The severe food insecurity is associated with risk factors for non-transmissible chronic-disease and cardiovascular disease in Distrito Federal, Brazil

A insegurança alimentar grave está associada a fatores de risco para doenças crônicas não transmissíveis e doença cardiovascular no Distrito Federal

Ana Lilian Bispo dos Santos[1]
Muriel Bauermann Gubert[1]
Andressa Cristina Santos de Deus[1]

[1] Universidade de Brasília,
Faculdade de Ciências da Saúde, Departamento
de Nutrição, Programa de Pós-Graduação em
Saúde Coletiva. Brasília-DF, Brasil.

Correspondence
Ana Lilian Bispo dos Santos
E-mail: analilian _ nutricao@yahoo.com.br

Abstract

Objective: Determining the association between risk factors and the occurrence of non-communicable diseases (NCDs) with severe food insecurity (SFI) in the Distrito federal, Brazil. *Method:* This is a cross-sectional study, conducted with the adult population of the Federal District. The data were collected through a questionnaire. The questionnaire comprised socioeconomic questions, protective and risk food consumption for NCDs, the occurrence of NCDs and food security assessed by the Brazilian Scale of Food Insecurity. The sampling was processed by quotas in according to the income and food security status. The sample consisted of 324 adults, of whom 74.1% had food security (FS) and 25.9% severe food insecurity. *Results:* The results show a positive association of SFI with cardiovascular disease (CVD) (OR: 1.79), the consumption of excess fat from red meat and chicken's skin and increased risk of obesity (OR: 2.21). This association becomes negative with consumption of protective foods such as beans (OR: 0.47), fruit (OR: 0.19) and vegetables (OR: 0.44). Individuals with SFI also have less chance to practice physical activity compared to those ones with FS (OR: 0.45). *Conclusion:* This study shows an association of SFI with CVD and higher prevalence of risk factors for NCDs. These findings are important to assist in the planning of public policies to combat hunger, which should focus on health promotion and reducing the occurrence of NCDs in the population with SFI.

Key words: Food security. Hunger. Chronic disease. Risk factors.

Resumo

Objetivo: Verificar a associação entre fatores de risco e ocorrência de doenças crônicas não transmissíveis (DCNT) com a insegurança alimentar grave (IAG) no Distrito Federal. *Método*: Trata-se de um estudo transversal, realizado com a população adulta do Distrito Federal. Os dados foram coletados por meio de questionário, que englobava perguntas socioeconômicas, consumo protetor e de risco para DCNT, ocorrência de DCNT e segurança alimentar aferida pela Escala Brasileira de Insegurança alimentar. A amostragem foi sistematizada por cotas, segundo renda e situação de IAG e segurança alimentar (SA). E composta por 324 adultos, dos quais 74,1% tinham segurança alimentar e 25,9% insegurança alimentar grave. *Resultados*: Os resultados apontam uma associação positiva de IAG com doença cardiovascular (DCV) (OR:1,79), consumo de excesso de gordura provenientes de carnes vermelhas e pele de frango e maior risco de obesidade (OR: 2,21). Essa associação passa a ser negativa com consumo de alimentos protetores contra DCNT, como feijão (OR:0,47), frutas (OR:0,19) e hortaliças (OR:0,44). Indivíduos com IAG têm também menor chance de praticarem atividade física se comparados aos com SA (OR:0,45). *Conclusão*: Este estudo evidencia uma associação da IAG com DCV e maior prevalência de fatores de risco para DCNT. Esses achados são importantes para auxiliar no planejamento de políticas públicas de combate à fome, que devem ter como foco a promoção da saúde e redução da ocorrência de DCNT em população com IAG.

Palavras-chave: Segurança alimentar e nutricional. Fome. Doença crônica. Fatores de risco.

Introduction

Food insecurity (FI) is characterized by the lack of regular and permanent access to quality food in sufficient quantity, based on health-promoting eating practices.[1] In 2013, FI would be present in 22.6% of Brazilian private households.[2] This prevalence was higher than in the United States, where 14.0% of the households had FI in 2014,[3] but similar to the prevalence found in Africa[4] and poor regions in Australia.[5]

Food insecurity is related to decreased consumption of some food groups (fruits and vegetables, whole grains, meats, dairy products) as well as reduction in variety and portion sizes.[6] Such factors may lead to inadequate intake of nutrients, leading to negative impacts on individuals' health status,[5] such as nutritional deficiencies[7] and non-communicable chronic diseases (NCDs),[8-10] among them, obesity.[11]

Studies show that previous malnutrition occurring during individual's gestation and infancy is a risk factor for chronic non-communicable diseases (NCDs).[12] There are indications, however, that FI experienced in adulthood may also be associated with NCDs.[9] This association would be explained by a qualitative and quantitative diet restriction,[13] with higher consumption of cheap energy coming from foods of high caloric density,[14] resulting in a positive energy balance and triggering obesity and other chronic diseases.[5,9] There is evidence that diets with insufficient consumption of fruits and vegetables and excessive consumption of simple sugars and saturated fat are important risk factors for NCDs.[15,16]

A study conducted in Australia has evidenced an association between FI and worse overall health status, increased need for health care and depression.[5] In the United States, a higher prevalence of hyperlipidemia, hypertension and diabetes has been identified among individuals with FI when compared to subjects presenting food safety (FS).[17] According to Gowda et al.,[8] FI has been associated with cellular inflammation in a study performed with the North American population. In Canada, FI has implied a higher risk of diet-sensitive chronic diseases.[18] In Jordan, researchers have identified FI as some factor associated with poorer glycemic control in patients with type 2 diabetes.[19]

In Brazil, however, there are still few studies verifying the association between FI and NCDs or their risk factors. Recent Brazilian studies have verified the association between FI and obesity in women and female adolescents.[20,21] Santos[22] considers that there is still no definitive answer about the relationship between hunger and obesity among men in Brazil.

This knowledge gap regarding the association between FI and NCDs in Brazil deserves to be better studied. Researching aspects related to this phenomenon is important for planning future strategies of nutritional interventions and public policies guaranteeing food security scenarios for the population, protecting against the occurrence of NCDs. Thus, the objective of this study was to investigate the association between risk factors and the occurrence of NCDs and severe FI (SFI) in the Federal District of Brazil (FD).

Method

It is a cross-sectional study carried out with an adult population in the Brazilian Federal District from February to June 2014.

Sampling was by convenience, being systematic and representative and by quota for the population of the Brazilian FD in situations of FS and SFI. Quotas were defined by stratification according to household income per capita and food security situation, covering only individuals in situations of FS or SFI. Estimated sample size was 324 subjects, 240 in FS and 84 in SFI situations, subject to maximum sampling error of 10% and a confidence interval of 95%.

Interviewees were selected on the same day of the interview, which occurred in four points of great people flow in the Brazilian Federal District: bus stations in Brasília downtown original plan (*Plano Piloto*) and in administrative regions of Taguatinga and Ceilândia, as well as the Brazilian FD subway Shopping Center station. Choice of such points as collection sites was due to the greater possibility of meeting the necessary sample quotas. Subjects were systematically approached after the end of each interview or waiver for non-eligibility and the first passerby near the interview site would immediately be selected. Individuals selected would respond to a screening questionnaire verifying their eligibility by inclusion/exclusion criteria and quota. If they would not be eligible, they would be dismissed and the next passerby would be invited to go to the collection site and so on.

The following inclusion criteria were adopted: being 18 years old or older, residing in the Federal District, having knowledge about the availability of food at home, being in situations of FS or SFI. Pregnant women, people with cognitive disabilities, deaf and mute were excluded from the sample. Individuals were approached at the collection sites and invited to participate in the survey until each sample quota was filled. Researchers would remain in some place determined by the sites administration and individuals would be approached when passing by such collection station. The interview would last around 10 minutes and be applied by trained researchers.

Data would be collected through the application of a questionnaire with closed-ended questions. The questionnaire was constructed using two modules from previous research. The module on the occurrence of NCDs and their risk factors was the one used in the Brazilian government Vigitel – *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Surveillance of Risk Factors and Protection for Chronic Diseases by Telephone Inquiry).[23] And the food security module includes the Brazilian Scale of Food Insecurity (EBIA, in the Portuguese abbreviation), used in the Brazilian government National Household Sampling Survey (PNAD, in the Portuguese abbreviation) in 2013.[2]

The questionnaire was previously tested in a pilot study. And it addressed the following topics: a) Demographic and socioeconomic characteristics; b) Diet patterns and physical activity (associated with the occurrence of NCDs); c) Weight and height; d) Frequency of alcohol consumption; e) Reference to previous medical diagnosis of NCDs (cardiovascular disease, diabetes and cancer); and f) Food security situation.

In order to verify the occurrence of NCDs, we have used the variable of previous medical diagnosis of diabetes, cardiovascular disease (congestive heart failure, stroke, acute myocardial infarction, cardiac arrhythmias, ischemia, angina, systemic arterial hypertension) and cancer.[23] As risk and protective factors for NCDs, the variables included in the Vigitel were included:[23] excess weight (body mass index ≥ 25 kg/m²) and obesity (body mass index ≥ 30 kg/m²); consumption of foods considered healthy markers: beans ($\geq$ once a day), fruit ($\geq$ thrice a day) and potherbs ($\geq$ thrice a day); consumption of unhealthy food: meat with excess fat, milk with fat content and regular

soft drinks; practice of physical activity in free time (≥ 150min/week); excessive consumption of alcoholic beverages (women: > 4 doses/occasion and men: > 5 doses/occasion).

Although obesity is considered a chronic disease, in this study it was evaluated as a risk factor for the development of other NCDs related to inadequate diets.[24]

A healthy eating score was calculated to assess food consumption issues, including the variables: beans, fruits, raw vegetables, cooked vegetables, milk and soda, at four levels of weekly consumption frequency (Table 1), according to the methodology proposed by Souza et al.[25] The score was calculated from the sum of the scores of the items, ranging from 0 to 24 points.

Chart 1. Description of the score used to calculate the healthy eating score.

	0	1	2	3	**4**
Beans	Never/ almost never	1 – Twice a week	3 – Four times a week	5 – Six times a week	Every day
Fruit	Never/ almost never	1 – Twice a week	3 – Four times a week	Every day or 5 – 6 times a week and 1 – Twice a day	Every day or 5 – 6 times a week and ≥ Thrice a day
Raw vegetables	Never/ almost never	1 – Twice a week	3 – Four times a week	Every day or 5 – 6 times a week and once a day	Every day or 5 – 6 times a week and ≥ Twice a day
Cooked vegetables	Never/ almost never	1 – Twice a week	3 – Four times a week	Every day or 5 – 6 times a week and once a day	Every day or 5 – 6 times a week and ≥ Twice a day
Milk	Never/ almost never	1 – Twice a week	3 – Four times a week	5 – Six times a week	Every day
Soft drinks	Every day	5 – Six times a week	3 – Four times a week	1 – Twice a week	Never/almost never and *diet/ light*

Source: Souza Ade M, Bezerra IN, Cunha DB, Sichieri R. Evaluation of food intake markers in the Brazilian surveillance system for chronic diseases – VIGITEL (2007-2009). Rev Bras Epidemiol. 2011;14 Suppl 1:44-52.

Variables were analyzed in the software SPSS *Statistics* version 20. Sample description was performed by means of univariate analysis. The estimates provided by the bivariate analysis of categorical variables were expressed by prevalence and 95% confidence intervals, using a chi-square test to compare categorical variables. Adjusted analysis was done by means of logistic regression and expressed in odds ratio (OR), with the variables considered in the model for the biological

adjustment being: gender, age and ethnicity; and social adjustment: schooling and income. Student's t-test was used to compare the means of healthy eating scores. The level of significance was 5%, with a 95% confidence interval.

All participants in the survey were informed about the purpose and procedures of the survey and such participation was voluntary and anonymous. And all signed an Informed Consent Form (ICF). This research was approved by the Research Ethics Committee (REC) of Brazilian university *Universidade de Brasília* under number 18340813.8.0000.0030.

Results

Final sample consisted of 324 adults living in the Brazilian Federal District, of which 74.1% in a situation of FS and 25.9% in a situation of SFI. Average age was 39.1 (SD ± 15.9) years and 53.7% were females. The most prevalent NCDs were cardiovascular disease (CVD) (21.9%), followed by diabetes mellitus (DM) (9.0%) and cancer (CA) (3.4%) (data not shown in Tables).

According to the sociodemographic characteristics, individuals with FS had higher levels of schooling and income than those with SFI. As for risk factors and NCDs, individuals with SFI had a higher CVD prevalence, obesity and chicken skin consumption and lower prevalence of physical activity and beans, fruits and vegetables consumption compared to those with FS ($p < 0.05$).

Table 1. Demographic, health, food consumption and food security situation characteristics of the Federal District of Brazil population (n = 324), 2014.

	FS (n = 240)		SFI (n = 84)		*P*
	n	%	N	%	
Gender					
Females	122	50.8	52	61.9	0.080
Males	118	49.2	32	38.1	
Age					
18 to 29 years	92	38.3	20	23.8	0.058
30 to 39 years	42	17.5	19	22.6	
40 to 49 years	45	18.8	25	29.8	
50 to 59 years	29	12.1	12	14.3	
≥ 60 years	32	13.3	8	9.5	

	FS (n = 240)		SFI (n = 84)		*P*
	n	%	N	%	
Ethnicity					
White	58	24.2	18	21.4	0.877
Black/dark-skinned	174	72.5	63	75.0	
Yellow/Brazilian Native	8	3.3	3	3.6	
Education (years of study)					
≤ 9 years	58	24.2	36	42.9	0.003
> 9 and ≤ 12 years	118	49.2	35	41.7	
> 12 years	64	26.6	13	15.4	
Per capita income					
≤ 1/4 MW	6	2.5	20	23.8	< 0.001
> 1/4 to 1/2 MW	32	13.3	24	28.6	
> 1/2 to 1 MW	60	25.0	23	27.4	
> 1 to 2 MW	77	32.1	11	13.1	
> 2 MW	65	27.1	6	7.1	
Eating standard					
Protective consumption					
Beans ≥ once a day	168	70.0	44	52.4	0.003
Fruit ≥ thrice a day	28	11.7	2	2.4	0.012
Potherbs ≥ thrice a day	61	25.4	11	13.1	0.019
Risk consumption					
Whole milk	140	58.3	46	54.8	0.569
Regular soft drink	120	50.0	40	47.6	0.707
Red meat fat	69	28.8	33	39.3	0.074
Chicken skin	50	20.8	30	35.7	0.006
Nutritional status					
Overweight (BMI ≥ 25 kg/m²)	86	35.8	25	29.8	0.313
Obesity (BMI ≥ 30 kg/m²)	28	11.7	19	22.6	0.014

	FS (n = 240)		SFI (n = 84)		*P*
	n	%	N	%	
Physical activity					
Recommended (≥ 150 min/week)	83	34.6	16	19.0	0.008
Consumption of alcoholic beverages					
Excessive use*	65	27.1	17	20.2	0.214
Chronic non-communicable diseases (NCDs)					
Cardiovascular disease (CVD)	46	19.2	25	29.8	0.043
Diabetes	20	8.3	9	10.7	0.511
Cancer	6	2.5	5	6.0	0.133

Minimum wage (MW) at the time of the research = BRL 724.00; * ♀ (+4 doses/occasion) and ♂ (+5 doses/occasion); cardiovascular disease (CVD): Congestive heart failure, stroke, acute myocardial infarction, cardiac arrhythmias, ischaemia, angina, systemic arterial hypertension.

Table 2 presents the OR for the occurrence of NCDs according to situation of FS. Individuals with SFI are 79% more likely to have CVD than individuals with FS. But when such variables are controlled by biological or social factors in the regression model, this association is no longer significant.

In the evaluation of food consumption according to the healthy eating index, in a scale with a maximum score of 24 points the average healthy eating score among individuals with FS was 15.8 (SD ± 4.4) points and 12.3 (SD ± 3.9) points in individuals with SFI ($p < 0.001$) (data not shown in Tables).

There was an association between SFI and lower consumption of foods considered as NCDs, such as beans (OR 0.47; CI 95% 0.28 – 0.79), fruits (OR 0.19; CI 95% 0.04 – 0.79), potherbs (OR 0.44; CI 95%: 0.22 – 0.89) and higher consumption of chicken skin (OR 2.11; CI 95% 1.23 – 3.64). These associations hold true even when biological and social variables are controlled. Adults with SFI also tend to consume more red meat with fat than FS when the model is adjusted for socioeconomic variables (Table 2).

Regarding nutritional status (Table 2), individuals with SFI are 2.21 times more likely to be obese than those with FS. But this association does not remain after regression adjustments. Adults with SFI also have a lower chance of being physically active compared to FS, even when these variables are controlled by biological factors in the model.

Table 2. Prevalences, crude and adjusted OR (by biological and social factors) for the association between severe food insecurity (SFI) and Chronic non-communicable diseases (NCDs), consumption of protective and risk foods for NCDs, nutritional status, activity and consumption of alcoholic beverages. Federal District of Brazil, 2014.

	Prev. (%) SFI	Prev. (%) FS	Crude OR (95% CI)	OR aj. bio. (95% CI)	OR aj. soc. (95% CI)
NCDs					
CVD	29.8	19.2	1.79 (1.01 – 3.15)*	1.87 (0.97 – 3.61)	1.52 (0.79 – 2.95)
Diabetes	10.7	8.3	1.32 (0.58 – 3.03)	1.28 (0.50 – 3.26)	0.94 (0.35 – 2.49)
Cancer	6.0	2.5	2.47 (0.73 – 8.31)	2.23 (0.63 – 7.87)	2.57 (0.63 – 10.58)
Protective consumption					
Beans	52.4	70.0	0.47 (0.28 – 0.79)*	0.47 (0.28 – 0.81)*	0.41 (0.23 – 0.73)*
Fruit	2.4	11.7	0.19 (0.04 – 0.79)*	0.18 (0.04 – 0.77)*	0.19 (0.04 – 0.90)*
Potherbs	13.1	25.4	0.44 (0.22 – 0.89)*	0.39 (0.19 – 0.79)*	0.43 (0.20 – 0.93)*
Risk consumption					
Whole milk	54.8	58.3	0.87 (0.52 – 1.43)	0.89 (0.53 – 1.49)	0.56 (0.31 – 1.01)
Regular soft drink	47.6	50.0	0.91 (0.55 – 1.50)	0.95 (0.56 – 1.62)	0.90 (0.51 – 1.59)
Red meat fat	39.3	28.8	1.60 (0.95 – 2.70)	1.71 (0.99 – 2.94)	1.83 (1.01 – 3.31)*
Chicken skin	35.7	20.8	2.11 (1.23 – 3.64)*	2.17 (1.23 – 3.81)*	1.89 (1.02 – 3.50)*
Nutritional status					
Overweight	29.8	35.8	0.76 (0.44 – 1.30)	0.64 (0.37 – 1.13)	0.76 (0.44 – 1.30)
Obesity	22.6	11.7	2.21 (1.16 – 4.22)*	1.86 (0.95 – 3.63)	1.71 (0.79 – 3.70)
Physical activity					
Recommended (≥ 150 min/week)	19.0	34.6	0.45 (0.24 – 0.82)*	0.47 (0.25 – 0.87)*	0.73 (0.37 – 1.44)
Alcoholic beverages					
Excessive consumption	20.2	27.1	0.68 (0.37 – 1.25)	0.78 (0.42 – 1.47)	0.84 (0.44 – 1.64)

OR – FS reference category. OR aj. bio. (OR adjusted for biological factors): odds ratio adjusted for gender, age and ethnicity; OR aj. soc. (OR adjusted for social factors): odds ratio adjusted for education and income; CI: Confidence interval; *$p < 0.05$.

Discussion

As expected, individuals with SFI presented lower schooling and income when compared to those with FS.[2] This greater economic vulnerability may be related to an inadequate food expenditure, as evidenced in previous studies.[26, 27] Individuals living in poverty tend to have some cheaper and nutritionally poorer diet, with higher consumption of foods with high caloric density and low nutritional value, as well as with less healthy food.[26,27] In the present study, people with SFI consumed fewer fruits, beans and vegetables, while eating fattier meats.

Data from Vigitel Brasil 2014 point that in the FD the percentage of regular consumption of fruits and vegetables, as well as that of meat with excess fat, in the FD population were 41.6% and 29.3%, respectively.[23] Unfortunately, Vigitel can not verify consumption among people with SFI or FS. In the present study, for adults with SFI, consumption percentages were 2.4% (fruit), 13.1% (potherbs), 39.3% (red meat fat) and 35.7% (chicken skin). This shows some worse eating pattern of individuals with SFI when compared to the FD population's consumption as a whole.

It was observed that individuals with SFI are more likely to present CVD compared to those with FS. The mechanisms by which food insecurity is related to higher occurrence of NCDs are not yet clear.[9] This association is well documented in relation to diabetes, but it lacks further studies as to the others.[17] This association between FI and NCDs seems to be mediated by inadequate food consumption with dependence on energy-dense and cheap foods[9,28] and with overweight and obesity present in this population.[20,21,29] The SFI population experiences the so-called double burden of diseases. While this population may be affected by micronutrient deficiencies, nutritional deficits and infectious diseases, it may also be affected by NCDs and obesity.[30,31] Thus, links between poverty and NCDs should be considered in the formulation of public policies to combat hunger.[32]

Regular physical activity is known to be a protective factor against NCDs.[33] In Brazil, the frequency of adults practicing leisure time physical activities, equivalent to at least 150 minutes per week, ranges from 30.4% in São Paulo to 47.1% in Florianópolis. In Brasília, for the population as a whole this practice was 37.4%.[23] In this study, this frequency was 19.0% among individuals with SFI. Adults in SFI situation are 55% less likely to engage in physical activity than those in FS. This association remains when adjusted for biological variables but is no longer significant when social variables are controlled in the model. Previous studies have shown that economically disadvantaged individuals have less access to and practice less physical activity than those in the most favored social class.[34-36] Poverty, present in the majority of SFI cases, contributes to social exclusion from the practice of physical activity. In this context, environments favor risk behaviors for NCDs regarding a population with SFI.[34-36]

Conclusion

Results from this study indicate a trend of positive association of SFI with CVD and higher consumption of meat with excess fat and obesity. This association becomes negative for variables related to protective behavior against NCDs, such as the practice of physical activity and bean, fruits and vegetables consumption.

Economically disadvantaged groups have high prevalence of NCDs and SFI. It is of critical importance to understand the association between these variables in terms of assisting in planning more efficient public policies to maintain health and food security conditions for these individuals, promoting the reduction of hunger without contributing to the increase of NCDs in the country.

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