RESEARCH ARTICLE

Social support and food insecurity among older Brazilians in São Paulo

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Abstract: Food insecurity is a growing problem in Brazil, especially among older adults; however, the related sociodemographic factors remain unclear. This study aimed to analyze the relationship between social support dimensions and food insecurity among community-dwelling older adult Brazilians in São Paulo. This cross-sectional study was conducted in three cities in Sao Paulo state, Brazil. The analysis included 598 community-dwelling individuals aged ≥60-years-old, and multiple logistic regression models were used to estimate the associations between the dimensions of social support and food insecurity after adjusting for sociodemographic characteristics. We found that 42.3% of participants were food insecure. In the bivariate analysis, the higher scores in the affective, material, positive social interaction, and informational social support dimensions were statistically associated with the lower odds of food insecurity. In the multiple regression analysis, older adults who had a higher score of positive social interaction were less likely to have food insecurity, whereas the African American ethnicity and those older adults with a total family income ≤2 times of the minimum wage were more likely to have food insecurity. The results indicate that the positive social interaction emerges as an important factor associated with food insecurity among older adults, beyond that of other well-known social factors associated with food insecurity, highlighting the importance of screening for food insecurity and social support in primary care to avoid potential adverse health outcomes among older adults.

Keywords: Older adults; Social determinants of health; Nutrition; Food insecurity; Social support; Brazil

1. Introduction

Food security and adequate nutrition are basic human rights and are important for health of population. However, the number of people with hunger and food insecurity is growing exponentially due to the coronavirus disease 2019 (COVID-19) pandemic and the current global economic crisis. Data from the latest report by the Food and Agriculture Organization (FAO) show that in 2020, approximately 2.37 billion people worldwide did not have access to adequate food – an increase of 320 million than in 2019 (FAO, IFAD, UNICEF, WFP, and WHO, 2021), and the situation is getting worse since the beginning of 2022 (FAO, IFAD, UNICEF, WFP, and WHO, 2022).

Food insecurity is characterized by the "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways." (Anderson, 1990, p1588). Data from the 2017 to 2018 Family Budget Surveys (in Portuguese, Pesquisa de Orçamentos Familiares – POF) in Brazil show that, after an upward trend in food security between 2004, 2009, and 2013, there

was a reduction in the prevalence of Brazilian private households that had the ability to feed their residents adequately (quantitatively and qualitatively). In 2017 – 2018, 63.3% of households in the country had consistent access to adequate food, a proportion which was lower than the figures for 2004 (65.1%) and 2013 (18.2%). Conversely, there was a significant increase in food insecurity, which came under the scenario of reduction. The survey also showed that 27.3% of older Brazilians had some degree of food insecurity (IBGE, 2020). Nutritional transition in Brazil is still underway, resulting in a double burden of disease related to nutritional excesses and deficiencies, obesity, and starvation, which are direct causes of poverty and food insecurity (Ghattas, 2014).

In tandem with the worsening food security is the rapid populational aging. It is projected that people aged 60 or older will reach 66 million in 2050, rising from 29 million in 2021; and these numbers equal to 28.8% of the population in 2050 and 13.8% in 2021 (United Nations, 2022). The rapid population aging in Brazil is mainly due to persistent low fertility and improved life expectancy. Data provided by the United Nations (2022) show that total fertility rate has been below the replacement (2.1 births per woman) for two decades and is project to maintain at the current level 1.6 till 2050. The average life expectancy at birth is also projected to be 78.9 years for men and 83.7 years for women in 2050, despite some reduction in 2019 – 2021 due to the COVID-19 pandemic (United Nations, 2022). As older adults are more vulnerable than general adults in the population, food insecurity among older adults will usually exacerbate their disadvantaged health conditions.

Among older adults, food insecurity was associated with negative impacts on mental, physical, and nutritional health, making older adults more susceptible to health problems such as frailty (Pérez-Zepeda, Castrejón-Pérez, Wynne-Bannister, *et al.*, 2016), depression (Jung, Kim, Bishop, *et al.*, 2019), cognitive decline (Portela-Parra and Leung, 2019), lower health-related quality of life (Fernandes, Rodrigues, Nunes, *et al.*, 2018), and worsening nutritional status (Grammatikopoulou, Gkiouras, Theodoridis, *et al.*, 2019). Social support has also been identified as an important mediator of food insecurity during aging (Wang and Bishop, 2019).

Although there is no consensus in the literature regarding the definition of social support, it can be understood as the perceived availability of interpersonal resources capable of responding to needs caused by stressful events. Social support can be divided into various dimensions. One common classification is composed of five dimensions: Material (financial or physical assistance), affective (love and affection), emotional (encouragement and empathy), positive social interaction (social companionship), and information (having someone to counsel and help them deal with problems) (Cassel, 1976; Cohen and Wills, 1985). This multiple domain characteristic of social support provides different insights into how social support could be associated with food insecurity. In the literature, it is hypothesized that social support, especially the material and emotional dimensions, could act as a protective factor against hunger and food insecurity, because social support may be decisive in the availability of help when someone has financial difficulties in buying food, for example, (Wang and Bishop, 2019).

Considering that in low- and middle-income countries (LMICs), the prevalence of food insecurity continues to increase, and in most of these countries, the population is rapidly aging, it is important to identify the social factors associated with food insecurity among older adults. Therefore, the aim of this study was to analyze the association between different dimensions of perceived social support and food insecurity among community-dwelling older adults in Brazil, a prime example of such LMICs. The main hypothesis of this study was that older adults with higher scores on all dimensions of social support would have the lowest chance of presenting with food insecurity.

2. Data and Methods

2.1. Data sources

We used data from the cross-sectional study "Evaluation of the prevalence of micronutrient deficiency among community dwelling older adults in the metropolitan area of Campinas – SP," conducted in three cities of São Paulo, Brazil in 2018 and 2019. The sample size for the principal study was based on the estimated total number of inhabitants aged ≥60 years in the municipalities of Campinas, Limeira, and Piracicaba in 2018. The calculation of the sample size considered a prevalence of 60% of older adults with at least one micronutrient deficiency, and a sampling error of 10%, along with a 95% confidence level. Thus, the minimum sample size was set at 600 older adults, with 170 participants being from the city of Limeira, 180 from Piracicaba, and 250 from Campinas.

Six hundred and eleven older adults registered in the Family Health Strategy program between 2018 and 2019 were interviewed. Participants were recruited through an invitation made at the basic health units (UBS) recommended by the respective health departments of each municipality. More details of the data collection have been previously published (Rolizola, Freiria, Silva, *et al.*, 2021). The main study eligibility criteria included (1) age of 60 years or older, (2) being a resident of one of the included cities, (3) being registered in the Family Health Strategy program, and (4) presenting the

ability to understand the procedures of the study. Exclusion criteria were: (1) Use of any dietary supplements based on vitamins and/or minerals, (2) being followed up on by a home care program, and (3) undergoing chemotherapy.

Data were collected in the primary healthcare units where older adults were enrolled. Participants with incomplete data on social support and food insecurity were excluded from the analysis ($n = 13$), thus a total of 598 older adults were included in the study. Signed consent forms were obtained from all participants.

2.2. Measures

2.2.1. Food insecurity

Food insecurity was measured using the abridged version of the Brazilian Food Insecurity Scale, a questionnaire validated for the Brazilian population (Santos, Lindemann, Motta, *et al*., 2014; Sperandio, Morais, and Priore, 2018). The scale is composed of five questions (yes/no): "*Were you worried that the food in your home would be finished before you could buy, receive or produce more food?*", "*Did the food finish before you had money to buy more?*", "*Did you run out of money and could not have a healthy and varied diet?*", "*Did you or an adult in your home reduce the amount of food in your meals, or skip meals, because there was not enough money to buy food?*", "*Did you eat less than you thought you should because there was not enough money to buy food?*", and identified individuals who experienced food insecurity during the previous 3 months. A sixth question that was used in the previous studies on older adults was: "*Have you ever been hungry but did not eat because you were not able to leave the home for food?*" was added to assess the possible mobility difficulties that could influence food access by older adults (Carder, Luhr, and Kohon, 2016; Chung, Gallo, Giunta, *et al*., 2012). Participants who answered "yes" to at least one question were evaluated as food insecure.

2.2.2. Social support

Social support was assessed using the Brazilian adapted and validated version (Griep, Chor, Faerstein, *et al*., 2005) of the Medical Outcomes Study Social Support Survey (Sherbourne and Stewart, 1991). The scale contains 19 questions and evaluates five dimensions of social support: material (four questions), affective (three questions), emotional (four questions), positive social interaction (four questions), and information (four questions). Each question on the scale was answered by indicating the frequency of the support received by the older adult, and each choice had a different score: never (1 point), rare (2 points), sometimes (3 points), almost all the time (4 points), and always (5 points). On each dimension evaluated, the participant obtained a score between 15 points (affective dimension) and 20 points (material, emotional, positive social interaction, and information dimensions). The sum of the points obtained in each dimension was multiplied by 100 and divided by the highest possible score in each dimension, with a higher score indicating a greater perception of social support perceived by older adults.

2.2.3. Sociodemographic covariates

The literature suggests that social, economic, and demographic factors are associated with food insecurity. For example, different studies have shown that higher income is an important factor influencing access to adequate food, along with education. In addition, Causasian older adults have food insecurity rates that are substantially lower than that of other ethnicities (Marín-León, Segal-Corrêa, Panigassi, *et al*., 2005; Fernandes, Rodrigues, Nunes, *et al*., 2018; Grammatikopoulou, Gkiouras, Theodoridis, *et al*., 2019; Ziliak and Gundersen, 2022). The following variables were included as covariates that could act as potential confounders in the relationship with social support because they were previously associated with food insecurity: Sex (male or female); family monthly income, classified into two groups: ≤latimes of the minimum wage, >2 times of the minimum wage. The minimum wage was R\$954.00 (US\$261.10) in 2018 and R\$998.00 (US\$257.20) in 2019 (we used mean imputation for individuals with missing data ($n = 52$) in this variable); schooling (0 – 8 years, 9 years or more, not informed); marital status (married, widowed, and single/divorced); ethnicity (Caucasians, African Americans – African Americans and Mixed Race, and Others – South native American and Asian); whether they were the head of the household (yes and no); working for pay (yes, no, and not informed); and age group (60 – 69-years-old, 70 – 79-years-old, and 80 years and older).

2.3. Analytical strategies

All analyses were conducted using Stata® version 12.0. In the descriptive analysis, frequencies and percentages were used for categorical variables, and means with standard deviations were estimated for the continuous variables. To examine the differences in the prevalence of food insecurity, we used Chi-square test for categorical variables and Mann–Whitney U test for social support dimensions as continuous variables (because they did not adhere to a normal distribution according to the Shapiro-Wilk test).

Logistic regression models were used to estimate crude and adjusted odds ratios (OR) and respective 95% confidence intervals (CI). Sociodemographic covariates that presented $P < 0.20$ in the unadjusted analysis were incorporated into the adjusted analysis. In the final model, all the social support dimensions and the sociodemographic covariates with $P < 0.05$ were maintained. Statistical significance was set at $P < 0.05$.

3. Results

Among the 598 participants, 42.3% were classified as having food insecurity and 76.8% had a family income equivalent to more than two minimum wages. Food insecurity was more prevalent among women (45.0%), those of African American ethnicity (49.0%), and among those with a family income equal to or less than two minimum wages (56.1%). No significant differences were observed in the first analysis with respect to age, marital status, whether the older adults worked, and whether they were the head of their household.

The characteristics of the sample, as well as the prevalence of food insecurity according to sociodemographic variables, are shown in Table 1.

Table 1. Sociodemographic characteristics of the sample and by food insecurity status.

	Total 100% (598)	Food secure 57.7% (345)	Food insecure 42.3% (253)	*P*
Sex				0.040
Male	30.6% (183)	63.9% (117)	36.1% (66)	
Female	69.4% (415)	55.0% (228)	45.0% (187)	
Age group (years)				0.147
60–69	52.2% (312)	55.5% (173)	44.5% (139)	
70–79	39.0% (233)	57.9% (135)	42.1% (98)	
80 and older	8.8% (53)	69.8% (37)	30.2% (16)	
Family monthly income				<0.001
≤2 times of minimum wage	23.2% (139)	43.9% (61)	56.1% (78)	
>2 times of minimum wage	76.8% (459)	61.9% (284)	38.1% (175)	
Ethnicity				0.007
Caucasians	55.5% (332)	61.1% (203)	38.9% (129)	
African Americans	40.6% (243)	51.0% (124)	49.0% (119)	
Others	3.9% (23)	78.3% (18)	21.7% (5)	
Head of Household				0.226
Yes	77.4% (463)	56.4% (261)	43.6% (202)	
No	22.6% (135)	62.2% (84)	37.8% (51)	
Schooling (years)				0.020
0–8	72.6% (434)	55.3% (240)	44.7% (194)	
9 and more	26.6% (159)	65.4% (104)	34.6% (55)	
Not informed	0.8% (5)	20.0% (1)	80.0% (4)	
Marital Status				0.064
Married	59.9% (358)	61.4% (220)	38.6% (138)	
Widowed/Single	28.2% (169)	53.2% (90)	46.8% (79)	
Divorced/Other	11.9% (71)	49.3% (35)	50.7% (36)	
Working for pay				0.488
Yes	19.6% (117)	62.4% (73)	37.6% (44)	
No	79.1% (473)	56.5% (267)	43.5% (206)	
Not informed	1.3% (8)	62.5% (5)	37.5% (3)	

Minimum Wage: Considered the minimum monthly income received at the time of interview 2018 = R$954.00 ($261.1)/2019 = R$998.00 (U$257.2). Chi-square test

Regarding the dimensions of social support (Table 2), it was observed that among all participants, the lowest mean score was obtained on the informational dimension (79.7 points) and the highest was observed on the affective dimension (92.1 points). Significant differences were observed in all dimensions considering the food insecurity status, except for the emotional dimension. Participants with food insecurity had the lowest score on the positive social interaction dimension (75.9 points) and those with food security had their lowest score on the informational dimension (81.5 points). Both groups obtained their highest scores on the affective dimension (93.8 and 89.7 points, respectively).

Table 3 presents the results of the regression models. In the univariate analyses, we observed an inverse association of all social support dimensions with food insecurity: the higher the score obtained, the lower the chances of the

Table 2. Social support characteristics of the sample stratified by food insecurity status.

	Total 100% (598)	Food secure 57.7% (345)	Food insecure 42.3% (253)	*P*
SS – Affective	92.1 (14.9)	93.8 (12.9)	89.7 (17.0)	0.002
SS – Emotional	82.4 (21.7)	84.1 (20.4)	80.0 (23.0)	0.051
SS – Material	84.6 (20.5)	86.8 (18.7)	81.6 (22.4)	0.003
SS – Positive social interaction	81.0 (23.1)	84.6 (19.8)	75.9 (26.1)	<0.001
SS – Informational	79.7 (23.2)	81.5 (22.1)	77.2 (24.4)	0.034

SS: Social support. Values are presented as mean (points) ± standard deviation. Mann–Whitney U test.

Table 3. Odds ratios for presence of food insecurity considering social support and sociodemographic factors.

	Crude OR[a]	CI	*P*	Final adjusted model		
				OR[b]	CI	*P*
SS – Positive social interaction	0.98	0.97 – 0.99	<0.001	0.98	0.97 – 0.99	0.002
SS – Material	0.98	0.97 – 0.99	0.002	0.99	0.98 – 1.00	0.140
SS – Emotional	0.99	0.98 – 0.99	0.022	1.00	0.99 – 1.02	0.326
SS – Affective	0.98	0.97 – 0.99	0.001	0.99	0.97 – 1.00	0.418
SS – Informational	0.99	0.98 – 0.99	0.025	1.00	0.99 – 1.01	0.523
Sex [ref. male]						
Female	1.45	1.01 – 2.08	0.041	-	-	-
Family monthly income [ref. >2 times of minimum wage]						
≤2 times of minimum wage	2.07	1.41 – 3.04	<0.001	2.01	1.35 – 2.98	0.001
Ethnicity [ref. Caucasians]						
African Americans	1.51	1.08 – 2.11	0.016	1.48	1.04 – 2.09	0.026
Others	0.43	0.15 – 1.20	0.110	0.39	0.13 – 1.13	0.084
Head of Household [ref. no]						
Yes	1.27	0.86 – 1.88	0.227	-	-	-
Schooling [ref. ≥9 years]						
0 – 8 years	1.52	1.04 – 2.22	0.022	-	-	-
Marital Status [ref. married]						
Widowed/single	1.39	0.96 – 2.02	0.075	-	-	-
Divorced/Other	1.63	0.98 – 2.73	0.058	-	-	-
Age group [ref. 60 – 69 years]						
70 – 79 years	0.90	0.64 – 1.27	0.562	-	-	-
80 and older	0.53	0.28 – 1.00	0.053	-	-	-
Working for pay [ref. no]						
Yes	0.78	0.51 – 1.18	0.245	-	-	-

SS: Social support; Minimum Wage: Considered the minimum monthly income received at the time of interview = 2018: R$954.00 ($261.1)/2019: R$998.00 (U$257.2). CI: Confidence interval. [a]crude OR derived from univariate logistic regression, [b]Derived from multiple logistic regression adjusting for all other variables in Table 1. For schooling and working for pay, the "not informed" category was suppressed from the model

individual presenting with food insecurity. Concerning sociodemographic covariates, older adults with <9 years of schooling ($P = 0.022$), women ($P = 0.041$), the African American ethnicity ($P = 0.016$), and individuals with low income ($P < 0.001$) were more likely to have food insecurity. In the adjusted model, only the positive social interaction dimension was significantly associated with the outcome ($P = 0.002$). Regarding sociodemographic covariates, only low-income (OR: 2.01; $P = 0.001$) and African American ethnicity (OR: 1.48; $P = 0.026$) were associated with food insecurity.

4. Discussion

In this study, we partially confirmed our initial hypothesis, showing that food insecurity was significantly associated with the positive social interaction domain of social support, and that this effect was independent of important indicators of social inequality, such as income and ethnicity.

The prevalence of food insecurity was different from that reported in the previous studies conducted among older adults in Brazil. Marín-León *et al*. (2005), for example, found a prevalence of 52% of food insecurity in families with older adults. Souza and Marin-Leon (2013),;however, found a prevalence of 21.8% in their study among older adults who attended popular restaurants. More recent data from a nationwide survey (2018/2019) showed that 27.3% of older Brazilians had some degree of food insecurity (IBGE, 2020). At the international level, the prevalence found in our study was much higher than that found in a study of older adults in the United States (7.8%) (Holben and Marshall, 2017) and Portugal (23%) (Fernandes, Rodrigues, Nunes, *et al*., 2018) but similar to that found in China (45%) (Cheng, Rosenberg, Yu, *et al*., 2015).

These differences observed between our study and national and international counterparts show that both the period and the region in which the research was conducted have great importance in determining the prevalence of food insecurity, along with the type of questionnaire used in the research. Our study was conducted more recently than other Brazilian studies, and our instrument included an additional question that assessed mobility difficulties that could also influence food access, which could explain the higher prevalence in relation to national data. Only a few recent studies have analyzed the association between social support and food insecurity among older adults, especially considering all social support dimensions. Burris *et al*. (2019) in a study with older adults who utilized primary care services, found that lack of social support was strongly associated with food insecurity. Similarly, Wang and Bishop (2019) found that low emotional social support was associated with food insecurity among older adults.

Although almost all dimensions of social support were significantly associated with food insecurity in our study, only the positive social interaction sustained this association in our adjusted model. This association can be understood when we consider food as beyond merely something that nourishes the body, but also as complex, with a social impact and connection with issues such as cultural belonging, family relationships, pleasure when eating, and behavioral aspects (Oliveira and Santos, 2020). In this context, less positive social interaction may decrease the desire to eat, which can lead to food insecurity among older adults. This phenomenon was also observed by Interlenghi and Salles-Costa (2015) in a study conducted in Rio de Janeiro that evaluated the association between food insecurity and social support among adults between 18 and 60-years-old. The study showed that individuals with high scores in the positive social interaction dimension had lower chances of experiencing food insecurity. Another qualitative study that analyzed food choices and food access among low-income older adults pointed out that social interactions, especially with family and friends, can positively affect the eating behavior of older adults, increasing the consumption of healthier meals and decreasing the intake of quick meals, such as toasts and cereals (Oemichen and Smith, 2016).

The importance of social interactions for healthy aging among older adults has been highlighted by the Brazilian Ministry of Health. The Brazilian Dietary Guidelines encourage making meals in the company of family members or friends to make this moment more pleasurable, which gives a sense of belonging and integrity to older adults, stimulating food intake and reducing their food vulnerability (Brazil, 2021). Positive social interaction with others can also help older adults not only maintain adequate nutrition but also improve their subjective well-being, providing an emotional resource to deal with adverse situations, such as food insecurity (Farriol-Baroni, González-García, Luque-García, *et al*., 2021; Na, Miller, Ballard, *et al*., 2018; Sharifian and Grühn, 2019).

Another factor significant in our results is income, which is considered to be one of the main determinants related to access and availability of food. In our study, those with a family income equal to or less than two minimum wages were more likely to experience food insecurity. This finding is expected and is accordance with plenty of previous studies. Grammatikopoulou *et al.* (2019) observed similar results in older adults from communities in Greece. In their study, older adults without food insecurity had a medium income of 700 euros per month, which was higher than that of the group with food insecurity, which had a medium monthly income of 560 euros. Fernandes *et al.* (2018), in a study of older adults in Portugal, found that having a monthly income of 500 euros or less, reporting having financial difficulties, or reporting that it was very difficult to live with their current income, were associated with increased odds of living in a food-insecure

household. In the United States, data from the report *The State of Senior Hunger in 2020* showed that among the older adults who fell below the poverty line, 38.2% had food insecurity (Ziliak and Gundersen, 2022).

It is important to highlight that in Brazil, 70.6% of older adults contribute to the family income, of which 62.5% help the family through their retirement income, a fact of great relevance nowadays, since the premature death of older adults by COVID-19 would have a high impact on the income of several Brazilian families, increasing the number of families falling below the poverty line (Camarano, 2020).

In Brazil, to attenuate the situation of food insecurity, the government provides some social security programs such as cash transfer programs, family agriculture food acquisition programs, and popular restaurants (places that offer lunch and dinner at a low cost, but only in specific regions). However, despite benefiting older adults, none of these programs were designed considering their specific needs. As mentioned by Lima-Costa *et al.* (2022), Brazil has undergone a period of important cuts in social security and health program investments in the past 4 years, including the extinction of the National Council for Food and Nutrition Security (in Portuguese, Conselho Nacional de Segurança Alimentar e Nutricional – CONSEA), an important institution that fought against food insecurity in Brazil. The extinction of the council reduced the articulation of society within the federal, state, and municipal government spheres, diminishing actions and programs that help food insecure individuals and may have a greatly negative impact in the short-term (Ribeiro-Silva, Pereira, Campello, *et al*., 2020).

Another factor that presented a high association with food insecurity in our study was self-reported ethnicity, showing that African American individuals had a 48% higher chance of having food insecurity compared to Caucasian. The same was observed in another study in the United States, in which African American older adults have a food insecurity rate close to 4 times that of Caucasian individuals (Ziliak and Gundersen, 2022) and in Canada, in which older adults who declared themselves non-white had a higher chance of having food insecurity (OR: 2.49; *P* < 0.001) (Leroux, Morrison, and Rosenberg, 2018).

In our study, some other factors shown in the literature as being associated with food insecurity, such as level of education, marital status, sex, current work, marital status, and being the head of the household, did not maintain a significant association in the final regression model. This demonstrates the importance of performing this type of research in different locations and analyzing other aspects (e.g., social support) in addition to those already described to better understand the sociodemographic factors associated with food insecurity in aging.

Although our study presents great potential for analyzing a sample of community-dwelling older adults who attend primary health care units, and, to the best of our knowledge, it is the first study to analyze the association between social support and food insecurity among older adults in Brazil, we must consider some limitations. The cross-sectional design did not allow inferences of cause and effect between the study variables. In addition, this study was limited to only community-dwelling older adults, making it difficult to generalize the results to other populations. Another important limitation is that we included only individuals registered in the Family Health Strategy program, so caution should be taken when generalizing the results to all older adults.

5. Conclusions

Our results highlight the important association between food insecurity and markers of social inequality as well as social determinants in health, especially social support. Considering these, our study presents important contributions to the practice in primary health-care units because stimulating social interaction and support may be a low-cost intervention capable of reducing the chances of food insecurity among older adults. Finally, our results highlight the importance of screening for food insecurity among older adults to prevent potential health problems related to this parameter.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Author's Contributions

C.N.F: Conceptualization, Investigation, Data Curation, Formal Analysis, Writing – Original Draft and Funding Acquisition. G.M.S and L.M.H: Investigation and Writing – Review and editing. F.S.A.B and T.R.P.B: Formal Analysis, Methodology and Writing – Review and editing. L.P.C: Conceptualization, Investigation, Methodology, Supervision, Funding Acquisition and, Writing – Review and editing. All authors read and approved the final manuscript.

Ethics Statement

This study was approved by the Research Ethics Committee of the Faculty of Medical Sciences – University of Campinas, under the protocol 95607018.8.0000.5404 following the Declaration of Helsinki.

Availability of Supporting Data

The datasets on which the conclusions of this manuscript rely on are not available publicly. The datasets used and/or analyzed during the current study are available from corresponding author, on reasonable request.

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