Original Article

Food insecurity and sociodemographic factors among children in São José dos Pinhais, Paraná, Brazil, 2017: a cross-sectional study*

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Abstract

Objective: To analyze association between food insecurity (FI) and sociodemographic factors among children. **Methods:** The study was carried out from May to November 2017 with mothers of children (18 – 35 months old) enrolled at public education facilities in São José dos Pinhais, Paraná, Brazil. FI was determined by the Brazilian Household Food Insecurity Measurement Scale. Multinomial logistic regression was used with a hierarchical model. **Results:** 395 mothers/children participated. Overall FI prevalence was 34.7% (95%CI 28.5;41.5), with prevalence of 25.7% (95%CI 19.2;32.3) for mild FI (MFI) and 9.0% (95%CI 8.5;9.4) for moderate/severe FI (MSFI). Families in the lowest income tercile had higher likelihood of MFI (OR=3.06 – 95%CI 1.26;7.41) or MSFI (OR=6.35 – 95%CI 1.89;21.4) when compared to the highest tercile. Higher MFI prevalence was identified in male children (OR=2.34 – 95%CI 1.49;3.68). **Conclusion:** FI was associated with lower income and MFI with male children. Public policies to increase income must be included in FI reduction strategies.

Keywords: Food Security; Socioeconomic Factors; Infant; Child; Cross-Sectional Studies.

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Introduction

Although the right to food, under construction in Brazil, Although the right to food, under construction in Brazil, has been strengthened with the Organic Law on Food and Nutritional Security[1] and with the inclusion of food among the positive social rights in the Constitution Federal (Constitutional Amendment No. 64, of February 4, 2010),[2] some 52 million people were still facing household food insecurity (FI) in 2013, 34% of whom were children between naught and 4 years old.[3]

> *Food insecurity is the violation of the right to access to food in sufficient quantity and quality to maintain daily activities in a regular and permanent manner. It should be understood as the expression of inequalities and power relations in the context in which people live.*

This situation has become worse in recent years and, according to the 2017-2018 Household Budgets Survey, conducted by the Brazilian Institute of Geography and Statistics (IBGE), national FI prevalence reached just over 36%, with half of all children under 5 years old living in households with some degree of FI.[4]

FI is the violation of the right to access to food in sufficient quantity and quality to maintain daily activities in a regular and permanent manner.[1] It should be understood as the expression of inequalities and power relations in the context in which people live.[5] Financial and political crises worsen food security[6] and, moreover, severe adverse situations can be especially challenging for families with children who rely on school meals, as demonstrated in the current health crisis caused by COVID-19.[7] This pandemic, cause by the spread of the novel coronavirus (SARS-CoV-2), has led to rapid exacerbation of FI among more socioeconomically vulnerable groups, among whom FI already existed.[8]

It is known that the level of household FI is a determining factor for the onset of acute or chronic non-communicable diseases in adulthood.[9] Among children, FI is associated with poorer health standards, poorer cognitive development and school performance.[10] Therefore, fighting FI is important at this stage of life, because it has a great impact on intelligence, schooling and income level in adulthood.[11]

The literature shows that social, demographic and economic factors influence FI.[12] Despite this, few studies have evaluated FI frequency and associated factors in households with children under 3 years of age, especially in Brazil. Wight et al. point out that few studies have investigated the causes of food insecurity among children. These authors conducted a large study involving North American children and presented evidence of strong association between poverty and FI in childhood.[13]

Knowing and monitoring FI distribution and its associated factors will allow not only the establishment of actions to reduce its frequency, but will also enable appropriate action strategies to be determined for times when FI becomes worse. Although the municipality of São José dos Pinhais is considered large and has the second largest gross domestic product (GDP) in Paraná, since 2016 it has been facing considerable reduction in taxation revenue from circulation of goods and provision of services.[14] This situation, also observed in the rest of the country, has caused an increase in unemployment, with the consequent expansion of social inequalities and vulnerabilities of specific population groups. This undoubtedly impacts access and ability to purchase food, as well as its availability for all family members.[6]

The objective of this study was to analyze association between FI and sociodemographic factors among children in the municipality of São José dos Pinhais.

Methods

This is a cross-sectional study, with a sample of children aged 18 to 35 months enrolled and attending education facilities in São José dos Pinhais, located in the metropolitan region of Curitiba, Paraná, Brazil. The research was conducted between May and November 2017.

Until 2012, the municipality of São José dos Pinhais had the second highest GDP in Paraná and a human development index of 0.758. IBGE estimated its population to be 307,530 inhabitants in 2017.[14]

The sample size calculation was performed using a formula for finite proportion estimation, considering that 2,667 children aged 18 to 35 months were enrolled at public municipal education facilities at the beginning of 2017. Outcome prevalence was taken to be 50% in order to maximize the sample size. A 95% confidence level and a maximum acceptable error of 5% were adopted, resulting in a minimum sample of 337 children, which was increased by 30% to compensate for the study design effect, and a further 20% to compensate for possible losses and refusals, totaling 526 children. Based on the sample size calculated, and keeping the confidence level at 95% and the power of the study at 80%, it would be possible to detect 50% prevalence in those exposed and 37.9% among those not exposed, equivalent to an odds ratio (OR) of 1.64. Using the same parameters for stratified analyses by sex, it would be possible to identify 29.6% prevalence for those exposed and 32.1% for those not exposed; and ORs of 2.38 and 2.12 for males and females, respectively.

We performed random cluster sampling in two stages: educational units and children. To ensure the representativeness of the sample, first of all 20 educational units out of the 43 existing in the city were randomly selected. The sample was distributed respecting the proportionality of the children enrolled at each Municipal Center for Early Childhood Education (*Centro Municipal de Educação Infantil* – CMEI). In each CMEI selected, the children were numbered in sequence according to the list provided by the school. They were then randomly selected until the number of children expected for each school was reached. If the selected child was not present or did not meet the inclusion criteria, another child was randomly selected.

The eligibility criteria for children to participate in the study were: being between 18 months and 35 months and 29 days old, regardless of sex; and being enrolled at a CMEI. Those children who had special feeding needs, as well as syndromes or systemic diseases that could present changes in feeding and would require specific nutritional attention were excluded from the study. Also excluded were questionnaires with incomplete answers to the Brazilian Food Insecurity Scale (*Escala Brasileira de Insegurança Alimentar* – EBIA) or that were not answered by the children's mothers.

Demographic, socioeconomic, and FI household variables were collected by means of a self-administered questionnaire sent to the child's home. The instrument was tested beforehand in a pilot study carried out at a CMEI that was not included in the main study design, involving 34 mothers of children in the same age group. The socioeconomic and demographic exposure variables were: the child's sex (female; male) and age (<24 months; ≥24 months); maternal schooling (years of study: ≤8; >8), marital status (in or not in a fixed relationship) and formal work status (yes; no); and per capita family income initially expressed in Brazilian Real (BRL) but subsequently categorized into terciles (1st tercile, R$19.50 to R$366.66; 2nd tercile, R$366.67 to R$625.00; 3rd tercile, R$625.01 to R$2,250.00).

Food insecurity was measured using the 2009 version of the EBIA scale, translated and validated in Portuguese.[15] The scale is used in the National Household Sample Survey (*Pesquisa Nacional por Amostra de Domicílios* – PNAD), conducted by IBGE,[16] and comprises 14 questions for families composed of adults and individuals under 18 years of age, addressing their experience in the last three months in relation to concern about lack of money to buy food, changes in the quality of food purchased and, finally, changes in the amount of food purchased. Classification of food security followed the criteria proposed by Reichenheim et al.[17] Families with 0 or 1 affirmative answer were classified as having food security (FS); 2 to 5 points indicated mild FI; 6 to 10 points indicated moderate FI; and 11 to 14 affirmative answers indicated severe FI.

The descriptive analysis of categorical variables included calculation of numbers and percentages (%), with respective 95% confidence intervals (95%CI). With regard to numerical variables, means and standard deviations (SD) were calculated. In order to test the association of FI with independent variables, the following categories were used: FS (food security), when 'EBIA score equal to or less than 1'; mild FI (MFI), when 'EBIA score between 2 and 5'; moderate FI and severe FI were grouped together (MSFI), and occurred when 'EBIA score equal to or greater than 6'. Crude and adjusted multinomial logistic regression analyses enabled ORs with 95%CIs to be estimated for association of food insecurity levels (mild and moderate/severe) with exposure variables. Presence of food insecurity was used as the reference category (versus: mild FI; moderate/severe FI).

Variables with a p-value <0.25 in the crude multinomial regression, in any of the FI categories, were included in the models, and were kept for adjustment when their p-value remained up to 0.25,[18] and were considered to be statistically significant when the p-value was <0.05.

Input of variables in the adjusted analysis followed the hierarchical model with three explanatory blocks: distal (maternal demographic characteristics: schooling and marital status); intermediary (socioeconomic characteristics: maternal employment status and per capita family income); and proximal (children's demographic characteristics: sex and age). Interactions between FI and sex were tested according to the exposure variables, and were considered significant when the p-value was <0.10. The analyses were replicated for the sample stratified by sex. Study design and sampling weights were considered in the analyses (survey command). The sampling weights were estimated based on the combination of the inverse random selection probabilities at each sample level: CMEI and child. In order to identify differences between the group that completely filled out the questionnaire and those that were excluded because the questionnaire was not incompletely answered regarding the questions on food insecurity, comparisons of covariates were performed using Pearson's chi-square test. The analyses were performed with the aid of Stata software version 12.0 (StataCorp LP., Texas, United States).

This study is part of the research entitled 'Dietary practices, dental caries and household food insecurity'. As recommended by the Declaration of Helsinki and National Health Council Resolution No. 466, dated December 12t^{h} 2012, the study project was submitted to the Federal University of Paraná Health Sciences Sector Research Ethics Committee, as per Certificate of Submission for Ethical Appraisal No. 65621417. 0.0000.0102, and was approved as per Opinion No. 2.033.588. Only children whose legal guardians signed the Free and Informed Consent form were included in the study.

Results

Among the 20 CMEIs randomly selected, 629 children were eligible for the study, and 526 were randomly selected. Of these, three children were excluded for having specific dietary needs, 16 guardians did not agree to their participation in the study, 68 did not return the questionnaire, 21 returned incomplete questionnaires regarding the questions on FI, and 23 questionnaires were not answered by the mothers. In all, 395 mothers/children participated in the study (24.9% losses and refusals).

Failure to answer the questions on food insecurity was greater among (i) mothers with more than 8 years of schooling (11.3%), when compared to those with less than eight years of schooling (3.3%; p=0.003), (ii) mothers classified in the highest per capita family income tercile (9.8%), when compared to those in the second (2.7%) and first tercile (3.4%; p=0.034), and (iii) mothers with male children (7.2%), when compared to those with female children (2.2%; p=0.049). Absence of this completed data did not differ according to the child's age group or formal maternal employment status.

The mean age of the children was 28.8 months (SD=4.8 months), with 80.2% being older than 24 months. Most of the children were male (55.7%). Regarding the mothers, mean age was 28.6 years (SD=6.4 years), most of them (80.3%) had studied for more than 8 years, 71.5% reported being in a stable marital relationship and half of them (50.4%) had formal employment status (Table 1).

Overall FI prevalence was 34.7% (95%CI 28.5;41.5): being 25.7% (95%CI 19.2;32.3) for mild FI, 5.5% (95%CI 3.1;7.8) for moderate FI and 3.5% (95%CI 1.5;5.6) for severe FI (Figure 1). In the bivariate analysis, presence of FI was associated with per capita family income: the lower the income tercil, the greater the likelihood of MFI and MSFI occurring. The likelihood of MFI was greater among male children (Table 2).

In the adjusted multinomial logistic regression model, we found that in the intermediary block, per capita family income remained significantly associated with MFI and MSFI. The odds of MFI and MSFI were higher in the first tercile of per capita family income [OR=3.06 (95%CI 1.26;7.41)] and [OR=6.35 (95%CI 1.89;21.4)], respectively, compared with the third tercile. Among children's demographic characteristics, only sex remained associated with MFI: boys were 2.34 (95%CI 1.49;3.68) times more likely to experience MFI compared to girls (Table 2).

Interactions of food insecurity with the children's sex and the 'maternal formal employment status'

Table 1 – Sample distribution according to demographic and socioeconomic characteristics of mothers and children enrolled at public education facilities (n=395), São José dos Pinhais, Paraná, Brazil, 2017

Characteristics	Total		Male		Female		p-value[b]
	n	%[a]	n	%[a]	n	%[a]	
Maternal demographic characteristics							
Schooling (years of study)							0.920
≤8	76	19.7	140	80.0	174	80.6	
>8	314	80.3	34	20.0	92	19.4	
Marital status							0.575
In a fixed relationship	276	71.5	51	29.8	59	27.4	
Not in a fixed relationship	110	28.5	123	70.2	153	72.6	
Socioeconomic characteristics							
Maternal formal employment status							0.345
Yes	197	50.4	93	52.9	104	48.4	
No	193	49.6	82	47.1	111	51.6	
Per capita family income							0.966
1st tercile	107	32.4	52	33.6	64	34.3	
2nd tercile	113	33.6	52	34.3	61	33.1	
3rd tercile	116	34.0	49	32.1	58	32.6	
Children's demographic characteristics							
Sex							
Male	219	55.7	–	–	–	–	
Female	176	44.3	–	–	–	–	
Age							0.238
18-23 months	77	19.8	40	23.1	37	17.1	
24-35 months	318	80.2	136	76.9	182	82.9	

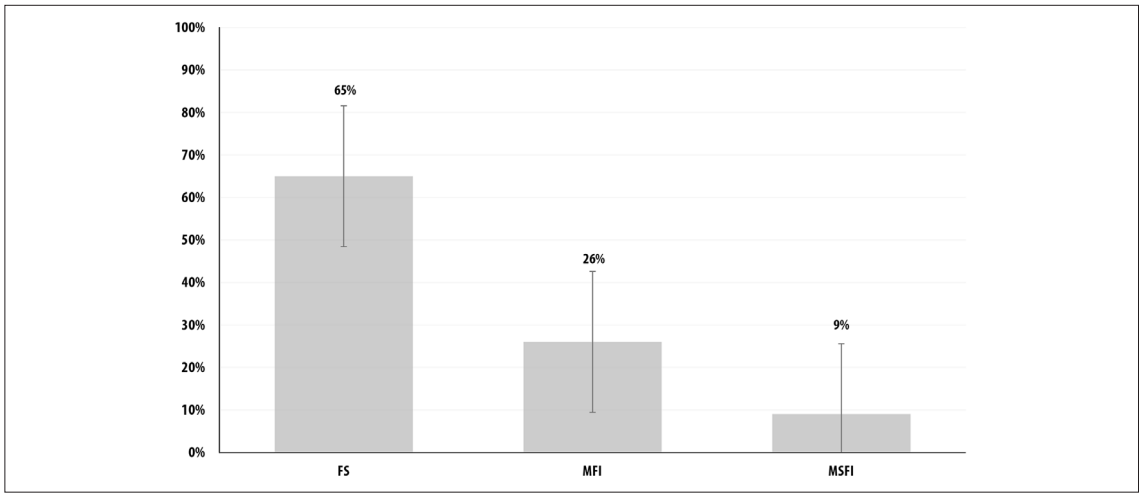
a) Corrected for design effect and sampling weights; numbers less than 395 because of missing data; b) Pearson's chi-square test, corrected for design effect and comparison by sex.

variable (p=0.06) and the 'per capita family income' variable (p=0.04) were identified. In the analysis stratified according to the children's sex in the intermediary block, per capita family income, when adjusted for maternal schooling, maintained significant association with MFI [OR=4.03 (95%CI 1.23;13.13)] and MSFI [OR=4.95 (95%CI 1.30;18.19)] in males (Table 3), and with MFI [OR=3.35 (95%CI 1.47;7.66)] in females (Table 4).

Discussion

The main finding of this study was association of higher odds of household FI with lower per capita family income and the child being of the male sex. Association of FI with sociodemographic factors has been widely reported[12,13,19-23] and can be seen in the most recent Brazilian survey, namely the 2017-2018 Family Budgets Survey conducted by IBGE.[4,21]

Cross-sectional studies, conducted with families of Brazilian preschoolers, were carried out: in 2011, in the municipality of Viçosa, Minas Gerais; in 2009, in the municipality of Maranguape, Ceará; in 2017, in two municipalities in Paraíba, Cabedelo and Bayeux; and in 2008, in eight municipalities in the state of Paraíba. In all these studies, food insecurity prevalence was always greater than 60%,[19,22-24] FI was assessed using the EBIA scale and families that gave negative answers for all questions were considered to be in a situation of food security. In addition to the sociodemographic and geographic characteristics of the populations assessed by the above studies,



Legend: FS, food security; MFI, mild food insecurity; MSFI, moderate or severe food insecurity.

Figure 1 – Prevalence rate and 95% confidence interval de food security, mild food insecurity and moderate or severe food insecurity among mothers and children (n=395), São José dos Pinhais, Paraná, Brazil, 2017

the large difference in prevalence compared to that found in the present study was partially determined by the cutoff points adopted for the families of preschoolers in São José dos Pinhais, where food security classification includes, in addition to families who do not provide a positive answer to any of the questions, those who have a score for only one question on the EBIA scale, as proposed by Reichenheim et al.[17]

The authors of the studies cited in the previous paragraph argue that the profile of a family that only answers one question positively would be closer to food security than to mild food insceurity.[17] Thus, in the present study, prevalence of FI among children would be higher if the cut-off points of the Brazilian national surveys were used,[3,4] in which food security is attributed only to families who answered any of the EBIA questions positively. Therefore, when making comparisons between studies that used the EBIA scale, special attention should be paid to the cutoff points used for classifying FI, since its prevalence differs according to this aspect. It is worth noting that special attention should also be paid when comparing the results of this study with studies that did not differentiate age groups, since in this study only families with children were included, which may also have influenced higher prevalence, since occurrence of FI increases in households with individuals under 18 years of age.[3,4]

In 2021, Hoffmann[21] analyzed FI data from samples representative of Brazil as a whole taken from the 2004, 2009 and 2013 PNAD, and the 2017-2018 Family Budgets Survey. That author showed that FI decreased between 2004 and 2013; however, in the 2017-2018 survey, there was a growth in FI prevalence when compared to all previous periods.[21] Furthermore, the increase in FI showed strong association with income distribution and poverty indicators (proportion of poor people, insufficient income and the Foster, Greer & Thorbeck index).[21] In the present study, family income remained associated with FI, even after adjusting for the demographic variables investigated. A study conducted in 2017 in two cities in Paraíba, with families of children under 5 years of age, found that moderate/severe food insecurity was associated with receiving the *Bolsa Família* Program benefit, the presence of children under 2 years of age in the family nucleus, lower socioeconomic status, and family dysfunction.[19] On the other hand, it was found that in vulnerable communities in the semiarid region of Northeastern Brazil, cash transfer programs adopted between 2011 and 2014 had an important impact on reducing food insecurity.[20]

In 2011, Kepple & Segall-Correia[25] proposed a conceptual framework for food security and nutrition in which macro-socioeconomic, regional, local (the latter at the community level) and household determinants are related in a hierarchical manner.

Table 2 – Sample characteristics, crude and adjusted multinomial logistic regression for mild food insecurity and moderate/severe food insecurity and independent variables among children (total group: male and female) enrolled at public education facilities (n=330), São José dos Pinhais, Paraná, Brazil, 2017

Characteristics	Food insecurity									
				Crude model				Adjusted model			
	FS[a] n (%)[f]	MFI[b] n (%)[f]	MSFI[c] n (%)[f]	OR[d] (IC95%)[e] (MFI)[b]	p-value[g]	OR[d] (IC95%)[e] (MSFI)[c]	p-value[g]	OR[d] (IC95%)[e] (MFI)[b]	p-value[g]	OR[d] (IC95%)[e] (MSFI)[c]	p-value[g]
Maternal demographic characteristics											
Schooling (years of study)											
≤8	33 (52.1)	22 (35.3)	9 (12.6)	1.90 (0.96;3.75)	0.063	1.86 (0.82;4.21)	0.127	1.90 (0.96;3.75)	0.063[i]	1.86 (0.82;4.21)	0.127[i]
>8	181 (67.3)	63 (24.0)	22 (8.7)	1.00		1.00		1.00		1.00	
Marital status											
In a fixed relationship	146 (64.1)	60 (27.0)	20 (8.9)	1.00		1.00		–	–	–	–
Not in a fixed relationship	63 (63.6)	24(25.0)	11(11.4)	1.07 (0.57;2.01)	0.817	0.70 (0.27;2.17)	0.601	–	–	–	–
Socioeconomic characteristics											
Maternal formal employment status											
Yes	118 (69.4)	40 (24.7)	10 (5.9)	1.00		1.00		1.00		1.00	
No	96 (59.1)	45 (27.8)	21 (13.1)	1.32 (0.75;2.32)	0.318	2.58 (1.18;5.65)	0.020	0.97 (0.51;1.83)	0.904[j]	1.64 (0.74;3.63)	0.211[j]
Per capita family income											
1st tercile	94 (80.7)	17 (15.1)	5 (4.2)	3.37 (1.59;7.15)	0.002[h]	7.30 (2.24;23.8)	0.003[h]	3.06 (1.26;7.41)	0.017[h,j]	6.35 (1.89;21.4)	0.006[h,j]
2nd tercile	69 (61.1)	36 (32.8)	7 (6.1)	2.87 (1.44;5.69)		1.93 (0.37;10.0)		2.77 (1.40;5.48)		1.78 (0.35;9.17)	
3rd tercile	51 (49.7)	32 (31.4)	19 (18.9)	1.00		1.00		1.00		1.00	
Children's demographic characteristics											
Sex											
Female	107 (70.6)	28 (18.1)	17 (11.3)	1.00		1.00		1.00		1.00	
Male	107 (59.0)	57 (33.0)	14 (8.0)	2.18 (1.33;3.58)	0.004	0.84 (0.40;1.77)	0.633	2.34 (1.49;3.68)	0.001[k]	0.88 (0.41;1.87)	0.713[k]
Age											
18-23 months	42 (59.3)	21 (30.0)	8 (10.7)	1.00		1.00		1.00		1.00	
24-35 months	172 (65.7)	64 (25.2)	23 (9.1)	0.76 (0.40;1.48)	0.394	0.77 (0.37;1.60)	0.460	0.73 (0.35;1.53)	0.388[k]	0.82 (0.37;1.81)	0.605[k]

a) FS: food security; b) MFI: mild food insecurity; c) MSFI: moderate or severe food insecurity; d) OR: odds ratio, in relation to the reference category (food security); e) 95%CI: 95% confidence interval; f) Corrected for design effect and sampling weights – numbers less than 330 because of missing data; g) Wald heterogeneity test; h) Wald linear trend test; i) Value adjusted to the distal block (maternal demographic characteristics); j) Value adjusted to the distal block (maternal demographic characteristics) and to the intermediary block (socioeconomic characteristics).; k) Value adjusted to the distal block (maternal demographic characteristics), to the intermediary block (socioeconomic characteristics) and to the block of children's demographic characteristics.

Table 3 – Sample characteristics, crude and adjusted multinomial logistic regression for mild food insecurity and moderate/severe food insecurity and independent variables among male children enrolled at public education facilities (n=152), São José dos Pinhais, Paraná, Brazil, 2017

Characteristics	Food insecurity										
				Crude model				Adjusted model			
	FS[a] n (%)[f]	MFI[b] n (%)[f]	MSFI[c] n (%)[f]	OR[d] (IC95%)[e] (MFI)[b]	p-value[g]	OR[d] (IC95%)[e] (MSFI)[c]	p-value[g]	OR[d] (IC95%)[e] (MFI)[b]	p-value[g]	OR[d] (IC95%)[e] (MSFI)[c]	p-value[g]
Maternal demographic characteristics											
Schooling (years of study)											
≤8	17 (58.0)	9 (28.1)	5 (13.9)	2.31 (0.99;5.41)	0.053	1.67 (0.39;7.19)	0.472	2.31 (0.99;5.41)	0.053[i]	1.67 (0.39;7.19)	0.472[i]
>8	90 (73.9)	19 (15.5)	12 (10.6)	1.00		1.00		1.00		1.00	
Marital status											
In a fixed relationship	35 (73.7)	6 (13.0)	6 (13.3)	1.00		1.00					
Not in a fixed relationship	71 (68.9)	22 (20.6)	11 (10.5)	1.69 (0.47;6.14)	0.404	0.85 (0.26;2.75)	0.771	–	–	–	–
Socioeconomic characteristics											
Maternal formal employment status											
Yes	59 (72.1)	19 (22.6)	4 (5.3)	1.00		1.00		1.00		1.00	
No	48 (68.9)	9 (12.7)	13 (18.4)	0.59 (0.23;1.53)	0.258	3.60 (1.23;10.56)	0.022	0.35 (0.11;1.07)	0.086[j]	2.46 (0.75;8.07)	0.218[j]
Per capita family income											
1st tercile	44 (84.7)	5 (9.4)	3 (5.9)	3.42 (1.17;9.94)	0.012[h]	6.78 (1.76;26.2)	0.011[h]	4.03 (1.23;13.13)	0.019h,j	4.95 (1.30;18.19)	0.023[h,j]
2nd tercile	37 (72.1)	13 (24.4)	2 (3.5)	3.04 (0.63;14.75)		0.69 (0.11;4.23)		3.51 (0.74;16.66)		0.53 (0.09;3.06)	
3rd tercile	26 (53.9)	10 (20.5)	12 (25.6)	1.00				1.00		1.00	
Children's demographic characteristics											
Child's age											
18-23 months	27(73.9)	6(16.3)	4(9.8)	1.00		1.00		–	–	–	–
24-35 months	80(69.5)	22(18.7)	13(11.8)	1.21 (0.46;3.24)	0.684	1.27 (0.25;6.52)	0.761	–	–	–	–

a) FS: food security; b) MFI: mild food insecurity; c) MSFI: moderate or severe food insecurity; d) OR: odds ratio, in relation to the reference category (food security); e) 95%CI: 95% confidence interval; f) Corrected for design effect and sampling weights – numbers less than 152 because of missing data; g) Wald heterogeneity test; h) Wald linear trend test; i) Value adjusted to the distal block (maternal demographic characteristics); j) Value adjusted to the distal block (maternal demographic chara cteristics) and to the intermediary block (socioeconomic characteristics).

Each level of this hierarchy affects the next and has its reference access to adequate food at the household level, favored by a context without financial constraints.[25] Association between income and FI was also discussed in a recent systematic review, published in 2020, which evaluated the relationship between social indicators and FI in Brazilian families and only included studies that used the EBIA scale to verify FI prevalence. It identified (i) a direct relationship between FI and lower income and (ii) a mediating role of income in the relationship between other social indicators and food insecurity.[12]

In addition to family income, a higher chance of mild FI was found among families with boys. Mild FI reflects the quality of food and/or the fear of having FI in the future.[15] However, children's sex was not associated with the most important levels of FI (moderate or severe), which are indicative of restricted food intake or hunger. Although the literature is inconclusive about an association between children's sex and FI,

Table 4 – Sample characteristics, crude and adjusted multinomial logistic regression for mild food insecurity and moderate/severe food insecurity and independent variables among female children enrolled at public education facilities (n=181), São José dos Pinhais, Paraná, Brazil, 2017

Characteristics	Food insecurity										
				Crude model				Adjusted model			
	FS[a] n (%)[f]	MFI[b] n (%)[f]	MSFI[c] n (%)[f]	OR[d] (IC95%)[e] (MFI)[b]	p-value[g]	OR[d] (IC95%)[e] (MSFI)[c]	p-value[g]	OR[d] (IC95%)[e] (MFI)[b]	p-value[g]	OR[d] (IC95%)[e] (MSFI)[c]	p-value[g]
Maternal demographic characteristics											
Schooling (years of study)											
≤8	17 (48.1)	13 (40.9)	4 (11.0)	1.64 (0.82;3.27)	0.153	1.98 (0.80;4.91)	0.131	1.64 (0.82;3.27)	0.153[i]	1.98 (0.80;4.91)	0.131[i]
>8	91 (61.1)	46 (31.8)	10 (7.1)	1.00		1.00		1.00		1.00	
Marital status											
In a fixed relationship	28 (54.3)	18 (35.9)	5 (9.8)	1.00		1.00		–	–	–	–
Not in a fixed relationship	76 (59.6)	40 (33.1)	9 (7.3)	0.84 (0.38;1.86)	0.652	0.68 (0.20;2.37)	0.530	–	–	–	–
Socioeconomic characteristics											
Maternal formal employment status											
Yes	59 (66.8)	21 (26.7)	6 (6.5)	1.00		1.00		–	–	–	–
No	48 (52.0)	36 (38.7)	8 (9.3)	1.86 (0.89;3.91)	0.095	1.82 (0.53;6.31)	0.324	–	–	–	–
Per capita family income											
1st tercile	26(46.2)	23 (41.0)	7 (12.8)	3.50 (1.63;7.51)	0.002[h]	7.60 (1.09;52.87)	0.050[h]	3.35 (1.47;7.66)	0.005[h,j]	7.41 (0.97;56.7)	0.075[h,j]
2nd tercile	32 (50.9)	24 (40.8)	5 (8.3)	3.15 (1.41;7.07)		4.46 (0.46;43.44)		3.12 (1.42;6.88)		4.44 (0.48;41.2)	
3rd tercile	50 (77.5)	12 (19.7)	2 (2.8)	1.00		1.00		1.00		1.00	
Children's demographic characteristics											
Age											
18-23 months	15 (42.2)	16 (46.4)	4 (11.4)	1.00		1.00		1.00		1.00	
24-35 months	93 (62.6)	43 (30.4)	10 (7.0)	0.44 (0.18;1.07)	0.068	0.42 (0.09;1.92)	0.245	0.46 (0.17;1.25)	0.121[k]	0.45 (0.09;2.15)	0.299[k]

a) FS: food security; b) MFI: mild food insecurity; c) MSFI: moderate or severe food insecurity; d) OR: odds ratio, in relation to the reference category (food security); e) 95%CI: 95% confidence interval; f) Corrected for design effect and sampling weights – numbers less than 181 because of missing data; g) Wald heterogeneity test; h) Wald linear trend test; i) Value adjusted to the distal block (maternal demographic characteristics); j) Value adjusted to the distal block (maternal demographic characteristics) and to the intermediary block (socioeconomic characteristics).; k) Value adjusted to the distal block (maternal demographic characteristics), to the intermediary block (socioeconomic characteristics) and to the block of children's demographic characteristics.

some studies suggest higher FI prevalence among families with male children.[26,27] A retrospective study conducted in 2016 with pediatric patients, especially Latinos, at a federal health center in New Jersey, United States, found higher FI prevalence among boys.[26]

The differences in FI prevalence according to children's sex need further studies to be able to understand them better. However, they may be related to family strategies to cope with difficulty in access to food, as well as to allocation of available food to certain family members.[27] A large study conducted between 1999 and 2005, with 1,600 families living in three cities in the United States, found significant differences in the levels of food provision among children of different genders and ages, in families of lower economic status. The food security data were obtained from a scale used by the United States Department of Agriculture with 18 questions, which when answered

positively indicated food insecurity. Levels of food insecurity (defined by at least two positive answers) were quite high among older children (11.5% in the 12 to 18 year old group; 5.6% in the 0 to 5 year old group), reaching the highest percentages in the group of boys 12 to 18 years old (13.8%). Differences in food insecurity according to children's age and sex were much stronger among families with single mothers and without the habit of eating together as a family, compared to families with married mothers who had this habit in their routine.[27]

This study has limitations. Generalization of its results should be done with caution, since the sample investigated represents a specific age group and a specific population group. It is noteworthy that the questionnaire being self-administered may have generated information bias, given the difficulty of the respondents in interpreting the questions. One should also consider the occurrence of selection bias, due to the possibility of non-participation of illiterate mothers, which might underestimate FI prevalence.

In addition, differences were found between the groups with complete and incomplete EBIA questionnaire answers. However, contrary to what would be expected, lack of complete answers regarding outcome classification was higher among mothers with higher income and schooling, which may have overestimated FI prevalence, and also among mothers with male children, which may also have influenced the results. Finally, the possibility of residual confounding should be considered: given the multifactorial nature of FI, other potential factors that may act as confounders may not have been collected, and they might have contributed to a better examination of the differences found between the sexes.

The FI prevalence rates found in the group we studied were higher than those found by the 2013 PNAD.[3] The most recent data on the Brazilian household FI situation, made available by the Household Budgets Survey in 2020, also showed an increase in FI prevalence rates when compared to those obtained by the 2004, 2009 and 2013 PNADs.[21]

These data point to FI as a situation to be constantly monitored, which presents great variability depending on the conditions that each family faces in its socioeconomic context.[3,4] FI can affect child health because of nicronutrient deficiencies, such as iron-deficiency anemia[26,28] and vitamin A deficiency.[29] In children who are in transition from the infant to preschool phase, occurrence of FI can cause important deficits in their growth and development,[10] associated with lower schooling levels and lower economic productivity in adulthood.[30]

The FI prevalence found among families of children attending public education facilities in São José dos Pinhais was high, and was associated with demographic and socioeconomic factors. It is interesting to note that, even using the new cutoff points proposed, association between FI, maternal schooling, and per capita family income remained as important factors related to access to quality food in sufficient quantities. Finally, the present study aimed to contribute to the considerable efforts to gain more knowledge about the food reality of children between the infant and preschool stages, being aware that production of information is an indispensable requirement for monitoring policies that aim to guarantee the right to food and nutritional security.[1,2]

Authors´ contributions

Chapanski VR, Costa MD, Fraiz GM, Höfelmann DA and Fraiz FC took part in the concept and design of the study, data analysis and interpretation, drafting and critically reviewing the manuscript. All the authors have approved the final version and are responsible for all aspects thereof, including the guarantee of its accuracy and integrity.

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