# Nutritional inequality among young people aged 10 to 17 years: an analysis based on data from the Household Budget Survey (POF)

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*Summary*. The study examines nutritional inequality among young people in Brazil, emphasizing its importance for human and economic development. The analysis uses data from the 2017/2018 Household Budget Survey (POF) to investigate the relationship between family income and youth nutrition. The results reveal significant disparities in food spending between different income groups, with poorer households allocating a higher proportion of their income to food compared to richer ones. In addition, lower-income households face a higher risk of nutritional deficiencies. These findings highlight the importance of public policies aimed at equitable access to healthy eating for all young Brazilians[1].

## Introduction

Nutritional inequality among young people in Brazil is a crucial challenge for development, impacting not only the human sphere, but also the economic sphere, especially when minimum levels of consumption are not adequately met.

It is critical to ensure proper nutrition during these phases to promote physical growth, cognitive development, and satisfactory academic performance, as well as prevent chronic diseases (Brown et al., 2011; Heckman, 2000). However, many young people face nutritional challenges, including malnutrition, micronutrient deficiencies, and weight problems such as obesity (FAO, 2021; GNR, 2020; IBGE, 2019). These issues are a reflection of the socioeconomic disparities that exist in society and changes in dietary patterns, such as the increase in the consumption of ultra-processed foods to the detriment of healthier options, such as fruits and vegetables (Monteiro et al., 2010).

In this context, investigations on the relationship between family income and the nutritional quality of young people's diets, such as those conducted using data from the Household Budget Survey (POF), are fundamental. Analysis of this data reveals significant disparities in spending on food

among different income strata. For example, low-income households tend to commit a higher proportion of their income to food, which can restrict their access to more nutritious and varied foods (Drewnowski, 2004).

The different patterns of spending on food are evidenced by comparing the average amounts spent by the poorest and richest families, as shown in Table 1. In the first quintile, families spend an average of R$ 399.00 per person monthly, of which R$ 108.10 (27.1%) is allocated to food. In contrast, in the fifth quintile, the average monthly per capita expenditure is R$ 3,570.40, with R$ 379.30 (10.6%) allocated to food. This indicates that, although poorer households have a considerably lower per capita budget, they commit a larger share of their income to food [2].

**Table 1.** Average per capita expenditures, total and food, of households with young people aged 10 to 17 years, by quintiles of per capita family income

| Income Quintiles | Expenses | | |
| --- | --- | --- | --- |
| | Total | Food | |
| | (R$) | (R$) | (%) |
| 20% poorest | 399.0 | 108.1 | 27.1 |
| 20%-40% | 700.9 | 160.2 | 22.9 |
| 40%-60% | 1085.3 | 218.0 | 20.1 |
| 60%-80% | 1564.3 | 253.8 | 16,2 |
| 20% richest | 3570.4 | 379.3 | 10.6 |

Source: Prepared by the authors based on data from the 2017/2018 Household Budget Survey (POF).

This disparity in food spending has a direct impact on the health and development of future generations if coupled with nutritional deprivation. Studies show that adequate nutrition during childhood and adolescence is crucial to ensure physical and cognitive development, directly influencing productive potential and future well-being (Heckman, 2000; Victora et al., 2008). Investing in the prevention of chronic diseases associated with malnutrition is essential to mitigate long-term economic health costs (Hoddinott and Kinsey, 2013). Thus, public policies aimed at promoting adequate

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[1] The creation of this technical note was motivated by the POF Indicators Panel, released by IMDS, which reveals the complexity of living conditions and family budgets in Brazil, with detailed analyses by themes and demographic segments. It can be accessed at:
https://imdsbrasil.org/en/indicador/
household-budget-survey/

[2] It should be noted that although the average total expenditure of the richest 20% is almost 9 times greater than its equivalent among the poorest 20% the difference in expenditure on food is only 3.5 times greater.

nutrition in all income brackets are essential to ensure sustainable human and economic development in Brazil.

## Data

This study is based on the population participating in the 2017/2018 edition of the National Food Survey (INA), conducted as a subsample of the Household Budget Survey (POF), a national survey that investigates households through sampling. The POF collects data on household expenses, living conditions, and consumption habits of Brazilian families.

In the 2017/2018 edition, personal food consumption data were collected from 20,112 households for all residents aged 10 years or older. The INA subsample corresponds to 34.7% of the 57,920 households investigated in the 2017-2018 POF. The households that participated in the subsample were randomly selected from among those households that were selected for the original sample of the 2008-2009 POF. The subsample allowed the construction of results for the following levels: Brazil and Major Regions (North, Northeast, Southeast, South and Midwest).

The current analysis covers residents of both sexes who live in households with at least one child or adolescent between 10 and 17 years of age. The choice of this specific age group for young people (between 10 and 17 years of age) is based on the inclusion of only residents aged 10 years or older in the POF food consumption subsample. The sample for calculations of household expenditure and income covers a total of 17,051 households. For the calculations related to the subsample of food consumption of young people aged 10 to 17 years, we used a sample of 6,792 young people.

## Body Mass

In this section we will look at how the Body Mass Index (BMI) can be used to assess the nutritional status of adolescents between the ages of 10 and 17, and how this measure varies according to per capita income.

BMI is an indicator that relates a person's weight and height, and can point to cases of overweight, obesity or malnutrition, which are risk factors for health [3].

To obtain the BMI, the weight (in kg) is divided by the height squared (in m), resulting in a value in kg/m$^2$. This value is then compared with the percentile tables that take into account the sex and age of the adolescent, and which are prepared by health agencies (See **Appendix** 1).

[3]Body Mass Index (BMI) is often used as a measure of body weight in relation to height and is widely applied in epidemiological and clinical studies. However, it is important to note that BMI has been the subject of criticism due to its simplicity and to the lack of consideration of other health-relevant factors, such as body composition, fat distribution, and muscle mass (Rothman, 2008).

Figure 1 shows a dispersion analysis in which per capita family income (on a logarithmic scale) is related to the distance between the BMI obtained in the survey and the minimum BMI to be at the Ideal Weight. The red line represents the minimum threshold for the young person not to be considered underweight. Points below this line indicate that individuals are malnourished.

**Figure 1.** Difference between the BMI gained and the minimum BMI to be considered in the "Ideal Weight": 2017/2018
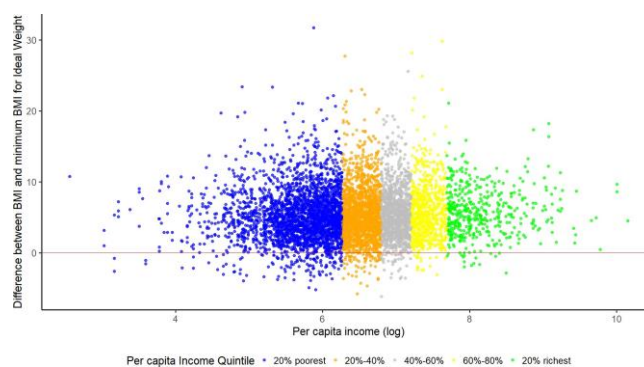


Source: Prepared by the authors based on the Household Budget Survey (POF), 2017/2018.

The per capita income quintiles show notable differences in the mean difference between the observed BMI and the ideal BMI, as well as in the proportion of underweight adolescents. The poorest 20% have, on average, 5.20 points of BMI above the ideal, with 5% of individuals underweight. On the other hand, the richest 20% have an average of 5.78 above the minimum BMI, with less than 3% underweight.

There is a positive correlation between family income and distance from the minimum BMI. In other words, it seems that the higher the family income, the greater the tendency for adolescents to have a BMI above the ideal minimum. These results indicate a possible association between increased income and higher BMI among adolescents. When we look specifically at young people who are underweight (those below the red line), we observed that the mean difference between the observed BMI and the minimum BMI for ideal weight is -1.51 for the poorest 20% and -0.91 for the richest 20%. These results highlight how socioeconomic disparity can influence the nutritional status of adolescents.

## Energy Needs

**A. Caloric Deprivation.** Energy needs are highly individual, varying based on factors such as age, gender, weight, and level of physical activity, as well as individual metabolic rate. For the proper functioning of the body, a minimum consumption of energy is essential, which is obtained through food. Setting a minimum intake for young people is complex, but estimates suggest a range between

1400 and 2600 calories (USDA, 2010).  Because our study focuses on deprivation, we set a very low threshold to identify individuals who are consuming below the minimum necessary.

Figure 2 shows the daily calorie intake of young people aged 10 to 17 years in relation to per capita family income (on a logarithmic scale).  The red line represents the consumption of 1,200 calories daily.  Points below this line indicate that individuals are consuming fewer calories than required.

**Figure 2.** Daily calorie consumption of young people aged 10 to 17 years: 2017/2018
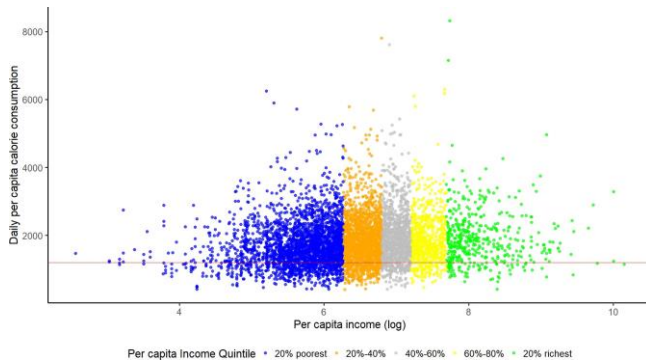


Note: The red line represents the daily consumption of 1,200 calories.
Source: Prepared by the authors based on the Household Budget Survey (POF), 2017/2018.

The analysis of the figure reveals a higher concentration of young people consuming less than 1200 calories daily  in the poorest strata.  About 22% of young people in the poorest 20% are below this threshold, compared with 16% in the richest 20%.  It is also observed that calorie consumption increases with the increase in family income. On average, the daily calorie intake per quintile of per capita income reveals that the poorest 20% have the lowest average consumption (1,705 calories), followed by the middle-income group (40%-60%) with the highest average (1,955 calories), and the richest 20% with an average of 1,922 calories.

The logistic regression analysis presented in Table 4 confirms and quantifies these relationships between income and probability of caloric deprivation.  Logistic regression is a statistical technique used to model and analyze the relationship between a dependent binary variable (such as being below minimum calorie intake) and a set of independent variables (in this case, income brackets).  The results indicate that belonging to the poorest 20% is significantly associated with a higher probability of being below the minimum calorie intake compared to the richest 20%, with a positive and highly significant coefficient (0.388).  The other income brackets do not show clear associations with the likelihood of caloric deprivation.

**Table 2.** Determinants of the Probability of Caloric Deprivation by Income Quintiles of Young People"

| Variables | Young People |
|---|---|
| Intercepted | -1.659*** |
| | (0.000) |
| 20% poorest | 0.388*** |
| | (0.004) |
| 20%-40% | 0.021 |
| | (0.882) |
| 40%-60% | -0.193 |
| | (0.213) |
| 60%-80% | -0.224 |
| | (0.183) |

Note: P-value in parentheses. * 10%; ** 5%; *** 1%.
Source: Prepared by the authors based on data from the 2017/2018 Household Budget Survey (POF).

**B. Food-Related Challenges.** Table 3 shows the percentage of young people, aged between 10 and 17 years, belonging to families who reported facing challenges or concerns related to the nutrition of these young people due to insufficient financial resources.  Possible difficulties or concerns include: *i. Loss of diversity and quality in food; ii. Food consumption below what is necessary; iii. Reduction of the amount of food in each meal; iv. Omission of one or more meals; v. Having only one meal a day or a complete fast; vi.  Experience hunger due to unavailability of food.*

**Table 3.** Percentage of young people aged 10 to 17 years in families who reported having some difficulty or family concern with food for young people aged 10 to 17 years due to lack of money

| Income Quintile | Young people below 1200 kcal |
|---|---|
| 20% poorest | 56.6 |
| 20%-40% | 27.6 |
| 40%-60% | 12.6 |
| 60%-80% | 9.7 |
| 20% richest | 4.0 |

Source: Prepared by the authors based on data from the 2017/2018 Household Budget Survey (POF).

Analysis of the table reveals a worrying disparity in food security among young people from different socioeconomic groups.  The data show that difficulty or concern about food is much more prevalent among young people from the poorest families, with more than half (56.6%) of these young people facing these issues.  In contrast, only 4.0% of young people from the wealthiest households report facing food difficulties.

The data presented reveal a clear association between the socioeconomic level of families and the prevalence of food-related financial difficulties among young people. This information suggests that young people from economically

disadvantaged families are at greater risk of not receiving the nutrients they need for proper growth and development. On the other hand, young people from wealthier families face these problems to a considerably lesser extent.

**C. Determinants.** A descriptive analysis of POF data reveals associations between individual and socioeconomic characteristics and the eating behavior of young people, especially in relation to caloric intake below 1200 calories per day (Appendix 2).

Logistic regression analysis (Table 4) reveals that certain socioeconomic and geographic factors are associated with the likelihood of caloric deprivation among young people, especially the poorest. The results indicate that the female gender is significantly related to a higher probability of insufficient calorie consumption (0.600 for young people in general and 0.482 for the poorest 20%). Similarly, the presence of only one adult with income in the household is associated with a higher risk of caloric deprivation (0.187 for young people overall and 0.317 for the poorest 20%). In addition, the more children there are in a family, the more likely they are to face calorie deprivation. This is evidenced by the positive coefficient (0.110) for young people in general, indicating that even families with only one child are significantly more likely to suffer from this condition.

In the richest region of the country, the Southeast, the high incidence of malnutrition among poor young people is remarkable. This result is surprising and raises suspicions about possible causes, such as the lower practice of self-consumption, which often serves as a safeguard against food shortages, as well as the impact of food prices in the region. However, it is important to point out that these possible causes need further studies for a more complete understanding of the underlying factors.

The analysis also highlights that young people residing in rural areas face a significantly higher likelihood of calorie deprivation (0.177 for youth overall). On the other hand, factors such as ethnicity (being white) and the condition of being the family reference (woman or white) did not show a significant impact on the probability of caloric deprivation among young people, with coefficients close to zero and non-significant p-values.

These results highlight the complexity of the problem and the importance of considering several factors when addressing calorie deprivation among young people, providing valuable input for the development of policies and interventions aimed at promoting adequate and equitable nutrition.

**Table 4.** Determinants of the Probability of Caloric Deprivation by Characteristics of Youth: Results of Logistic Regression Analysis

| Variables | Young People | Poorest 20% of Young People |
|---|---|---|
| Intercepted | -2.298*** | -2.098*** |
| | (0.000) | (0.000) |
| Young Woman | 0.600*** | 0.482*** |
| | (0.000) | (0.000) |
| Young White | 0.062 | 0.057 |
| | (0,445) | (0,640) |
| Young Person attending school | -0.225* | -0.239 |
| | (0.098) | (0,219) |
| Family reference: Woman | 0.046 | -0.120 |
| | (0.505) | (0.225) |
| Family reference: White | -0.106 | -0.136 |
| | (0.209) | (0.306) |
| Only one Adult with Income | 0.187*** | 0.317*** |
| | (0.007) | (0.001) |
| Number of Children | 0.110*** | 0.093*** |
| | (0.000) | (0.003) |
| Rural Household | 0.177** | 0.047 |
| | (0.016) | (0.642) |
| Northeast | 0.240** | 0.403* |
| | (0.036) | (0.067) |
| North | 0.340*** | 0.434* |
| | (0.006) | (0.056) |
| Southeast | 0.355*** | 0.693*** |
| | (0.003) | (0.003) |
| South | 0.437*** | 0.493 |
| | (0.003) | (0.118) |

Note: P-value in parentheses. * 10%; ** 5%; *** 1%.
Source: Prepared by the authors based on data from the 2017/2018 Household Budget Survey (POF).

## Food Groups

The NOVA classification (Monteiro et al., 2010) it is critical to assess the quality of the diet by dividing foods into four distinct groups. The first group includes fresh or minimally processed foods, such as fruits, vegetables, and fresh meats, which are considered healthy because they preserve nutrients and do not contain artificial additives. In contrast, the fourth group encompasses ultra-processed foods such as soft drinks and cookies that are formulated primarily with substances extracted from food or synthesized in the laboratory and contain various additives.

When analyzing the caloric intake of young people aged 10 to 17 years in relation to food categories by per capita income (as shown in Figure 3), a significant trend is observed. As income increases, the percentual amount of calories from fresh or minimally processed foods tends to decrease (Figure 3a), while the caloric intake of ultra-processed foods increases (Figure 3b).

This dynamic reflects not only food choices, but also the

**Figure 3.** *Calorie* intake consumed by young people aged 10 to 17 years by food group: 2017/2018
**(a)** In natura or minimally processed food                                      **(b)** Ultra-processed foods
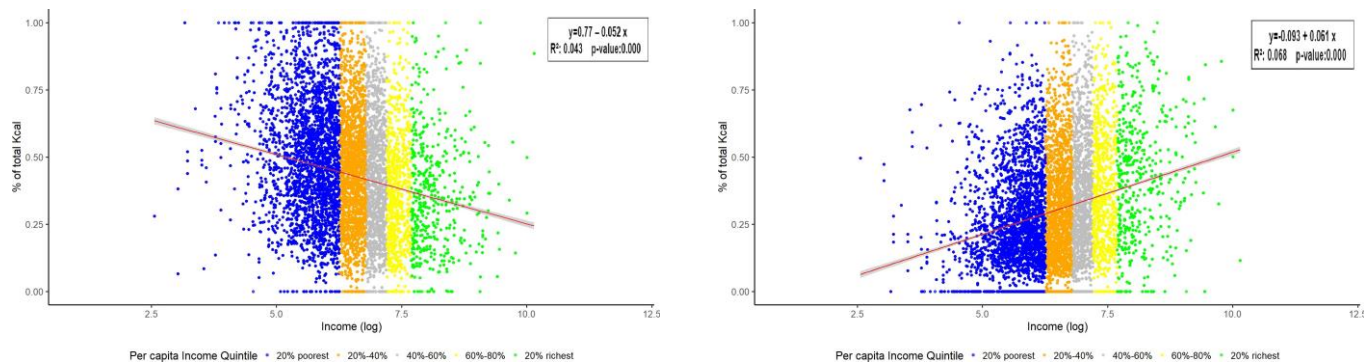


Source: Prepared by the authors based on data from the 2017/2018 Household Budget Survey (POF).
Note: Graph 3a shows the trend in the number of calories consumed by young people aged 10 to 17 years from fresh or minimally processed foods in relation to per capita income (on a logarithmic scale).  Graph 3b shows the trend in the number of calories consumed by young people aged 10 to 17 years from  ultra-processed foods in relation to per capita income (on a logarithmic scale).
Note 2: The equations that define the trend lines are displayed in the text box.  $R^2$ and the p-value for slope.

constraints imposed by income.  The poorest tend to eat mainly basic foods, such as rice, beans and eggs, which are affordable and make up the basic food basket. On the other hand, the richest have greater access to higher value-added foods.  However, this differentiation does not necessarily translate into a healthier diet for the poorest; It reflects their limitations in accessing a wider variety of foods.

These trends highlight the importance of considering not only the quantity but also the quality of the diet and access to healthy foods across all income brackets.  Promoting more nutritious and balanced eating habits requires policies and interventions that encourage equitable access to a variety of fresh, minimally processed foods and avoid  over-reliance on ultra-processed foods, which are associated with health risks.  Ensuring universal access to a healthy diet is essential to combat food inequalities and promote the general well-being of the population, at all income levels.

## Conclusion

The study addressed the relationship between nutrition and family income among young Brazilians, highlighting the significant socioeconomic disparities that impact diet quality and nutritional status.  The analysis of data from the 2017-2018 Household Budget Survey (POF) revealed distinct patterns of food consumption in different income strata, highlighting that poorer households face a higher risk of food deprivation and nutritional insecurity.

The results showed a significant correlation between family income and several nutritional indicators, such as Body Mass Index (BMI), caloric intake, and preference for food categories. Young people from poorer families tend to have lower calorie intake and a diet with a higher proportion of fresh or minimally processed foods, while those from wealthier families consume more calories and have a greater

preference for ultra-processed foods.

In addition, the analysis of food-related difficulties revealed that young people from the poorest households face a higher risk of malnutrition and food insecurity, with nearly half reporting concerns about a lack of sufficient food. On the other hand, young people from wealthier families experience fewer difficulties in this regard, reflecting a greater availability of financial resources to purchase diversified foods.

These findings reinforce the importance of public policies aimed at promoting food and nutrition security, especially among low-income populations.  Strategies that aim to increase access to healthy foods and promote nutrition education can play a crucial role in reducing nutritional inequalities and improving the health of the Brazilian child and adolescent population.

In this context, it is essential to consider recent initiatives such as Decree No.  11,936, of 2024, which establishes measures for the composition of the basic food basket, aiming to ensure a more diversified and nutritious food supply for all Brazilians (BRASIL, 2024a).  It is also relevant to mention Decree No.  11,937, of 2024, which creates the Solidarity Kitchen Program, seeking to provide balanced and healthy meals to individuals in situations of social vulnerability (BRASIL, 2024b).  Such initiatives, together with other policies such as the National Plan for Food and Nutrition Security (BRASIL, 2009) and the Food Acquisition Program (BRASIL, 2010), demonstrate efforts to improve the diet of Brazilians and combat nutritional inequalities.

Therefore, this study highlights the need for interventions that address not only food availability but also the social and economic determinants that influence eating habits and access to an adequate diet.  By prioritizing equity and universal access to nutritious food, we can make progress

in building a healthier and more equitable society for future generations.

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## Appendix 1

BMI table by age and sex

| Sex | Age (years) | Severe acute malnutrition | Moderate acute malnutrition | Normal | Overweight | Obesity |
|-----|-------------|---------------------------|-----------------------------|--------|------------|---------|
| Women | 10 | less than 12.4 | 12.4–13.4 | 13.5–19.0 | 19.1–22.6 | 22.7 or more |
| Women | 11 | less than 12.7 | 12.7–13.8 | 13.9–19.9 | 20.0–23.7 | 23.8 or more |
| Women | 12 | less than 13.2 | 13.2–14.3 | 14.4–20.8 | 20.9–25.0 | 25.1 or more |
| Women | 13 | less than 13.6 | 13.6–14.8 | 14.9–21.8 | 21.9–26.2 | 26.3 or more |
| Women | 14 | less than 14.0 | 14.0–15.3 | 15.4–22.7 | 22.8–27.3 | 27.4 or more |
| Women | 15 | less than 14.4 | 14.4–15.8 | 15.9–23.5 | 23.6–28.2 | 28.3 or more |
| Women | 16 | less than 14.6 | 14.6–16.1 | 16.2–24.1 | 24.2–28.9 | 29.0 or more |
| Women | 17 | less than 14.7 | 14.7–16.3 | 16.4–24.5 | 24.6–29.3 | 29.4 or more |
| Men | 10 | less than 12.8 | 12.8–13.6 | 13.7–18.5 | 18.6–21.4 | 21.5 or more |
| Men | 11 | less than 13.1 | 13.1–14.0 | 14.1–19.2 | 19.3–22.5 | 22.6 or more |
| Men | 12 | less than 13.4 | 13.4–14.4 | 14.5–19.9 | 20.0–23.6 | 23.7 or more |
| Men | 13 | less than 13.8 | 13.8–14.8 | 14.9–20.8 | 20.9–24.8 | 24.9 or more |
| Men | 14 | less than 14.3 | 14.3–15.4 | 15.5–21.8 | 21.9–25.9 | 26.0 or more |
| Men | 15 | less than 14.7 | 14.7–15.9 | 16.0–22.7 | 22.8–27.0 | 27.1 or more |
| Men | 16 | less than 15.1 | 15.1–16.4 | 16.5–23.5 | 23.6–27.9 | 28.0 or more |
| Men | 17 | less than 15.4 | 15.4–16.8 | 16.9–24.3 | 24.4–28.6 | 28.7 or more |

Source: (OMS, 2007)

## Appendix 2

Characteristics of young people by income and nutritional profile

| Indicators | Young People | Young People Under 1200 Kcal Intake | Poorest 20% of Young People | Poorest 20% of Young People Under 1200 Kcal Intake |
|------------|--------------|-------------------------------------|------------------------------|----------------------------------------------------|
| Young Women (%) | 48.50 | 60.94 | 49.77 | 59.35 |
| Young Whites (%) | 32.82 | 32.62 | 23.44 | 23.84 |
| Young People Attending School (%) | 94.78 | 93.48 | 94.44 | 93.14 |
| Family Reference: Woman (%) | 42.61 | 44.46 | 46.84 | 45.97 |
| Family Reference: White (%) | 29.91 | 28.24 | 19.87 | 18.87 |
| Families with Only One Adult with Income (%) | 31.51 | 34.85 | 40.57 | 45.80 |
| Average number of children in the family | 2.28 | 2.47 | 2.91 | 3.05 |
| Rural Households (%) | 27.27 | 30.30 | 36.06 | 36.54 |
| Northeast (%) | 37.26 | 36.39 | 48.20 | 45.63 |
| North (%) | 18.62 | 21.03 | 26.26 | 27.27 |
| Southeast (%) | 21.37 | 22.15 | 14.73 | 18.18 |
| South (%) | 9.79 | 10.30 | 4.21 | 4.12 |
| Midwest (%) | 12.96 | 10.13 | 6.61 | 4.80 |

Source: Prepared by the authors based on data from the 2017/2018 Household Budget Survey (POF).