.988
Upper (\$1000+)	5.50 (0.84)	6.60 (1.52)	0.277
Annual family income			
Lower (\$0 - \$34,999)	6.00 (2.08)	6.58 (1.29)	0.050
Middle (\$35,000 - \$99,999)	6.27 (1.47)	6.54 (1.72)	0.293
Upper (\$100,000 - \$200,000+)	6.19 (1.36)	6.74 (1.57)	0.525
Weight category by BMI			
Underweight/Normal weight	6.06 (1.57)	6.55 (1.41)	0.867
Overweight/Obese	6.48 (1.74)	6.59 (1.65)	0.598
Perception of physical health			
Fair/Poor	6.38 (1.69)	6.73 (1.68)	0.581
Good/Very good	6.13 (1.57)	6.48 (1.37)	0.257
Perception of mental/emotional health			
Fair/Poor	6.11 (1.61)	6.56 (1.46)	0.985
Good/Very good	6.22 (1.60)	6.78 (1.59)	0.563

Note. Food secure is defined as having either marginal or high food security and food insecure is

defined as having either low or very low food security.

Chapter Five Discussion

Hypothesis Testing and Interpretation of Results

Food Security Status and Sociodemographic Variables

The prevalence of food insecurity among the 226 App State sophomores who were included in the present study was 46%, which was almost identical to the rate identified for students at the university during the spring semester of 2016 (McArthur et al., 2018a). As hypothesized, over one-third of the sophomores were found to be food insecure. This finding suggests that sophomores are among a population that are at an increased risk of being food insecure. It is possible that this high rate of food insecurity among this population is due to the unique transitional period experienced during the sophomore year, with many students moving from dorms to off-campus apartments, taking on new expenses associated with the change in living environment, and possibly having to shop for and cook food for themselves more than they have in the past.

Previous research has reported several sociodemographic characteristics associated with college student food insecurity which include identifying as female, living off-campus, annual income <\$15,000, and being employed (Martinez et al., 2018a; McArthur et al., 2018a; Patton-López et al., 2014). The present study found that a greater percentage of food insecure students were female. Although there was a greater proportion of food insecure females than food insecure males, the hypothesis that a significantly greater proportion of females would be food insecure compared to males was not supported. However, this difference could be due to an overrepresentation of female students in the present study. Regarding off-campus versus on-campus residence, a proportion of students who were food insecure lived off-campus. However,

this finding was not significant. Thus, the hypothesis that a significantly greater proportion of food insecure students would live off-campus was not supported. The increased financial burden of living off-campus associated with becoming more independent and taking on new responsibilities and expenses such as rent, utility bills, and parking expenses, may explain why there was a higher rate of food insecurity among students who lived off-campus.

In addition, previous studies have reported conflicting findings pertaining to race/ethnicity and college student food insecurity. The findings from the current research revealed no significant difference between food security status and race/ethnicity. This finding failed to support the hypothesis that a significantly greater proportion of food secure students would identify with the “white” race/ethnic group compared to percentage food insecure students who identified as white, non-Hispanic. This is likely attributed the overrepresentation of white, non-Hispanic students in the study sample, as well as the overrepresentation of this ethnic background among the university’s entire student body. Concerning the students’ income, findings revealed no significant differences between the level of personal monthly income and food security status. Related findings did not support the hypothesis that a significantly greater proportion of food insecure students would report a personal monthly income less than \$500 compared to food secure students. However, findings related to family income revealed that a significantly greater proportion of food insecure students than food secure students had a lower (\$0-\$34,999) family annual income. Although there was a significant difference, this did not support the hypothesis that a significantly greater proportion of food insecure students would report a family yearly income of less than \$25,000 compared to food insecure students. However, if the original hypothesis had stated “a significantly greater proportion of food insecure students would report a yearly family income in the “lower” category compared to food secure students,” the hypothesis would have been supported. Comparisons between the food secure and food insecure sophomores were also made based on

their employment status. Results indicated that a greater proportion of food insecure students were employed compared to food secure students, however this difference was not significant. Employment data did not support the hypothesis that a significantly greater proportion of food insecure students would be employed compared to food secure students. These findings differ from previous research reporting that employed students were more likely to be food insecure (Patton-López et al., 2014; Payne-Sturges et al., 2018).

Investigators who have examined the prevalence and correlates of food insecurity among college students have also examined students' self-reported health and weight status. Previous literature has found that food insecure students often report greater instances of perceived suboptimal health, being overweight or obese, and higher BMI when compared to their food secure counterparts (Hagedorn & Olfert, 2018; Martinez et al., 2019; McArthur et al., 2018a; Patton-López et al., 2014; Payne-Sturges et al., 2018). In alignment with past research, the present study found a significant difference between food security status and perception of current physical health and mental/emotional health. These data supported the hypothesis that a greater proportion of food insecure students would rate their current physical health as poor or fair compared to food secure students, and that a greater proportion of food secure students would rate their current physical health as good or very good compared to their food insecure counterparts. Additionally, these findings supported the hypothesis that a significantly greater proportion of food insecure students would rate their current mental/emotional health as poor or fair compared to food secure students, and a significantly greater proportion of food secure students would rate their current mental/emotional health as good or very good compared to food insecure students. In addition, BMI was significantly and positively correlated with the sophomores' AFSSM scores. This finding supported the hypothesis that there would be a significant positive correlation between the students' AFSSM scores and their BMIs. This result indicated that the higher students scored on the AFSSM, or the greater the degree of food

insecurity, the higher their BMIs. This is likely due to the sophomores' diet quality. Previous research indicates that food insecure college students cope with food insecurity by using strategies such as purchasing cheap, processed foods and eating less healthy food to eat more food (McArthur et al., 2018a).

Several investigators examining college student food insecurity have identified significant relationships between food security status and various academic variables. However, several researchers who have studied relationships between food insecurity and students' enrollment status have found no significant differences (Martinez et al., 2018b; McArthur et al., 2018a; Patton-López et al., 2014). Similarly, the current study revealed that the vast majority of both food secure and food insecure sophomores were full-time students, and the rates of food secure and food insecure students were very similar for full-time and part-time students. This finding did not support the hypothesis that a significantly greater proportion of part-time than full-time students would be food insecure. Furthermore, several researchers have reported that receiving financial aid is a strong predictor of food insecurity (Gaines et al., 2014; Martinez et al., 2019; McArthur et al., 2018a; Morris et al., 2016). The present findings were in accord with these studies, such that a significantly greater proportion of food insecure students were financial aid recipients. Therefore, the hypothesis that there would be no significant difference in the proportions of food secure and food insecure students who receive some form of financial aid was not supported. Food insecurity exists due to lack of resources, whether it be lack of grocery stores or lack of transportation. However, one of the primary factors influencing food insecurity is lack of money/financial resources. Students who themselves or have families are financially disadvantaged are more likely to need financial help to attend college. Which could be why a significantly greater proportion of food insecure students received financial aid. Additionally, it was hypothesized that a significantly greater proportion of students who did not purchase an on-campus meal plan would be food insecure compared to students who did

purchase a meal plan. The present study found that a larger percentage of food insecure students did not purchase a meal plan compared to percentage of food insecure students who did purchase a meal plan however, this was not significant. Additionally, although insignificant, a greater proportion of food secure students purchased a meal plan compared to food insecure students. Food secure students may have greater financial resource adequacy and may be able to afford additional expenses such as meal plans and parking passes, which could be why more food secure students purchased meal plans. Although previous research has examined students' year in school and food security status, it is unknown to whether any studies have examined students' academic majors and food security status. The current study considered food security status based on the sophomores' intended majors, which we either classified as either intended majors in the health sciences or intended majors in other schools/colleges. The present findings revealed no significant differences between the students' food security status and their intended majors.

The findings related to social support indicated that the sophomores' food security status strongly determined their need for support for food access. The findings indicated that a significantly greater proportion of food insecure students could use some degree of additional support for accessing food. This finding supported the hypothesis that a significantly greater proportion of food insecure students would report that they could use "a lot more" or "some more" support to access food compared to food secure students. As previously mentioned, a significantly greater proportion of food insecure students has an annual family income in the "lower" category, indicating that their families likely do not have the means to provide the students with additional monetary support, which could explain why more food insecure students needed additional help accessing food. The questionnaire included an item asking the students to check, from a list, those learning opportunities they believed would help them increase their access to food. It was hypothesized that the three skills selected most often by

food secure and food insecure students would be “make a budget and stick to it,” “plan balanced meals,” and “shop for affordable, healthy foods.” The present findings revealed that these three sources of support were the most commonly selected by both food secure and food insecure students. However, the sources of support ranked in descending order from the most to least frequently selected were as follows, “shop for affordable, healthy foods,” “plan balanced meals,” and “make a budget and stick to it.”

Results from the present study found that the food group consumed most often by food secure and food insecure sophomores was grains and cereals. This finding supported the hypothesis that food secure and food insecure students would consume grains and cereals more times per day compared to the other food groups. Grains and cereals include foods like bread, pasta, rice, cold breakfast cereals, hot cereals, etc. These products are often cheap and tend to be filling, which is likely why students in both groups consumed these types of food more often. Several investigators have reported that food insecurity is significantly associated with lower fruit and vegetable consumption, and that food insecure students consume fewer fruits and vegetables daily compared to food secure students (Gallegos et al., 2014; Martinez et al., 2019). Similarly, Gallegos et al. (2014) found that students with severe food insecurity consumed fewer fruits, vegetables, and legumes daily than did the other participating students. In accord with these studies, findings from the current study revealed that a significantly greater proportion of food secure sophomores consumed vegetables and vegetable juices and fruits and fruit juices more often (three to seven or more times per day) than food insecure sophomores. This finding supported the hypothesis that a significantly greater proportion of food secure students would consume vegetables and vegetable juices as well as fruits and fruit juices more times per day compared to food secure students. Additionally, the current study found that the proportion of food secure and food insecure students who consumed meats, seafood and poultry “most often” (three to seven or more times per day) was almost identical. Therefore, the

hypothesis that a significantly greater proportion of food secure students would consume meat, seafood, and poultry more times per day compared to food insecure students was not supported. Meats, seafood, and poultry tend to be relatively more expensive items, which could explain why sophomores in both groups consumed similar amounts, as many college students have limited funds. Furthermore, it was hypothesized that a significantly greater proportion of food secure students would consume “other protein foods” (e.g. eggs, peanut butter, legumes, and nuts, etc.) more times per day compared to food insecure students. Although the present study found that a greater proportion of food secure sophomores consumed “other protein foods” more frequently than food insecure sophomores, this finding was not significant. In addition, the current study revealed that food insecure sophomores consumed dairy foods more often than food secure sophomores, although this difference was not significant. This finding did not support the hypothesis that a significantly greater proportion of food secure students would consume dairy foods more times per day compared to food insecure students. Research has found that college students do not meet the recommendations for calcium intake, as milk and dairy foods are primary sources of calcium this could also indicate that college students do not consume the recommended daily servings of dairy foods (Rose et al., 2018). It was also found that a greater proportion of food insecure students consumed sweets more often than food secure students, although this difference was minimal and was not significant. This finding did not support the hypothesis that a significantly greater proportion of food insecure students than food secure students would consume sweets more times per day. Similarly, McArthur et al., (2018b) reported no significant differences between food secure and food insecure students’ average intake of sweets. The two food groups that food secure and food insecure students selected most frequently as those they would eat more from with greater access were fruits and juices and vegetables and juices. However, the third most commonly selected food group that sophomores indicated they would eat more from with greater access differed between food

secure and food secure students, with food secure students selecting meat, seafood, and poultry and food insecure students selecting other protein foods. Therefore, the hypothesis that the food groups selected most often by food secure and food insecure students as those they would eat more from if they had greater access would be vegetables and juices, fruits and juices, and meat, fish, and poultry was not supported. McArthur (2018a) reported similar findings, in which both food secure and food insecure students identified fruits and fruit juices and vegetables and vegetable juices as the foods they would want to consume more often given greater access.

Food Security Status and Cooking Self-Efficacy

Previous research has reported mixed findings regarding the association between cooking self-efficacy and food security status. Gaines et al. (2014) reported that a significant difference existed in terms of food security based on cooking self-efficacy. The authors noted that post hoc testing revealed that high food secure students reported significantly higher cooking self-efficacy when compared with their marginally food secure and food insecure counterparts. However, the same study found that cooking self-efficacy was not related to food security in fully adjusted models. Similarly, Hagedorn and Olfert (2018) reported no significant difference in food security status based on cooking skills. In line with previous findings, the present study reported no significant correlation between food security and cooking self-efficacy. This finding did not support the hypothesis that there would be a significant inverse correlation between the students' AFSSM scores and their scores on the cooking self-efficacy scale. It is possible that no significant correlations existed due to the fact that the cooking self-efficacy scale was not a validated scale and may not have accurately measured the sophomores' cooking confidence. Furthermore, it was hypothesized that food secure students would earn a significantly higher mean score on the cooking self-efficacy scale compared to food insecure students. Although findings from the current study revealed that food secure students earned a

higher mean score on the cooking self-efficacy scale than did food insecure students, this difference was not significant. Additionally, the present study found no significant difference between the mean scores of food secure and food insecure sophomores based on gender. This finding did not align with the hypothesis that food secure and food insecure females would earn a significantly higher mean score on the cooking self-efficacy scale compared to food secure and food insecure males. Overall, food secure students earned a higher score on each activity of the cooking self-efficacy scale compared to the food insecure students. However, a general linear model revealed that no individual significant differences existed between the mean scores of food secure and food insecure students on any of the individual activities on the cooking self-efficacy scale. This finding did not support the hypothesis that food secure students would earn significantly higher mean scores compared to food insecure students for the following activities from the cooking self-efficacy scale: making safe food purchases; preparing foods safely; storing cold and frozen foods safely; cooking new foods; using knives to slice, dice, chop, or mince; using leftovers to make different foods; and accurately using measuring cups and spoons. However, an independent t-test revealed that a significant difference existed between food secure and food insecure sophomores' self-efficacy score on the cooking activity, "accurately using measuring cups and spoons," in which food insecure students had a lower score or felt less confident for performing this activity.

Food Security Status and Cooking Frequency

McArthur et al. (2018) reported that cooking for self or others was a significant predictor for food insecurity, with a greater food insecurity rate among those who reported never cooking for themselves or others. Conversely, the present study found that a greater proportion of food secure sophomores reported cooking for themselves "less often" compared to food insecure sophomores, and the frequency that food secure and food insecure students cooked for themselves "more often" was almost identical. These data did not support the

hypothesis that a significantly greater proportion of food secure students would prepare or cook food for themselves “more often” compared to food insecure students. Similarly, a greater proportion of food secure students indicated that they cooked for others “less often” compared to food insecure students, and a smaller proportion of food secure students cooked for others “more often” compared to food insecure students, however neither of these differences were significant. These findings did not support the hypothesis that a significantly greater proportion of food secure students would prepare or cook for others “more often” compared to food insecure students. Food insecure students may possibly depend on others more, with regard to food access, and may participate in sharing group meals with friends or roommates more than food secure students. This could be a possible explanation for why food insecure students prepared food for others “more often” than food secure students. Additionally, it was hypothesized that a significantly greater proportion of food secure than food insecure students would have regular access to kitchen appliances (i.e., refrigerator; freezer; oven; stove top or hot plate; microwave; blender), cooking equipment (i.e., knives; cutting boards; mixing bowls, measuring cups, and spoons; baking sheets; pots and pans), and eating utensils (i.e., silverware, cups, glasses, plates, and bowls). Although a greater proportion of food secure sophomores had regular access to each one of these items compared to food insecure sophomores, there were no significant differences and the aforementioned hypothesis was not supported.

Food Security Status and Food Safety Knowledge

The food safety knowledge of food secure and food insecure sophomores was found to be somewhat variable, with different groups scoring higher on different questions. The findings revealed that food insecure students earned a higher mean score on the food safety knowledge test, however, there was no significant difference between their mean test scores. This finding did not support the hypothesis that food secure students would earn a significantly higher mean score on the food safety knowledge test compared to food insecure students. Additionally,

a correlational analysis revealed a significant positive correlation between the sophomores' AFSSM scores and their scores on the food safety knowledge test. This suggests that as the degree of food insecurity increased, the students' scores on the food safety knowledge test also increased. However, the correlation was very small indicating that this finding is of no applicable importance. This finding did not support the hypothesis that there would be a significant inverse correlation between the students' AFSSM scores and their scores on the food safety knowledge test. Furthermore, it was hypothesized that food secure and food insecure females would earn a significantly higher mean score on the food safety knowledge test compared to food secure and food insecure males. However, results yielded no significant differences between gender and mean score on the food safety knowledge test. This could indicate that college students are a population who lack knowledge on safe food handling and food safety recommendations. This is supported by previous research that reported very poor food safety knowledge scores (Green & Knechtges, 2015). The same study claims their findings are in alignment with other previous research indicating that students have limited knowledge of food safety, including safe handling practices.

Suggested Interventions for Reducing Students' Food Insecurity at Appalachian State University

Food insecurity is a serious and complex problem, and an increasing body of literature has found that college students are a population disproportionately affected by food insecurity. Communicating the scope of this problem is an essential first step in the process of implementing interventions focused on alleviating food insecurity. Raising awareness about campus food insecurity and about available resources is fundamental to ease the burden of this problem.

App State has already implemented several measures to combat student food insecurity. The university has several on-campus food pantries and other resources for food insecure and

secure students and faculty. App State's effort to alleviate food insecurity was initiated when the Office of Sustainability opened the East Hall Resource Hub and Free Store in 2016. The Resource Hub, or food pantry provides food and the free store provides clothing and hygiene products to Appalachian State University students, faculty, staff and their family members. The East Hall food pantry offers non-perishable staples, fresh bread, seasonings, seasonal, local fruits and vegetables when available, and cooking utensils. The associated Free Store also offers school supplies, first aid items, luggage, personal care items, and clothing. In total, Appalachian State has four on-campus locations for accessing food resources. One of these resources includes the Mountaineer Meal Share program developed by the Division of Student Affairs' Case Management department in partnership with the Student Government Association, Dining Services, and the Dean of Students. Mountaineer Meal Share is a short-term program that provides students with money towards on-campus meals. The program allocates up to \$50 to approved students whose meal plan balance drops below \$25 or to students without a meal plan who are experiencing food insecurity.

The university also offers several campus gardens, the newest is the Appalachian Roots Garden. The garden space is maintained by the staff, volunteers, and student interns of the Office of Sustainability. This garden space includes solar energy stations and a children's play space that is often visited by the students of a local child development program. The primary purpose of the Roots garden is to help students, community members, and children cultivate a deeper connection to land and food through experiential learning. However, the garden is also a location for education and outreach on sustainable and traditional gardening practices. It is also important to note that this garden provides a service to the community and helps to improve food insecurity through its donation garden that is used to grow food for organizations that provide support for food-insecure populations. Although the campus offers these excellent resources, among others, such as additional food pantries, many students are likely not aware

of their availability, and programs such as these are only effective when the individuals in need are able to use the available resources. Additionally, while resources such as food pantries, supplemental programs, campus gardens, and other emergency food assistance programs can temporarily benefit and help to alleviate food insecurity in the short-term, long-term interventions focused on skill-building are necessary to prevent and reduce food insecurity among college students.

The findings from the present study were used to help develop a course that was pilot tested at Appalachian State during the spring semester of 2020. The course, Skill Building for Food Security, was developed by Drs. Laura McArthur and Melissa Gutschall from the Department of Nutrition and Healthcare Management. The purpose of this course was to teach information and skills to reduce student risk for food insecurity while attending App State and in the long-term. The topics addressed were: basic nutrition concepts, contributors to food insecurity for college students, coping strategies used by food insecure college students, and the unfavorable consequences of prolonged food insecurity to physical and mental/emotional health and academic performance. The skills taught were: food budgeting, safe food handling, meal planning, food purchasing, food preparation, container gardening, applying for food assistance programs, and advocating for food assistance on-campus. This course was interdisciplinary, with classes taught by faculty members from the nutrition, public health, physics, social work, honors college, and sustainability programs at the university. Results regarding the effectiveness of the course will be assessed during the 2020-2021 academic year.

Building from the aforementioned course, a proposed intervention is to remodel the First Year Seminar course. Many students report not gaining valuable information or skills as a result of taking this course. This course should be re-worked to teach freshmen valuable knowledge and skills to reduce students' risk of becoming food insecure while attending college. Similar to the aforementioned course, the freshman seminar should be restructured to

teach freshmen a couple important skills, in addition to the usual orientation to college life. The two most important topics that should be incorporated into the first-year seminar include how to shop for affordable, healthy foods and how to plan and prepare easy, low-cost, nutritious and balanced meals. These two topics were selected most frequently by food secure and food insecure students as ways that would be most beneficial for increasing access to food. This indicates that many students may not be educated on such topics prior to transitioning to college, although these life skills are essential for eating healthy on a budget and simply for day-to-day life. Educating students on these topics in their first year would be ideal because it would set them up to have a successful remainder of their college career. This way students would be more prepared for the transition most students experience in their upcoming sophomore year, moving off campus and taking on more independence and financial burdens. Furthermore, reaching students during their freshman year through a mandatory course could help to teach students life-long lessons and skills to build on and help to prevent students from experiencing food insecurity while in college as well as later in life.

Another effort to help alleviate food insecurity among App State students would be for the university to partner with the local farmers' market. Both food secure and food insecure students indicated that the two food groups they would eat more from if provided greater access were fruits and vegetables. The university could arrange for the campus transportation system, Appalcart, to set up more routes that take students to the weekly farmers' market. This would allow students to have greater access to fresh, locally grown fruits and vegetables. However, these foods can sometimes be more expensive. The partnership should set up a student discount for food items offered at the farmers' market. This way, although the vendors would be selling their products for a discounted price, they would likely receive more business from students. Such a program might prompt more students to consume more fruits and vegetables and increase their access to locally produced food items.

Additionally, another proposed intervention is to implement monthly cooking demonstrations at the East Hall Resource Hub and Free Store. It is probable that the Resource Hub and Free store is underutilized by students due to the stigma associated with acquiring food from a food pantry. Nutrition student interns could provide cooking demonstrations on how to make easy, healthy, affordable meals using the types of food available at the Resource Hub. This intervention could be undertaken as a research project to assess the effectiveness of these cooking demonstrations on increasing the number of students who use the Resource Hub and reducing associated stigma. As a part of this project the interns could develop recipe cards for each month's meal for viewers to take home. Advertising these cooking demonstrations could increase awareness for the Resource Hub and bring in customers who may have never visited without such advertisement. Making these demonstrations a type of social event could also help to decrease the stigma associated with food pantries. Offering cooking demonstrations could not only increase the popularity and awareness of the Resource Hub, but it would help to teach food insecure and secure students how to use the foods they are able to get from the pantry to help create healthy meals on a budget. Additionally, on the days the cooking demonstrations are held, the Resource Hub should also hold a canned food drive to help stock the Resource Hub to be able to meet the demands of the students and individuals who use the pantry. This could be an effective strategy to help the staff and volunteers of the Resource Hub keep the shelves stocked. Lastly, providing these cooking demonstrations could help to reduce food insecurity by raising awareness about the availability of the Resource Hub, teaching students how to cook simple meals, and how to use the foods offered at the pantry (with the addition of some other ingredients) to create healthy meals on a budget.

Study Limitations and Strengths

Although many of the findings from this study are similar to those from previous research, this study had several limitations that prevent the authors from inferring that these

findings are representative of the nations' population of college students. Such limitations include: the use of a non-probability sample, collecting data from a single campus, self-reporting of all data, overrepresentation of female students, and limited race/ethnic diversity of the sample and the university as a whole. In addition, neither the cooking self-efficacy scale nor the food safety knowledge test were validated instruments that were designed by the authors. Validated and reliable instruments would strengthen the credibility of the scale and test findings. Furthermore, surveys were sent to students recently after they had returned from winter break. During this time students may have had greater food access and resources, been seasonally employed, or received extra money from the holidays. Students who had access to additional resources may have had greater food security during the time of the survey. Regardless, a strength of the present study was the final response rate of 12.6% of the sophomores who were surveyed. Additionally, this study is one of the first to analyze the relationship between food insecurity and cooking self-efficacy and food safety knowledge. This study also contributes to the growing body of literature about the correlates of college student food insecurity.

Areas for Future Research

The results from the current study indicated that there were no significant differences between food security status and sophomores' food safety knowledge or cooking self-efficacy. However, both of these variables are likely to impact food security status considering that the definition of food security includes being able to access safe, nutritious foods, and students with lower cooking self-efficacy may not be as capable of preparing nutritious foods. Future research at Appalachian State University should examine the relationship between these variables using validated tests and scales to more effectively measure food safety knowledge and cooking self-efficacy. In addition, nation-wide studies should continue to examine the correlates of food insecurity associated with academic year to help design interventions targeted for students at

different stages in their college careers and to know exactly when the most appropriate time is to implement interventions.

Conclusions

The findings from this research revealed that nearly half of the surveyed sophomores were food insecure. The transition from the freshman to sophomore year is often coupled with increased challenges such as moving off-campus from residence halls which can lead to increased responsibility and financial burden related to new living expenses. This combination of events may be contributing to the high rate of food insecurity in this population. However, the prevalence of food insecurity identified in the present study was almost identical to the rate identified for App State students in 2016 (McArthur et al., 2018a). This could indicate that the group of sophomores surveyed are representative of the entire student body at Appalachian State University, in regard to food security status. Additionally, food security status was not significantly associated with cooking self-efficacy. However, the cooking self-efficacy scale was developed by the authors and was not validated for accuracy of results. Furthermore, on average, food insecure students scored higher on the food safety knowledge test, and there was a significant positive correlation between students' AFSSM scores and food safety knowledge scores. This could be due to food insecure students having to know more about food safety because they may not always be able to obtain foods in a safe manner (e.g. dumpster diving, etc.). However, the correlation coefficient was small, indicating that this finding is of not applicable importance. This significance of this weak correlation was likely due to the sample size. Additionally, like the cooking self-efficacy scale, the food safety knowledge test was designed by the authors and was not a validated test. Therefore, the authors cannot conclude that the food safety knowledge test is an effective measure of the students' actual knowledge of food safety. In conclusion, the present findings emphasize the importance of implementing additional programs and interventions to improve students' access to safe and nutritious foods

and reduce the high rate of food insecurity, especially among the sophomore class attending Appalachian State University.

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Appendix A

Recruitment Letter

You are invited to participate in a research study about reducing the hunger problem among App State students. If you agree to participate, you will be asked to complete an online questionnaire that should take about ten minutes of your time.

The findings from this study will benefit App State students by helping us design activities to fight hunger on campus. It is anticipated that you will experience no risks or discomforts from participating 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.

If you participate, you may enter a drawing to win a \$50 gift card from Amazon.com.

Participation is completely voluntary, and you may stop answering questions at any time.

If you have questions about this study, please contact Laura McArthur, PhD, 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.

If you have any questions about this study, please contact Laura McArthur, PhD, RD at (828) 262-2971 or at mcarthurlh@appstate.edu

Appendix B

Modified Ten-Item USDA/ERS Adult Food Security Survey Module (AFSSM)

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 Sometimes Never

2. The food I buy 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

Question 5 was only displayed if the students selected "Yes" to question 4.

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

Question 10 was only displayed if the students selected "Yes" to question 9.

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

Appendix C

Food Safety Knowledge Test

Food Characteristic Subscale (n=2)

Which food is most likely to become contaminated with bacteria that cause foodborne illness?

- a. Chicken
- b. Black beans
- c. Bread
- d. Baked potatoes

Which characteristic of food is associated with an increased risk of foodborne illness?

- a. Low-sugar
- b. High-protein
- c. High-acid
- d. Low-moisture

Safe Storage Subscale (n=3)

What is the longest time leftover turkey can be safely left on the table before refrigerating it to reduce the risk of bacterial contamination?

- a. 4 hours
- b. 30 minutes
- c. 2 hours
- d. 1 hour

At what temperature should you keep your freezer to store foods safely?

- a. 0° F
- b. 15° F
- c. 25° F
- d. 32° F

Where should fresh meats be placed in your refrigerator to prevent them from contaminating other foods?

- a. With produce
- b. On the top shelf
- c. On the bottom shelf
- d. They should not be stored in your refrigerator

Safe Food Preparation Subscale (n=3)

Which is the safe temperature for reheating meat and poultry to reduce your risk of foodborne illness?

- a. 75° F
- b. 120° F
- c. 100° F
- d. 165° F

Which food is being thawed improperly?

- a. Whole chicken thawed in a refrigerator
- b. Frozen fish thawed under cool running water
- c. Frozen turkey thawed on the kitchen counter at room temperature
- d. Frozen hamburger patties thawed on a grill while they are being cooked

Which best describes the appearance of a hamburger when it is safely cooked?

- a. Mostly pink on the inside
- b. Brown all the way through
- c. Some pink on the inside
- d. Some pink on the outside

Other Subscale (n=3)

Which is an important strategy for reducing your risk of foodborne illness?

- a. Wash hands before and after handling raw meat, poultry, fish, or shellfish
- b. Cook and reheat foods at the temperature shown in the recipe or on the package
- c. Refrigerate leftovers immediately after serving
- d. All of the above

How long should you spend washing your hands with soap and warm water before and after preparing food?

- a. 10 seconds
- b. 20 seconds
- c. 2 minutes
- d. 1 minute

Which product would be safe to buy?

- a. A carton of eggs with one cracked egg
- b. A container of yogurt with a past expiration date
- c. A punctured can of green beans
- d. A frozen pizza with no ice crystals on the outside of the package

Appendix D

Questionnaire

Part One

Food Security

These first questions ask about your access to food since enrolling at Appalachian State University (ASU), whether you live on or off campus. Please check the button with the answer that BEST applies to you. Please do not leave any questions unchecked.

As a sophomore at ASU ...

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

a. Often b. Sometimes c. Never

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

a. Often b. Sometimes c. Never

3. I can't afford to eat balanced meals.

a. Often b. Sometimes c. Never

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

a. Yes b. No

If you answered "Yes" to question 4, please complete question 5. Otherwise, skip to question 6.

5. How often did this happen?

- a. Almost every month
- b. Some months, but not every month
- c. In only one or two months

6. There have been times when I have eaten less than I thought I should because I didn't have enough money for food.

- Yes
- b. No

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

- a. Yes
- b. No

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

- a. Yes
- b. No

9. There have been times when I have not eaten for a whole day because I didn't have enough money for food.

- a. Yes
- b. No

If you answered "Yes" to question 9, please complete question 10. Otherwise, skip to Part Two.

10. How often did you not eat for a whole day because there wasn't enough money for food?

- a. Almost every month
- b. Some months, but not every month
- c. In only one or two months

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

0 1 2 3 4 5 6 7 8 9 10 11 12

Grains/cereals (e.g. breakfast cereals, breads, crackers, noodles, other pastas, rice, sweet pastries/cookies/cake, etc.)

Vegetables/juices (e.g. potato, carrot, green leafy vegetables, corn, broccoli, etc.)

Fruits/juices (e.g. apple, orange, tomato, peach, grape, etc.)

Meat/fish/poultry (e.g. beef, pork, chicken, fish, shellfish, etc.)

Other protein foods (e.g. eggs, peanut butter, nuts, seeds, soy foods, different beans other than green beans, etc.)

Dairy foods (e.g. fat-free or regular milk, block cheese, cottage cheese, ice cream, yogurt, etc.)

Sweets (e.g. hard/gummy candy, candy bars, regular soft drinks, jams/jellies, honey, table sugar, etc.)

12. Please check the food group(s) that you would eat more from if you had greater access.

- a. Grains/cereals (e.g. breakfast cereals, breads, crackers, noodles, other pastas, rice, sweet pastries/cookies/cake, etc.)
- b. Vegetables/juices (e.g. potato, carrot, green leafy vegetables, corn, broccoli, etc.)
- c. Fruits/juices (e.g. apple, orange, tomato, peach, grape, etc.)
- d. Meat/fish/poultry (e.g. beef, pork, chicken, fish, shellfish, etc.)
- e. Other protein foods (e.g. eggs, peanut butter, nuts, seeds, soy foods, different beans other than green beans, etc.)
- f. Dairy foods (e.g. milk, block cheese, cottage cheese, ice cream, yogurt, etc.)
- g. Sweets (e.g. hard/gummy candy, candy bars, regular soft drinks, jams/jellies, honey, table sugar, etc.)

13. I could use ___ support to help me access food. Check the answer that best applies to you.

A lot more

a. Some more

b. A little more

c. I do not need more help accessing food

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

- a. Make a budget and stick to it
- b. Learn to grow food by container gardening
- c. Participate in a community gardening project where you exchange work hours for produce
- d. Learn how to plan balanced meals
- e. Make a list before shopping for food
- f. Learn how to identify and shop for affordable, healthy foods
- g. Learn how to use different cooking skills to prepare and cook healthy meals
- h. Shop for, store, prepare, and cook foods safely

Part 2

Basic Food Safety Questions

15. Which food is most likely to become contaminated with bacteria that cause foodborne illness?

- a. Chicken
- b. Black beans
- c. Bread
- d. Baked potatoes

16. Which is the safe temperature for reheating meat and poultry to reduce your risk of foodborne illness?

- a. 75 degrees F
- b. 120 degrees F
- c. 100 degrees F
- d. 165 degrees F

17. Which is an important step for reducing your risk of foodborne illness?

- a. Washing hands before and after handling raw meat, poultry, fish, or shellfish
- b. Cooking and reheating foods at the safe temperatures
- c. Refrigerating leftovers immediately after serving
- d. All of the above

18. Which is a common symptom of foodborne illness?

- a. Anemia
- b. Diarrhea
- c. Impaired speech
- d. Development of warts

19. Which characteristic of food is associated with an increased risk of foodborne illness?

- a. High-protein
- b. Low-sugar
- c. High-acid
- d. Low-moisture

20. What is the longest time leftover turkey can be safely left on the table before refrigerating it to reduce the risk of bacterial contamination?

- a. 2 hours
- b. 30 minutes
- c. 4 hours
- d. 1 hour

21. How long should you spend washing your hands with soap and warm water after handling raw meat, poultry, fish, or shellfish?

- a. 10 seconds
- b. 1 minute
- c. 2 minutes
- d. 20 seconds

22. At what temperature should you keep your freezer to store food safely?

- a. Zero degrees F
- b. 15 degrees F
- c. 25 degrees F
- d. 35 degrees F

23. Which can cause food to become unsafe?

- a. A freezer temperature of zero degrees F
- b. Chopping broccoli on the same cutting board immediately after chopping raw chicken
- c. Thoroughly washing hands after playing with a pet before preparing food
- d. Cooking food for the amount of time specified in the recipe

24. Where should fresh meats be placed in your refrigerator to prevent them from contaminating other foods?

- a. Fresh meats should be placed on the bottom shelf
- b. Fresh meats should be placed on the top shelf
- c. Fresh meats should be stored with produce
- d. Fresh meats should be cooked right away and not stored in your refrigerator

25. Which food is being thawed improperly?

- a. Whole chicken being thawed in a refrigerator
- b. Frozen fish being thawed under cool running water
- c. Frozen turkey being thawed on a prep table at room temperature
- d. Frozen hamburger patties being thawed on a grill while they are being cooked

26. Which best describes the appearance of a hamburger when it is safely cooked?

- a. Mostly pink on the inside
- b. Brown all the way through
- c. Some pink on the inside
- d. Some pink on the outside

27. Which product would be safe to buy?

- a. A carton of eggs with one cracked egg
- b. A frozen pizza with no crystals on the outside of the package
- c. A punctured can of green beans
- d. A container of yogurt with a past expiration date

Questions assessing cooking self-efficacy

28. How confident do you feel about

- 1 Not at All Confident
- 2 A Little Confident
- 3 Confident
- 4 Very Confident

Cooking foods using the microwave?

following a simple recipe?

Cooking foods that you have not cooked before?

Using knives to slice, chop, dice, or mince food ingredients?

Using a mixer?

Accurately using measuring cups and spoons?

Setting temperatures on the stove and oven?

Using a blender?

Storing unused food ingredients rather than throwing them out to minimize food waste?

Reusing leftover foods?

Preparing meals that include fresh, frozen, or canned vegetables?

Preparing foods safely to protect yourself from foodborne illnesses?

29. I cook for myself:

- a. Never
- b. 1-3 times/month
- c. 1-6 times/week
- d. At least once/day

30. I cook for others:

- a. Never b. 1-3 times/month c. 1-6 times/week d. At least once/day

31. I would rate my cooking skills as:

- a. Poor b. Fair c. Good d. Very good

32. I have regular access to the following types of cooking equipment: (click all that apply).

- a. Refrigerator
- b. Stove top or hot plate
- c. Oven
- d. Microwave
- e. Knives for chopping, slicing, dicing, etc.
- f. Cutting board
- g. Mixing bowls, measuring cups and spoons, baking sheets
- h. Pots, pans
- i. Freezer
- j. Blender
- k. Silverware, cups, glasses, plates, and bowls

Part Three

Demographic and lifestyle questions

These final questions ask for information about you and your lifestyle. All of your answers will be kept confidential. Please check the answers that best apply to you, or write the answer in the textbox provided.

33. The gender I identify with is:

a. Male

b. Female

c. Nonbinary

d. If none of the above apply to you, please describe: _____

34. My age is _____ years

35. My marital status is

a. Not married

b. Married

36. I have dependent children living with me

a. Yes b. No

If you answered "yes" to question 26, please indicate how many dependent children live with you. Otherwise skip to question 28.

37. Please indicate how many dependent children live with you

38. I currently weigh about: ___ pounds

39. My height is about: (drop down menu) ___ feet, ___ inches

40. My year in school is

- a. Freshman
- b. Sophomore
- c. Junior
- d. Senior
- e. Graduate Student
- f. Other: please identify _____

41. I am an international student

- a. Yes
- b. No

42. My student status at ASU is:

- a. Part-time student
- b. Full-time student

43. My intended major at ASU is in

- a. Beaver College of Health Sciences
- b. College of Arts and Sciences
- c. College of Fine and Applied Arts
- d. Hayes School of Music
- e. Reich College of education
- f. Walker College of Business
- g. I am undecided about my major

44. My race/ethnic background is: Check all that apply

- a. White
- b. White, Hispanic or Latino
- c. Black, African-American
- d. Black, Hispanic or Latino
- e. American Indian or Alaska native
- f. Asian
- g. Native Hawaiian or other Pacific Islander
- h. If none of the above apply to you, please describe

45. My employment status is:

- a. Unemployed
- b. One or more part-time jobs
- c. One full-time job
- d. Other: please identify _____

46. I live:

- a. On-campus
- b. Off-campus
- c. I am homeless

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

- a. Yes
- b. No

48. My personal (not family) monthly income falls between:

- a. \$0-\$500
- b. \$501-\$1000
- c. \$1001-\$1500
- d. \$1501+

49. My family (not personal) yearly income falls between:

- a. \$0-\$15,000
- b. \$15,000-\$24,999
- c. \$25,000-\$34,999
- d. \$35,000-\$49,999
- e. \$50,000-\$74,999
- f. \$75,000-\$99,999
- g. \$100,000-\$149,000
- h. \$150,000-\$199,999
- i. \$200,000+

50. I would rate my current physical health as:

- a. Poor
- b. Fair
- c. Good
- d. Very good

51. I would rate my current mental/emotional health as:

- a. Poor
- b. Fair
- c. Good
- d. Very good

52. I currently participate in an on-campus meal plan

a. Yes

b. No

Thank you for completing this questionnaire!

Appendix E**Table of Tested Correlations**

Correlation Coefficients for Hypothesis Testing

Association	r	p-value
AFSSM Score and BMI	0.160	0.023
AFSSM Score and Cooking Self-Efficacy Score	-0.126	0.068
Cooking Self-Efficacy Score and BMI	-0.086	0.229
AFSSM Score and Food Safety Test Score	0.146	0.037
Food Safety Test Score and Cooking Self-Efficacy Score	0.067	0.343
Food Safety Test Score and BMI	0.008	0.909

Vita

Hannah Elizabeth Boone was born in Boone, North Carolina, to Michael and Sarah Boone. She graduated from Appalachian State University in 2018 and was awarded a Bachelor of Science degree in Nutrition and Foods and minored in chemistry. The following autumn, she accepted a teacher assistantship in Nutrition and began the Combined Master of Science in Nutrition and Dietetics Internship Program at Appalachian State University. The M.S. was awarded in May 2020.

Hannah Boone has a love for nutrition and strives to use this background to improve the health and quality of life of others through practicing nutrition as a preventative measure for better health. She is pursuing registration with the Academy of Nutrition and Dietetics with the hopes of soon becoming a clinical Registered Dietitian. She resides in Boone, N.C., with her significant other, Joseph Miller, and two English Bulldogs.