

The Effect of Food Insecurity on Fruit/Vegetable Consumption and Body Mass Among Low

Income and Minority Adults

by

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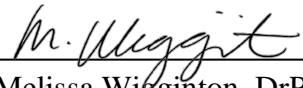
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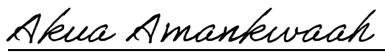
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Abstract

Food insecurity is a public health concern across the United States. It is rooted in poverty and can have long-lasting health consequences on communities (U.S. Agency for International Development, 2021). In 2020, California's food insecurity rate was 20%, demonstrating that one-fifth of the state's residents lack access to healthy, nutritious foods (California Association of Food Banks, 2020). This study aimed to examine the effect of food insecurity, specifically cutting, or skipping meals, on variables such as fruit/vegetable consumption and body mass index (BMI) in low income, minority adults, using the 2020 California Health Interview Survey (CHIS) data. The results showed a significant relationship between cutting or skipping meals and fruit consumption ($t(-2.81) = 2381, p = .005$). There was also a significant relationship between cutting or skipping meals and BMI ($t(3.525) = 2381, p < 0.001$). The findings from this study suggest health educators and community agencies should promote food assistance programs in minority communities. Furthermore, interventions need to be tailored to promote healthy eating to different cultures. Public health professionals must advocate for programs that support access to healthy food in underserved communities.

Keywords: Food insecurity, low income, racial/ethnic, adults, fruit/vegetable consumption, BMI

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Overview of the Literature

Defining Food Insecurity

Food security is a public health issue defined as households always having access to sufficient food to live a healthy, active life (U.S. Agency for International Development, 2021). A food-secure family does not live in hunger or fear hunger. On the other hand, food insecurity is defined as the absence of economic resources for food in households (Feeding America, 2021). Food insecurity may result in hunger (Healthy People 2020, 2022). Hunger signifies a physical, personal feeling of distress. In 2020, 89.5% of Americans were food secure (Coleman-Jensen, Rabbitt, Hales, & Gregory, 2021). Food insecurity occurs when households do not attain or face serious challenges to attaining adequate food on a regular basis. In 2020, the number of adults with low food insecurity was 9.4 million (Coleman-Jensen et al., 2021). Food insecurity is often a factor of poverty and has long-lasting effects on nations, communities, and families to progress and succeed. Prolonged malnutrition, which can often occur in food insecure households, increases susceptibility to diseases, decreases cognitive development, and delays growth (U.S. Agency for International Development, 2021). Food insecurity is a problem that needs to be addressed to ensure all individuals live a healthy life.

Food Insecurity in the United States

Food insecurity is seen throughout the United States. One study found that, in high food secure households, there were no reported signs of food-access issues (Coleman-Jensen et al., 2021). On the contrary, households with very low food security reported signs of disturbed eating patterns and reduced food intake because individuals could not afford food (Coleman-Jensen et al., 2021). One in 25 households throughout the nation experienced very low food security in 2020 (Food Research & Action Center, 2021). Thirty-eight million individuals

resided in food-insecure households that same year (Food Research & Action Center, 2021). The incidence of food insecurity differs and varies by state, but the highest prevalence is reported in the South followed by the country's Midwestern, Western, and Northeastern regions (Food Research & Action Center, 2021). Numerous Americans across the nation struggle with food insecurity, ultimately affecting their ability to access food.

How Food Insecurity Effects Adults in California

Food insecurity can affect a person's well-being; consequently, individuals must often make difficult decisions, such as paying rent or purchasing nutritious food (California Association of Food Banks, 2020). Although California grows half of the country's vegetables and fruits, one in five Californians, or about eight million, are food insecure (California Association of Food Banks, 2020). In California, several factors impact food insecurity and the ability to access nutritious food, such as the accessibility of healthy, locally sourced food in neighborhoods, the cost and location of purchase, and the ability to safely prepare and store food (Let's Get Healthy California, 2020). California's food insecurity rate is 20%, which is alarming since food is a necessity that individuals need to live a healthy life, and people have limited availability to healthful foods (California Association of Food Banks, 2020). To help fight food insecurity, California food banks distributed over one billion pounds of food in 2020 (California Association of Food Banks, 2020). Moreover, people facing hunger in California stated needing over two billion dollars more each year to sustain proper nutrition (Feeding America, 2022). In California, millions face the struggles of food insecurity, which is worrisome.

How Food Insecurity Impacts Low Income and Minority Adults

Income and racial/ethnic disparities greatly influence food security. In 2014, 40% of low income households struggled with food insecurity (Let's Get Healthy California, 2020).

Additionally, food security affects racial/ethnic groups differently, with research indicating Blacks and Latinos experience food insecurity at higher rates and are more food insecure compared to Whites (Myers & Painter, 2017). In 2016, Black households reported being two times more likely to be affected by food insecurity than their White counterparts, and the incidence of food insecurity among Hispanic families was 18.5% (Healthy People 2020, 2022).

Another factor that affects food insecurity is physical access to food (Healthy People 2020, 2022). Low income individuals lack food access, including restricted access to full-service grocery stores or supermarkets. Research showed that Hispanic and Black communities contain less full-service grocery stores than White and Non-Hispanic neighborhoods (Healthy People 2020, 2022). Areas that lack access to affordable and healthful food are called food deserts (Healthy People 2020, 2022). Small, privately owned convenience stores are more common in food deserts than full-service supermarkets. Convenience stores in food deserts frequently contain less selection, higher food prices, and low-quality food options (Healthy People 2020, 2022). For many low income and minority adults, food insecurity is a problem due to the lack of healthy food available to them in their respective neighborhoods.

The Impact of Food Insecurity of Fruit/Vegetable Consumption on Low Income and Minority Adults

Food insecurity affects a person's health in various ways. Individuals cope with low food security by consuming nutrient-poor but calorie-rich foods, which can result in health-related concerns ranging from malnourishment to obesity (Center for Disease Control and Prevention [CDC], 2020). Most Americans over age two do not consume the recommended two cups of fruits and three and a half cups of vegetables per day (Yeh et al., 2016). Therefore, individuals in the United States rarely meet the recommended daily five servings of fruits and vegetables (FVs)

(Yeh et al., 2016). Hoy et al. (2020) found that those with increased access to a variety of FVs to select from tended to consume FVs more significantly. Findings suggested that increasing access to FVs encourages consumption of healthier foods (Hoy et al., 2020).

Cost, taste, access, and food preparation time affect FV consumption in low income households, particularly in economically deprived neighborhoods (Mook et al., 2016). Additional factors may impact the dietary patterns of food insecure individuals, which results in low income households utilizing numerous mechanisms, such as restricting foods or consuming unhealthy foods, to manage their minimal resources (Mook et al., 2016). Myers and Painter (2017) suggested that Blacks and Hispanics are more likely to be food insecure than native- and foreign-born Whites, regardless of immigrant status. Food insecurity severely impacts low income and minority adults, thus influencing their FVs consumption (Myers & Painter, 2017).

The Impact of Food Insecurity on Body Mass Index (BMI) of Low Income and Minority Adults

Adults with low food security are at a higher risk for various adverse health outcomes (Healthy People 2020, 2022). Studies demonstrated that food insecure adults are at higher risk for obesity and other health issues. For instance, Cheung et al. (2015) suggested that low food security is related to rising body mass index (BMI). Obesity is higher among individuals with lower income, and one probable explanation for this is the lack of access to nutritious foods (Cheung et al., 2015). Food insecurity may affect BMI by generating a "substitution effect" whereby individuals choose energy-dense, low-cost foods, such as fast food, instead of healthier foods, such as FVs. Copious studies have shown the association between obesity, low food insecurity, and high BMI (Cheung et al., 2015). Moreover, research denoted the relationship between very low food security and obesity in low income racial/ethnic groups (Leung et al., &

Villamor, 2012). Although other California adults may be affected by food insecurity and obesity, there were no results of a positive relationship among Whites (Leung et al., 2012). Research demonstrated the impact of food insecurity on BMI among low income and minority adults. Vedovato and colleagues (2015) found that food insecurity and obesity were major issues among Blacks adults residing in food deserts. In addition, adults from food insecure households were found to be more likely to have a higher BMI than adults in food-secure households (Vedovato et al., 2015). Food insecurity and BMI are complex concerns that will affect an individual's health.

Food insecurity affects many individuals throughout the country. Adults in food insecure households often face hard choices, such as purchasing healthy foods or paying bills (California Association of Food Banks, 2020). Therefore, people with low food security consume nutrient-poor but calorie-rich foods, consequently affecting health-related issues, such as malnourishment or obesity (CDC, 2020). Blacks and Hispanics are significantly affected by food insecurity; hence they are less likely to consume FVs than Whites (Myers and Painter, 2017). In low income and minority families, adults facing food insecurity had a higher BMI than those not struggling with food insecurity (Vedovato et al., 2015). In summary, food insecurity is a serious concern that negatively affects adults' ability to live a healthy and fulfilling life.

Purpose of Study

Food insecurity can influence individuals to consume nutrient-poor foods, leading to severe health consequences. The purpose of this study was to determine if there are racial/ethnic differences between food insecurity, fruit/vegetable consumption, and BMI among low income minority adults. The outcomes of this study may inform health promotion efforts to educate policymakers on the importance of creating laws that promote programs that intends to improve dietary practices. This study answered the following questions:

1. Among minority adults, is there a relationship between fruit/vegetable consumption and food insecurity?
2. Among minority adults, is there an association between BMI and food insecurity?

Research Hypotheses

For the first research question, it was hypothesized that there would be a relationship between fruit/vegetable consumption and food insecurity. For the second research question, it was hypothesized that there would be an association between BMI and food insecurity.

Method

Design

This study used an observational, cross-sectional design to examine the relationship between FV consumption, BMI, and food insecurity among racial/ethnic minority adults in California. The dependent variable was food insecurity, while the independent variables were FV consumption and BMI. Secondary data from the 2020 California Health Interview Survey (CHIS) were used. The CHIS dataset is the most prominent state health survey in the country (UCLA Center for Health Policy Research, 2012). It is conducted by the UCLA Center for Health Policy Research in partnership with the Department of Health Care Services and the California Department of Public Health (UCLA Center for Health Policy Research, 2012). It is a mixed-mode survey (telephone and web) that collects data on numerous health topics, such as diabetes, obesity, asthma, food security, and health insurance coverage (UCLA Center for Health Policy Research, 2022). CHIS is a cross-sectional study survey that provides data on all 58 counties in California to describe the health care needs of California's diverse population (UCLA Center for Health Policy Research, 2012).

Procedures

The 2020 CHIS dataset was utilized in this study. This dataset is publicly accessible and de-identified and was downloaded from the UCLA Center for Health Policy website. The CHIS questionnaire was administered either via telephone or the Internet. Samples were drawn from random digit dial phone methods and an online questionnaire (UCLA Center for Health Policy Research, 2012). Households from all 58 counties throughout California partook in the 2020 CHIS. The questionnaire contains three components: (1) part I, (2) part II, and (3) a follow-up survey. There are 15 sections throughout the questionnaire. Part I and II contains questions are

used for all counties and includes questions relating to demographics, health-related views, behaviors, and conditions (i.e., poverty status, health care access, mental health, sexual health, etc.). The follow-up survey provides a few questions about participants completing other UCLA surveys and allows space for participants to include their contact information should UCLA have additional questions (UCLA Center for Health Policy Research, 2012).

The CHIS is conducted yearly, allowing the survey to produce one-year estimates (UCLA Center for Health Policy Research, 2012). The CHIS respondents include individuals from various ethnic groups to obtain for health-related data for racial/ethnic populations across California. The survey is provided in six languages: English, Spanish, Chinese (Mandarin and Cantonese), Korean, Vietnamese, and Tagalog. The same core questions are recurring in every survey to measure noteworthy shifts over time (UCLA Center for Health Policy Research, 2012). New questions are also included in every survey year to report evolving essential issues for planning and policy development (UCLA Center for Health Policy Research, 2012).

Participants

The 2020 CHIS dataset included 21,949 respondents. There were 8,475 minority adult respondents; however, after removal of those who did not answer the CHIS questions relevant to this study, the final sample size resulted in 2,383 adult participants. A minimum sample size of 232 was required for this research based on estimations using G*Power software with a medium effect size of 0.30, an alpha level of 0.05, and a power of 80% using a two-tail test for an independent samples *t*-test. G*Power analysis enables estimating the range of an appropriate effect size to incorporate in research and is utilized in social and behavioral sciences (Faul et al., 2009).

Dependent Variable

In this study, self-reported food insecurity was the dependent variable. The question on the CHIS utilized to measure this variable was, *“In the last 12 months, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn’t enough money for food?”* (AM3) (CHIS, 2020). The variable was recoded as “AM3_recoded” to include only responses that denoted if the respondent stated whether they struggled with food insecurity. Responses were recoded as 1 = 1 (yes), 2 = 2 (no), and 999 was recoded as system missing.

Independent Variables

In this study, there were three independent variables: fruit consumption, vegetable consumption, and BMI. For the first research question, fruit consumption was the independent variable and was obtained from question AE2 which asked, *“During the past month, how many times did you eat fruit? Do not count juices. You can tell me per day, per week, or month.”* This variable was recoded to exclude responses that were not ascertained (-9), didn’t know (-8), refused (-7), proxy skipped (-2) or inapplicable (-1). Vegetable consumption was derived from the CHIS question AE7 which asked, *“During the past month, how many times did you eat vegetables like green salad, green beans, or potatoes? Do not include fried potatoes or cooked dried beans such as refried beans, baked beans or bean soup.”* This variable was recoded to exclude responses that were not ascertained (-9), didn’t know (-8), refused (-7), proxy skipped (-2) or inapplicable (-1).

For the second research question, BMI was the independent variable. The variable was calculated from the CHIS questions, *“These next questions are about your height and weight. How tall are you without shoes?”* and *“When not pregnant, how/How much do you weigh without shoes?”*. The variable was calculated using the BMI calculation (weight in pounds x

703) / [height in inches x height in inches]). This variable was recoded to exclude responses that were not ascertained (-9), didn't know (-8), refused (-7), proxy skipped (-2) or inapplicable (-1). In addition, to remove outliers, the top and bottom 1% were deleted from the final dataset.

While not a research variable, the current study aimed to compare results for both research questions among minority participants. Therefore, the variable that measured race (OMBSRREO_P1) was used and was derived from the CHIS question, "*Please tell me which one or more of the following you would use to describe yourself. Would you describe yourself as Native Hawaiian, Other Pacific Islander, American Indian, Alaska Native, Asian, Black, African American, or White?*". This variable was recoded as 1 = 1 (Hispanic), 3 = 1 (African American), 4 = 1 (American Indian/Alaska Native), 5 = 1 (Asian), 6 = 1 (Other/ Two or More Races), 2 = 2 (Non-Hispanic White), and any missing data (999) was coded as system missing. This recoded variable was then used to select cases and allow for a comparison between minority adults (Hispanic, African American, American Indian/Alaskan Native, Asian and other/two or more races). This variable was a continuous variable.

Data Analysis

The Statistical Package for Social Services (SPSS) version 27 was utilized to run an independent samples *t*-test to determine if there was a significant difference between groups who were and were not food insecure. To answer the two research questions, two *t*-tests were conducted. A *p*-value of 0.05 was used to established statistical significance. Furthermore, frequencies and descriptive statistics for each variable were also evaluated.

Results

Participant Demographics

A total of 8,475 participated in the study. Participants were mostly female (58.0%), and predominately White (61.4%) (see Table 1 in Appendix). The next largest racial/ethnic groups were Hispanic (19.7%) and Asian (12.5%). The mean age of participants was 53.11 years, and thus represents middle aged adults. In this study, 37.2% of the sample had a normal BMI (between 18.5 through 24.99). Finally, 18.4% of respondents stated they had cut the size of their meals or skip meals because there was not enough money for food, which was the measure for food insecurity in the current study.

Major Findings

For the first research question, the study explored the relationship between food insecurity and FV consumption. An independent samples *t*-test was used to compare the mean number of times adults reported eating fruit per week to the adults who reported that they cut or skipped meals in the past 12 months due to not having enough money for food (see Table 2 in Appendix). There was a significant difference found between the means of the two groups ($t(-2.81) = 2381, p = .005$). The mean number of times adults reported eating fruits was significantly higher ($M = 10.25, sd = 12.73$) for those who reported not having to skip/cut meals in the past 12 months compared to those who reported having to skip/cut meals in the past 12 months ($M = 8.41, sd = 10.73$). These findings illustrate food insecure individuals consume a lower quantity of fruits.

Additionally, an independent samples *t*-test was used to examine the effect of the mean number of times adults reported eating vegetables per week, comparing those who reported cutting or skipping meals in the past 12 months and those who did not report cutting/skipping

meals in the past 12 months. No significant difference was found ($t(-1.43) = 2381, p = .153$).

The mean servings of vegetables reported by of adults was not significantly different ($p = .153$) when comparing those who cut or skipped meals ($M = 8.69, sd = 12.73$) and those who did not cut/skip meals ($M = 9.54, sd = 11.18$). Therefore, there is no difference in vegetable consumption for those who are or are not food insecure (see Table 2 in Appendix).

The second research question aimed to determine if, among minority adults, there was a difference between mean BMI and food insecurity. An independent sample t -test was used to compare the mean BMI between adults who reported cutting or skipping meals and those who did not report cutting or skipping meals. Results found a significant difference in the mean BMI among the two groups ($t(3.525) = 2381, p < 0.001$). Specifically, the mean BMI was significantly lower ($M = 28.06, sd = 6.34$) for those who reported not skipping or cutting meals, compared to the mean BMI of for those who reported skipping or cutting meals ($M = 29.27, sd = 7.16$). Thus, food insecure individuals have a higher BMI (see Table 3 in Appendix).

Discussion

The purpose of this study was to examine the relationship between food insecurity, FV consumption, and BMI in low income, minority adults. The study outcomes showed significant relationships when examining one research question that has the potential to impact public health, despite having a few study limitations and inconsistencies. The following section discusses the findings as they relate to the current literature.

Summary of Major Findings

The first research question examined the relationship between FV consumption and food security. Federal guidelines recommend 1.5 to 2 cups of fruit per day for a healthy dietary pattern (CDC, 2017). However, only 12% of adults met the intake recommendation for fruit (CDC, 2017). The findings indicate a significant relationship between fruit consumption and food insecurity. This study's indicator of food insecurity was cutting or skipping meals. The mean servings of fruits ($M = 10.25$) adults stated eating was significantly higher for individuals who stated not skipping/cutting meals in the past 12 months compared to individuals who stated skipping/cutting meals in the past 12 months ($M = 8.41$). This study found neither group met the fruit recommendations; although, food secure individuals were closer to meeting the guidelines. In addition, these findings show food insecure individuals consume less fruits than food secure people. These results are consistent with the original hypothesis as well as consistent with the studies performed by Myers and Painter (2017) and Mook et al. (2016). Myers and Painter (2017) found Blacks and Hispanics are more likely to be impacted by food insecurity, affecting their FV consumption. According to the study by Mook et al. (2016), the cost of fruits and vegetables is a factor that influences FV consumption in low income homes, particularly in economically deprived communities. Fruits and vegetables are often high-cost, perishable items

with a brief period of usable life. Thus, purchasing items that are less healthy and last longer can be more cost effective. The current results further support the notion that food insecurity predicts fruit consumption intake in low income, minority adults.

On the contrary, there was no significant difference found between mean vegetable consumption and cutting or skipping meals in this study. The daily vegetable recommendation is to consume 2 to 3 cups of vegetables per day (CDC, 2017). In 2015, 9% of adults met the daily vegetable recommendation (CDC, 2017). Results in this study demonstrated that the mean servings of vegetables reported by those who cut or skipped meals ($M = 8.69, sd = 12.73$) was lower than for individuals who stated not skipping/cutting meals ($M = 9.54, sd = 11.18$); although, the difference was not significant. In this study, neither group met the recommended servings of vegetables, but food insecure individuals consumed a lower mean serving of vegetables. This study illustrated food insecurity does not affect vegetable consumption in low income, minority adults. These findings are inconsistent with the original hypothesis and research by Hoy et al. (2020) and the CDC (2020). Hoy et al. (2020) suggested that individuals with more access to FV tend to consume them more often and in higher amounts. In addition, research has found that individuals with low food security are more likely to consume calorie-rich and nutrient-poor foods (CDC, 2020). However, this study demonstrates that food insecurity does not affect vegetable consumption in low income, minority adults.

A possible explanation is the cost of vegetables and the availability of fresh vegetables in minority neighborhoods (Mook et al., 2016). Racial/ethnic communities may have limited access to fresh fruits and vegetables regardless of food insecurity. Minority neighborhoods are often food deserts, making access to healthful food difficult (Healthy People 2020, 2022).

Convenience stores are the primary food source in racial/ethnic communities; therefore, food selection is low-quality, less healthy, and more expensive (Healthy People 2020, 2022).

The second research question aimed to examine the relationship between BMI and food security. Results revealed a significant association between mean BMI and cutting or skipping meals. The study revealed that the mean BMI ($M = 28.06$) was significantly lower for individuals who stated not skipping/cutting meals compared to the mean BMI ($M = 29.27$) of individuals who stated skipping/cutting meals. The results from this study illustrate food insecure individuals are more likely to have a higher BMI. These findings support the original hypothesis. These results are also consistent with findings from Cheung et al. (2015) and Vedovato et al. (2015). Cheung et al. (2015) stated that food insecurity is associated with high BMI in low income adults. Due to the lack of access to healthy foods, low income individuals eat fast food more than FVs (Cheung et al., 2015). Furthermore, Vedovato et al. (2015) denoted that low income minority adults who struggle with food insecurity have a higher BMI than food-secure households. The results in this study reinforce the concept of food insecurity affecting BMI in low-income, minority adults.

Public Health Implications

Food insecurity is prevalent among low income minority adults in California (Let's Get Healthy California, 2020). There are various studies available that highlight how food insecurity affects FV consumption and BMI. Prior research has indicated the relationship between food insecure individuals and obesity in racial/ethnic adults (Leung et al., 2012). The current study found a significantly lower weekly fruit consumption and higher mean BMI among those with food insecurity when compared to those who were food secure. These findings demonstrate a need for public health to support programs that help food insecure, low income minority adults.

The current study found that mean BMI is higher among those who reported experiencing food insecurity. Public health professionals can address this by creating courses that teach individuals how to eat healthy on a budget and promoting healthy lifestyle practices. Previous research has examined self-efficacy's role in exercise and healthier dietary habits (Annesi & Gorjala, 2010). The current findings support that cognitive-behavior training in self-regulation may help self-efficacy for appropriate intake of food and promote exercise to reduce obesity. Public health must advocate for food insecure, low income racial/ethnic adults to ensure all individuals live healthy lives.

Health educators should generate culturally appropriate educational materials when working with racial/ethnic groups. Programs should promote healthier options for foods regularly eaten in the minority group to ensure that educators are culturally competent. Bennett and colleagues (2022) found that Blacks reported the lowest fruit and vegetable consumption among minority groups and did not meet daily recommendations. In addition, Hispanics had higher fruit and vegetable intake than most racial/ethnic groups but did not meet the daily recommendations (Bennett et al., 2020). Nutrition courses developed by health educators must ensure that eating healthy is promoted in a way that highlights traditional foods and incorporates FVs. Public health campaigns should support better adherence to healthy eating recommendations and ensure interventions are culturally tailored.

Governmental and local agencies can collaborate to improve communities by conducting a needs assessment, making healthy food more accessible, designing green spaces in all neighborhoods, and ensuring communities have opportunities to lead healthy lives. Interventions and proper knowledge of community resources are crucial to spreading awareness in communities facing food insecurity. For instance, food assistance programs, such as

Supplemental Nutrition Assistance Program (SNAP), have the potential to address barriers to accessing nutritious, healthy foods (Healthy People 2020, 2022). Studies have demonstrated that these programs may diminish food insecurity (Healthy People 2020, 2022). Hence, encouraging participation in food assistance programs can immensely impact low income racial/ethnic communities. Public health professionals can partner with health care providers, community leaders, and other community organizations to inform individuals about food assistance programs or other programs that combat food insecurity. By disseminating information on food assistance programs, public health professionals can tackle food insecurity as a social determinant of health (Healthy People 2020, 2022). Public health advocates must continue to advocate for interventions or programs for low income minority adults that aid in access to healthy food. Educating community members on the available resources within neighborhoods is also essential.

Limitations

This research study has various limitations. The CHIS is a self-reported survey, which can lead to response bias. For instance, respondents might not have been truthful when responding to the questions, which would have skewed the study's outcomes. Recall bias is another limitation because the responses might not have been valid. The CHIS questionnaire requires participants to remember precise details about what they ate or did in the past 30 days to 12 months when responding to questions, which can be difficult to recall accurately.

Furthermore, BMI is a limitation because respondents might not have responded to the BMI questions honestly. BMI is an estimation of an individual's weight in pounds (or kilograms) divided by the square of height in feet (or meters) (CDC, 2022). The CHIS questionnaire is self-reported data; thus, respondents might not have reported their correct height and weight. If all

respondents were truthful when answering the BMI questions, the BMI might have been higher. The responses might be skewed, therefore affecting the data.

The cross-sectional design utilized in this study was another limitation. Cross-sectional study designs can only assess the differences across groups through a snapshot in time (Setia, 2016). There are numerous weaknesses in a cross-sectional design; it cannot determine causation, these studies are prone to selection bias, and the prevalence of a result depends on the incidence of disease and the survival after the outcome (Setia, 2016). The purpose of this study was to detect a relationship and association; therefore, a limitation was that causation could not be recognized. Another weakness of the study design was selection bias due to the questionnaire not selecting participants who reflect the entire population. Lastly, only choosing cross-sectional surveys may not be appropriate to comprehend disease trends in studies (Setia, 2016). Although cross-sectional designs help capture data for a specific point in time, this research design has many weaknesses, as mentioned above.

Another limitation of this study was the probability of a type I error because of a large sample size. Future research may want to contemplate looking at males or females separately to diminish the sample size. Fruit consumption and BMI were significantly related to food insecurity and were likely overpowered; however, vegetable consumption was not significant and possibly underpowered. If the study used fewer participants, then the normal distribution of results might not have occurred, which is an assumption of an independent samples *t*-test (Kent State University, 2022). Additionally, this study only used one method of determining food insecurity: cutting or skipping meals. The CHIS dataset included 6 questions regarding food insecurity, but only one method of food insecurity was utilized in this study. Therefore, data acquired from this research will not fully assess all methods of food insecurity. Participants

might have also stated they skipped and skipped meal, even if they are food secure. There is the possibility of response bias affecting food insecurity in the dataset. Research could benefit from including other measures of food insecurity to capture more information on how food insecurity impacts FV consumption and BMI.

Recommendations for future research are to utilize data from the United States Department of Agriculture (USDA) Economic Research Service (ERS) to investigate how food insecurity affects an entire household. Furthermore, a longitudinal study can assist in determining causation instead of utilizing a cross-sectional design. Finally, suggestions are to run separate analyses for the variables with high respondents and the variables with low respondents so that researchers can use a smaller subset of the population without influencing the variables. In addition, logistic regressions should be used to explain the relationships between the variables in future research.

Conclusion

The findings from this study established some evidence that concurred with previous research and outcomes that did not. Food insecurity impacting fruit consumption and BMI aligned with prior results, while food security influencing vegetable consumption did not have a significant relationship among low income minority adults. Vegetable consumption not being affected by food insecurity did not concur with prior outcomes that found supporting data that low vegetable consumption is related to food insecurity. Therefore, food insecurity affects both fruit and vegetable consumption. Recommendations are that future research utilize various procedures to determine relationships between variables. Moreover, it is suggested to investigate how food insecurity affects adults and youth in a household. Findings from this study may help identify the relationship between food insecurity, dietary habits, and obesity.

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Appendix: Tables

Table 1

Demographic Characteristics of 2020 CHIS Respondents

Variable	<i>n</i>	%	Mean
Sex (n=8,475)			
Male	3,559	42.0%	
Female	4,916	58.0%	
Race/Ethnicity (n=21, 949)			
White	13,474	61.4%	
Hispanic	4,317	19.7%	
Asian	2,745	12.5%	
African American	744	3.4%	
American Indian or Alaskan Native	86	0.4%	
Two or more Races	583	2.7%	
	21,949	100%	
Age (n=21,949)			53.11
Number of Times ate Fruit in Past Week (n=2,383)			9.51
Number of Times ate Vegetables in Past Week (n=2,383)			9.90
BMI (n= 8,475)			27.41
Underweight	183	2.2%	
Normal	3,149	37.2%	
Overweight	2,855	33.7%	
Obese	2,288	27.0%	
Adults Skipping Meals (n=2,283)			
Yes	439	18.4%	
No	1944	81.6%	

Table 2*Results of the Effect Examination of Food Insecurity on Average Fruit/Vegetable Consumption*

	Cut or skipped meals		Did not Cut or skip meals		t	p	Cohen's d
	M	SD	M	SD			
Fruit servings per week	8.41	10.72	10.25	11.32	-2.81	0.005	12.38
Vegetable servings per week	8.69	12.73	9.54	11.18	-1.43	0.153	11.02

Note: n=2383; M= Mean; SD= Standard Deviation; t= computed test statistic; p= Significance

Level; Cohen's d uses the pooled variance; Source= CHIS.

Table 3*Results of the Examination of Food Insecurity on Average BMI*

	Cut or Skipped meals		Did not Cut/Skip meals		t	p	Cohen's d
	M	SD	M	SD			
Body Mass Index	29.37	7.15	28.06	6.34	3.525	<0.001	6.50

Note: n=2383; M= Mean; SD= Standard Deviation; t= computed test statistic; p= Significance

Level; Cohen's d uses the pooled variance; Source= CHIS.