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## Prevalence of food insecurity in low-income population in Ohio, USA

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### Abstract

This study was carried out to examine Food Insecurity (FI) in a low-income population in Ohio, America. The study involved screening of 351 participants-who were over 18 years of age, Ohio residents, living in Allen, Hancock or Seneca counties. The study assessed different parameters such as race, financial status, education, family structure, food expenditure and health. Statistical tools were used for data analysis. Participants were divided into 12 income groups according to monthly household income, highest participants were found in income group 500-999 category (36.66%) and lowest in 3500-3999 category (1.87%). The highest amount of participants were found in food insecurity score group (FIS) 5 (20.23%), while lowest in FI groups 1 and 2 (1.95%). As income increased, FI index in total participants decreased including males and females. The Black/ African American population was highest with food insecurity observed in FIS group 10 (3.77%) Caucasian population was highest with food insecurity in the number amongst all the ethnic groups. Hispanic / Latino population was lowest with food insecurity in the study and found in FIS group 4, 5 and 6 (.27%). Native American/ American Indian population was highest with food insecurity in the FIS group 7 (1.08%) and least was in group 10 (.27%). Participants having some college education were observed with food insecurity in all the FIS score category except in groups 1, 2 and 3. In the study, 50.59% of the population was self-reported diabetic, 65.55% self-reported hypertensive, and 45.56% population having reported some type of heart trouble. This study highlighted the importance of screening for FI, particularly in low-income populations, and our understanding of the association between FI and chronic disease in low-income population.

**Keywords:** Ohio, Low-income population, Food Insecurity, Diabetes

### 1. Introduction

Food insecurity (FI) is an “economic and social condition of limited or uncertain access to adequate food”<sup>[1]</sup>. Adverse health consequences of inadequate access to food are apparent throughout the lifespan. Insufficient resources for food leads to individuals developing poor dietary habits and choosing less expensive, more filling, less healthy food options<sup>[2,3]</sup>. FI for a household is defined by limited or uncertain availability of nutritionally adequate and safe foods. FI can also be identified as limited or uncertain ability to acquire acceptable foods in socially acceptable ways<sup>[4]</sup>.

Although all households facing FI experience negative consequences of not having enough food, certain populations are more sensitive and experience this challenge more acutely. The most recent assessment of household food security in 2019 conducted by Koh, K *et al.*<sup>[5]</sup> in Columbus, Ohio showed that food security disproportionately affects vulnerable populations, including children, the elderly, minorities, and low-income households<sup>5</sup>. Most of the food-insecure households in the United States have low levels of income. A report supported by the United States Department of Agriculture (USDA) showed that in 2009, 14.7% of all US households were food insecure at some time during the year, including 5.7% with “very low” food security<sup>[4]</sup>. The high prevalence of FI in low-income households in some parts of America led to high intake of energy-intense food with low nutrients, resulting in higher prevalence of anemia, obesity, and other chronic diseases<sup>[6]</sup>. It is common fact that families with low-income generally eat a less nutritious diet than those with a higher income, either because they cannot afford enough food or because they eat foods that are nutritionally poor.

This leads to health inequalities, as low-income families are more susceptible to health problems associated with obesity or malnutrition. The main factors contributing to food poverty in the country are a lack of money to buy food, low availability of healthy foods and limited cooking skills [7].

U.S. Federal Poverty Guidelines were used to determine the low-income population. Poverty Guidelines are issued each year in the Federal Register by the Department of Health and Human Services (HHS). The guidelines are a simplification of the poverty thresholds for use for administrative purposes. These guidelines are sometimes loosely referred to as the “federal poverty level” (FPL), but that phrase is ambiguous and should be avoided, especially in situations (e.g., legislative or administrative) where precision is important. In this study we had used an average number in the family as three and their income 21,330 dollars per year [8]. As per 2019 poverty guidelines, Office of the Assistant Secretary for Planning and Evaluation (ASPE) U.S. Department of Health and Human Services (HHS). ASPE is the principal advisor to the Secretary of the HHS on policy development, and is responsible for major activities in policy coordination, legislation development, strategic planning, policy research, evaluation and economic analysis.

Poverty and low-income are associated with FI, but adequate household income is not sufficient to ensure food security [5]. The latest report of USDA states that FI rate for households with children (13.9 percent) was two-fifths higher than the rate for households without children (9.9 percent). The rates of FI were much higher for households headed by African Americans (21.2 % — two and a half times the rate for white non-Hispanic households) and Hispanics (16.2 % — two times the rate for white non-Hispanic households). Households in rural areas are experiencing considerably deeper struggles with hunger compared to those in metropolitan areas, with higher rates of food insecurity overall (12.7 percent compared to 10.8 percent), and higher rates of very low food security (4.8 percent compared to 4.2 percent) according to Economic Research Service (ERS) report findings. This is a problem because rural wages on average are lower and work-support services are unavailable or harder to find and access in the rural area. FRAC report found the FI rate is highest in the Southern census region, followed by the Midwest, West, and Northeast. The prevalence of FI varied considerably by state, ranging from 7.8 percent in New Hampshire to 16.8 percent in New Mexico (for the three-year period of 2016–2018). Even in the best performing states, 1 in 13 households was food insecure. Of the 10 most populous states, four had FI rates higher than the national average of 11.7 percent from 2016–2018: Texas (14 percent), North Carolina (13.9 percent), Ohio (13.2 percent), and Michigan (12.9 percent) FRACReport, 2019) [9].

The above figures showed prevalence of FI varied in different states and varied as per the economic status of the families. Hence the study is conducted to observe

prevalence of FI in low-income population in Northwest Ohio, in a high-income country such as the USA. This study can categorize prospective research requirements and recommend policy and program reactions.

## **2. Material and methods**

### **2.1 Methods**

This cross-sectional FI screening study was conducted and sponsored by West Ohio Food bank, Ohio, USA from 9th August, 2019 to 30<sup>th</sup> September, 2019 in Northwest Ohio. Residents were from Allen, Hancock & Seneca counties. The University of Findlay Institutional Review Board (IRB) completed its review of the project utilizing human subjects, granted authorization and had been approved for Exempt Status. This research was both qualitative and quantitative. Research design was non-experimental and data generated was of primary type. Outcomes of responses to appropriate resources were documented to ascertain conditions moving towards food security and leading productive life.

### **2.2 Study population**

Study involved screening of 514 subjects who were over 18 years of age, residing in Ohio’s Allen, Hancock or Seneca counties, at or below 200% poverty level using federal guidelines and from all ethnic groups. The perceived level of risk was less than minimal to the subjects and anonymity of subjects was maintained. The study was conducted to determine impact of FI and social determinants of health. The participants who were willing to answer the questions were interviewed in person and included in the study. Consent form details were provided to subjects and no compensation in form of monetary basis was given to subjects.

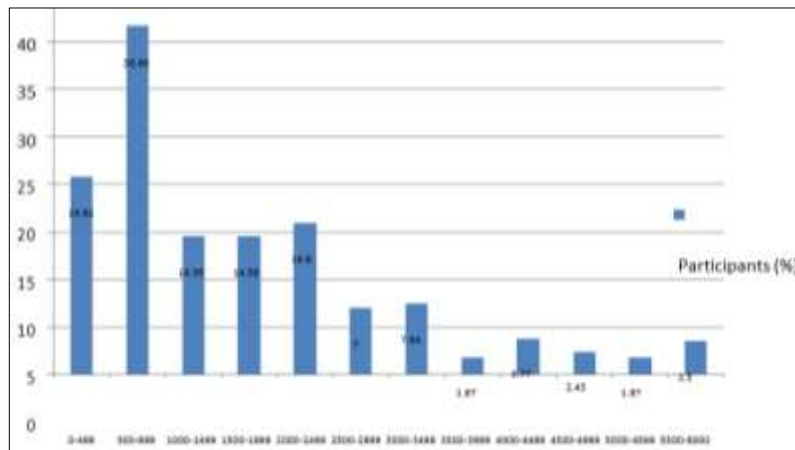
### **2.3 Survey instrument and survey administration**

The questionnaire was prepared to include general information, self-reported health issues, and food insecurity of subjects. The questionnaire was created in order to answer the research question. To ensure reliability and validity of the questionnaire, sample was completed by 10 participants beforehand. The questionnaire was validated and then administered to the subjects. All paper questionnaires will be shredded after three years, at West Ohio Food Bank following the organization’s destruction policy. Data was stored as soft copy in the office of the Master of Business Administration Assistant Dean for the period prescribed by law.

### **2.4 Statistical analysis**

The study was assessed and analyzed using different parameters such as age, sex, race, financial status, family structure, food and expenditures. Health and FI of the participants were analyzed using Statistical Package for Social Sciences tool. Probability and correlation was used to understand the statistical information and data.

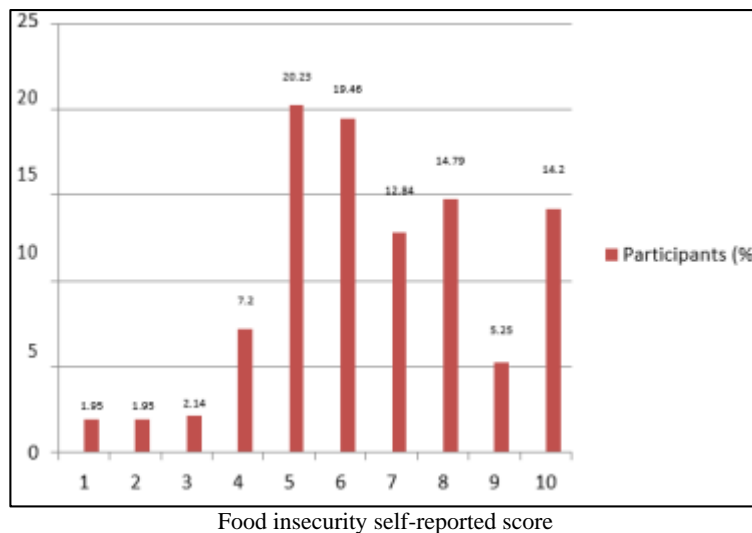
**3. Results**



**Graph 1:** Distribution of participants as per monthly household income. n=514

Participants were divided into 12 income groups, starting from 0-499 category, with 499 differences, till 5500-6000 dollars category. Highest participants were found in income group 500-999 category that is 36.66%, while lowest were

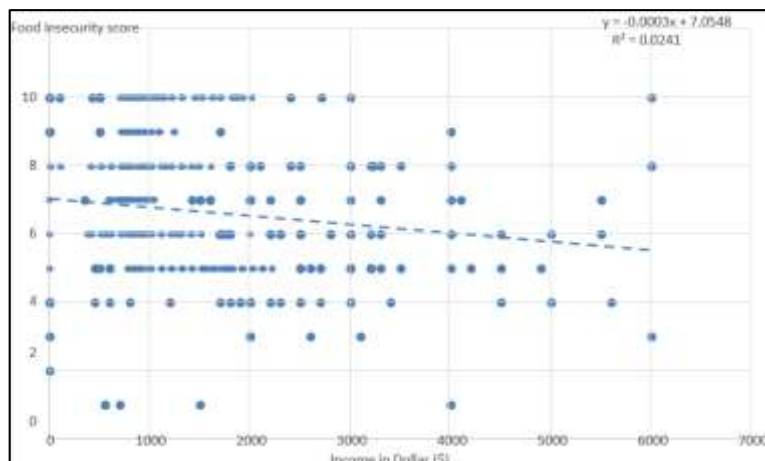
in 3500-3999 that is 1.87%. Participants falling in income groups up to 1500-1999 were considered low-income groups in the study.



**Graph 2:** Distribution of participants as per the Food Insecurity Score (FIS). n=514

This graph shows the percentage of self-reported food insecurity score on scale 1 to 10 with 10 being the highest need for food. The highest participants with food insecurity

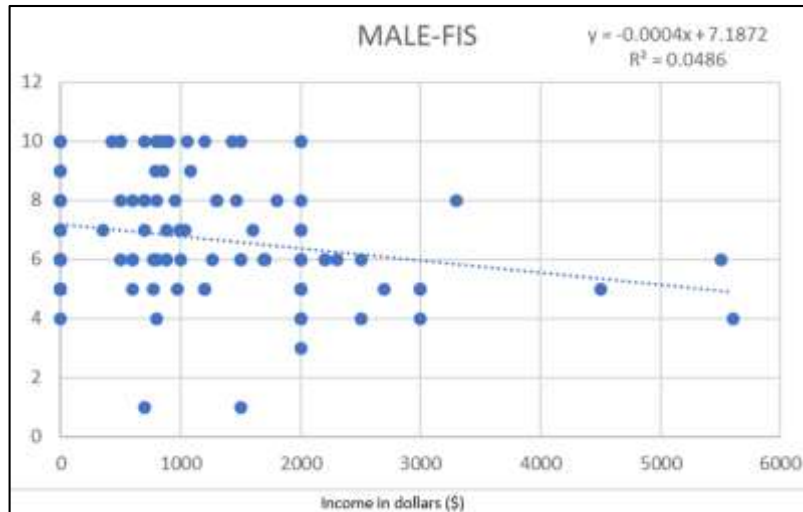
were found in FIS 5 (20.23%), followed by in 6(19.46%), while lowest was in FIS 1 and 2 (1.95%).



**Graph 3:** Correlation of Food Insecurity Index verses income in general population.

This scatter plot denotes the Correlation of FI Index versus income in general population. It is inversely proportional.

As the income increases, FI Index in total participants decreases.

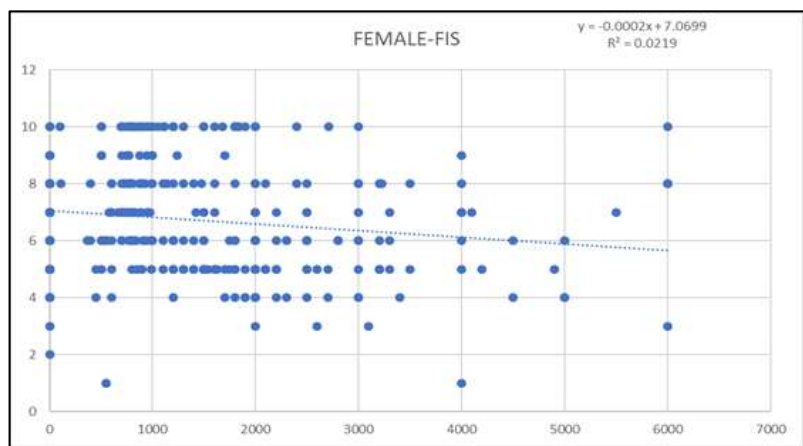


(MALE-FIS: Male Food Insecurity Score)

**Graph 4:** Correlation of Food Insecurity Index verses income in males.

This scatter plot denotes the Correlation of FI Index verses income in males. It is inversely proportional. As the income

increases, FI index in males decreases.

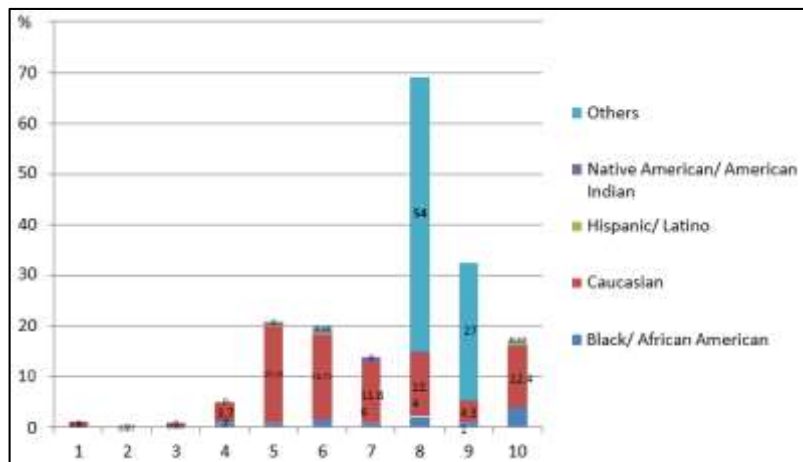


Income in dollars (\$) (FEMALE-FIS: Female Food Insecurity Score)

**Graph 5:** Correlation of Food Insecurity Index verses income in females.

This scatter plot denotes the Correlation of FI Index verses income in females.

It is inversely proportional. As the income increases, FI Index in females decreases.

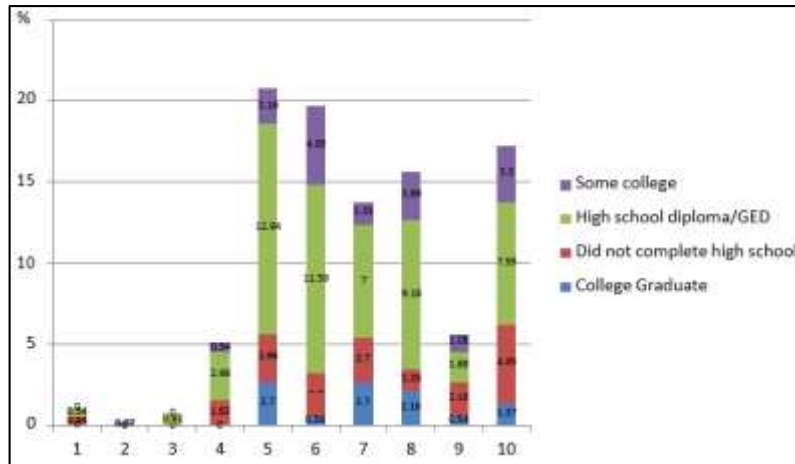


Self-Reported Food Insecurity Score

**Graph 6:** Distribution of low-income population according to Food Insecurity Score and Ethnicity n=351

Black/ African American population was observed highest for food insecurity in FIS group 10 (3.77%) followed by in FIS group 8 (2.16%) and least was in FIS group 2 and 3 (0 %). Caucasian population was highest for food insecurity in the number amongst all the ethnic groups. The Caucasian population were observed highest for food insecurity in FIS group 5(19.14%), followed by in group 6 (16.71%) and least was in group (.27%). Hispanic / Latino population was

lowest for food insecurity in the study and found in FIS group 4, 5 and 6 (.27%). Native American/ American Indian population was highest for food insecurity in the FIS group 7 (1.08%) followed in group 5, 6 and 8 (.54%) and least was in group 10 (.27%) Other population was highest for food insecurity in FIS group 6 and 8 (.54%) and lowest in group 9 and 10 (.27%).

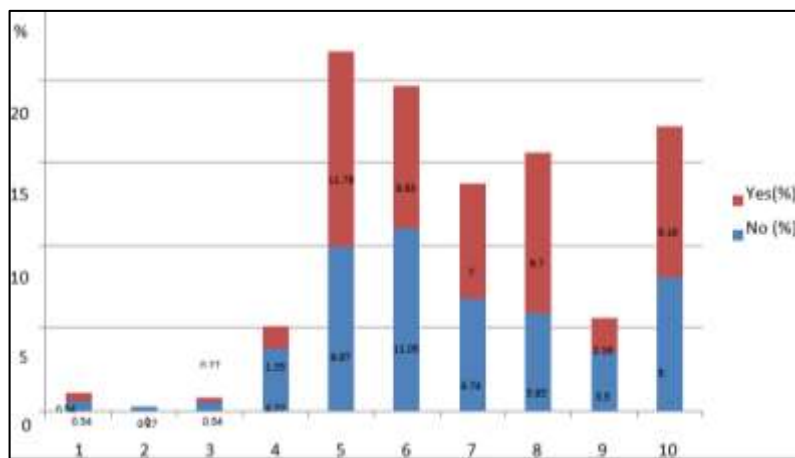


Self-reported Food insecurity score.

**Graph 7:** Distribution of low-income population according to Food Insecurity Score and Education n=351

Participants having some college education were observed for food insecurity in all the FIS score category except 1, 2 and 3. Participants did not complete high school education were observed for food insecurity in all the FIS score

category except 1 and 2. Highest participants were found with food insecurity in FIS score group 5 (12.94%) having high school diploma, while lowest were in FIS group 1 (.54%), followed by in 2 (00.00%).

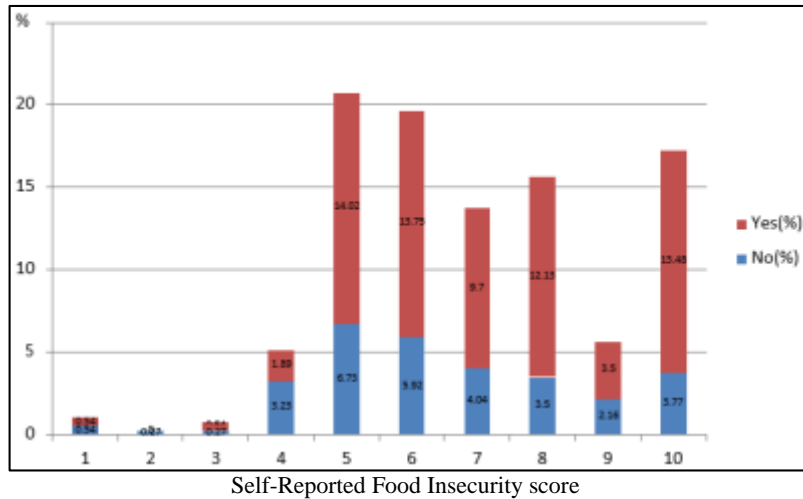


Self-Reported Food Insecurity score.

**Graph 8:** Distribution of low-income population according to Food Insecurity Score and Diabetes. n=351

The above graph represents the participants who had self-reported diabetes with their self-reported food insecurity score. In the study, 50.59% low-income, self-reported diabetic population was observed. Highest low-income

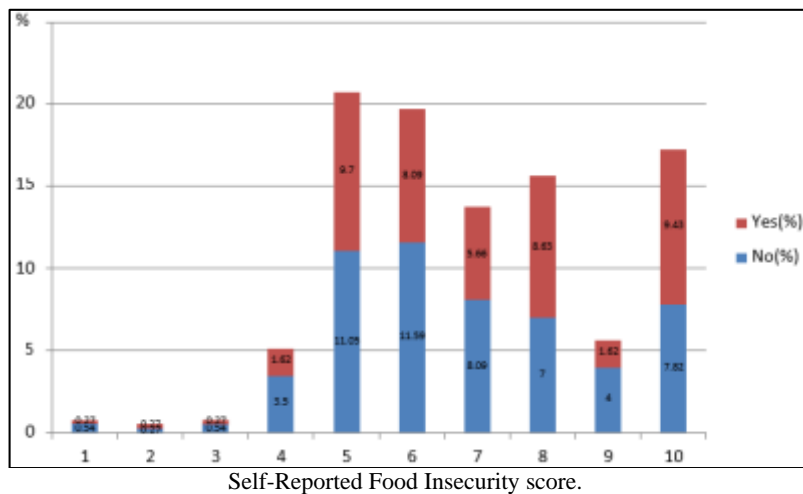
having diabetes was observed in FIS group 5 (11.78%), while lowest low-income having diabetes was observed in FIS group 3 (0.27%) followed by group 2 (00.00%)



**Graph 9:** Distribution of low-income population according to Food Insecurity Score and hypertension n=351

The above graph represents the participants who had self-reported hypertension with their self-reported food insecurity score. In the study, 65.55% low-income hypertensive population was observed. Highest low-income

having hypertension was observed in FIS group 5(14.02%), while lowest low-income having hypertension was observed in FIS group 3 and 1 (0.54%) followed by group 2 (00.00%).



**Graph 10:** Distribution of low income population according to Food Insecurity Score and heart trouble n=351

The above graph represents the participants who had self-reported heart trouble with their self-reported food insecurity score. In the study, 45.56% low-income population, having heart trouble, was observed. Highest low-income having heart trouble was observed in FIS group 10(9.43%), while lowest low-income having heart trouble was in FIS group 1, 2 and 3 (0.27%).

**4. Discussion**

FI is an important problem in middle- and low-income countries with important implications for public health [10]. Recently, US workers have developed the concept of FI as it applies to populations of high-income Countries [11]. FI has been defined as the ‘limited or uncertain availability of nutritionally adequate safe foods, or limited or uncertain ability to acquire foods in socially acceptable ways’ [12]. FI is socially defined and includes problems with the quantity and quality of the food available, uncertainty about the supply of food, and experiences of going hungry [13]. Experiences of FI include running out of food, running out of money to buy food, skipping meals, experiencing hunger and being unable to buy food. This

could also lead to buying cheaper foods because of financial constraints. Estimates suggest that up to 12% of US households may experience some degree of FI. [14] FI has been associated with unfavorable food choices and it has been suggested that food insecurity may predispose to the development of health implications [15].

This study documented the screening of FI in low-income participants at Ohio’s three different counties. All participants were successfully screened for food in security over a 2-month period. Most of the participants were in the low-income population. The families made up of 3 household members and having less than \$2000 income per month were included in the low-income category for the simplicity of statistical analysis. Out of 514 participants, 351 fell in this category. The highest number of participants fell in income category of \$500 –999 (36.66%) followed by \$0-499(20.82%), while lowest were in \$3500-3999 and \$5000-5499 (1.87%). The scatterplot was plotted using Statistical Package for Social Sciences (SPSS) against participant’s income status and Food Insecurity score. It denoted inversely proportional correlation of Food Insecurity Index verses income in general population. As the income

increased, FI Index in total participants decreased. The same observations were made when data was divided by gender. The scatterplot against male and female participant's income status and Food Insecurity score, denoted inversely proportional correlation of FI Index verses income in males and females. As the income increased, FI Index in males and females decreased. Highest participants were found in Food Insecurity score 5, followed by in 6 and lowest in <sup>[2]</sup>.

In the study, 50.59% low-income self-reported diabetic participants were observed. The highest results of low-income diabetic population was observed in FIS group 5(11.78%), while lowest levels of low-income diabetic population was in FIS group 3 (0.27%) followed by group 2 (00.00%). The epidemic of type 2 diabetes has hit the low-income population particularly hard. Low socioeconomic status was associated with a higher prevalence of diabetes and a greater risk for diabetes complications <sup>[14]</sup>. There are many specific elements of poverty that predispose adults to diabetes and poor diabetes control, but a great number of these potentially predisposing factors have not been fully investigated. To understand this association there is additional research opportunity for future studies. FI has been postulated as one mechanism by which poverty might predispose adults of low socioeconomic status to poor diabetes control <sup>[15]</sup>. However, the association between FI and glycemic control has not been adequately done in clinical populations of adult patients with diabetes, and mechanisms for a relationship between food insecurity and glycemic control remain unclear. FI is a multidimensional concept, encompassing reductions in food quantity and food quality. Other studies conducted by Drewnowski *et al.* <sup>[16]</sup>, suggest that FI may increase patients' difficulty following a diabetes-appropriate diet because they shift their dietary intake toward inexpensive, calorically dense foods. Calorie dense foods generally includes a high proportion of added fats and sugars, and other refined carbohydrates to maintain caloric needs <sup>[16]</sup>. These foods generally make glycemic control more difficult to achieve. However, other authors such as Seligman *et al.* <sup>[17]</sup> hypothesized that additional mechanisms existed by which food insecurity may directly influence glycemic control <sup>[17]</sup>.

In the study, 65.55% low-income hypertensive population was observed. The highest level of low-income hypertensive population was observed in FIS group 5(14.02%), while the lowest level of low-income hypertensive population was in FIS group 3 and 1 (0.54%) followed by group 2 (00.00%). In the study, 45.56% low-income population was reported having heart trouble. Highest level of low-income heart trouble population was observed in FIS group 10(9.43%), while lowest level was in FIS group 1, 2 and 3 (0.27%).

A number of studies have reported cross-sectional associations between FI and self-reported chronic disease, including heart disease, diabetes, hypertension, and general health status<sup>18</sup>. In a sample of >2500 adults recruited from community sites in rural Ohio, Holben *et al.* <sup>[19]</sup> found no relationship between FI and clinical indicators of disease, including hypertension, hyperlipidemia, and hyperglycemia, except for higher mean HbA1c levels among women <sup>[19]</sup>. Some work in a population-based sample suggests that FI may in fact be a risk factor for hypertension and diabetes among nonelderly adults <sup>[20]</sup>.

Our study was limited by small sample sizes for some variables. In particular, inadequate disease control among adults with self-reported disease was limited. The Food

Security Survey Module assesses food security at the household level. A single blood pressure or blood sugar measurement was generally not adequate for a diagnosis of hypertension or diabetes. This misclassification was also likely to bias our results. Differential rates of nonparticipation may have also biased study results. We limited our sample to households with incomes <200% of the FPL. This sample restriction limits the generalizability of our findings to the U.S. population as a whole but provided important new information about the population generally at risk for FI and increases the homogeneity of our sample with respect to unmeasured potential confounders such as neighborhood environment. Finally, we used a self-reported measure of FI because no objective measures of FI exist. The objective measures are based on refined measures of poverty lines, expressed as a monetary measure of individual income welfare, such as expenditure on good and services, for which nutritional requirements are met or not met at given prices. The present study was qualitative and quantitative type. The survey questionnaire included the type of questions and specific wording that were most appropriate to distinguish household facing different degrees of insecurity. However, use of a self-reported measure is appropriate because many of the effects of FI may be mediated by an individual perception of the degree to which food budgets are inadequate. Despite these limitations, this study adds important low-income population-based data of FI.

We were unable to confirm an association between FI and either diabetes or hypertension. Our findings differ from other Latin American study (Mexico) which found diabetes and hypertension to be more prevalent among food insecure populations compared to food secure women <sup>[23]</sup>. They also differ from prior studies conducted in low-income US women linking Food Insecurity Score to a higher diabetes prevalence and, to a lesser extent, hypertension and certain other chronic diseases and their risk factors <sup>[18, 22]</sup>.

## 5. Conclusion

This study highlights the importance of screening for FI, particularly in low-income population, as it is likely under-recognized, under-diagnosed, and under-treated. Awareness of FI, its effects on health, and the need for screening is likely to increase promoting food security. Screening for FI took little time to complete and could be done by self-administered patient questionnaires. This study added important population-based data to our understanding of the association between FI and chronic disease in low-income population <sup>[26]</sup>.

## 6. Recommendations

Food Research and Action Centre (FRAC), a leading nonprofit organization in America, is working to eradicate poverty related hunger and malnutrition in the United States. It has identified some essential strategies for decisively attacking FI in low-income populations. Such strategies include creating jobs, raising wages, increasing opportunities, and sharing prosperity. Also, improve government income-support programs for struggling families is needed; to strengthen The Supplemental Nutrition Assistance Program (SNAP) and Child Nutrition Programs. FRAC supports strategies to vulnerable populations and is willing to work with states, localities, and nonprofits to expand and improve participation in federal

nutrition programs. Other strategies would include making sure all families have convenient access to reasonably priced, healthy food; and to build political will [3].

## 7. Acknowledgement

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