Food (in) Security and Nutritional Dietary Quality In Brazil

Insegurança alimentar e nutricional e qualidade da dieta no Brasil

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ABSTRACT

Objective
Verify association between the perception of food insecurity and the diet quality of the Brazilian population, applying The Brazilian Food Insecurity Scale and the Brazilian Healthy Eating Index Revised.

Methods
Cross-sectional study using data from the Householder Budget Survey collected in 2017/18 with two 24-hour recalls. A multinomial regression model was used with Odds Ratio and a 95% confidence interval, with the final model being the insertion of variables according to the theoretical model of hierarchy adopted.

Results
A total of 57,920 households were analyzed, and of these, 39.22% lived with some degree of Food Insecurity. There was a significant difference between female heads of the household, mixed race and black race, households with adults and children and living in rural regions as the three levels of AI [Food insecure] (p=<0.001), with a greater chance of food insecurity in these households. The average Brazilian Healthy Eating Index Revised for the 46,152 individuals was 54.23 points for those who were not food insecure, and 54.11 points for those who experienced severe food insecurity.

Conclusion
It is concluded that there is an association between the perception of food insecurity and the nutritional quality of the diet of the Brazilian population, which can lead to malnutrition and obesity.

Keywords: Adult. Diet. Food security.

RESUMO

Objetivo
Verificar a associação entre a percepção de insegurança alimentar e a qualidade da dieta da população brasileira, aplicando a Escala Brasileira de Insegurança Alimentar e o Índice de Qualidade da Dieta Revisado a partir de dois recordatórios de 24 horas.

Métodos
Estudo transversal que utilizou dados da Pesquisa de Orçamentos Familiares de 2017-2018. Utilizou-se o modelo de regressão multinomial com Odds Ratio e intervalo de confiança de 95%, sendo o modelo final com inserção das variáveis de acordo com o modelo teórico de hierarquia adotado.

Resultados
Foram analisados 57.920 domicílios, e destes, 39,22% viviam com algum grau de Insegurança Alimentar. Verificou-se diferença significativa entre pessoas do sexo feminino como chefe do domicílio, raça pardo e preto, domicílios com adultos e crianças e residir na região rural como os três níveis de Insegurança Alimentar (p=<0,001), havendo uma maior chance de insegurança alimentar nesses domicílios. A média do Índice de Qualidade da Dieta Revisado para os 46.152 indivíduos foi de 54.23 pontos para os que não apresentavam insegurança alimentar, e 54.11 pontos para aqueles que vivenciaram insegurança alimentar grave.

Conclusão
Conclui-se que existe associação entre a percepção de insegurança alimentar e a qualidade nutricional da dieta da população brasileira, o que pode levar à desnutrição e obesidade.

Palavras-chave: *Adulto. Dieta. Segurança alimentar.*

INTRODUCTION

Food and nutrition security is based on healthy dietary practices and includes regular and permanent access to a sufficient quantity of foods with a high nutritional quality that does not compromise access to other indispensable needs, respect cultural diversity, and are sustainable in the social, economic, and environmental spheres [1].

Results of the *Pesquisa Nacional por Amostra de Domicílios* (PNAD, National Household Sample Survey) conducted in 2009 and 2013 showed that Food Insecurity (FI) was present in 30.2% of households in 2009 and decreased to 22.6% in 2013 [2,3]. However, data from the last national survey revealed an increase in FI to 36.7% within Brazilian households in 2018 [4]. A report published by the United Nations in 2019 showed that malnutrition increased in 2018 and affected 821.6 million people worldwide. This same document reported that two billion people (26.4%) are currently experiencing FI globally [5]. If these malnutrition and FI trends from the past decade continue, in 2030, hunger may exceed 840 million people worldwide, regardless of the impacts of the COVID-19 pandemic [6].

Parallel to FI is the dietary nutritional quality. Because diet quality is affected by FI, ensuring access to a healthy diet is crucial to reverse this current scenario [6]. The publication of the National Dietary Survey, which was conducted on a sample of the Brazilian population aged 10 and older (2019), indicated that there was a high consumption of ultra-processed foods impacting the nutritional quality of the diet, regardless of household income or dynamics [7,8].

From this perspective, the objective of the study was to verify the association between the perception of food (in)security and diet quality within the Brazilian population.

METHODS

This is a cross-sectional study based on secondary data from the Household Budget Survey (HBS), conducted from July 2017 to July 2018 by the *Instituto Brasileiro de Geografia e Estatística* (IBGE, Brazilian Institute of Geography and Statistics).

The research used a complex sampling plan based on a set of census sectors called the "Master Sample", which was considered in all IBGE national surveys with a household sample. The selection of the sample occurred by conglomerate in two stages. In the first stage, the census sectors were the primary sampling units selected by systematic sampling with a probability proportional to the number of households in each sector. Secondary sampling units were households selected by simple random sampling. The complete methodology is available in the original source of 2017/2018 HBS [9].

Data from two samples were used in this study, (1) the main one, with data from 57.920 households, and (2) the subsample used for the National Dietary Survey (module 7 of the HBS), corresponding to 25% of all investigated families, with data from all individuals ages 10 years and older living in the selected households. This was a total of 46,164 individuals.

Data collection occurred based on the type of information being collected, that was organized in modules. In this study, Module 6 was used to assess households living conditions and FI, assessed using the *Escala Brasileira de Insegurança Alimentar* (EBIA, Brazilian Food Insecurity Scale); and Module 7 covered personal food consumption.

The EBIA was validated by Segall-Corrêa e Marín-León and updated during a technical workshop on scale analysis occurred in Brasília (2010) [10]. This scale was composed by 14 questions, classifying households based on FI experiences regarding the previous three months. The scale addresses concerns related to lack of food due to financial issues and specific questions and scores for families with minors [11]. Households with people under 18 years of age without AI scored 0 points, mild food insecurity scored 1–5 points, moderate food insecurity scored 6–9 points, and severe food insecurity scored 11–14 points. For households that did not have children under 18 years of age, the score varies from 0–8 points, where households without FI obtained 0 points, mild food insecurity 1-3 points, moderate 4–6 points and severe 7–8 points.

Personal food consumption involved collecting information on the actual food consumption of individuals ages 10 years or older through two 24-hour recalls applied on non-consecutive days. The interview was developed following a structured script based on the multiple-pass method [12]. The information collected in this module was used in the calculation of the Brazilian Healthy Eating Index – Revised (BHEI-R).

The BHEI-R is an instrument used to assess the diet quality within a population based on a combination of different types of foods, nutrients, and dietary components in relation to dietary recommendations and/or health outcomes. It was adapted from the Healthy Eating Index and has 12 components, such as: total fruits; whole fruits; total vegetables; dark green and orange vegetables and legumes; total cereals; whole grains; milk and dairy products; meat, eggs and legumes; oils; saturated fat; sodium; and AA fats, that refer to calories from solid fat, alcohol, and added sugar. The total score is represented by the sum of the 12 components, oscillating between zero (worst quality of the diet) and 100 points (best quality) which can be understood from the attachment 1. Intermediate intake values were calculated proportionally [13].

Other selected variables used in regression model involved householder characteristics – sex (male/ female), self-reported self-report skin color (white/ brown or black/ yellow or indigenous) and education (until 8 years/ 8 years or more); and living conditions: per capita family income

(interquintile range points of R$ 301.81, R$ 555.79, R$ 922.39 and R$ 1528.22); family composition (only adults or adults with kids or adults with elderly); residence condition (own paid or others); residence matter (urban/ rural); main form of water supply (categorized as "general network" or "others"); and cooking gas access (piped or bottle), categorized as "yes" or "not".

Descriptive analyses were performed for all variables, considering confidence intervals of 95%. A multinomial regression model was used to test associations between FI and covariates ($p<0.05$). After bivariate analysis, the final model was calculated, with the insertion of variables according to the theoretical hierarchy model adopted. The first model level was composed by householder characteristics, while the second also included family composition. Finally, living condition variables were added in the third level, plus residence condition in the fourth level.

Furthermore, linear regression model adjusted for total energy value and per capita family income was used to verify the association between FI levels and BHEI-R (p-value <0.05), considering National Dietary Survey subsample.

The microdata was obtained from the IBGE website and all analysis was conducted using the Stata 14.0 statistical program, considering the effect of the study design and incorporated the sample weights through the survey module.

Although the data of this study related to humans, as they came from a public use and access database, there was no need to submit the study to the Research Ethics Committee.

RESULTS

There was a predominance of householder's men (58.15%), brown and black (54.52%), with 9 years of education or more (56.68%), lived in the urban region (86.23%) with only adults (39.79%). As described in Table 1, most used the general network of water supply (84.90%) and had access to cooking gas (97.62%). Regarding food security, 24.00% of the households assessed had a perception of mild FI, 8.14% of a moderate FI and 4.55% of a severe FI – resulting in 36.69% of the Brazilian population in some condition of food insecurity.

Table 2 shows the results of the bivariate multinomial analyses between EBIA and householder characteristics and living conditions. A significant difference was observed between some variables. Those who had a woman as head of the family, brown and black race, with children at home and residence in the rural region, were more likely to live with some level of food insecurity. There was also a significant difference for those households where the head of the family had 9 or more years of schooling, had piped water, and used gas as fuel and had their own house or paid off, as a protective factor for all levels of food insecurity.

The final multinomial regression model (Table 3) confirms the significant difference between of gender, race and education of household head variables with all levels of food insecurity (p=<0.001). It was also possible to observe the significant persistence of the variable family condition, water supply and cooking gas, as a protective factor for food insecurity.

Table 4 suggests an association between moderate food insecurity and diet quality, which can improve the diet quality score by an average of 0.44 points (p=0.017; 95% CI 0.08 to 0.81), when adjusted for total energy value and per capita family income. However, the BHEI-R average was around 54 (95 CI) for both Food Security and FI levels, suggesting a generalized low nutritional dietary quality (Figure 1).

Table 1 – Distribution of (%) Householder characteristics and living conditions. Brazil, 2017/2018.

Variables	Total	Food security	Mild food insecurity	Moderate food insecurity	Severe food insecurity
			%		
Population	100	63.31	24.00	8.14	4.55
Householder sex[a]					
Male	58.15	61.35	54.35	50.09	48.11
Female	41.85	38.65	45.65	49.91	51.89
Householder self-reported skin color [a]					
White	44.07	51.49	34.16	26.39	24.69
Brown and black	54.52	46.92	64.85	72.39	73.89
Yellow, and indigenous	1.41	1.59	0.99	1.22	1,42
Householder education [a]					
Until 8 years	43.32	37.96	47.75	58.76	67.02
9 years or more	56.68	62.04	52.25	41.24	32.98
Per capita family income (IQ)[b]					
Q1	12.35	5.84	18.37	30.48	38.65
Q2	15.00	10.49	21.79	25.06	23.80
Q3	17.50	15.47	23.11	18.17	14.96
Q4	24.48	26.71	22.47	18.17	15.65
Q5	30.67	41.49	14.26	8.22	6.94
Family composition					
Only adults	39.79	42.14	32.90	39.05	44.82
Adults and kids	35.85	30.38	47.89	40.95	39.23
Elderly with or without adults and children	24.36	27.48	19.21	19.99	15.95
Residence condition					
Own paid	72.58	74.68	68.93	69.67	67.86
Others	27.42	25.32	31.07	30.33	32.14
Rural or Urban area					
Urban	86.23	88.35	84.41	79.44	78.48
Rural	13.77	11.65	15.59	20.56	21.52
Main form of water supply					
General network	84.90	87.40	82.65	76.79	76.37
Others	15.10	12.60	17.35	23.21	23.63
Cooking gas (piped or bottle)					
Yes	97.62	98.04	97.91	96.01	92.98
Not	2.38	1.96	2.09	3.99	7.02

Note: [a]Person identified by the participants as the reference in the household; [b]Per capita Income Quintiles.

DISCUSSION

It was observed that regardless of FI, the population in general is eating inadequately. The lowest averages of the components of the BHEI-R were observed for total fruits, whole fruits, whole grains and milk and dairy, similar to findings by Assumpção et al. [14] and *Pesquisa Nacional sobre Insegurança Alimentar no Contexto da Pandemia de Covid-19 no Brasil* [VIGISAN, National survey on Food Insecurity in Context of the Pandemic of Covid-19 in Brazil] [15]. Furthermore, among the FI categories, there is a reduction in the participation of fresh or minimally processed foods, such as fruits. On the other hand, there is also an increase in the consumption of saturated fat.

Although moderate FI indicates a violation of eating patterns, individuals in moderate FI had a very slightly higher BHEI-R score when compared to individuals in food security (less than one point). It is known that diets with a greater diversity of foods tend to be associated with higher intake of both, healthy and unhealthy foods [16]. In this way, Panigassi et al. (2008) observed that Brazilians living in Campinas who experienced some degree of FI had a lower consumption of meat, milk and derivatives, fruits, vegetables and legumes, as well as consuming less sweets and soft drinks [17]. In addition, the second national survey on food insecurity in the context of the

Table 2 – Chances of being in food security and householder characteristics and living conditions. Brazil 2017/2018.

Variable (reference category)[a]	Mild food insecurity (%)			Moderate food insecurity (%)			Severe food insecurity (%)		
	OR	p-value	95% CI	OR	p-value	95% CI	OR	p-value	95% CI
Householder sex[b] (Male)									
Female	1.33	<0.001***	1.25-1.41	1.58	<0.001***	1.46-1.71	1.71	<0.001***	1.54-1.90
Householder self-reported skin color[b] (white)									
Brown and black	2.08	<0.001***	1.95-2.22	3.01	<0.001***	2.72-3.33	3.28	<0.001***	2.88-3.74
Yellow, and indigenous	0.93	0.618	0.71-1.23	1.49	0.03	1.03-2.16	1.86	0.002	1.25-2.77
Householder education (Until 8 years)									
9 years or more	0.67	<0.001***	0.63-0.71	0.43	<0.001***	0.39-0.47	<0.001***	0.30	2.69-3.37
Per capita family income (IQ)[c]									
Q2	0.66	<0.001***	0.60-0.73	0.46	<0.001***	0.40-0.52	0.34	<0.001***	0.30-0.40
Q3	0.47	<0.001***	0.43-0.52	0.23	<0.001***	0.20-0.26	0.15	<0.001***	0.12-0.17
Q4	0.27	<0.001***	0.24-0.29	0.13	<0.001***	0.11-0.15	0.09	<0.001***	0.08-0.10
Q5	0.11	<0.001***	0.09-0.12	0.04	<0.001***	0.03-0.05	0.03	<0.001***	0.02-0.04
Family composition (Only adults)									
Adults and kids	2.02	<0.001***	1.89-2.15	1.45	<0.001***	1.32-1.59	1.21	<0.001***	1.09-1.36
Elderly with or without adults and children	0.89	0.006	0.82-0.96	0.78	<0.001***	0.69-0.88	0.54	<0.001***	0.47-0.63
Residence condition (Others)									
Own paid	0.75	< 0.001***	0.70-0.80	0.78	< 0.001***	0.71-0.86	0.71	< 0.001***	0.64-0.80
Residence matter (urban)									
Rural	1.39	< 0.001***	1.29-1.50	1.96	< 0.001***	1.73-2.23	2.07	< 0.001***	1.81-2.38
Main form of water supply (Others)									
General network	0.68	< 0.001***	0.63-0.74	0.47	< 0.001***	0.42-0.53	0.46	< 0.001***	0.40-0.53
Cooking gas / piped or bottle (not)									
Yes	0.93	0.495	0.76-1.13	0.47	< 0.001***	0.38-0.59	0.26	< 0.001***	0.21-0.32

Note: ***$p<0.05$. [a]Reference category: food security; [b]Person identified by the participants as the reference in the household; [c]Per capita income Quintiles. CI: Confidence Interval; OR: Oddis Rattio.

COVID-19 pandemic in Brazil (VIGISAN II) showed that moderate and severe FI levels affected the healthy food consumption in almost half of the Brazilian households (beans: 46.5%; rice: 49.0%; meat: 39.4%; vegetables: 48.5%; and fruits: 45.5%) [15].

According to the 2019 Food and Agriculture Organization of the United Nations report, we are experiencing a global syndemic, where malnutrition, obesity, and climate change interact. There is a synergy of pandemics that occur simultaneously, affect one another, share common determinants, and exert mutual influence on their burden on society [5]. Currently, food systems increase obesity and malnutrition and generate 25% to 30% of greenhouse gas emissions. Such systems cover food production and marketing chains, food environments, and eating practices [5]. It can be concluded that, in addition to the problem of FI related to hunger, the world goes through other issues of FI which exceed food access and supply and decrease individuals' quality of life due to the lack of food or concern of inadequate food supply for the family. Furthermore, a low diet quality caused by excessive consumption of ultra-processed food results in chronic diseases [5].

Observing other data from 2017/2018 HBS, it is possible to notice differences in the pattern of food acquisition for Brazilian households in relation to family income. Excluding two subgroups of ultra-processed foods (crackers and margarine), the total caloric intake in all other subgroups increase as income increases. From the first to the last fifth of the income, the caloric share increases by 30-40% for cold cuts, sausages, and sweet cookies; 200% for cakes, pies, sweetened carbonated drinks, sweetened non-carbonated drinks, and prepared sauces; and over 200% for breads, chocolate, dairy drinks, ice cream, prepared meals, pizza, lasagna, and pastry dough. Subgroups that decrease

Table 3 – Multinominal regression between EBIA and householder characteristics and living conditions (final adjusted modell). Brazil 2017/2018.

Variable (reference category) [a]	Mild food insecurity (%)			Moderate food insecurity (%)			Severe food insecurity (%)		
	OR	*p*-value	95% CI	OR	*p*-value	95% CI	OR	*p*-value	95% CI
General features									
Householder sex [b] (Male)									
Female	1.44	<0.001***	1.35-1.53	1.79	<0.001***	1.65-1.94	2.03	<0.001***	1.82-2.26
Householder self-reported skin color [b] (white)									
Brown and black	1.85	<0.001***	1.73-1.97	2.54	<0.001***	2.30-2.80	2.61	<0.001***	2.29-2.97
Yellow, and indigenous	0.93	0.587	0.71-1.21	1.53	0.019	1.07-2.20	1.92	0.001	1.29-2.86
Householder education (Until 8 years)									
9 years or more	0.61	<0.001***	0.57-0.65	0.42	<0.001***	0.38-0.47	0.28	<0.001***	0.25-0.31
Family composition									
Family composition (Only adults)									
Adults and kids	1.98	<0.001***	1.86-2.11	1.41	<0.001***	1.28-1.55	1.19	<0.01	1.06-1.38
Elderly with or without adults and children	0.79	<0.001***	0.73-0.86	0.61	<0.001***	0.55-0.70	0.39	<0.001***	0.33-0.45
Residence condition									
Main form of water supply (Others)									
General network	0.83	<0.001***	075-0.91	0.65	<0.001***	0.56-0.75	068	<0.01*	0.58-0.81
Cooking gas / piped or bottle (not)									
Yes	1.08	0.408	0.89-1.31	0.63	<0.001***	0.52-0.78	0.36	<0.001***	0.29-0.46
Residence matter (urban)									
Rural	1.04	0.462	0.94-1.15	1.11	0.199	0.94-1.31	1.06	0.511	0.86-1.28
Residence									
Residence (Others)									
Own paid	0.81	<0.001***	0.76-0.87	0.80	<0.001***	0.72-0.88	0.73	<0.001***	0.65-0.83

Note: ***$p<0.05$. [a]Reference category: food security; [b]Person identified by the participants as the reference in the household. CI: Confidence Interval; OR: Oddis Rattio.

Table 4 – Linear Regression between the individuals BHEI-R score and households Food and Nutritional Insecurity level, adjusted by the total energy intake and per capita family income. Brazil 2017/2018.

EBIA [a]	Brazilian Healthy Eating Index – Revised [13]		
	β	*p*-value	95% CI
Mild food insecurity	0.13	0.318	-0.12-0.38
Moderate food insecurity	0.44	0.017*	0.08-0.81
Severe food insecurity	-0.99	0.668	-0.55-0.35

Nota: ***$p<0.05$. [a]Reference category: food security; **β**: Beta coefficient; CI: Confidence interval; EBIA: *Escala Brasileira de Insegurança Alimentar*.

their total caloric intake as income increases included rice (from 20.1%, in the first fifth of the income, to 10.9%, in the last), beans (from 5.4% to 3.4%), cassava flour (from 3.6% to 0.8%), corn flour, cornmeal, and others (from 3.1% to 1.5%). Subgroups that increase their total caloric intake as income increases include milk (from 4.3%, in the first fifth of the income to 5.4% in the last), beef (from 2.7% to 3.9%), and fruits (from 1.8% to 3.9%) [8].

Studies carried out in Brazil highlight a higher prevalence of all levels of FI in families with more precarious housing, those who do not have piped water and who do not have access to gas for preparing meals [18]. Per capita family income between higher quintiles decreased the chance of households experiencing FI, corroborating with Vianna and Segall-Correa [18]. In the systematic review developed by Bezerra et al. [19], family income was the variable that was most significantly associated with food insecurity. According to the national survey on food insecurity in the context of the COVID-19 pandemic in Brazil (VIGISAN), families with a per capita income higher than one minimum wage had more food access, when compared to those with less income [15,20]. It is possible to observe that since 2018, many families have migrated from less severe levels of food insecurity
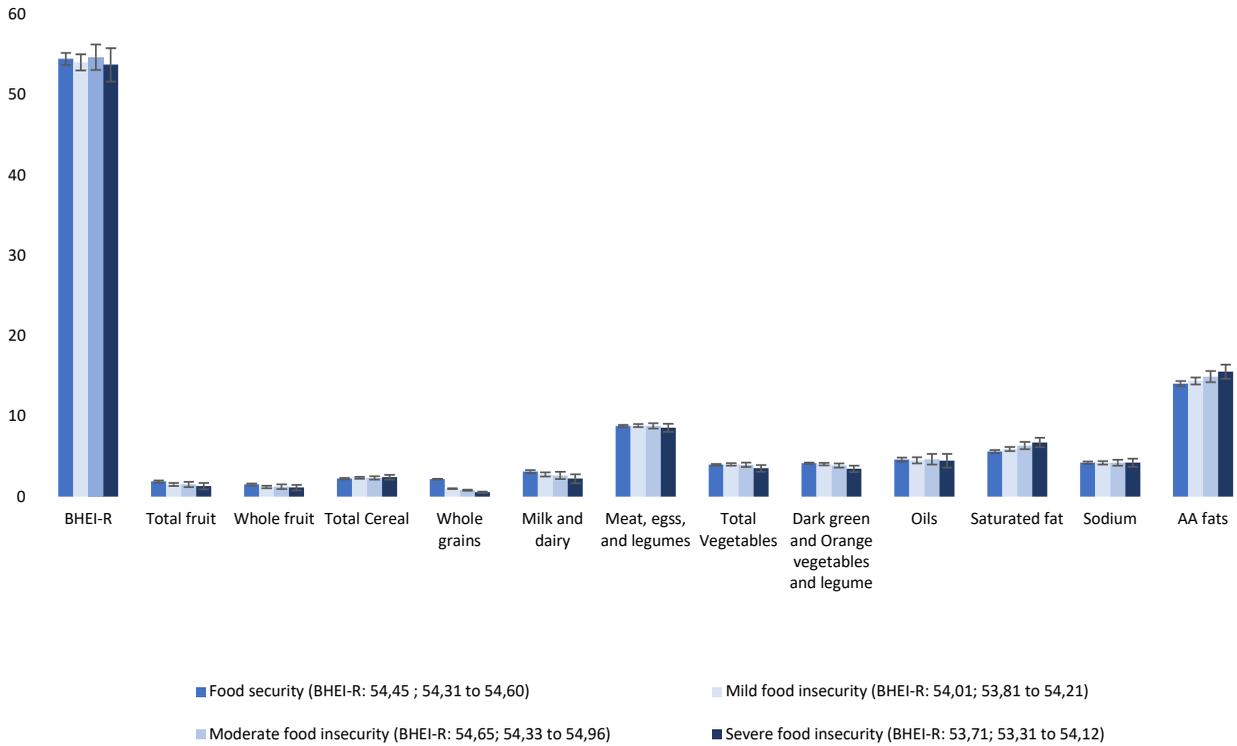
Figure 1 – Average BHEI-R of individuals according to the levels of Food and Nutritional Insecurity in their households. Brazil 2017/2018.

to the most serious, violating the human right to adequate and healthy food, where food insecurity spreads in more than 60% of Brazilian homes [20]. Assumpção et al. [14] observed that a worse diet quality is related to lower income and lower levels of education of the family head, making clear that there is a relationship between poor socioeconomic conditions, FI and diet quality.

Studies show that households located in rural region have a higher prevalence of FI, when compared to households located in the urban region [17-19,21-23]. Santos et al indicate an association between all types of FI with the region where the households are located; the prevalence of FI was 32% in rural area, while in urban region was 29.3% [22]. Furthermore, a recently published data show that FI is present in more than 60% of households in Brazilian rural areas [21].

It was also observed that resided in their own home (that had been paid off) had a lower chance of experiencing food insecurity, which is possibly linked to the fact that families transfer the income that would go towards paying part of the residence or rent, for the purchase of food. According to Meressi and Steinberger [24], the excessive burden of residential house rent is an important threat to the poorest populations in terms of access to housing and food.

It is important to highlight that, although unexpectedly, the higher BHEI-R score association was just observed to individual in moderate FI, not extending to severe FI. The experience of hunger lived in households, among adults and children, is expressed by the severe FI. No study was identified in the scientific literature that associated perception of food insecurity with diet quality by the BHEI-R. Publications related to this topic address food consumption, energy intake in specific populations [23-26]. Other authors reported that FI can affect access and food choices, impacting in the dietary quality. A low dietary quality added to a food consumption in a considered insufficient quantity is correlated with life quality reduction and chronic non-communicable diseases development [27-31].

Among the strengths of the study, we can highlight the representative sample of the Brazilian population, use of two 24-hour recalls, and use of tools previously described and validated. However, it is worth highlighting the criticisms of the BHEI-R, an indicator that was proposed before the publication of the Dietary Guidelines for the Brazilian Population (2014) and should be updated [26,31]. Thus, it was selected as a summary measure of the overall diet quality, which is usually applied for analysis of secondary data [31].

Between 2018 and 2020, the prevalence of food security in Brazil decreased by 18.6%, reaching 44.8% [20]. Considering the impacts of the COVID-19 pandemic, the prevalence of moderate and severe FI in 2022 reached 15.2% and 15.5%, respectively [15]. The intensification of the main recent trend drivers of FI and malnutrition (armed conflicts, weather phenomena, economic shocks: pandemics), together with the high cost of nutritious food and growing inequalities, will continue hampering food and nutrition security, which will only grow again when agrifood systems are transformed to provide nutritious, low-cost, healthy, and affordable diets in a sustainable and inclusive manner [32-36].

CONCLUSION

It was concluded that the population in general, regardless of FI, is eating inadequately. However, it was clear that FI could affect the nutritional quality of the diet in different ways, which can lead to malnutrition and obesity. In addition, public policies that guarantee protection rights for the vulnerable population are weakened or dismantled. It is necessary that the population have access to a healthy diet so that hunger is eradicated in Brazil and globally, and it is important that public policies be articulated to strengthen sustainable food systems and healthy food environments.

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