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Evaluation of Food Insecurity in Students Attending a University in the Southern Region of the United States

Jaqlene Villalpando

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Evaluation of food insecurity in students attending a university in the southern region of
the United States

By

Jaqlene Villalpando

A Thesis
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Master of Science
in Nutrition
in the Department of Food Science, Nutrition, and Health Promotion

Mississippi State, Mississippi

May 2019

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Evaluation of food insecurity in students attending a university in the southern region of
the United States

By

Jaqlene Villalpando

Approved:

Diane K. Tidwell
(Major Professor)

Brent J. Fountain
(Committee Member)

Brittney D. Oliver
(Committee Member)

Terezie T. Mosby
(Committee Member)

Marion W. Evans, Jr.
(Graduate Coordinator)

George M. Hopper
Dean
College of Agriculture and Life Sciences

Name: Jaqlene Villalpando

Date of Degree: May 3, 2019

Institution: Mississippi State University

Major Field: Nutrition

Major Professor: Diane K. Tidwell

Title of Study: Evaluation of food insecurity in students attending a university in the southern region of the United States

Pages in Study: 61

Candidate for Degree of Master of Science

Food insecurity plagues college students and is associated with negative health and academic outcomes. The aim of the study was to examine the prevalence of food insecurity, its determinants, and food intake outcomes associated with students found to have low food security. A cross-sectional study design utilizing an online questionnaire covering socio-demographic, food security, coping strategy, and money expenditure items were administered to Mississippi university students (n=595) via email.

Descriptive, correlation, and chi-square analyses determined how student characteristics were associated with food security. A total of 246 (41.3%) students were food insecure. Significant variables associated with food insecurity were African American or other minority, low GPA, use of public transportation, do not own a car, fair or poor perceived health status, higher money expenditure scores, and lower coping strategy scores.

Additional research and institutional strategies are needed to close the gap of food insecurity among this population.

DEDICATION

This work is lovingly dedicated to my husband and family who provided unswerving support through patience, prayer, encouragement, and child care. Without you, this would not have been possible.

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Dr. Tidwell has stood by my side over the past five years, gently urging me on to the end, and never letting me quit along the way. I will forever be grateful for her vast knowledge and wisdom imparted to me during this process. I am also thankful for Drs. Fountain, Mosby, and Oliver for serving on my graduate committee.

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CHAPTER I

INTRODUCTION

Food insecurity, defined as the limited or uncertain access to nutritionally adequate or safe foods is a problem facing over 15 million American households (Anderson, 1990; Coleman-Jensen, Rabbitt, Gregory, & Sing, 2017). Within the United States, certain divisions of the population have demonstrated several risk factors for developing food insecurity including single parent households, non-Hispanic Black and Hispanic ethnicities, those living in poverty, and those living in rural communities or southern states in the United States (Coleman-Jensen et al., 2017; Freudenberg et al., 2013). Assessment of food insecurity historically focuses on adults and children of households whose food situation is severe enough that at least some of its members experience times of anxiety over having insufficient food to meet its needs (Coleman-Jensen et al., 2017). Students attending college are typically comprised of adults newly transitioning into a state of independence (Mukigi et al., 2018); a rising concern for this subset of the population has gained attention in recent years as they represent a faction sometimes missed when measuring household food insecurity (Bruening, Brennhofner, Van Woerden, Todd, & Laska, 2016). Studies shed light on the fact that college students appear especially vulnerable to food insecurity and habitually report a prevalence of food insecurity higher than U.S. national household averages (Bruening et al., 2016; Chaparro, Zaghloul, Holck, & Dobbs, 2009; Davidson & Morrell, 2018; Freudenberg et al., 2011;

Gaines, Robb, Knol, & Sickler, 2014; Hughes, Leveritt, Donadlson, & Serebryanikova, 2011; Morato et al., 2015; Morris, Smith, Davis, & Null, 2016; Patton-López et al., 2014; Payne-Sturges, Tjaden, Caldeira, Vincent, & Arria, 2018; Silva et al., 2015).

In addition to stressing the lack of affordable or accessible healthful foods, spending priorities must also be considered in the typical college-aged student when considering etiologies of food insecurity. Some evidence suggests that adequate financial aid is not available to support the food resource needs of college attendees and that students may lack the financial and food management skills necessary to be the best stewards of the existing resources available (Alaimo, 2005; Gaines et al., 2014; Larson, Perry, Story, & Neumark-Sztainer, 2006). The increased burden of rising tuition costs and limited subsidies further contributes to the unique hardship facing those attending college (National Center for Education Statistics, n.d.). Regardless of the contributors to food insecurity among college students, the negative impacts appear consistent. Food insecurity is associated with poor academic performance and general health outcomes in this group (Gundersen & Ziliak, 2015; Silva et al., 2015; Sharkey, Johnson, & Dean, 2011; Stuff et al., 2004).

Food assistance programs such as the U.S. Supplemental Nutrition Assistance Program (SNAP), Women, Infants, and Children's (WIC) program, and Meals on Wheels are available to low income individuals, but many college students do not qualify for such benefits intended to help offset the burden of food insecurity. This ineligibility for federal assistance is perplexing considering students enrolled in college are often experiencing a time of limited income and time constraints that would normally allow

adults the opportunity to work to generate money (Davidson & Morrell, 2018; Gaines et al., 2014; Gunderson & Ziliak, 2015; USDA Food and Nutrition Service, 2018).

Mississippi has the second highest prevalence of adult obesity at 37.3%, a poverty rate of 20.8%, and median income of \$41,754 that is more than \$15,000 below the median U.S. household income (Grant et al., 2018; Data USA., n.d.). Unlike the downward trend of household food insecurity in the U.S., Mississippi has hit a plateau. Additionally, 50 of the 82 counties in Mississippi are considered “persistent poverty” counties, indicating poverty rates that are consistently higher than 20% for 30 or more years (Hossfeld & Rico Mendez, 2018).

Poignant to the present research is the fact that Mississippi usually leads the nation in obesity, poverty, and household food insecurity (Coleman-Jensen et al., 2017). Students attending college in Mississippi would seem especially susceptible to food insecurity. Due to limited studies examining food insecurity among students attending college in the southern region of the United States, further research is needed to explore the prevalence, potential determinants, and consequences of food insecurity among students attending Mississippi colleges and universities.

CHAPTER II

REVIEW OF LITERATURE

Defining Food Security and Occurrence in the United States

The United States Department of Agriculture (USDA) defines food security as having access to enough food for an active, healthy life at all times (United States Department of Agriculture (USDA), 2018). When one considers a family skipping a meal so they can make their food stretch or a parent foregoing dinner to allow more food for his or her child, a household in a low income country may come to mind. However, food insecurity and hunger are not limited to low income countries. In fact, over 12.3% or 15.6 million U.S. households suffer from “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” and are therefore considered food insecure (Anderson, 1990; Coleman-Jensen et al., 2017). Data indicate that, although prevalence of household food insecurity is trending down, its occurrence still exceeds that of the pre-recession rate of 11.1% in 2007 (Coleman-Jensen et al., 2017).

The Household Food Security Survey Module (HFSSM) is a portion of the U.S. Census Bureau’s Current Population Survey that measures food security in the United States (Coleman-Jensen et al., 2016). The USDA Economic Research Service ERS reports the results gathered by the HFSSM. For over twenty years, the USDA has conducted these surveys annually, quantifying food access, adequacy, spending, and

assistance. Questions from the HFSSM were designed to measure food insecurity based on the number of reported conditions and behaviors that characterize difficulty meeting basic food acquisition and intake needs (Coleman-Jensen et al., 2017; Economic Research Service USDA, 2012). The survey covers food spending, food assistance program participation, food sufficiency and security, and ways to avoid or ameliorate food deprivation. The Committee on National Statistics, which is an expert, multi-disciplinary panel, validated the study and determined that the measurement methods and language used to identify and define food security was accurate and relevant (USDA, 2018). The HFSSM is considered the reference standard for assessment of food security status among various populations and has often been used to assess food insecurity in studies involving college students (Chaparro et al., 2009; Hughes et al., 2011; Morris et al., 2016; Patton-Lopez, Lopez-Cevallos, Cancel-Tirado, & Vazquez, 2014).

Food security contains four subcategories in accordance with USDA (2018) standardized language: high, marginal, low, and very low food security. *High food security* represents those households with good access to food or without food limitations. *Marginal food security* characterizes those households with some anxiety over having too little variety or quantity of food, without impacting food intake. *Low food security* is characterized by "reduced quality, variety, or desirability of diet" (USDA, 2018) with little or no reduced food intake. *Very low food security* is defined by multiple indicators of disrupted eating patterns as a result of food resource constraints. Food security is considered a household-level economic and social condition of limited or uncertain access to adequate food; whereas hunger is an individual, physiological

condition. Although food insecurity may exist outside of hunger, hunger can be a potential consequence of severe food insecurity (USDA, 2018).

The U.S. Adult Food Security Survey Module (AFSSM) is an extension of the HFSSM administered to households without children present (ERS USDA, 2012). The AFSSM contains 10 questions aimed at evaluating various conditions, experiences, or behaviors related to household food practices that specifically measure the degree of food insecurity (Bickel, Nord, Price, Hamilton & Cook, 2000). The number of affirmative responses to the 10 questions determines the overall score and severity of food security status. For instance, a score of zero affirmative answers correlates with no food access problems, qualifying as high food security. One to two affirmative answers indicating anxiety over household food shortage without impacting food intake would be considered as marginal food security; both high and marginal food security are identified as being food secure overall in most studies. Three to five affirmative answers indicating reduced diet quality, variety, and appeal without hunger would indicate low food security. More than five affirmative answers of reduced food intake and disrupted eating patterns would be recognized as very low food security. Low and very low food security are often combined to indicate overall food insecurity (Bickel et al., 2000; Chaparro et al., 2009).

Overview and Populations at Risk for Food Insecurity

Patterns characterizing populations particularly prone to household food insecurity have begun to emerge. Food insecurity has been observed in association with poverty, unemployment, limited access to food assistance programs, and transportation limitations (Alaimo, 2005; Gaines et al., 2014). An average 38.3% of the households that met criteria for food insecurity according to the most recent HFSSM had incomes below

the poverty threshold (Coleman-Jensen et al., 2017). Other trademark predictors included single parent households headed by women, adults with disabilities, black non-Hispanic or Hispanic households, lower education, or non-standard work homes (Coleman-Jensen et al., 2017). Rural and principle cities in metropolitan areas were also more susceptible to food insecurity compared to suburban outliers. Southern states rank lowest in food security compared to other regions of the United States. According to the most recent 2016 Current Population Survey, Mississippi leads the nation in household food insecurity at 18.7% compared to the least food insecure state, Hawaii (8.7%) (Coleman-Jensen et al., 2017).

Alaimo (2005) suggests that four common stages of household-level food insecurity exist: “(1) preoccupation or worry about food supply; (2) unsuitable food or poor food quality; (3) shortage of food; and (4) lack of control over the food situation.” Gaines et al. (2014) extends Alaimo’s (2005) conceptual model describing the food insecurity continuum. Both depict a relationship between risk factors, indicators, coping mechanisms, and potential individual outcomes associated with food insecurity. Households, or in the case of the present study, students, may oscillate along a spectrum between periods of high food security and low food security, depending on the burden of household risk factors involved. Socio-demographic status, financial resources, employment status, nutritious food availability, social support, food skills, and health impairments are some examples of household risk factors that may threaten food security (Gaines et al., 2014; Alaimo, 2005). When these risk factors morph into preoccupation with having an inadequate food supply, poor food quality or lack of control over food situation, the food security status then changes from secure to insecure. Food acquisition

and coping strategies are inherently initiated in an attempt to restore food security. Typical coping strategies include stretching food by skipping meals or eating smaller portions to make it last longer, eating less healthy meals, or eating nutritionally compromised meals like cheap, processed food in order to be able to eat more (McArthur, Ball, Danek, & Holbert, 2018; USDA, 2018). Engaging in federal food assistance programs, emergency food systems, or eliciting additional social support are additional means used by families in attempts to restore food security (Alaimo, 2005; Gaines et al., 2014). Low food security can lead to bouts of psychological anguish, disordered eating practices, diminished nutritional quality of diet, or hunger. Potential long-term individual consequences of food insecurity can develop as well which may evolve into impaired physical, psychosocial, or nutritional health status, or diminished work or academic capacity (Alaimo, 2005; Gaines et al., 2014).

Prevalence of Food Insecurity in College Students

While much is known about the familial impact of food insecurity in the United States, there is limited research on the prevalence and impact of food insecurity among college students. The USDA tracks food insecurity at the household and childhood levels, but college students are frequently excluded from national surveillance data (Bickel et al., 2000; USDA, 2018). Nonetheless, several universities have assessed the prevalence of food insecurity ranging from 14% to 59% and well above the national average in most studies (Bruening et al., 2016; Chaparro et al., 2009; Davidson & Morrell, 2018; Gaines et al., 2014; Morris et al., 2016; Maroto, Snelling, & Linck, 2015; Patton-Lopez et al., 2014).

Regardless of varying demographic locations or sample characteristics studied, college students are consistently found to be at high risk for food insecurity (Bruening et al., 2016; Chaparro et al., 2009; Davidson & Morrell, 2018; Morris et al., 2016; Maroto et al., 2015; Patton-Lopez et al., 2014). Rural universities like a university in Oregon (59%) (Patton-Lopez et al., 2014) and urban universities like the University Massachusetts Boston (one-fourth of students sampled) (Silva et al., 2015), found high incidence of food insecurity among their students sampled. A study evaluating freshmen at Arizona State University measured food insecurity rates of 32% (Bruening et al., 2016) was similar to those evaluating undergraduates that excluded freshmen like the 21% identified at the University of Hawaii at Mānoa (Chaparro et al., 2009). Some of the highest food insecurity rates (56%) discussed in literature involved community college students in Maryland (Maroto et al., 2015). Various regional studies highlight that college students are challenged with food insecurity, regardless of location: northeast in New Hampshire (25%) (Davidson & Morrell, 2018) and City University New York (39%) (Freudenberg et al., 2013); southeast at the University of Alabama (14%) (Gaines et al., 2014); midwest among four universities in Illinois (35%) (Morris et al., 2016); coastal in Hawaii (21%) (Chaparro et al., 2009); internationally in an Australian university (46%) (Hughes et al., 2011)

The studies involving students at an Alabama university (Gaines et al., 2014) and the four Illinois universities (Morris et al., 2016) draw the strongest parallel with the regard to demographic characteristics, but McArthur et al.'s (2018) study design was most similar to the present research. The study at the University of Alabama observed undergraduate students to have a 14% food insecurity rate that was lower than rates

reported in other comparable studies but proved to be consistent with the 18% national household level for the state of Alabama reported at that time (Gaines et al., 2014). One major limitation indicated in this study was the fact that it followed a natural disaster that may have skewed its findings. Although this particular study did not confirm increased risk associated with the college-aged population, it still highlighted areas for concern due to lack of food assistance and propensity for financial uncertainty throughout college careers of students (Gaines et al., 2014).

Correlates of Food Insecurity

Food Resources/Eating Practices

One study observed that students with lower breakfast consumption, lower home-cooked meal consumption, and less healthy off-campus eating practices were more likely to report food insecurity (Bruening et al., 2016). When campus meal plans or other household members prepared students' food, this was often associated with food security compared to those who frequently consumed takeout which was correlated with food insecurity (Davidson & Morrell, 2018; Hughes et al., 2011). Another variable associated with college student food insecurity included lower self-efficacy in the ability to prepare nutritionally balanced meals. An inverse relationship was seen in food insecure students and an increased knowledge of food management and cooking skill development (Alaimo, 2005; Gaines et al., 2014).

Mental Health

An association between food insecurity and depression, anxiety, and other mental/emotional markers has been established. It can detrimentally affect students'

performance in the classroom, resulting in poor academic outcomes (Freudenberg et al., 2013; Lin et al., 2013; Silva et al., 2015). Silva et al. (2015) also stated that similar to those with housing insecurity, students with food insecurity were observed to have lower class attendance. Watson, Malan, Gilk, & Martinez (2017) summarize students' claims that "mental and physical health impacts, including stress, inability to focus on their work, fatigue and lack of energy, irregular sleep patterns, irritability, depression, headaches, and weight gain linked to inadequate food intake".

Higher rates of food insecurity translated into increased reports of mental health issues, unhealthy eating patterns, and alcohol use behaviors among this population (Bruening et al., 2016). Some evidence supports a negative association between food insecurity and social skill development and reading performance among children (Alaimo et al., 2001; Jyoti, Frongillo, & Jones, 2005). Increased incidence of grade repetition and missed school days have been linked with food insufficiency among children and teenagers compared to their food secure counterparts. Psychosocial difficulties in food insufficient teenagers have been severe at times and known to manifest in outcomes such as psychological counseling, school suspension, difficulty getting along with others, or having no friends (Alaimo, Olson, & Frongillo, 2001). While not specifically studied with regard to college students in all cases, it is not unreasonable to assume that these attributes might apply to college students suffering a similar socioeconomic crisis. Other studies suggest that college students with food insecurity had higher odds of reporting anxiety, depression, worries surrounding finances or relationships, and lower self-esteem (Freudenberg et al., 2013; Lin et al., 2013).

General Physical Health

Children in food insecure households (Gunderson & Ziliak, 2015), food insecure college students (Hughes et al., 2011; Patton-Lopez et al., 2014; Payne-Sturges et al., 2019), and food insecure adult households (Stuff et al., 2004) demonstrated higher odds of reporting fair or poor overall health status through lower self-reported health assessment scores more often. Gunderson and Ziliak (2015) observed that children had higher odds of reporting fair to poor health and seniors had greater limitations with activities of daily living when food insecurity was reported. Research has shown an inverse relationship between food security and weight status to some degree; women with food insecurity had greater likelihood of being overweight or obese compared to their food secure counterparts; however, these studies have not drawn causation between food insecurity and weight gain with time (Larson et al., 2006; Townsend, Pearson, Love, Achterberg, & Murphy, 2001). Hossfeld and Rico Mendez (2018) discuss a strong relationship between poverty rates and obesity rates in the United States stating if you were to take the two and overlap them, a pattern emerges; as poverty increases, so does obesity.

Socio-demographic Factors

Similar to national household food insecurity risk factors, a correlation has been drawn between certain socio-demographic characteristics and higher incidence of food insecurity among college students. Those who identified as a minority, experienced housing instability, were first generation college students, or received financial aid had a significant correlation with food insecurity (Chaparro et al., 2009; Gaines et al., 2014; Payne-Sturges et al., 2018; Silva et al., 2015). Several studies support a link between

housing problems and higher incidence of food insecurity (Chaparro et al., 2009; Freudenberg et al., 2013; Maroto et al., 2015; Morris et al., 2016; Patton-Lopez et al., 2014; Payne-Sturges et al., 2018). Housing instability and food insecurity were observed to negatively impact class attendance, performance, and the ability to continue at a university according to Silva et al. (2015). Chaparro et al. (2009) and Gaines et al. (2014) identified students living alone or those who had financial independence from family were more likely to report low food security; whereas, those still living with parents often had higher food security likely due to the increased financial support or alleviation of financial burden associated with housing or food costs (Hughes et al., 2011; Maroto et al., 2015; Morris et al., 2016). Maroto et al. (2015) reported that, within their sample studied, “students who lived alone had the highest rate of food insecurity compared to students in all other living situations.”

First generation students, or those students in which neither parental guardian earned a four-year degree or higher, were found to have a higher incidence of food insecurity (Davidson & Morrell, 2018). Those who received financial aid or student loans were at greater risk of food insecurity compared to those who were financially independent, but use of credit cards showed an inverse relationship to food insecurity (Davidson & Morrell, 2018; Gaines et al., 2014; Hughes et al., 2011; Patton-Lopez et al., 2014). Students who earned less than \$15,000 per year or were employed with low income were more food insecure compared to their counterparts (Hughes et al., 2011; Patton-Lopez et al., 2014). Gunderson and Ziliak (2015) and Alaimo (2005) observed budgeting behaviors and financial management skills to be associated with higher food security in their studies; however, others found that those preoccupied with expense

tracking or budgeting often reported lower food security (Gaines et al., 2014; Hughes et al., 2011). In the second scenario, use of budgeting behaviors may be the result of compensatory or coping mechanisms employed in response to food insecurity.

Chaparro et al. (2009) says that in terms of fiscal responsibility, there was no significant difference between food secure and food insecure students' monthly spending patterns, except with "expenditures on transportation, eating out, entertainment and shopping." Increased spending in these areas showed a significantly increased probability of food insecurity among students. Limited income, increased cost of tuition and housing, increased reliance on credit cards and loans, ineligibility for federal food assistance programs, and developing financial and food management skills were other predictors of low food security for students attending college. (Alaimo, 2005; Gaines, et al., 2014).

Coping Strategies

Food coping strategies in themselves, measured by higher Coping Strategy Scale scores, were correlated with higher odds of reporting food insecurity according to Hagedorn and Olfert (2018). Non-food related coping strategies include attempts at generating income, living with a parent, budgeting, getting food assistance, borrowing money through loans or credit cards, and in extreme cases, stealing or pawning items to obtain food (Gaines et al., 2014; Hughes et al., 2011; Morris et al., 2016). Coping strategies involving modifications to eating patterns include compromising nutritional quality or quantity of food by means of stretching food, buying cheap food in order to eat more, or purchasing food past its sell-by date (Alaimo, 2005; Bhattacharya, Currie, & Haider, 2004; Connel et al., 2000; Kendall, Olson, & Frongillo, 1996; McArthur et al., 2018). Although some studies suggest that using multiple forms of financial support

points to food insecurity, Gaines et al. (2014) noted that students receiving food assistance, either by federal government support or charitable outlets, was positively associated with food security; seeking food assistance has often been utilized as a coping strategy to relieve food insecurity (Alaimo, 2005; Chaparro et al., 2009; Gaines et al., 2014;).

Alaimo (2005) observed that households tend to follow a pattern of coping tactics based on how socially acceptable the strategy was for the family. For example, food pantries or other emergency food systems would often be kept as a last resort to procure food only under dire circumstances.

Consequences of Food insecurity

Consequences of food insecurity may vary slightly depending on the population affected, but academic performance, nutrition/health outcomes, and potential long-term societal outcomes are of particular concern for college students experiencing food insecurity. Research suggests that the effects of food insecurity are often of temporary consequence that households may fluctuate in and out of based on cash and resource flow within the home, and the same is likely true for college students.

Townsend et al. (2001) described a paradox between food insecurity and overweight/obesity that often coexists. In spite of reduced access to food for optimal functioning, women who rated themselves with mild to moderate food insecurity had higher body mass indexes (BMI) indicating overweight status. Conversely, voluntary restriction for weight maintenance in the food secure women or involuntary food restriction from insufficient food or resources from high food insecurity women both resulted in lower BMIs. A cyclical effect contributing to weight gain from temporary

food shortages is suggested as one explanation for this inconsistency. Townsend et al. (2001) explained that this cycle ensues when money or food stamps are plentiful at the beginning of a cycle and is followed by a period of food shortage or restriction until the next pay period, and so on. During times of high food availability, households or individuals may overeat highly palatable, energy-dense foods or binge eat followed by subsequent food coping strategies during times of low food availability (Townsend et al., 2001).

Rising rates of obesity and the poverty paradox may also be explained by the increased availability of energy-dense processed food, reduced consumption of fruits and vegetables, and increased sedentary lifestyles (Hossfeld & Rico Mendez, 2018). Entertainment supporting inactivity (e.g. screen viewing) are often preferred or more easily accessible than those encouraging increased activity (e.g. joining a gym). The eating pattern associated with food insecurity described above often leads to certain nutrient deficiencies. This lends credence to the fact that inappropriate, not necessarily inadequate, caloric intakes are consumed during times of food insecurity (Bhattacharya et al., 2004; Bruening et al., 2016).

A longitudinal cohort study evaluated children in kindergarten and again in third grade. Significant weight gain was observed in girls whose families were food insecure in kindergarten, regardless of food security status in the third grade. Additionally, greater weight gain was observed in boys who remained in food insecure households through the third grade compared to those who transitioned from food insecurity in kindergarten to food secure status in the third grade. This study also found an association between food

insecurity and delays in social skill and reading skill development among children (Jyoti et al., 2005).

Several studies have drawn strong correlations between both higher grade point averages (GPA) and higher food security, as well as lower GPAs related to lower food security (Maroto et al, 2015; Morris et al., 2016; Patton-Lopez et al., 2014). Maroto et al. (2015) examined the relationship of food insecurity on GPA among students attending community college. Researchers of this study stated that “food security status was not significantly associated with GPA when all GPA categories were considered ($p=0.436$)” (Maroto et al., 2015); however, when comparing GPA categories, there was a significant relationship with food insecurity. Students with a GPA range of 3.5-4.0 were significantly less likely to be categorized as food insecure compared to those with GPAs between 2.0-2.49. The authors did denote, however, that the relationship between GPA and food insecurity did lose significance when students’ race and living situation were added to the regression model (Maroto et al., 2015). The results of another study showed that food insecure students were significantly less likely to report a GPA of 3.1 or higher (Patton-Lopez et al., 2014).

Research supports that students with housing instability, such as difficulty paying rent, are at significantly high risk for food insecurity (Payne-Sturges et al., 2018). Strong correlations between students living off campus and increased incidence of food insecurity in comparison to those living on campus was also observed on several occasions (Hagedorn & Olfert, 2018; Payne-Sturges et al., 2018). Mirabitor, Peterson, Rathz, Matlen, & Kasper (2016) reported that students living in housing with no food provision had significantly lower fruit and vegetable intake compared to those living in

places like fraternity or sorority houses where food was provided. With the extensive impacts on educational and health outcomes discussed through various works, it is important to further examine the prevalence of food insecurity among young adults attending college in southern regions of the U.S. that are especially prone to these effects and high poverty rates.

CHAPTER III

METHODOLOGY

Purpose of Study and Research Questions

The purpose of this study was to investigate food insecurity among students attending a public university in Mississippi. The research questions for this study were:

- (1) What is the prevalence of food insecurity in students attending a university in the southern region of the U.S.?
- (2) What determinants of food insecurity occur in the university students?
- (3) What are the nutrition/food intake outcomes for food secure vs. food insecure students?

Study Design, Participants, Questionnaire, and IRB Approval

This study used a cross-sectional design with an online survey sent via email with the subject heading of “MSU Announcement” (Appendix A). The survey was sent to all students enrolled at Mississippi State University’s main campus (n=20,429) on April 1, 2016. Students could choose to participate in the survey by clicking on the link in the email from any computer or mobile device with email access. Participants’ responses were anonymously recorded into the Qualtrics software program (Qualtrics, Provo, UT). The survey took approximately 20 minutes to complete. Students were asked to complete the entire survey but were not required and could stop at any time. Entrance into a drawing for a \$50 Amazon gift card was offered as an incentive to participate in the

study. After students finished the survey, they could click on a second link in the email and enter their name and email address if they wanted to be included in the random drawing for the gift card. A computer generated random drawing was conducted at the end of the study in June 2016 and one student won the gift card. Prior to beginning the study, approval was obtained from the Mississippi State University Institutional Review Board as IRB# 16-044.

It should be noted that this study was part of a large multi-university project which investigated food insecurity at seven universities in the southeastern and Appalachian areas of the U.S. Each university could use their own data as desired but was required to send survey results to the principal investigator located at a university in the Appalachian area. One or two professors from each university participated in telephone conference meetings to assist in the design of the questionnaire.

Questionnaire Variables and Measuring Food Insecurity

The final questionnaire included 81 items. Demographics included self-reported height, weight, gender, age, race/ethnicity, academic year, current GPA, on- or off-campus living status, part-time or full-time student, employment status, receipt of financial aid, participation in a meal plan, personal monthly income (dollar amount), international student (yes/no), marital status, presence of dependent children living with the student, health insurance status, vehicle ownership, and use of public transportation. Other variables asked students to rate their current health status as excellent, good, fair, or poor, in addition to questions about their cooking skills.

The Guide to Measuring Household Food Security (Bickel et al., 2000) and the 10-item U.S. Adult Food Security Survey (AFSS) Module (ERS USDA, 2012) were used

as guidelines for measuring food security/insecurity. Questions were slightly modified to be more applicable to college students versus adults living in households with children. Food security was measured with items such as “In the last 12 months, I worried whether my food would run out before I got money to buy more”, “The food I bought just didn’t last, and I didn’t have money to get more” and “I couldn’t afford to eat balanced meals.” The response format for these items followed a likert-type scale such as “Never”, “Sometimes” or “Often.” Several dichotomous items (yes/no) asked questions such as “In the last 12 months, did you ever cut the size of your meals or skip meals because there wasn’t enough money for food?”, “In the last 12 months, were you ever hungry but didn’t eat because there wasn’t enough money for food?”, and “In the last 12 months, did you ever not eat for a whole day because there wasn’t enough money for food?” The first 10 items on the questionnaire (Appendix A) are referred to as the Adult Food Security Scale (Bickel et al., 2000), which were used to determine students’ food security status. Food insecurity was determined by the number of affirmative responses. According to Bickel et al. (2000), households reporting three or more conditions are considered food insecure. Very low food security is indicated in households with no children as the reporting of at least three conditions in addition to reporting they ate less than they felt they should, and they cut the size of meals or skipped meals and did so in three or more months (Bickel et al., 2000).

The questionnaire included eight items related to money expenditures that affected food purchasing behavior: spending money on alcohol, cigarettes, recreational drugs, tattoos, gasoline, car repairs, public transportation, or pet care instead of using money to buy food. The response format was “Never”, “Sometimes” or “Often”

(Appendix A). The questionnaire included 29 coping strategy items such as “Joined a church or other organizational group where free meals are provided”, “Obtained food from a food bank or food pantry”, “Used a credit card to buy food”, “Sold textbooks”, “Sold personal possessions”, and “Held one or more part-time or full-time jobs” with a response format of “Never”, “Sometimes” or “Often.” Four items asked about academic progress: class attendance, attention span in class, understanding concepts taught in class, overall progress in school including graduating on time. The questionnaire was pilot tested online with 41 students by a professor at a university in the southeastern region of the U.S. This resulted in modifying the wording on two coping strategies for clarity and sex was changed to gender with an option of “other” in addition to female and male.

Sample Size

Sample size was determined for the Mississippi State University study using an online calculator (<https://www.qualtrics.com/blog/calculating-sample-size/>) with an estimated population of 20,000, a confidence level of 95%, and margin of error of 5%. It was determined that a minimum of 377 completed surveys would be required for analysis.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 24, 2016, Armonk, NY). Descriptive statistics were determined for all demographic data and student characteristics. The status of food security was calculated using the USDA’s scoring method for the 10-item AFSS (Bickel et al., 2000; ERS USDA, 2012). Responses of “yes”, “often”, “sometimes”, “almost every month” and

“some months but not every month” were coded as affirmative. The sum of affirmative responses indicated food security status: 0 for high food security, 1-2 for marginal food security, 3-5 for low food security, and 6-10 for very low food security. Overall, scores of 0-2 indicate food security and scores of 3 or more indicate food insecurity (ERS USDA, 2012).

The eight money expenditure items and the 29 coping strategy items were coded as 1 for “never”, 2 for “sometimes” and 3 for “often”: scores ranged from 8-24 for the money expenditure scale and 29-87 for the coping strategy scale. The responses of items pertaining to academic progress, cooking skills, and health status were coded as 1 for “poor”, 2 for “fair”, 3 for “good” and 4 for “excellent.”

Cronbach alpha reliability scores were calculated for scales. Pearson correlation coefficients were determined between the AFSS, the money expenditure scale (MES), the coping strategy scale (CSS), GPA, BMI, cooking skills, and health status. Chi-square analysis was conducted to determine significance between demographic variables and other characteristics and food secure vs. food insecure students. Results of continuous variables are reported as means \pm standard deviations (SD). The level of significance was set at $p < 0.05$.

CHAPTER IV

RESULTS AND DISCUSSION

Characteristics of Participants

A total of 600 students responded to the survey. Two students reported an age of 17 and were omitted; additionally three students completed less than 75% of the survey and were excluded. The sample was representative of students enrolled at the time of study for white (73.6%), non-Hispanic black (15.5%), and other minority (9.8%) students; however, it was over representative of female students (68.6%) compared to male students (30.4%). The response rate for this study (2.9%) was much lower than the one mentioned by researchers conducting a similar study at a university in Alabama (87.4%) Gaines et al. (2014). Nonetheless, they produced comparable sample sizes (n=557 for Alabama; n=595 for current study) due to the larger pool of potential respondents for this study (n=20,429) compared to the one completed by Gaines et al. (2014). The remaining 595 participants were comprised of freshmen, sophomores, juniors, seniors, and graduate students. For this sample of 595 student respondents, 58.7% were food secure and 41.3% were food insecure in accordance with the USDA methodology for determining food security status (Bickel et al., 2000).

Summary statistics on demographic and lifestyle characteristics are presented in Table 4.1. The students sampled were predominantly full-time status (92.1%), single (89.7%), without dependent children (95.1%), domestic students (95.1%), with a mean

age of 22 yrs \pm 5.2 SD, BMI of 25.2 kg/m² \pm 6.2 SD, and GPA of 3.4 \pm 0.6 SD. A median monthly personal income of \$400 per month was reported. Most participants (73.8%) reported receiving some form of financial aid such as a scholarship, grant, private or federal loan. The sample was mostly comprised of non-Hispanic white (73.6%) and female (68.6%) students but was similarly representative of various student classifications and majors related to agriculture, food, or health versus all other majors. Only approximately one-third (31.4%) of the students reported living on campus. The majority reported having a car (88.1%), but nearly one-fourth (23.9%) reported using public transportation. Approximately half of the students (48.6%) reported having a job in addition to attending college. The majority of students (56.5%) responded that they participated in a campus meal plan. Only 12.9% of students reported never cooking for themselves or others and the majority (44.5%) reported sometimes cooking. Cooking skills (70.6%) and health status (85.9%) of students were predominantly good or excellent for both items.

Table 4.1 Characteristics of Participants (n = 595)^a

Characteristic	Mean \pm SD (range) or n (%)
Age (yrs) (n = 587)	22.2 \pm 5.2 (18 – 57)
Weight (kg) (n = 557)	71.8 \pm 17.6 (43.2 – 141.8)
Height (cm) (n = 566)	169.2 \pm 9.8 (139.7 – 200.7)
Body mass index (kg/m ²) (n = 557)	25.2 \pm 6.2 (15.1 – 49.7)
Grade point average (n = 560)	3.4 \pm 0.6 (1.0 – 4.0)
Personal income (\$) per month (n = 560)	400.00 ^b

Table 4.1 (continued)

Gender (n = 593)	
Female	408 (68.6)
Male	181 (30.4)
Other	4 (0.7)
Race/ethnicity	
African American, not of Hispanic origin	92 (15.5)
American Indian	3 (0.5)
Asian	27 (4.5)
Hispanic	8 (1.3)
White, not of Hispanic origin	438 (73.6)
Other	20 (3.4)
Student classification (n = 590)	
Freshman	122 (20.5)
Sophomore	116 (19.5)
Junior	126 (21.2)
Senior	101 (17.0)
Graduate	125 (21.0)
Major (n = 570)	
Related to agriculture, food, or health	262 (44.0)
Not related to agriculture, food, or health	308 (51.8)
Live on or off campus (n = 594)	
On campus	187 (31.4)
Off campus	407 (68.4)
Student status (n = 590)	
Full-time	548 (92.1)
Part-time	42 (7.1)
Employment status (n = 594)	
Unemployed	269 (45.2)
One or more part-time jobs	220 (37.0)
One full-time job	69 (11.6)
Other	36 (6.1)
Marital status (n = 589)	
Not married	534 (89.7)
Married	60 (10.1)
Do you have any dependent children living with you? (n = 592)	
Yes	26 (4.4)
No	566 (95.1)
Are you an international student? (n = 589)	
Yes	23 (3.9)
No	566 (95.1)

Table 4.1 (continued)

Use public transportation such as the bus (n = 589)	
Yes	142 (23.9)
No	447 (75.1)
Do you have a car? (n = 592)	
Yes	524 (88.1)
No	68 (11.4)
Do you currently receive income from some type of financial aid like a scholarship, grant, private or federal loan? (n = 593)	
Yes	439 (73.8)
No	154 (25.9)
Do you currently participate in an on-campus meal plan? (n = 591)	
Yes	255 (42.9)
No	336 (56.5)
How often do you cook for yourself or for others? (n = 593)	
Often	251 (42.2)
Sometimes	265 (44.5)
Never	77 (12.9)
How would you rate your cooking skills? (n = 591)	
Excellent	134 (22.5)
Good	286 (48.1)
Fair	139 (23.4)
Poor	32 (5.4)
How would you rate your current health? (n = 592)	
Excellent	176 (29.6)
Good	335 (56.3)
Fair	75 (12.6)
Poor	6 (1.0)
Do you currently have health insurance? (n = 593)	
Yes	542 (91.1)
No	51 (8.6)
Food security status for all participants ^c	
Food secure	349 (58.7)
Food insecure	246 (41.3)

^aNumber of participants is reported if not all participants responded to the item.

^bMedian is reported due to some extreme/unreasonable dollar amounts reported for income.

^cFood security/insecurity determined according to Bickel et al. (2000), McArthur et al. (2018), and USDA (2000).

Sample Characteristics by Food Security Status

Sample characteristics by food security status are presented in Table 4.2.

Investigation of socio-demographic variables with food security showed significant associations between food insecurity status and age ($p=0.005$), race ($p=<0.001$), GPA ($p=<0.001$), use of public transportation ($p=0.004$), receiving financial aid ($p=0.001$), and health status ($p=0.003$). Similar to observations in other studies, students of African American or other minority races (Maroto et al., 2015; Morris et al., 2016; Payne-Sturges et al., 2018) and students with lower GPAs (Maroto et al, 2015; Morris et al., 2016; Patton-Lopez et al., 2014) were the strongest correlates of food insecurity among this sample of students.

Younger age (18-24 yrs), use of public transportation or having no car, and students who reported fair or poor health status were also significantly more likely to be food insecure. Food insecurity was more common in female students than in males. The majority of food secure students denied using financial aid as a source of financial support. Those students who were either unemployed or had part-time employment were significantly more food insecure compared to the full time or other employment status. This aligns with other researchers' assertion that students who were employed reported food insecurity at almost twice the rate of those students not employed (Hughes et al., 2011; Patton-Lopez et al., 2014). No significant differences were observed among the participant characteristics in either food secure or insecure groups for BMI, student classification, major, status, living on or off campus, personal income or marital status.

Table 4.2 Characteristics of participants and food security and food insecurity

Characteristic (n)	Food secure n (%)	Food insecure n (%)	P value
Gender			.047*
Female (408)	229 (56.1)	179 (43.9)	
Male (181)	118 (65.2)	63 (34.8)	
Age (yrs)			.005**
18 – 24 (489)	275 (56.2)	214 (43.8)	
25+ (98)	70 (71.4)	28 (28.6)	
Race/ethnicity			<.001***
White (438)	280 (63.9)	158 (36.1)	
African American and other minorities (150)	63 (42.0)	87 (58.0)	
Body mass index ^a			.746
Underweight (71)	39 (54.9)	32 (45.1)	
Normal weight (234)	142 (60.7)	92 (39.3)	
Overweight (137)	77 (56.2)	60 (43.8)	
Obese (115)	69 (60.0)	46 (40.0)	
Grade point average			<.001***
Less than 2.74 (83)	34 (41.0)	49 (59.0)	
2.75 to 3.24 (126)	61 (48.4)	65 (51.6)	
3.25 to 4.0 (351)	233 (66.4)	118 (33.6)	
Student classification			.066
Freshman (122)	75 (61.5)	47 (38.5)	
Sophomore (116)	63 (54.3)	53 (45.7)	
Junior (126)	62 (49.2)	64 (50.8)	
Senior (101)	64 (63.4)	37 (36.6)	
Graduate (125)	81 (64.8)	44 (35.2)	
Major			.548
Related to agriculture, food, or health (262)	150 (57.3)	112 (42.7)	
Not related to agriculture, food, or health (308)	184 (59.7)	124 (40.3)	
Live on or off campus			.524
On campus (187)	106 (56.7)	81 (43.3)	
Off campus (407)	242 (59.5)	165 (40.5)	
Student status			.283
Full-time (548)	319 (58.2)	229 (41.8)	
Part-time (42)	28 (66.7)	14 (33.3)	
Employment status			.044*
Unemployed (269)	161 (59.9)	108 (40.1)	
One or more part-time jobs (220)	115 (52.3)	105 (47.7)	
One full-time job (69)	47 (68.1)	22 (31.9)	
Other (36)	25 (69.4)	11 (30.6)	

Table 4.2 (continued)

Personal income (\$) per month			.123
Less than 100 (159)	100 (62.9)	59 (37.1)	
100 to 499 (113)	57 (50.4)	56 (49.6)	
500 and more (215)	124 (57.7)	91 (42.3)	
Marital status			.106
Not married (534)	307 (57.5)	227 (42.5)	
Married (60)	41 (68.3)	19 (31.7)	
Use public transportation			.004**
Yes (142)	68 (47.9)	74 (52.1)	
No (447)	275 (61.5)	172 (38.5)	
Have a car			.043*
Yes (524)	314 (59.9)	210 (40.1)	
No (68)	32 (47.1)	36 (52.9)	
Receive financial aid			.001**
Yes (439)	240 (54.7)	199 (45.3)	
No (154)	107 (69.5)	47 (30.5)	
Rate current health			.003**
Excellent or good (511)	311 (60.9)	200 (39.1)	
Fair or poor (81)	35 (43.2)	46 (56.8)	

^aBody mass index (kg/m^2) categories defined as underweight (< 18.5), normal weight ($18.5 - 24.9$), overweight ($25.0 - 29.9$), obese (≥ 30).

Significance (P value): * $<.05$, ** $<.01$, *** $<.001$ as determined by chi-square analysis.

Descriptive Statistics

Overall descriptive statistics and Cronbach alpha scores for each of the scales used within the questionnaire to evaluate food security status, money expenditure habits, and coping mechanisms used by all participants are presented in Table 4.3. Cronbach alpha scores for the adult food security scale, money expenditure scale, and coping strategy scale were .732, .776, .878, respectively. Scores of .70 and above indicate acceptable measures of internal consistency, the items in the scale are related, and the items are measuring the same concept (Tavakol & Dennick, 2011).

The AFSS yielded a mean score of 2.8 ± 2.4 . This shows that two to three affirmative answers for food insecurity were selected by students on average, indicating marginal to low food security status for most participants. The 8-item money expenditure scale had a minimum response score of 6 and maximum response of 21 affirmative answers. A lower mean score of 8 (out of a possible 24) indicated that little extraneous money was spent that would have negatively affected food purchasing behavior. Many coping strategies are utilized sometimes or often by students as evidenced by the higher mean score of 75.1 in the 29-item coping strategy scale.

Table 4.3 Summary of the adult food security scale, money expenditure scale, and coping strategy scale for all participants (n = 595)

Item	Cronbach alpha score	Minimum	Maximum	Mean \pm SD
Adult Food Security Scale (Questions 1-10)	.732	0.0	9.0	2.8 ± 2.4
Money Expenditure Scale (Questions 12-19)	.776	6.0	21.0	8.1 ± 1.8
Coping Strategy Scale (Questions 21-49)	.878	35.0	87.0	75.1 ± 8.2

Coping Strategies Employed

Coping strategies used by food insecure participants are summarized in Table 4.4 according to three scales: food intake/access, money saving, and selling scales.

Purchasing cheap processed foods was the main coping strategy, which was used by

50.4% of food insecure students, followed by eating less healthy meals so more food could be eaten (29.7%), overeating when food was plentiful (23.6%), or taking food home from on-campus dining hall (21.1%). About one-third of participants reportedly engaged in money-saving ventures to cope with food insecurity, which included menu planning (37.8%), stretching food (35.0%), or employment (33.7%). Attending on-campus or community functions where free food was served was reported by 26.8% of respondents, seeking family support for food (26.4%), sharing groceries (25.6%) or rent (23.6%) with other people, borrowing money from family or friends (23.6%), and conserving utility costs was reported by 23.2% of the participants. Selling of personal possessions ranked highest on the selling scale for coping mechanisms. Only 13 participants (5.3%) reported participation in a federal or state food assistance program, such as SNAP or the WIC program.

McArthur et al. (2018) also reported coping strategies used by food insecure university students using the food intake/access, money saving, and selling scales. They reported a similar food intake/access scale median of 9 with most students (57.4%) purchasing cheap, processed food, eating less healthy meals to eat more food (35.4%), and eating more than needed when food was plentiful (24.9%). McArthur et al. (2018) reported a lower money saving scale median of 14 compared to the present study, which had a money saving scale median of 14 (Table 4.3). A median value of 4 was reported in both the present study and in the McArthur et al. (2018) study for the selling scale with similar results of selling personal possessions and textbooks as the main selling coping strategies.

Table 4.4 Summary of food insecure participants' use of coping strategies (n = 246)

Coping strategy item	Median (range) ^a or n (%) ^b
Food intake/access scale (median and range for the 6 following items, possible range 6 to 18)	10 (6 – 16)
Purchased cheap processed food	124 (50.4)
Ate less healthy meals so you could eat more food	73 (29.7)
Ate more than normal when food was plentiful	58 (23.6)
Taken food home from on-campus dining hall	52 (21.1)
Obtained food from a dumpster or trash	3 (1.2)
Bartered (traded) services or items to get food	3 (1.2)
Money saving scale (median and range for the 19 following items, possible range 19 (if participants responded to all items) to 57)	30 (18 – 55)
Planned menus before buying food	93 (37.8)
Stretched food to make it last longer	86 (35.0)
Held one or more part-time or full-time jobs	83 (33.7)
Attended on-campus or community functions where there was free food	66 (26.8)
Visited family on weekend in order to bring back food to school	65 (26.4)
Shared groceries and/or meals with roommates	63 (25.6)
Borrowed money from family or friends	58 (23.6)
Shared the rent with other people	58 (23.6)
Used less utilities (e.g., electricity, water)	57 (23.2)
Cut out food coupons	49 (19.9)
Used a credit card to buy food	45 (18.3)
Saved a supply of food in case of emergency	30 (12.2)
Joined a church or other organization group where free meals are Provided	14 (5.7)
Participated in a federal or state food assistance program (e.g., SNAP, WIC, etc.)	13 (5.3)
Saved money on medications or medical appointments to buy food	9 (3.7)
Eaten meals at places where you can “pay what you can” (e.g., FARM Café)	8 (3.3)
Participated in a research study/clinical trial to buy food	6 (2.4)
Taken fewer classes to save tuition money	5 (2.9)
Obtained food from a food bank or food pantry	2 (0.8)

Table 4.4 (continued)

Selling scale (median and range for the 4 following items, possible range 4 (if participants responded to all items) to 12)	4 (3 – 10)
Sold personal possessions	11 (4.5)
Sold textbooks	8 (3.3)
Sold your blood/plasma to buy food	5 (2.0)
Sold your sperm/eggs to buy food	1 (0.4)

^aMedian of the sum of the items' responses (1 = never, 2 = sometimes, or 3 = often multiplied by the number of items in that scale).

^bNumber and percentage of participants reporting they used this coping strategy often (response format choices: never, sometimes, or often).

Correlations between Characteristics Assessed

Relationships between AFSS, MES, CSS, GPA, BMI, cooking skills, and health status for the food secure and food insecure groups are presented in Tables 4.5 and 4.6, respectively. Several correlations were found across both groups. Higher AFSS scores, indicating increased food insecurity, were correlated with higher MES scores in both groups but showed a slightly stronger correlation was seen in food insecure participants ($p < 0.01$). Students prone to spending money on things such as alcohol, cigarettes, gas, pet care, or car repairs instead of purchasing food, represented by higher MES scores, had a significantly lower incidence of employing food coping strategies; whereas, food secure students may have been more frugal, avoiding such expenditures, or had adequate funds available to support both food procurement and discretionary spending habits.

For both groups, those who employed more food coping strategies had significantly lower MES scores ($p < 0.01$), and lower self reported health scores ($p < 0.01$). Higher GPA was associated with a lower BMI for both groups but a stronger relationship was seen among food secure participants ($p < 0.01$) than food insecure participants ($p < 0.05$). The same inverse relationship was seen between BMI and cooking skills

between both groups ($p < 0.05$) where a lower BMI was correlated with higher perceived cooking skills in both groups; however, a positive association between BMI and health scores was also observed ($p < 0.05$). This indicated that students with a higher BMI tended to report their health status as good or excellent.

More money expenditures on non-food items, designated by higher MES scores, were associated with lower GPA but higher self-reported health scores in the food secure group. One could conjecture that the more money contributed towards the use of certain recreational type expenditures like drugs or alcohol could be associated with poor academic outcomes such as lower class attendance or grades.

Food security was inversely related to CSS for the food insecure group ($p < 0.01$). For this study, this indicates that higher food security status meant more coping strategies were employed by students in this group; though not statistically significant, a negative correlation was seen between FSS and CSS among the food secure group as well. It is important to note that this finding is counter to other studies alleging that increased coping strategy scores correlated with increased AFSS scores or higher food insecurity (Hagedorn & Olfert, 2018; McArthur et al., 2018). Considering Alaimo's (2005) conceptual model for food insecurity, coping strategies serve as an adaptation mechanism in response to food insecurity and in an attempt to restore food security. With this in mind, increased coping strategies potentially indicate or help to mitigate food insecurity (Tables 4.5 and 4.6).

The food insecure group showed a significant inverse relationship between CSS with AFSS ($p < 0.01$) and BMI ($p < 0.01$). AFSS scores, indicating food insecurity, and GPA was also inversely related in the food insecure group ($p < 0.05$). Higher cooking skill

ratings were linked to increased number of coping strategies implemented in food insecure participants ($p < 0.05$) (Tables 4.5 and 4.6).

Table 4.5 Correlation matrix with Pearson correlation (r) values for food secure participants

Item	Food security scale	Money expenditure scale	Coping strategy scale	GPA	BMI	Cooking skills
Money expenditure scale	.112*					
Coping strategy scale	-.072	-.310**				
GPA	-.094	-.227**	.101			
BMI	.038	.060	-.099	-.176**		
Cooking skills	.034	-.045	.049	-.016	-.110*	
Health status	.016	.163**	-.164**	-.167**	.139*	-.037

Significance: * $<.05$, ** $<.01$, *** $<.001$

Table 4.6 Correlation matrix with Pearson correlation (*r*) values for food insecure participants

Item	Food security scale	Money expenditure scale	Coping strategy scale	GPA	BMI	Cooking skills
Money expenditure scale	.325**					
Coping strategy scale	-.321**	-.284**				
GPA	-.159*	-.126	.103			
BMI	.009	.022	-.192**	-.151*		
Cooking skills	-.079	-.090	.158*	.058	-.150*	
Health status	.076	.105	-.183**	-.095	.186*	.048

Significance: * $<.05$, ** $<.01$, *** $<.001$

Food Intake Results

A comparison between usual intake and desired intake of various food groups among participants is summarized in Table 4.7. Food secure students consumed significantly more vegetable/juices ($p=<0.001$), fruit/juices ($p=0.005$), and other protein foods ($p=0.038$) than the food insecure students. Consistent with these findings, the food insecure students reported having a significantly greater desire to consume more food from all food groups except for sweets; specifically, an increased desire to consume more vegetable/juices, fruit/juices, meat/fish/poultry, and dairy ($p=<0.001$).

Both groups reported that most foods currently eaten come from meat/fish/poultry and grains/cereals. The groups begin to diverge in terms of usual food intake at this point. The food secure group consumed vegetables/juices, fruit/juices, dairy foods, and sweets listed in descending order according to self-reported consumption. The food insecure

group, however, indicated eating more dairy foods and fruit/juices instead of vegetables/juices and sweets. What is interesting to note is that, though not statistically significant, 44.3% of the food insecure group identified sweets as a food group where most of their foods come from as opposed to 36.4% of the food secure group ($p=0.052$).

The food secure group prioritized animal protein, vegetables, and fruit over other food groups in terms of consumption, and yet, indicated a desire to consume more of these same foods if available, vegetables and fruits ranking highest priority. This may suggest that, in spite of prioritizing produce in their current diets, they are still lacking adequate vegetable and fruit intake compared to the recommended number of fruit and vegetable servings on average. Another potential explanation is that this group is mostly satisfied with their current diet and not interested in reprioritizing their food intake substantially, even if increased access to these foods was available.

The food groups consumed in the food insecure group agrees with previous research suggesting that a higher percentage of energy intake from carbohydrate or cheap, energy-dense foods contributes to weight gain. Decreased consumption of fruits and vegetables correlated with lower food security. This eating pattern also leads to difficulty meeting the recommended intakes for potassium, vitamin A, vitamin C, folate, and fiber (Bhattacharya et al., 2004; Connell, Yadrick, Hinton, & Su, 2000; Kendall et al., 1996).

Table 4.7 Food group results between food secure and insecure participants

Food group	Food secure n (%) ^a	Food insecure n (%) ^b	P value
Identify the food groups where most of the foods come from that you currently eat:			
Vegetables/juices	248 (71.1)	124 (50.4)	<.001***
Fruits/juices	226 (64.8)	131 (53.3)	.005**
Grains/cereals	272 (77.9)	186 (75.6)	.507
Meat/fish/poultry	282 (80.8)	191 (77.6)	.347
Other protein foods	189 (54.2)	112 (45.5)	.038*
Dairy foods	199 (57.0)	134 (54.5)	.537
Sweets	127 (36.4)	109 (44.3)	.052
Identify the food groups that you would eat more of if you had access to these foods or access to resources to allow you to eat more of these foods:			
Vegetables/juices	200 (57.3)	187 (76.0)	<.001***
Fruits/juices	193 (55.3)	177 (72.0)	<.001***
Grains/cereals	85 (24.4)	86 (35.0)	.005**
Meat/fish/poultry	169 (48.4)	157 (63.8)	<.001***
Other protein foods	111 (31.8)	109 (44.3)	.002**
Dairy foods	98 (28.1)	105 (42.7)	<.001***
Sweets	41 (11.7)	36 (14.6)	.302

^aPercentages calculated using total number of food secure participants (n = 349).

^bPercentages calculated using total number of food insecure participants (n = 246).

Significance (P value): *<.05, **<.01, ***<.001 as determined by chi-square analysis.

When students were asked what would currently help them improve their food situation, 36.5% responded with “part-time/full-time job(s).” Other responses included learning how to eat healthy (27.4%), learning how to make a budget (27.1%), learning to cook (22.0%), having more financial aid at school (20.8%), and learning how to shop for food (17.5%). Ninety-four students (15.8%) responded with “garden on/near campus” but only 36 students (6.1%) indicated that having a food pantry on/near campus would improve their food situation. Options that students could choose from are listed in the

questionnaire (Question 78) in Appendix A. The participants were able to write in other items that would help them and 51 responded (8.6%), which included multiple responses of more time to cook, more time to shop and prepare food, and having a kitchen. Quotes from students included: “more block meals on meal plan”, “have the on campus meal places have better and more efficient hours”, “more food options on campus”, “a place to cook”, “actual food available on campus for a reasonable price”, “decent minimum wage”, and “more on campus dining options on weekends.”

Participants were asked how they felt about their current food situation and 275 students (46.2%) replied they were satisfied. However, 9.9% (n=59) indicated they were frustrated, 6.7% (n=40) responded they were worried, 6.2% (n=37) responded as “embarrassed”, 5.9% (n=35) felt insecure, and 3.7% (n=22) felt helpless. Mukigi et al. (2018) conducted an exploratory study about food insecurity among college students and reported students felt embarrassed about asking for help. This was a barrier that may have contributed to low utilization of available campus resources. They noted that there is a need for campuses to “create awareness on food insecurity with the aim of de-stigmatizing food insecurity” (Mukigi et al., 2018).

Overall, this study observed a high prevalence of food insecurity in students. A University of California study found prevalence of food insecurity to be 42% among students surveyed, which was similar to the present study’s 41.3%. The qualitative study examined themes surrounding food insecurity from students’ perspective. Focus groups identified the campus and food environment, life skills in college, and skepticism regarding the university’s commitment to meeting the basic needs of students as

overarching themes and opportunities for addressing low food security that students are faced with (Watson et al., 2017).

Limitations

The cross-sectional design of the present study limits conclusions of causation between food insecurity and variables that contribute to food insecurity. The larger sample size helps to strengthen the data including characteristics associated with food insecurity in this population; however, student volunteers offering self-reported data also limits reliability of study findings to some degree. It is felt that the food security screening instrument used to measure food insecurity among college students is valid (USDA, 2018). Nonetheless, the underlying etiology of food insecurity and specific barriers potentially limiting resolution of this issue are still inconclusive. Additional qualitative studies may provide greater insight into the causes themselves, especially with regard to food selection, eating patterns, and engagement in food assistance programs. Inconsistencies with the response format and listing of items within scales on the questionnaire required some data to be reverse coded for analysis and represent an additional limitation to this study.

CHAPTER V

CONCLUSION

This study determined that of the 595 students surveyed, 246 students (41.3%) were food insecure. This high prevalence of food insecurity from a Mississippi university is consistent with other studies indicating a discrepancy between college students and household food insecurity based on national estimates. The rate of food insecurity was twice as high as the most recent national estimate of household food insecurity for Mississippi (18.7%) (Coleman-Jensen et al., 2017), and higher than most other colleges where food insecurity among their students was measured (Bruening et al., 2016; Chaparro et al., 2009; Davidson & Morrell 2018; Maroto et al., 2015; Morris et al., 2016; Patton-Lopez et al., 2014). Several variables were associated with food insecurity including students who were African American or other minority, had lower GPAs, used public transportation, did not own a car, reported fair or poor perceived health status, had higher money expenditure scores, or lower coping strategy scores.

The research findings indicated that diets may be lacking in macro- and/or micronutrient quality to sustain optimal health (Bruening et al., 2016; Bhattacharya et al., 2004; Connel et al., 2000; Kendall et al., 1996; McArthur et al., 2018). This is evidenced by the food insecure group reportedly consuming mostly meat/fish/poultry, grains/cereal, and dairy food groups. They also consumed significantly fewer vegetables and fruits, but both groups expressed a desire for greater access to these foods. Purchasing cheap,

processed food, skipping meals, and eating less healthy meals so more food could be eaten were some of the most common coping strategies employed that may also contribute to nutritional inadequacies in this group. These results reinforce McArthur et al.'s (2018) conclusion that habitually poor diets and food coping strategies typically associated with food insecurity “suggest(s) a dietary profile featuring foods high in fats and simple carbohydrates and low in protein, micronutrients, and fiber that could compromise their nutrient reserves.”

This study further strengthens previous findings of an inverse correlation between academic performance and food insecurity (Maroto et al, 2015; Morris et al., 2016; Mukigi et al., 2018; Patton-Lopez et al., 2014). Lower GPA was significantly associated with food insecurity and higher GPA was associated with food security among the sampled students.

Extrapolating larger potential individual and societal consequences resulting from food insecurity manifestation among students attending college is not a stretch. For example, weight gain and unhealthy eating patterns influenced by food insecurity may further contribute to the rising obesity, nutrition-related chronic disease, and resultant healthcare cost epidemic within the United States (NCCDPHP, 2017). Food insecurity that translates into poor academic achievement may result in delayed or unattained tertiary education; thus potentially impacting the socioeconomic potential of individuals, especially first generation college students or those coming from lower socioeconomic circumstances whose trajectory would not be for educational advancement otherwise.

Additional research would help close the gap identifying underlying causes and effective interventions targeting those with known risk factors contributing to food

insecurity in this population. Investigating differences among student classification or between in-state versus out-of-state students may help determine barriers to food security and opportunities for tailoring interventions to the students' needs. Nonetheless, enough information is already known to begin addressing food security problems facing students: limited access to food or food resources, social or financial constraints, and knowledge deficits.

Policy changes that would garner more government food assistance encompassing this sect of the population should be considered. Hossfeld & Rico Mendez (2018) suggested that increased federal funding for agriculture that supports sustainable food crop farming in Mississippi may prove advantageous in ameliorating food deserts that may negatively impact access to and cost of produce in this region.

From an institutional level, amplifying existing programs or developing additional student support services that provide more cost-effective nutritional food opportunities need to be explored further. One opportunity for expansion on the current study is in assessing students' existing knowledge of institutional or community resources available and how many of those services are actively being utilized by students. The present study indicated very low participation rate in food pantries (n=2). What is not known is whether this is due to unawareness of this resource available or due to the perceived socially unacceptable nature of this food acquisition means. Some students expressed a desire for more awareness and outreach of free resources available for struggling students according to Watson et al. (2017). Mukigi et al. (2018) suggests use of on campus community gardens and food pantries, and "the universities can also negotiate with the

private companies running cafeterias on campus to offer subsidized nutritious meals and to establish food recovery programs with the aim of assisting needy students.”

One qualitative study pointed out that students often “normalized the struggle to eat as part of the college experience” (Watson et al., 2017) and other students may come from a background of food insecurity. Some students may demonstrate apathy in learning or applying additional coping mechanisms to combat food insecurity, as it is just accepted as the conventional way of life for them. On the other hand, barriers to behavior may involve the stigma surrounding feelings of embarrassment that often accompany food insecurity (Mukigi et al., 2018). Strategies targeting these issues should include relating to students by making them aware of the high prevalence of food insecurity among college students. Disseminating this information to students could utilize personal institutional accounts or commercial publicity efforts with student reported testimonials. A support group that helps to generate discussion, promotes awareness, and provides tangible support for food insecure student may also prove beneficial. Receiving literature via mail, electronically, or in public viewing areas should also be considered in marketing strategies to respect the anonymity for those whom are not prepared to openly discuss this issue.

Additionally, aims at decreasing the nutrition-related knowledge deficits associated with applying sound nutritious eating patterns on limited resources should be emphasized. Mukigi et al. (2018) identified two motivators making food selections for college students when grocery shopping: 1) Cost and 2) Satiety. Because meal planning was identified as one of the main coping strategies used and an interest in learning how to eat healthy, make a budget, cook, and shop for food was identified among this sample of

students, educational programs teaching these skills could prove to be an effective strategy. A user-friendly grocery shopping guide could be developed to assist students in making cost-effective selections that would also translate into more satiable meals/snacks. The handout could include suggestions for tailoring frequently consumed foods (i.e. Ramen noodles, eggs, oatmeal) and adding or modifying them in ways to make them more calorically- and/or nutrient-dense. This and other resources outlying community-wide food programs/services could be sent to students via email, around campus in high-traffic areas, or student dining areas.

One study proposes the concept of a mobile market involving local growers to provide access to healthy, affordable food in communities warranting such a need (Hossfeld & Rico Mendez, 2018). Cooperative programs involving local food systems like on-campus farmer's market could prove to be a sustainable solution that proves beneficial for all parties involved. Building communities to help address societal level issues is another area for potential. Partnering with churches offering college meals or food pantries as part of their ministry may help to alleviate stresses associated with food insecurity among college students.

This study adds to the growing knowledge of literature evaluating prevalence and risk factors associated with food insecurity among the college student demographic. It also sheds light on how students are allocating their time, money, and resources on dietary and lifestyle factors that could potentially change the course of their academic and health outcomes.

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APPENDIX A

PARTICIPANT RECRUITMENT EMAIL AND RESEARCH QUESTIONNAIRE

Recruitment Email

Hello!

You are invited to take part in a research study about your usual access to food. Your participation would be very valuable to us since the answer you provide will help us design activities about how to enhance student access to nutritious food. This questionnaire is about food security in college students, having enough resources to eat an adequate diet, and it also asks about which types of food you usually eat. We do not anticipate that you will experience any inconvenience from completing this questionnaire other than the time it takes to answer the questions. It will take about 10 to 15 minutes of your time to complete this self-administered questionnaire. There is the chance to win a \$50 Amazon gift card for participating.

Your participation in this study is strictly voluntary and you are free to stop answering questions at any time. We assure you that the answers you give will not be connected to your email address and that only group answers, not individual answers, will be reported in the article that we write about this research.

You must be at least 18 years old to participate. This research study has been approved by the Institutional Review Board (IRB) at Mississippi State University. Thank you for considering this invitation. If you have any questions about this study, please contact Dr. Diane Tidwell in the Department of Food Science, Nutrition, and Health Promotion.

Phone: (662) 325-0239. Email: d.tidwell@msstate.edu. Thank you.

By clicking on the link below you have consented to participate.

Research Questionnaire

Questionnaire

Part One

Select the answer choice that BEST applies to you. All questions concern your access to food within the past 12 months.

1. Which statement best describes the food available to you in the past 12 months?

Check your answer.

- A. Enough of the kinds of food I want to eat
- B. Enough, but not always the kinds of food I want to eat
- C. Sometimes not enough to eat
- D. Often not enough to eat

For questions 2 through 5 please select the answer choice that BEST applies to you.

2. In the last 12 months, I worried whether my food would run out before I got money to buy more.

Often Sometimes Never

3. The food I bought just didn't last, and I didn't have money to get more.

Often Sometimes Never

4. I couldn't afford to eat balanced meals.

Often Sometimes Never

5. In the last 12 months, did you ever cut the size of your meals or skip meals because there wasn't enough money for food?

Yes No

If you answered "Yes" to question 5, please complete question 6. Otherwise, skip to question 7.

6. How often did this happen? Please choose the answer choice that BEST applies to you.

- A. Almost every month
- B. Some months, but not every month
- C. In only one or two months

7. In the last 12 months, did you ever eat less than you thought you should because there wasn't enough money for food?

Yes No

8. In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?

Yes No

9. In the last 12 months, did you lose weight because there wasn't enough money for food?

Yes No

10. In the last 12 months, did you ever not eat for a whole day because there wasn't enough money for food?

Yes No

If you answered "Yes" to question 10, please complete question 11. Otherwise, skip to question 12.

11. 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

12. During the past 12 months, about how often did you spent money on the following instead of using the money to buy food?

Purchased alcohol instead of using money to buy food

Often Sometimes Never

13. Purchased cigarettes instead of using money to buy food

Often Sometimes Never

14. Purchased recreational drugs instead of using money to buy food

Often Sometimes Never

15. Spent money on car repairs instead of using money to buy food.

Often Sometimes Never

16. Spent money on gasoline instead of using money to buy food.

Often Sometimes Never

17. Spent money on public transportation to school/work instead of using money to buy food.

Often Sometimes Never

18. Spent money on pet care instead of using money to buy food.

Often Sometimes Never

19. Spent money on tattoos instead of using money to buy food.
Often Sometimes Never

20. Did you spend money on anything else instead of using money to buy food? Please indicate: _____

Part Two

Below is a list of strategies that some people use to get food when their own food is low or when they have run out of food. Please select how often you have used any of these strategies in the past 12 months to get food.

21. Sold textbooks
Often Sometimes Never

22. Sold personal possessions
Often Sometimes Never

23. Taken fewer classes to save tuition money
Often Sometimes Never

24. Used less utilities (e.g. electricity, water)
Often Sometimes Never

25. Shared the rent with other people
Often Sometimes Never

26. Held one or more part-time or full-time jobs
Often Sometimes Never

27. Used a credit card to buy food
Often Sometimes Never

28. Planned menus before buying food
Often Sometimes Never

29. Cut out food coupons
Often Sometimes Never

30. Sold your blood/plasma to buy food
Often Sometimes Never

31. Sold your sperm/eggs to buy food
Often Sometimes Never

32. Participated in a research study/clinical trial to buy food
Often Sometimes Never
33. Borrowed money from family or friends
Often Sometimes Never
34. Attended on-campus or community functions where there was free food
Often Sometimes Never
35. Obtained food from a food bank or food pantry
Often Sometimes Never
36. Bartered (traded) services or items to get food
Often Sometimes Never
37. Participated in a federal or state food assistance program (e.g. SNAP, WIC, etc.)
Often Sometimes Never
38. Taken food home from on-campus dining hall
Often Sometimes Never
39. Saved money on medications or medical appointments to buy food
Often Sometimes Never
40. Stretched food to make it last longer
Often Sometimes Never
41. Shared groceries and/or meals with roommates
Often Sometimes Never
42. Obtained food from a dumpster or trash
Often Sometimes Never
43. Saved a supply of food in case of emergency
Often Sometimes Never
44. Ate more than normal when food was plentiful
Often Sometimes Never
45. Eaten meals at places where you can “pay what you can” (e.g. FARM Café)
Often Sometimes Never
46. Joined a church or other organizational group where free meals are provided
Often Sometimes Never

47. Ate less healthy meals so you could eat more food

Often Sometimes Never

48. Purchased cheap, processed food (e.g. ramen noodles, frozen pizza, candy, etc.)

Often Sometimes Never

49. Visited family on the weekend in order to bring back food to school

Often Sometimes Never

Part Three

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

50. Your gender is: Male Female Other

51. How old are you? _____years

52. Which term best describes your marital status?

A. Not married

B. Married

53. A. Do you have any dependent children living with you? Yes No

If you answered "Yes", please complete the rest of this question. Otherwise, skip to question 53.

B. How many children currently live with you? _____

54. A. About how much do you currently weigh? _____ pounds

B. About how tall are you? _____ feet _____ inches

55. What year are you in school?

Freshman Sophomore Junior Senior

Graduate Student Other: please indicate _____

56. A. Are you an international student? Yes No

If you answered "Yes", please complete the rest of this question. Otherwise, skip to question 56.

B. How long have you been in the United States? _____

57. Are you a:

A. Part-time student

B. Full-time student

58. What is your major? _____

59. How would you rate your overall progress in school including graduating on time?

Excellent Good Fair Poor

60. How would you rate your class attendance?

Excellent Good Fair Poor

61. How would you rate your attention span in class?

Excellent Good Fair Poor

62. How would you rate your understanding of concepts taught in class?

Excellent Good Fair Poor

63. What is your current grade point average (GPA)? _____

64. What is your race/ethnic background? Select all that apply.

A. African-American, not of Hispanic origin

B. American Indian

C. Asian

D. Hispanic

E. White, not of Hispanic origin

F. Other: please indicate _____

65. Which term best describes your employment status?

A. Unemployed

B. One or more part-time jobs

C. One full-time job

D. Other: please indicate _____

66. Do you live:

A. On-campus

B. Off-campus

67. Do you have a car?

Yes No

68. Do you take public transportation such as the bus?

Yes No

69. Do you currently receive income from some type of financial aid like a scholarship, grant, private or federal loan?

Yes No

70. What is your personal (not family) average monthly income? \$ _____

71. How would you rate your current health?

Excellent Good Fair Poor

72. Do you currently participate in an on-campus meal plan?

Yes No

73. Do you currently have health insurance?

Yes No

74. How often do you cook for yourself or for others?

Often Sometimes Never

75. How would you rate your cooking skills?

Excellent Good Fair Poor

76. A. Please identify the food group(s) where most of the foods come from that you *currently eat*. Select your choice(s).

- Grains/cereals (e.g. breakfast cereals, breads, crackers, noodles, other pastas, rice, sweet pastries/cookies/cake, etc.)
- Vegetables/juices (e.g. potatoes, carrot, green leafy vegetables, corn, broccoli, etc.)
- Fruits/juices (e.g. apples, oranges, tomatoes, peaches, grapes, etc.)
- Meat/fish/poultry (e.g. beef, pork, chicken, fish, shellfish, etc.)
- Other protein foods (e.g. 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.)

B. Please identify the food group(s) that you would eat more foods from if you had access to these foods or access to the resources that would allow you to eat more of

these foods. Select your choice(s).

- Grains/cereals (e.g. breakfast cereals, breads, crackers, noodles, other pastas, rice, sweet pastries/cookies/cake, etc.)
- Vegetables/juices (e.g. potatoes, carrot, green leafy vegetables, corn, broccoli, etc.)
- Fruits/juices (e.g. apples, oranges, tomatoes, peaches, grapes, etc.)
- Meat/fish/poultry (e.g. beef, pork, chicken, fish, shellfish, etc.)
- Other protein foods (e.g. 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.)

77. As a student, generally how do you feel about your current food situation? Select all that apply.

Satisfied	Secure	Pleased	Fine/OK
Embarrassed	Ashamed	Guilty	Humiliated
Anxious	Worried	Insecure	Helpless
Angry	Resentful	Sad	Frustrated

Other: please indicate _____

78. What would currently help you improve your food situation? Select all that apply.

Part-time/full-time job(s)
Better transportation to the store
Learn to grow food
Get a roommate
Financial help from others (e.g. parents or friends)
More financial aid at school
Learn how to shop for food
Learn how to eat healthy
Learn how to make a budget
Food pantry on/near campus
Garden on/near campus
Sign up for school meal plan
Learn to cook
Other: please indicate _____

79. Can you count on anyone to provide you with support in accessing food such as driving you to the store or helping you prepare meals?

Yes No Don't need help

80. In the last 12 months, who was *most helpful* in providing you with access to food?
Select one choice only.

Spouse	Sister/Brother	Parent
Friend	Other relative	Neighbors
Coworkers	Church members	Club members
Professionals	Don't know	Other, please indicate: _____

81. A. In the last 12 months, could you have use more support with food than you received?

Yes No Don't know

If you answered "Yes" to question 73A, please complete the rest of this question.

B. How much support could you have used?

A lot more Some A little more