# The Effect on Household Food Security When Household Income Increases

## Introduction

Food security is a fundamental issue that influences not only an individual's health but also broader social, economic, and political stability. Inadequate access to food can perpetuate cycles of poverty, reduce productivity, and create long-term challenges for governments in areas such as healthcare and education. For individuals to thrive, they need consistent access to nutritious food, which is essential for maintaining good health. When food security is compromised, it leads to malnutrition, poor health, and can contribute to economic instability. This issue is closely tied to global challenges, such as poverty and inequality, making it critical to understand how food security affects populations worldwide. By gaining knowledge of these challenges, we can better address the underlying causes of food insecurity and work toward sustainable solutions.

The relationship between economic factors and food security is crucial. Research indicates that changes in household income, employment status, and access to social support systems can have a significant impact on a family's ability to secure enough food. When families experience improvements in their living conditions, whether through increased income or employment, their food security generally improves. This highlights the importance of policies aimed at increasing economic stability, as they can directly reduce food insecurity.

Food security also varies significantly among different groups, with some populations facing greater challenges than others. Vulnerable groups such as children, the elderly, and low-income families often experience higher rates of food insecurity. Access to federal nutrition assistance programs has been shown to play a vital role in improving food access for these groups, helping to reduce food insecurity. By improving our understanding of how economic status and public policy affect food access, we can develop more effective solutions to combat food insecurity, ultimately leading to healthier communities and greater social stability.

# Literature Review

The article *Severity of Household Food Insecurity Is Sensitive to Change in Household Income and Employment Status among Low-Income Families* demonstrates how changes in income, employment, and overall welfare affect the severity of food insecurity in low-income families over the course of a year. The study was conducted in 2005-2007, and it involved 501 families in Toronto's high poverty neighborhoods. A total of 331 families completed baseline and follow-up interviews. The results showed that while food insecurity was persistent (68% of families were food insecure at both interviews), its severity changed for many families (73.4% had different responses on the household food security survey module between the two interviews). Among market-rent households a $2,000 increase in income and securing a full-time job were associated with significant reductions in food insecurity severity. The study highlights that improvements in income and employment are linked to better food security, suggesting that policies aimed at increasing income and employment could reduce food insecurity in low-income households (Coleman-Jensen, A., Rabbitt, M. P., Gregory, C. A., & Singh, A., 2022).

According to the article *Household Food Security in the United States in 2021,* this report represents food security statistics for U.S. households in 2021, based on data from the current population survey food security supplement. In 2021, 89.8% of U.S. households were food secure meaning they had consistent access to enough food for an active and healthy lifestyle. The remaining 10.2% of households were food insecure at some point during the year with 3.8% experiencing very low food security, where food intake and eating patterns were disrupted due to limited resources. Although overall food insecurity remained stable compared to 2020, some subgroups saw significant changes. Food insecurity increased among households without children, particularly women living alone, and elderly individuals living alone. However, food insecurity decreased for households with children, particularly those with children under age 6, married couples with children, single mothers, Black non-Hispanic households, low-income households, and those in the South. Among children, food insecurity declined with 6.2% of households with children experiencing food insecurity down from 7.6%. Very low food security among children remained stable at 0.7%. In terms of spending, food secure households spent 16% more on food than food insecure households of the same size. Approximately 56% of food insecure households participated in federal nutrition assistance programs including SNAP, WIC, and the national school lunch program (Rachel Loopstra, 2013).

An article published in the *Medical Journal of the Islamic Republic of Iran (MJIRI)* performed a cross-sectional study among 30,809 households with questionnaires of food security during 2011. It found that 37.8% were food insecure, and 62.7% of the poorest households lacked adequate food access. Multiple logistic regression models were used to investigate the independent effect of economic status on household food insecurity. Findings showed that 37.8% of the households were food insecure. There were significant associations between economic

status and household food insecurity after adjusting other variables. It was concluded that economic status was identified as the most significant determinant of household food security as 62.7% of poorest households were food insecure (Asadi-Lari, M., et al., 2019).

An article published in the *Journal of Nutrition* examined how changes in income, employment status, and receipt of welfare affected the severity of food insecurity over one year among low-income families. "In 2005-2007, 501 families living in market and subsidized rental housing were recruited through door-to-door sampling in high-poverty neighborhoods in Toronto. One year later, families were re-interviewed. The final longitudinal analytic sample included 331 families," (Loopstra, R., & Tarasuk, V., 2013). They found that 68% of families were food insecure in both interviews. Among market-rent families, a $2,000 gain in income during the year was associated with a 0.29 decrease in raw score and gain of full-time employment was associated with a 1.33 decrease in raw score. This study suggests that improvements in income and employment are related to improvements in families' experiences of food insecurity (Loopstra, R., & Tarasuk, V., 2013). This reinforces Loopstra and Tarasuk's conclusion that even modest increases in income or employment can positively impact food access for low-income households.

A study of 1,600 disadvantaged households with children in three U.S. cities from 1999 to 2005 found significant differences in food allocation across age and gender groups. Food insecurity levels are much higher among older children than younger ones, and sometimes higher among older boys than older girls. "Allocations are strongly correlated with the dietary needs of the child as well as with household structure and the level of family organization. However, the differences appear only in the poorest households with the lowest levels of money income and household resources in general, and most differences disappear in significance or are greatly

reduced in magnitude when resources rise to only modest levels," (Moffitt, Robert A., & Ribar, David C., 2018).

However, while previous studies have shown a relationship between income and food security, few have focused on the specific income thresholds that lead to significant changes in food security outcomes across different income groups. This gap in the literature is important as it can inform policy interventions aimed at reducing food insecurity in low-income households. This trend is also strongly reflected in our own findings. Through multiple regression analysis and descriptive statistics, our study provides further evidence of the critical role economic stability plays in ensuring food security. Additionally, by using more recent U.S. data, our analysis provides updated insights that build on previous studies and reflect current economic and social conditions.

# Methodology

## Table 1 Descriptive Statistics

| Statistic | N | Mean | St. Dev. | Min | Max |
| --- | --- | --- | --- | --- | --- |
| YEAR | 39,583 | 2,021.51 | 0.50 | 2,021 | 2,022 |
| MONTH | 39,583 | 12.00 | 0.00 | 12 | 12 |
| FSSTATUS | 39,583 | 0.86 | 0.34 | 0 | 1 |
| FSSTATUSA | 39,583 | 1.38 | 0.80 | 1 | 4 |
| FSSTATUSC | 39,583 | 1.08 | 0.30 | 1 | 3 |
| AGE | 39,583 | 36.97 | 14.31 | 15 | 85 |
| MARST | 39,583 | 0.57 | 0.50 | 0 | 1 |
| LABFORCE | 39,583 | 0.70 | 0.46 | 0 | 1 |

To evaluate how household income affects food security, we used a multiple regression model with household food security (FFSTATUS) as the dependent variable. FFSTATUS is a binary variable where 1 indicates food security and 0 indicates low to very low food security. The key independent variable is family income (FAMINC), which is ordinal and categorized into defined income brackets. Additional control variables include LABFORCE (binary; in or out of the labor force), MARST (binary; married or not), and NCHILD (number of own children categorized into 0, 1, 2, 3, and 4+).

This approach is consistent with Loopstra and Tarasuk's (2013) longitudinal study, which also used changes in income and employment status to assess food insecurity among 501 low-

income Canadian households. Their findings indicated that a $2,000 increase in annual income was associated with a measurable decline in food insecurity severity. Our methodology follows similar logic, using household-level variables to explore how shifts in economic standing relate to food security outcomes.

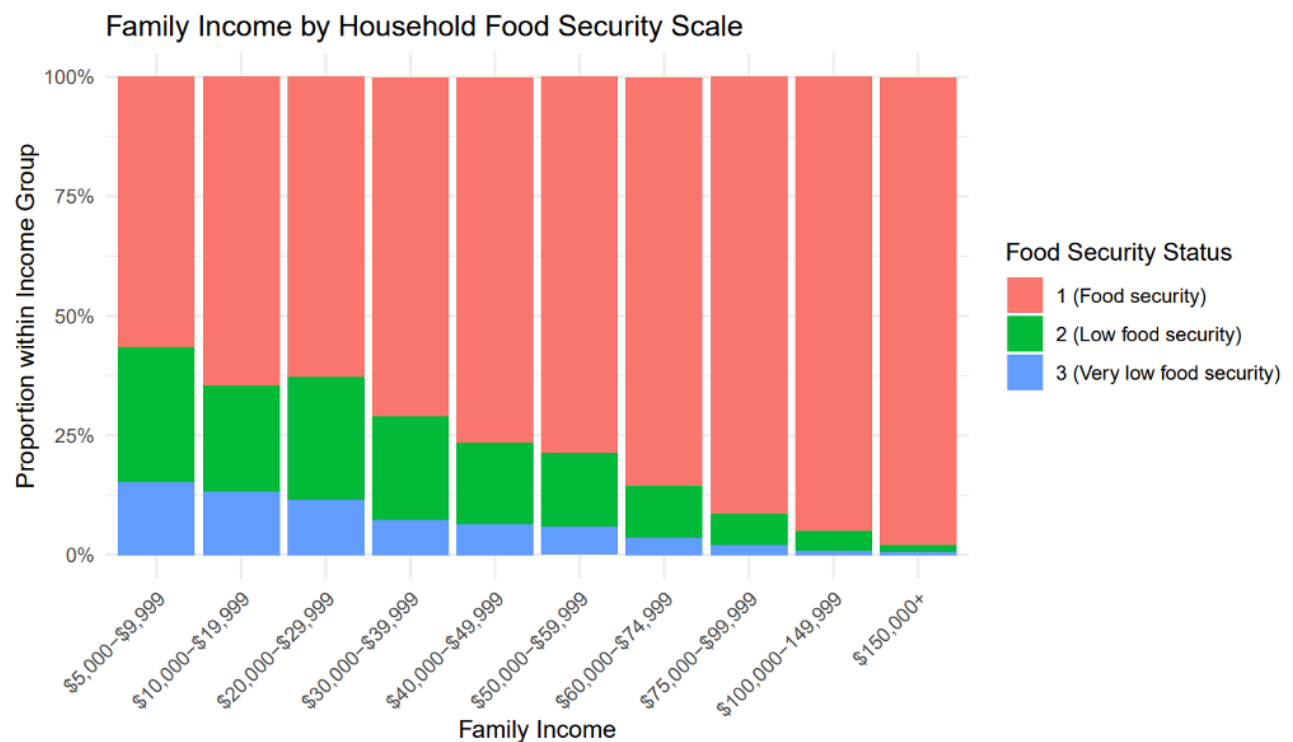## Figure 1

Family Income by Household Food Security Scale



Figure 1 shows the percentage of households experiencing food security across income groups. In the lowest income bracket ($5,000 - $9,999), only about 57% of households are food secure. In contrast, about 98% of households earning $150,000 or more are food secure. This trend supports findings from the USDA's 2021 report (Coleman-Jensen et al., 2022), which noted that low-income households and those without children were among the most vulnerable to food insecurity. Notably, food insecurity shows a steep decline in households earning more than

$75,000, aligning with findings by Moffitt and Ribar (2018), who observed that even modest income gains among disadvantaged households significantly reduced food insecurity especially among older children in low resource homes.

# Results

### Reduced Multiple Regression

Table 2 Reduced Multiple Regression

Note: * p < 0.05, ** p < 0.01, *** p < 0.001

| Term | Estimate | Std. Error | p-value |
| --- | --- | --- | --- |
| (Intercept) | 0.56651 | 0.01274 | 0*** |
| FAMINC$10,000-$19,999 | 0.079634 | 0.01506 | 1.2435e-07*** |
| FAMINC$20,000-$29,999 | 0.061061 | 0.014411 | 2.2698e-05*** |
| FAMINC$30,000-$39,999 | 0.14513 | 0.013978 | 3.1878e-25*** |
| FAMINC$40,000-$49,999 | 0.19987 | 0.014167 | 4.3154e-45*** |
| FAMINC$50,000-$59,999 | 0.22002 | 0.014122 | 1.4516e-54*** |
| FAMINC$60,000-$74,999 | 0.29063 | 0.013705 | 3.0275e-99*** |
| FAMINC$75,000-$99,999 | 0.34851 | 0.013437 | 4.2579e-147*** |
| FAMINC$100,000-$149,999 | 0.38512 | 0.013287 | 8.3368e-183*** |
| FAMINC$150,000+ | 0.41445 | 0.013165 | 7.329e-215*** |

In the reduced multiple regression model, individuals in the highest income group ($150,000+) were 41.45 percentage points more likely to be food secure than those in the $5,000–$9,999 range. This effect remained statistically significant across all income brackets, suggesting that income is a strong predictor of food security. This echoes findings by Loopstra & Tarasuk (2013), who observed significant improvements in food access among low-income

families with income increases as small as $2,000. Similarly, in the MJIRI study by Asadi-Lari et al. (2019), food insecurity prevalence sharply declined with improved economic status, reinforcing our findings that income plays a central role.

In the full regression model, other significant variables included marital status (MARST) and number of children, particularly in larger households (NCHILD4+). However, AGE, LABFORCE, and NCHILD1 were not statistically significant. These results contrast slightly with some literature, such as the USDA (2022) report, which found higher food insecurity among elderly individuals and single-person households. This difference may stem from our dataset or the interaction between variables like marital status and labor force participation.

## Multiple Regression

### Population Regression Model

$$Pr(FSSTATUS_i) = \beta_0 + \beta_1 FAMINC\$10,000 - \$19,999 + \beta_2 FAMINC\$20,000 - \$29,999 + \beta_3 FAMINC\$30,000 - \$39,999 + \beta_4 FAMINC\$40,000 - \$49,999 + \beta_5 FAMINC\$50,000 - \$59,999 + \beta_6 FAMINC\$60,000 - \$74,999 + \beta_7 FAMINC\$75,000 - \$99,999 + \beta_8 FAMINC\$100,000 - \$149,999 + \beta_9 FAMINC\$150,000 + \beta_{10} Age + \beta_{11} MARST + \beta_{12} NCHILD1 + \beta_{13} NCHILD2 + \beta_{14} NCHILD3 + \beta_{15} NCHILD4 + \beta_{16} LABFORCE$$

#### Table 3 Multiple Regression

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

| Term | Estimate | Std. Error | p-value |
|---|---|---|---|
| (Intercept) | 0.562 | 0.0134 | 0*** |
| FAMINC$10,000-$19,999 | 0.08 | 0.015 | 1.02e-07*** |
| FAMINC$20,000-$29,999 | 0.0569 | 0.0144 | 7.49e-05*** |
| FAMINC$30,000-$39,999 | 0.137 | 0.014 | 8.25e-23*** |
| FAMINC$40,000-$49,999 | 0.19 | 0.0142 | 5.64e-41*** |
| FAMINC$50,000-$59,999 | 0.206 | 0.0141 | 4.1e-48*** |
| FAMINC$60,000-$74,999 | 0.275 | 0.0137 | 1.91e-88*** |
| FAMINC$75,000-$99,999 | 0.328 | 0.0135 | 2.83e-129*** |
| FAMINC$100,000-$149,999 | 0.362 | 0.0134 | 6.51e-160*** |
| FAMINC$150,000+ | 0.388 | 0.0133 | 9.27e-186*** |
| AGE | -6.61e-05 | 0.000136 | 0.628 |
| MARST | 0.0596 | 0.00446 | 1.14e-40*** |
| NCHILD1 | -0.00486 | 0.00582 | 0.404 |
| NCHILD2 | -0.014 | 0.00595 | 0.0183* |
| NCHILD3 | -0.0302 | 0.00683 | 1.02e-05*** |
| NCHILD4+ | -0.0551 | 0.00841 | 5.57e-11*** |
| LABFORCE | 0.00386 | 0.00388 | 0.32 |

## Description of Results

Based on the p-value column in Table 3, there are three variables that have no significant effect in determining where a household is placed on the food security scale. These variables include AGE, NCHILD1, and LABFORCE. In contrast, family income (FAMINC) is highly significant, with the p-values for each group below the significance level of 0.05 in both the reduced and full model. Similarly, the remaining variables, MARST, NCHILD2, NCHILD3, and

NCHILD4+, are also statistically significant. These results suggest that household structure and income level play a key role in food security status, while age and labor force participation may not have a direct or consistent impact.

## Joint Significance

Table 4 Joint F-Test (NCHILD)

| Model | Residual Df | RSS | Df | Sum of Squares | F Value | P Value |
|-------|-------------|-----|-----|----------------|---------|---------|
| Model 1 | 39570 | 4083.541 | | | | |
| Model 2 | 39566 | 4076.962 | 4 | 6.58 | 15.963 | 4.597e-13 |

In our multiple regression model, a household with only one child was not a significant predictor. Therefore, we performed a joint F-test to assess whether including different categories of number of children collectively improved the model. The results of the F-test indicated that when all the categories of NCHILD are considered together, their inclusion significantly improves the model. This suggests that while NCHILD1 alone may not be a strong predictor, having all the categories of number of children is necessary for determining a household's food security status.

## Test for Heteroskedasticity

| Table 5 Breusch-Pagan Test | | |
|---|---|---|
| Statistic | P-value | DF |
| 5811 | < 2.2e-16 | 16 |

Based on the Breusch-Pagan test, the null hypothesis is rejected because the p-value is less than the significance level of 0.05. Therefore, we have significant evidence of heteroskedasticity in the multiple regression model, indicating that the variance of the residuals

is not constant. To correct for heteroskedasticity, we ran a linear regression model using robust standard errors.

Table 6 Robust Multiple Regression

Note: * p < 0.05, ** p < 0.01, *** p < 0.001

| Term | Estimate | Std. Error | p-value |
|---|---|---|---|
| (Intercept) | 0.562 | 0.0201 | 4.14e-170*** |
| FAMINC$10,000-$19,999 | 0.08 | 0.0229 | 0.000488*** |
| FAMINC$20,000-$29,999 | 0.0569 | 0.0221 | 0.0099** |
| FAMINC$30,000-$39,999 | 0.137 | 0.0212 | 1.01e-10*** |
| FAMINC$40,000-$49,999 | 0.19 | 0.0213 | 4.15e-19*** |
| FAMINC$50,000-$59,999 | 0.206 | 0.0211 | 1.77e-22*** |
| FAMINC$60,000-$74,999 | 0.275 | 0.0204 | 4.5e-41*** |
| FAMINC$75,000-$99,999 | 0.328 | 0.0201 | 8.15e-60*** |
| FAMINC$100,000-$149,999 | 0.362 | 0.0199 | 9.66e-74*** |
| FAMINC$150,000+ | 0.388 | 0.0198 | 3.19e-85*** |
| AGE | -6.61e-05 | 0.000145 | 0.648 |
| MARST | 0.0596 | 0.00518 | 1.36e-30*** |
| NCHILD1 | -0.00486 | 0.00662 | 0.463 |
| NCHILD2 | -0.014 | 0.00668 | 0.0357* |
| NCHILD3 | -0.0302 | 0.00768 | 8.54e-05*** |
| NCHILD4+ | -0.0551 | 0.00961 | 9.61e-09*** |
| LABFORCE | 0.00386 | 0.00423 | 0.361 |

Using the robust approach to adjust for heteroskedasticity, the standard errors decreased, leading to smaller p-values and confidence intervals. Despite this adjustment, the same predictors remained significant, demonstrating the robustness of the results. This suggests that our findings about the relationship between income and food security are stable, even when accounting for heteroskedasticity. Variables such as family income, marital status, and number of children continued to show statistically significant associations with food security, while age, labor force status, and having only one child remained non-significant.

While robust standard errors correct for heteroskedasticity, it is important to note that other limitations such as unmeasured confounding variables or potential data biases could still influence the results. Future studies could build upon this analysis by considering additional covariants to refine these findings.

Correcting for heteroskedasticity strengthens the reliability of our conclusions, reinforcing that income and family structure are important factors in determining food security. Additionally, this suggests that interventions targeting these areas are likely to have a meaningful impact.

# Conclusion

Our study shows a clear link between income and food security: as household income goes up, families are more likely to have enough food. This matches what other researchers have found. Studies by Loopstra & Tarasuk (2013), Coleman-Jensen et al. (2022), and Asadi-Lari et al. (2019) all show that even small increases in income can make it easier for families to get the food they need. We found the biggest improvements in food security among households earning more than $75,000, which supports the idea that fighting poverty is key to reducing food insecurity.

In addition, these findings highlight the importance of integrating food security into broader economic and social policies. By addressing the root causes of income inequality and providing targeted support to vulnerable populations, governments can improve food access, reduce inequality, and enhance overall well-being in the long term. Future research should

explore how different income levels interact with other factors, such as education and community support programs, to affect food security.

We also found that family structure matters. Being married and the number of children in a household can affect food security. This supports Moffitt and Ribar's (2018) findings that how resources are shared within a family plays an important role, especially in low-income households.

Policy implications from this research are clear, showing increasing household income through job creation, wage growth, and expanded eligibility for nutrition assistance programs like SNAP and WIC can significantly reduce food insecurity. As over half of food insecure households in the U.S. rely on such programs (USDA, 2022), strengthening these safety nets could be a critical step in ensuring equitable food access. Addressing food insecurity through economic policy not only improves health and well-being but can also reduce public expenditures on healthcare, education, and social services over the long term.

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