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Applied nutritional investigation

Home food insecurity during the suspension of classes in Brazilian public schools due to the COVID-19 pandemic

Erica Costa Rodrigues M.D. [a],*, Raquel de Deus Mendonça Ph.D. [b], Priscila Pena Camargo M.D. [a], Mariana Carvalho de Menezes Ph.D. [b], Natália Caldeira de Carvalho Ph.D. [c], Adriana Lúcia Meireles Ph.D. [b]

[a] *School of Nutrition, Federal University of Ouro Preto, Ouro Preto, Brazil*
[b] *Department of Clinical and Social Nutrition, Federal University of Ouro Preto, Ouro Preto, Brazil*
[c] *Department of Food, Federal University of Ouro Preto, Ouro Preto, Brazil*

A B S T R A C T

Objectives: We sought to evaluate the effect of socioeconomic conditions and variables related to the COVID-19 pandemic on the food insecurity of students during suspension of classes in public schools.
Methods: This was a telephone survey ($n = 612$) of adults responsible for purchasing food through representative samples of students in two Brazilian municipalities in June and July 2020. The outcome was food insecurity, assessed using the Brazilian Food Insecurity Scale. Multivariate logistic regression models were used to estimate the odds ratio (OR) and 95% confidence interval (CIs) for sociodemographic and pandemic-related factors of COVID-19.
Results: The total prevalence of food insecurity in households was 82%, with 65.7% mild food insecurity, 11.3% moderate, and 5.0% severe. After adjustment for confounding factors, households with the highest number of children (OR = 2.17; 95% CI, 1.10−4.27) and households that received local-government basic food baskets (OR = 1.64; 95% CI, 1.04−2.58) were significantly associated with food insecurity. Furthermore, households that did not experience a decrease in income during the pandemic were inversely associated with food insecurity (OR, 0.17; 95% CI, 0.09−0.32).
Conclusions: The prevalence of food insecurity was high, and policies for the distribution of food baskets may not be sufficient to guarantee food security for the most vulnerable families with a greater number of children. Considering the possible worsening of food insecurity during the COVID-19 pandemic, the National School Feeding Program has the potential to play a strategic role in promoting food security for students.

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Introduction

Since 1988, school feeding has been a right of all students of public basic education in Brazil, guaranteed by the constitution through the School Feeding Program (Programa Nacional de Alimentação Escolar [PNAE]). The program is one of the oldest public policies of the state, and has guidelines regarding the reach of food and nutritional security of students in an equal way considering specifics of age group and health conditions [1].

The PNAE serves approximately 40 million students across all regions of the country and aims to contribute to biopsychosocial development, learning, and school performance, healthy eating habits, and actions of food and nutrition education. Research

shows that the consumption of school meals is higher among male students, students who identify as brown and black, students who do not live in the capital, students who work, and students whose mothers have less education [2]. For some of the students served by the program, especially those with unfavorable socioeconomic conditions, school meals are very important, often their main daily meal [3].

With the beginning of the COVID-19 pandemic—a health tragedy that ravages Brazil, which is first in the world rankings of deaths and confirmed cases [4]—the federal government adopted measures of social distancing as a way to contain the infection and preserve the responsiveness of the health systems [5].

The adoption of social restrictions has drastically altered the daily life habits of the population, such as working and studying conditions, access to food, and physical activity. It also has socioeconomic effects, such as reduced wages and decreased income

[6]. In March 2020 the government also adopted the suspension of face-to-face classes in schools, without a contingency plan for school feeding. In public schools, this has meant the interruption of school meals and precarious access to food for students, which may increase the risk of some children living in food insecurity, since schools offered daily meals through the PNAE [7].

Changes in the PNAE during the COVID-19 pandemic have also affected the commercialization of family farming products. Since 2009, the law has established that at least 30% of the program's financial resources must be used to purchase foodstuffs from family farmers in the locality or surroundings; without school meals, there have been difficulties selling the produce [8].

To mitigate the effects of the absence of school meals, the Brazilian government authorized states and municipalities to distribute kits or basic food baskets to the families of students with PNAE resources [9]. It remains uncertain whether the strategy adopted by municipal governments to distribute basic food baskets can truly reduce food insecurity in students' homes, in a scenario of great social inequalities such as Brazil. Brazil was ranked the ninth most unequal country out of the 164 countries ranked by the World Bank in 2020, with a Gini index equal to 53.9 [10].

Thus, the PNAE shows itself as a public policy of paramount importance for coping with food insecurity, during and after the pandemic. It requires the monitoring of the food-security situation among students in the absence of a regular supply of school meals that can provide strategic data for policy operation at the local and regional levels. Therefore, this study aimed to evaluate the effect of socioeconomic conditions and variables related to the COVID-19 pandemic on students' household food insecurity during the suspension of classes in public schools.

Methods

Design and location

This was a cross-sectional study with data from the baseline of the longitudinal Study of Food and Nutritional Security in the Pandemic of COVID-19 (ESANP) carried out in two medium-sized Brazilian municipalities (Mariana and Ouro Preto) located in the state of Minas Gerais. Ouro Preto has an estimated population of 74 558, an average monthly income of $714.00, and a human development index of 0.741. Mariana has a population of 61 288, an average monthly income of $557.00, and a human development index of 0.742, slightly above that of Minas Gerais (0.731) and slightly below that of Brazil (0.765) [11].

According to data from the school feeding sector of the municipalities, during face-to-face classes students enrolled in daycare centers full-time received four meals a day (breakfast, fruit, lunch, and afternoon snack). Part-time students (preschool, elementary school, youth, and adult education) received two meals (breakfast and lunch). The meals offered to students mainly contained milk, meat, vegetables, fruits, rice, and beans. During the suspension of classes, the municipal governments made a monthly distribution of a basic food basket per household, regardless of the number of students residing there.

Data collection

According to school census data [12], in 2020 Ouro Preto and Mariana had 7143 and 6076 students enrolled in the municipal public schools, respectively, distributed in daycare centers, preschool, elementary education, and youth and adult education. This totals 13 219 students in both cities, all of whom were eligible for the study sample. For the calculation of the sample of basic-education students, we considered proportional stratification by teaching follow-up (daycare centers and elementary school, including children and adolescents ages 6 mo to 17 y); if the same phone number was drawn, for example, siblings, a new draw was made within the same level of education. We considered an outcome prevalence (household food insecurity) of 36% [13], margin of error of 5%, and confidence interval of 95%, obtaining a minimum sample of 374 households. A percentage of recomposition was added to the sample size, considering the anticipated losses arising from refusals throughout the longitudinal study.

Student data were obtained from lists provided by the school feeding sector in the municipalities, including the name of the student, guardian's name, and contact phone number. Data collection was carried out through telephone interviews with the adults responsible for purchasing food in the homes of students in public

schools (93.6% were mothers or fathers of the students) during the months of June and July 2020. Telephone lines that were permanently busy, were disconnected, or remained unavailable after five unsuccessful attempts at contact were excluded from the study.

Instrument and variables analyzed

The interview questionnaire with the adults was built from national studies [13,14] and included food-insecurity assessment, sociodemographic variables, and variables related to the COVID-19 pandemic.

The outcome variable was food insecurity, measured using the Brazilian Food Insecurity Scale (EBIA) supplemental Table S1. The EBIA evaluates the family's self-perceived food-access conditions for the last 3 mo through 14 closed questions (yes/no), with 1 being the score for each positive answer (yes) and 0 for each negative answer (no) [15]. The instrument has been validated for the Brazilian population [13], with studies showing Cronbach's α ranging from 0.91 to 0.94 [16].

The EBIA presents degrees of severity according to the score (0 to 14 points): food security (0 points): there is regular and permanent access to food; mild food insecurity (1−5 points): there is some uncertainty about access to food in the future; moderate food insecurity (6−9 points): there is a quantitative reduction in food for the family; and severe food insecurity (10−14 points): there is a disruption of eating patterns not only among adults but also among children or adolescents in the family, and experience of hunger [13]. For the purposes of analysis in this study, the responses obtained through the EBIA were categorized into two groups: food insecurity (mild, moderate, and severe) and food security.

The explanatory variables were divided into blocks: sociodemographic variables and variables related to the COVID-19 pandemic.

The sociodemographic block included the following variables relating to the student's guardian: sex (female/male), marital status (married/not married: single, separated, widowed), skin color (white/non-white: black/brown, yellow), employment status (unemployed/employed), education (elementary/high school/university), and receipt of benefits from government social programs (yes/no). It also included the residential area (urban/rural), number of people in the household (<5/>5), number of children in the household (<3/>3), and socioeconomic classification (high level [A/B1/B2/C1]/low level [C2/D/E]). For the construction of this last variable, housing characteristics (access to drinking water, street paving, material goods present in the household, and education of the head of the family) were used, which were then categorized according to the Brazilian Economic Classification Criterion [17] and the child's age.

The block of variables related to the COVID-19 pandemic included the receipt of emergency aid provided by the government (yes/no), access to the basic basket or food kit (yes/no), report of someone infected with SARS-CoV-2 at home (yes/no), income reduction during the pandemic (yes/no), and the impact of income reduction (without impact/small/large/very large), in addition to the routine adopted during the pandemic (staying at home all the time/going out sometimes/always).

Data analysis

The data were organized in Excel spreadsheets and imported into Stata 13.0. Descriptive analyses were performed to calculate the mean and SD of the variables. For the univariate analysis, each covariate was crossed with the outcome variable (safety × food insecurity) using the χ^2 trend test and binary logistic regression to estimate the gross odds ratio (OR) and select the factors that were included in the multivariate model.

The variables selected as candidates for multivariate analysis were based on the P value cutoff point of 0.20 in the univariate analysis and biological plausibility or scientific support. Using the stepwise backward procedure, variables with greater scientific evidence related to social determinants of food insecurity at the proximal level [18] were kept in the model for a better understanding of the phenomenon, and those with less significance (highest P value) were analyzed and removed one by one from the model until the final multivariate model contained the variables with a significance level of $P < 0.05$ after adjustment for the socioeconomic variables.

The block variables were hierarchically allocated so that each block was adjusted to a new model, the first block being the sociodemographic variables and the second the variables related to the pandemic.

The variables of socioeconomic classification, income, and education of the adults interviewed were highly collinear; therefore, we chose to use education in the multivariate model instead of income. In our studies, the variable of income had a lower number of responses, which could interfere with the analyses; thus, the education variable was used as an income proxy. We evaluated the interaction (receipt of the basic food basket × education of the respondent adult and effect of the reduction in income × education of the respondent adult) through a ratio test that compared the fully adjusted model and the same model with product-term interactions. We did not find a significant result for these interactions (respectively, $P = 0.584$ and $P = 0.116$).
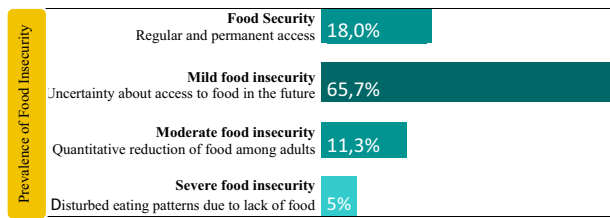
Fig. 1. Condition of household food insecurity in Mariana, Ouro Preto, Brazil, in 2020, by degrees of severity (*n* = 612).

This study was approved by the Ethics Committee of the Federal University of Ouro Preto (CAAE: 32005120.6.0000.5150), and informed verbal consent was obtained from all participants, which was recorded in mp4 format by the interviewer.

Results

A total of 612 households were assessed, with 82.0% (*n* = 502) having food insecurity. Severe food insecurity was observed in 5.0% (*n* = 31) of the total households, 11.3% (*n* = 69) had moderate food insecurity, and 65.7% (*n* = 402) had mild food insecurity (Fig. 1).

The sociodemographic characteristics according to the food-insecurity situation are shown in Table 1. Of the adults interviewed who were responsible for the purchase of food at home, 92.2% were women, 59.6% were married, 84% declared themselves non-white, 50.7% were not employed at the time of the interview, 48.3% reported receiving welfare assistance from the government, and 69.3% lived in households with two to four people.

Table 2 shows the variables related to the COVID-19 pandemic according to the food-insecurity situation of the households; 63.9% declared that they had received emergency aid from the government, 66.5% had a reduction in family income during the pandemic, and approximately 47% reported having received the basic food basket provided by local governments. We found that households in which at least one person received emergency aid from the government, households in which there was a large or very large reduction in income during the pandemic, and households that received a basic food basket were more likely to live in food insecurity.

In Table 3 we present the final multivariate model, after adjusting for socioeconomic characteristics. Having more than three children in the household (multivariate adjusted OR, 2.17; 95% CI, 1.10−4.27) and access to the basic food basket (multivariate adjusted OR, 1.64; 95% CI, 1.04−2.58) remained associated with food insecurity, and households that did not suffer a reduction in income during the pandemic remained less likely to experience food insecurity (multivariate adjusted OR, 0.17; 95% CI, 0.09−0.32).

Discussion

We found that 82% of the households assessed experienced some degree of food insecurity during the suspension of face-to-face classes in the COVID-19 pandemic in Brazil, with 5% having

Table 1
Distribution of sociodemographic characteristics according to household food-insecurity status (*n* = 612) using univariate logistic regression

Variable	All (*n* = 612)	Food security (*n* = 110)	Food insecurity (*n* = 502)	Unadjusted bivariate OR (95% CI)	*P*
Child's age (y)*	8.2 (7.9−8.6)	8.1 (7.3−8.9)	8.2 (7.9−8.6)	1.01 (0.96−1.06)	0.680
Respondent's sex					
Female	92.2	86.4	93.4	1.00 (ref.)	
Male	7.8	13.6	6.6	0.45 (0.23−0.85)	0.015
Marital status					
Married	59.6	69.1	57.5	1.00 (ref.)	
Not married	40.4	30.9	42.5	1.65 (1.06−2.57)	0.026
Referred Skin color					
White	15.3	15.7	15.2	1.00 (ref.)	
Non-white	84.7	84.3	84.8	1.04 (0.59−1.84)	0.894
Employment status					
Unemployed	50.7	41.8	52.6	1.00 (ref.)	
Employed	49.3	58.2	47.4	0.65 (0.43−0.98)	0.042
Respondent's education†					
Elementary	28.8	20	30.7	1.00 (ref.)	
High school	56.1	52.7	56.8	0.70 (0.41−1.19)	0.189
University	15.1	27.3	12.5	0.30 (0.16−0.55)	< 0.001
Benefits (social programs)					
Not receiving	51.7	66.4	48.5	1.00 (ref.)	
Receiving	48.3	33.6	51.5	2.15 (1.39−3.33)	< 0.001
Area of residence					
Urban	65.0	70.0	63.9	1.00 (ref.)	
Rural	35.0	30.0	36.1	1.32 (0.84−2.06)	0.229
Number of people in the household					
2−4	69.3	67.3	69,7	1.00 (ref.)	
5−16	30.7	32.7	30.3	0.89 (0.57−1.39)	0.614
Number of children in the household					
0−2	80.4	89.1	78.5	1.00 (ref.)	
≥3	19.6	10.9	21.5	2.24 (1.18−4.23)	0.013
Socioeconomic classification‡					
High level	64.9	44.9	69.3	1.00 (ref.)	
Low level	35.1	55.1	30.7	0.36 (0.24−0.55)	< 0.001

CI, confidence interval; OR, odds ratio
Values are expressed as percentages unless otherwise indicated
*Independent-samples *t* tests; values expressed as mean (95% CI).
†*n* = 608.
‡*n* = 595; based on the Brazilian Economic Classification Criteria.

Table 2
Distribution of variables related to the COVID-19 pandemic according to the situation of household food insecurity (*n* = 612) through univariate logistic regression

Variable	All (*n* = 612)	Food security (*n* = 110)	Food insecurity (*n* = 502)	Unadjusted bivariate OR (95% CI)	*P*
Government emergency aid					
Not receiving	36.1	44.5	34.3	1.00 (ref.)	
Receiving	63.9	55.5	65.7	1.54 (1.01−2.34)	0.043
Access to the basic food basket					
No	53.2	64.4	50.8	1.00 (ref.)	
Yes	46.8	35.6	49.2	1.75 (1.13−2.72)	0.011
Someone infected with SARS-CoV-2 at home					
No	97.2	96.4	97.4	1.00	
Yes	2.8	3.6	2.6	0.70 (0.23−2.20)	0.547
Income reduction					
No	33.5	50.0	28.9	1.00 (Ref.)	
Yes	66.5	50.0	70.1	2.35 (1.54−3.57)	< 0.001
Effect of income reduction					
Large/very large	37.6	10.9	43.4	1.00 (ref.)	
None/small	62.4	89.1	56.6	0.16 (0.09−0.30)	< 0.001
Routine adopted					
Stay at home	41.7	33.6	43.4	1.00 (ref.)	
Go out always/sometimes	58.3	66.4	56.6	0.66 (0.43−1.02)	0.060

CI, confidence interval; OR, odds ratio
Values are expressed as percentages unless otherwise indicated

severe food insecurity. According to worldwide data [19], in 2019 the prevalence of severe food insecurity was 9.7% and that of moderate/severe food insecurity was 25.9%; groups most vulnerable to food insecurity in the context of the pandemic are those that were already exposed to critical food deprivation before the start of the pandemic [20]. The Household Budget Survey carried out in Brazil in 2017−2018 (before the pandemic) estimated that 36.7% of households were in some degree of food insecurity, and 4.6% of those in severe food insecurity [13].

According to the World Food Program's Global Monitoring of School Meals during School Closures due to COVID-19, 369 million children missed school meals in April 2020. In June 2021, 154 million children in 79 countries whose schools remained closed may have been without access to school food [21].

In Brazil, school is an environment where students have access to healthy food regularly through the PNAE [7]. The COVID-19 pandemic directly affected the functioning of the program [9]. Even though municipalities have offered basic food baskets to some students, we observed in this study that households that received a basic food basket were 1.64 times more likely to face food insecurity.

An intervention study with low-income students conducted in Virginia (USA) before the pandemic identified that there was no improvement in home food security in a group of students who received a food backpack on weekends and school breaks compared to a group that did not receive this intervention [22].

Table 3
Effect of the COVID-19 pandemic on students' household food insecurity (*n* = 612) through multivariate logistic regression

Variable	Final model*	
	OR (95% CI)	*P*
Number of children in the household		
0−2	1.00 (ref.)	
≥3	2.17 (1.10−4.27)	0.025
Effect of income reduction		
Large/very large	1.00 (ref.)	
None/small	0.17 (0.09−0.32)	< 0.001
Access to the basic basket or food kit		
No	1.00 (ref.)	
Yes	1.64 (1.04−2.58)	0.034

CI, confidence interval; OR, odds ratio
*Final result after adjustment for the two blocks of variables (socioeconomic and pandemic).

Regarding the acquisition, availability, and nutritional adequacy of the Brazilian basic food basket, diets based on the consumption of items in this basket have been shown to have low amounts of fruits, vegetables, and cereals, lower amounts of calcium, potassium, and vitamin A, and higher energy and sodium than is recommended for adults [23].

Our findings suggest that the distribution of basic food baskets by municipalities may not be sufficient to guarantee students' dietary needs, or that the distribution of food occurs inappropriately, without regard for the number of residents and the age group of children and adolescents, and social vulnerabilities present in households.

In the regular school term in Brazil, the food offered to children must meet 30% of the nutritional needs of part-time students and 70% of the nutritional needs of full-time students [7]. Owing to the interruption of school meals, which prompted the distribution of basic food baskets to family units, it is possible that the minimum recommendations of the PNAE will not be achieved for students who live in family groups with a greater number of people.

Although our study is unable to establish the extent to which the financial and political crisis experienced in Brazil since 2016 [24] has affected the food insecurity of students' families, it is possible that some of these families were already in greater socioeconomic difficulties before the COVID-19 pandemic, and were more exposed to the effects of the pandemic.

In the present study, families with three or more children were 2.17 times more likely to experience food insecurity. Large national surveys [13] have demonstrated that considering the distribution of age groups, the greatest vulnerability to dietary restriction has been observed in households with children and adolescents. A study conducted in Bangladesh which assessed determinants of food insecurity and food diversity among the population during the pandemic found that the composition of the family unit was significantly associated with food insecurity, and that the larger the family, the greater the risk of living in food insecurity [25].

Another study, which looked at school food-service disruptions due to COVID-19 in Nigeria, found that these disruptions were associated with an increase in the food insecurity index. Single mothers and poorer households experienced relatively large deteriorations in food security due to disruption of school feeding services. This reinforces the hypothesis that the interruption of school food services during the pandemic compromises the food security of students served by school food programs [26].

The effects of the COVID-19 pandemic have had implications for various sectors of the economy, with job losses, reduced wages, and reduced income [27]. In our study, 66.5% of participants reported a drop in income due to the pandemic, which was associated with greater chances of experiencing food insecurity.

A study that evaluated changes in the food-security situation in Brazil during the recent financial and political crisis, before the COVID-19 pandemic, identified a strong association between family income and food insecurity, increasing the probability of food insecurity by six times among the poorest [24]. Evaluating food insecurity among university students during the COVID-19 pandemic, a North American study identified that students whose incomes were affected by unemployment, work leave, and reduced work shifts had significantly greater chances of experiencing food insecurity [6].

Additionally, studies indicate that households with lower income and a greater number of people may not be able to buy enough food regularly to meet their needs, or may be forced to buy smaller quantities of food, aggravating the situation of food insecurity [28,29]. In our study, 62.7% of the families had four to six individuals, and 55.3% of those families belonged to the lowest socioeconomic classification (D/E).

In a scenario of high food prices, a reduction in income decreases the purchasing power of families, especially low-income families. According to data from the Broad National Consumer Price Index, expenditure on food and beverages increased by 2.24% in November 2020, mainly driven by the increase in meals eaten at home, which showed an increase of 2.89%. Among foods, the largest increases were seen in the prices of soybean oil, polished rice, tomatoes, milk, and meat [30]. It is important to highlight that these foods make up the basis of the Brazilian diet, and any price variation can hinder low-income families from accessing healthy foods that are adequate to their needs.

It is possible that the COVID-19 pandemic created socioeconomic vulnerability for families that had already suffered from the effects of the economic and political crisis in Brazil in recent years. The scenario observed during the COVID-19 pandemic—a decrease in economic activity in the country compared to previous years and an increase in unemployment and prices of basic foods—configures the resurgence of food insecurity in Brazil in the pandemic context.

In perspective of public policies, our results suggest that policymakers should expand social protection mechanisms, such as adequate financial support for the most vulnerable families; distribution of sufficient basic food baskets, containing healthy, locally produced food purchased from small producers; and regulation of large variations in the prices of foods that form the basis of the population's diet.

This study has several strengths. To our knowledge, it is one of the first studies to assess the prevalence of food insecurity among public-school students in Brazil during the COVID-19 pandemic. The randomized and stratified sampling process is representative of the population of students in public schools in the two cities studied. The study uses the EBIA full version, an instrument validated for the Brazilian population and used in several national surveys [13,14].

Potential limitations of the study, such as the use of telephone interviews, may imply participation bias, since only people with an active telephone line could participate. The analyses were performed with data from students enrolled in public schools. Students enrolled in private schools were not included in this research; therefore, the results cannot be extrapolated to all students in the municipalities. A study before the pandemic scenario, carried out with adolescents living in Brazilian capitals, identified a significantly higher proportion of students from public schools living in household food insecurity (28.6%) compared to students from private schools (13.8%) [31]. Although students from private schools represent a smaller portion of students in basic education, more studies need to be carried out to assess the food insecurity of students in different contexts, especially in situations of health crisis, such as the COVID-19 pandemic.

Conclusion

Financial access to food may be compromised in the face of the health emergency caused by the COVID-19 pandemic in Brazil, and the increase in infections and deaths caused by the novel coronavirus strain in Brazil in 2021 imposes new restrictions on the movement of people, further extending the time before the resumption of face-to-face classes at schools in the country.

Therefore, we understand that the PNAE has a strategic role in guaranteeing the human right to adequate food for public-school students during and after the pandemic. The program is present in all municipalities in Brazil, facilitating the rapid arrival of resources to those in need. In addition to the distribution of basic food baskets, other actions such as maintaining the purchase of fresh food from small local producers (thus favoring their food security as well) and increasing the value of resources transferred to states and municipalities by the federal government in response to the large increase in food prices can guarantee universal service to students in different regions.

Acknowledgments

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.nut.2021.111448.

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