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Factors associated with risk of malnutrition in the elderly in south-eastern Brazil

Fatores associados ao risco de desnutrição em idosos do sudeste do Brasil

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ABSTRACT: ***Objective:*** The aim of this study was to evaluate the prevalence of malnutrition risk and its association with socioeconomic, behavioral, and health characteristics in the community-dwelling elderly. ***Methods:*** A cross-sectional study with individuals aged ≥ 60 years. Nutritional status was evaluated using the Mini Nutritional Assessment. Socioeconomic, behavioral, and health information was also collected from all participants. The association between each variable and the risk of malnutrition was calculated and adjusted using Poisson hierarchical regression. ***Results:*** The initial sample consisted of 3,101 elderly people, of whom 28.3% (95%CI 25.3 – 31.4%) were at risk of malnutrition. The multivariate analysis showed that the risk of malnutrition was significantly higher in women without formal education, who did not live with a partner, and identified as black-skinned. The risk of malnutrition was twice as high in individuals with no family income as compared to those who earned at least three minimum wages. Smokers were also more likely to be at risk of malnutrition than individuals who had never smoked. Participants suffering from kidney, respiratory or heart disease were at higher risk of malnutrition than those with no history of such illnesses. ***Conclusion:*** These findings could be used to help in the development of health policies and in the establishment of adequate programs aimed at reducing the risk of malnutrition in this population.

Keywords: Nutrition. Nutritional Status. Elderly. Mini Nutritional Assessment.

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RESUMO: ***Objetivo:*** O objetivo do trabalho foi avaliar a prevalência do risco de desnutrição e sua associação com fatores socioeconômicos, hábitos comportamentais e condições de saúde em idosos residentes na comunidade. ***Metodologia:*** Estudo transversal, realizado com indivíduos com ≥ 60 anos de idade. O estado nutricional foi avaliado pela Mini Avaliação Nutricional e foram obtidas informações socioeconômicas, hábitos comportamentais e de condições de saúde. Para a identificação dos fatores associados ao risco de desnutrição foram realizadas análises brutas e ajustadas por meio da regressão de Poisson, utilizando modelo hierárquico. ***Resultados:*** Foram analisados 3.101 idosos e, destes, 28,3% (IC95% 25,3 – 31,4) foram classificados com risco de desnutrição. Na análise multivariada, a prevalência de risco de desnutrição foi significantemente maior entre as mulheres, sem escolaridade, que não vivem com parceiros e cor de pela preta. O risco de desnutrição foi duas vezes maior nos indivíduos sem renda quando comparados aos que recebem acima de três salários mínimos. Os fumantes demonstraram maior probabilidade de risco de desnutrição quando comparados com os não fumantes. Os indivíduos que autorrelataram ter doenças renais, respiratórias e cardíacas apresentaram maior risco de desnutrição que aqueles que não relataram esses problemas. ***Conclusão:*** Estes resultados podem servir de subsídio para a formação de políticas de saúde no estabelecimento de programas adequados visando a redução do risco de desnutrição nesta população.

Palavras-chave: Nutrição. Estado Nutricional. Idosos. Avaliação Nutricional.

INTRODUCTION

The risk of malnutrition, or of being in the pre-malnutrition stage, is an important public health concern in elderly populations. A study pointed a prevalence of 31.9% of community-dwelling elderly individuals, and 46.2% of frail elderly persons living in the community, hospitals or institutions were found to be at risk of malnutrition[1]. These findings suggest that the early treatment of those at risk of malnutrition may reduce the prevalence of this condition in elderly populations[2].

Nutritional impairment has a clear negative impact on the individual, as well as on his/her family and country. Malnutrition is an independent risk factor for mortality[3]. The mortality rate in malnourished elderly Brazilians aged between 60 and 69 years was 3.34 deaths per 1,000 inhabitants, and among those aging 70 years or more, 11 deaths per 1,000 inhabitants[4]. In addition, heart disease[5], respiratory disease[6], and frailty are strongly associated with malnutrition[7]. Several social and behavioral factors were also found to be associated with malnourishment[8,9]. However, the risk of malnutrition has not been sufficiently explored in the literature.

Added to this, an ageing population is no longer a feature specific to developed countries[10]. In 2010, according to the Brazilian Institute for Geography and Statistics (IBGE), 20,590,599 Brazilian citizens were aged 60 years or older, which amounts to 10.8% of the national population[11]. Average life expectancy has also increased in recent decades, reaching 74 years in 2012 and remaining higher for women than for men (78 and 71 years, respectively)[12]. This has fostered the discussion about the concept of quality-adjusted or 'healthy' life expectancy, which examines the maintenance of functioning and quality of life in old age[13].

Nutritional status and nutritional risk directly impacts quality of life. According to Ferreira et al.[14], the risk of malnutrition is an important contributor to mortality in elderly populations.

The risk of malnutrition and any associated factors must therefore be studied to minimize their economic and social costs. The identification of factors associated may help in the implementation of nutritional intervention programs against malnutrition in the elderly. The aim of this study was to evaluate the prevalence of malnutrition risk and its association with socioeconomic, behavioral, and health features in community-dwelling elderly people from Triângulo Mineiro region, Minas Gerais State.

METHODS

STUDY DESIGN AND POPULATION

This was a cross-sectional study with a target population of 80,134 individuals aged 60 years or older[11], conducted as part of a project entitled 'Health profile of the elderly population of the health region of Uberaba / Minas Gerais', which aimed to investigate the sociodemographic and health profile of the elderly population of 27 cities located in Triângulo Mineiro region, Minas Gerais State, south-eastern Brazil.

Sample size was calculated based on the elderly population of each city[11] and according to the following parameters: 5% sampling error, 95% confidence interval, and proportion of elderly individuals per city (the elderly divided by total population). The minimum sample size, calculated as the sum of minimum sample sizes, was 3,513.

As per the municipal Health Department and Family Health, all individuals aged 60 or older living in the urban regions were invited to go to the Primary Health Care Units of their municipalities to participate in the assessment.

The following inclusion criterion was applied to all participants: scores above the minimum threshold on the Mini Mental State Examination[15]. The score of the MMSE was adjusted by education according to Bertolucci et al[16]. Exclusion criteria were: wheelchair bound, having severe hearing or visual impairments which interfered with communication, and being bedridden.

All research protocols were approved by the Human Research Ethics Committee of Universidade Federal de Minas Gerais (protocol number 1640 / 2010), and by the Research Ethics Committee of the Medical School of Universidade de São Paulo (protocol number 083 / 15).

DATA COLLECTION

Data were collected between May 2012 and April 2013. A multidimensional questionnaire was applied individually to each participant by a trained interviewer after they signed the informed consent form. A pilot study was performed in three cities of the health region of Uberaba in order to test questionnaire viability, which resulted in minor changes to the instrument in question.

Nutritional status was evaluated using the Mini Nutritional Assessment (MNA) translated into Portuguese[17]. Total score ≥ 24 indicates satisfactory nutritional status, scores between 17 and 23.5 indicate risk of malnutrition, and < 17 means actual malnutrition. The MNA is a valid, highly sensitive (96%) and specific (98%) instrument for the assessment of nutritional status in the elderly[18,19].

ANTHROPOMETRIC ASSESSMENT

Anthropometric measures were taken using the standard techniques proposed by Lohman et al.[20]. All assessments were performed by trained professionals with the same supervisor (a nutritionist). Body mass was measured to the nearest 50 g using a Filizola® portable electronic scale, with maximum capacity of 150 kg. Height (m) was measured using a portable stadiometer. Body mass index was determined using the following formula: BMI = body mass/height^2. Mid-arm and calf circumferences were measured to the nearest mm using an inelastic flexible measuring tape.

SOCIOECONOMIC, BEHAVIORAL, AND HEALTH CHARACTERISTICS

Three sets of independent variables were considered:

1. Gender (female and male), age range (60 – 69, 70 – 79 and ≥ 80 years), education (none, 1 to 4 years, ≥ 5 years), living arrangement (alone or accompanied), skin color (white, yellow, brown, black), family income (0, ~1 minimum wage, > 1 and ≤ 3 minimum wages, > 3 minimum wages);
2. Smoking history (never, former smoker, current smoker), current alcohol consumption (yes, no);
3. Evaluated by self-report, using the following question: "Has a doctor ever told you that you have or had any of the following diseases: diabetes, hypertension, cancer, respiratory, rheumatic, musculoskeletal, heart or kidney disease?".

DATA ANALYSIS

Data were input in duplicate into a Microsoft Office 2007 Excel® spreadsheet. Statistical analyses were performed using Stata® version 11.0.

Malnourished individuals were excluded from the analysis. Descriptive analyses were first performed, with all results presented as percentages. The association between each risk factor and the risk of malnutrition was calculated and adjusted using the Poisson regression test. Results were considered significant when $p < 0.05$.

Since several factors could confound the association between variables of interest, hierarchical analysis was used to select the most important confounders. The hierarchical approach

accounts for the effects of each confounder on the same and superior levels[21]. Multivariate analysis using a hierarchical model (Figure 1) was used to evaluate all independent variables associated with the risk of malnutrition. Socioeconomic factors were not adjusted for the effects of any other variables, since the theoretical model selected considers them to be determined by social features. As a result, behavioral factors were adjusted for socioeconomic variables, and health-related factors were adjusted for both socioeconomic and behavioral ones. Variables with $p \leq 0.20$ within each level were considered potential confounders[22].

RESULTS

Of the 3,430 elderly individuals who took part in the study, 329 (9.6%) did not have all the desired sociodemographic information. However, 54 of these individuals (1.7%) were classified as malnourished. The final sample, therefore, consisted of 3,047 individuals, of whom 865 (28.3%) were at risk of malnutrition.

In the crude analysis, all variables were significantly associated with a risk of malnutrition in the sample, exceptions being hypertension and diabetes. After adjustments based on our hierarchical model, only the following variables remained as associated with risk of malnutrition: gender, education, skin color, income, not living with a partner, smoking habit, respiratory, heart and kidney disease (Table 1).

According to the multivariate analysis (Table 1), the risk of malnutrition was significantly higher in females (PR = 1.19, 95%CI 1.05 – 1.34), individuals with no formal education (PR = 1.63, 95%CI 1.32 – 2.00) and subjects not living with a partner (PR = 1.17, 95%CI 1.04 – 1.32). Individuals identified as black-skinned were 1.21 times (1.04 – 1.41) more likely to be at risk of malnutrition than those identified as white-skinned. The risk of malnutrition was twice as high in individuals with no family income compared to those who earned at least three times a minimum wage (PR = 2.21, 95%CI 1.42 – 3.70). Smokers were also more likely to be at risk of malnutrition (PR = 1.63, 95%CI 1.42 – 1.86) than individuals who had

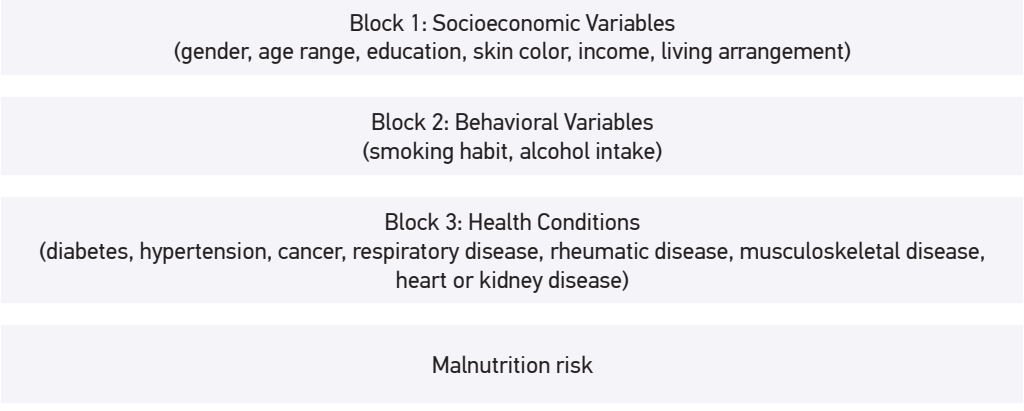

Figure 1. Hierarchical theoretical model for malnutrition risk in elderly individuals.

Table 1. General characteristics, prevalence of malnutrition risk, raw prevalence ratios and adjusted values for socioeconomic, behavioral and health variables, Uberaba, 2013.

Variables	Frequency	Malnutrition risk	Crude	p-value*	Adjusted	p-value*
	n (%)	n (%)	PR (95%CI)		P (95%CI)	
Block 1						
Gender						
Male	1,180 (38.7)	292 (24.7)	1	0.001	1	0.006
Female	1,867 (61.2)	570 (30.5)	1.23 (1.09 – 1.39)		1.19 (1.05 – 1.34)	
Age Range						
60 to 69 years	1,611 (52.8)	417 (25.8)	1	0.000	1	0.160
70 to 79 years	1,083 (35.5)	321(29.6)	1.14 (1.01 – 1.29)		1.05 (0.93 – 1.19)	
≥ 80 years	353 (11.5)	124 (35.1)	1.35 (1.15 – 1.59)		1.17 (0.99 – 1.39)	
Education						
None	895 (29.3)	347 (38.7)	1.98 (1.62 – 2.42)		1.63 (1.32 – 2.00)	0.000
1 to 4 years	1,670 (54.8)	421 (25.2)	1.29 (1.05 – 1.57)		1.14 (0.93 – 1.39)	
5 or more years	482 (15.8)	94 (19.5)	1		1	
Skin colour						
White	1,831 (60.0)	479 (26.1)	1	0.001	1	0.040
Yellow	64 (2.1)	23 (35.9)	1.37 (0.98 – 1.92)		1.25 (0.90 – 1.75)	
Brown	738 (24.2)	219 (29.6)	1.13 (0.99 – 1.29)		1.12 (0.98 – 1.28)	
Black	414 (13.5)	141 (34.0)	1.30 (1.11 – 1.51)		1.21 (1.04 – 1.41)	
Family income (in minimum wages)†						
0	42 (1.3)	16 (38.1)	2.77 (1.75 – 4.41)	0.000	2.29 (1.42 – 3.70)	0.000
1	1,138 (37.3)	386 (33.9)	2.47 (1.89 – 3.23)		1.96 (1.49 – 2.58)	
> 1 ≤ 3	1,495 (49.0)	409 (27.3)	1.99 (1.52 – 2.60)		1.76 (1.34 – 2.31)	
> 3	372 (12.2)	51(13.7)	1		1	
Living arrangement						
Accompanied	1,747 (57.3)	431 (24.6)	1	0.000	1	0.006
Alone	1,300 (42.6)	431 (33.1)	1.34 (1.20 – 1.50)		1.17 (1.04 – 1.32)	

Continue...

Table 1. Continuation.

Variables	Frequency	Malnutrition risk	Crude	p-value*	Adjusted	p-value*
	n (%)	n (%)	PR (95%CI)		P (95%CI)	
Block 2						
Smoking status						
Never	1,816 (59.6)	473 (26.0)	1	0.000	1	0.000
Former smoker	785 (25.8)	205 (26.1)	1.00 (0.87 – 1.15)		1.10 (0.95 – 1.27)	
Current smoker	446 (14.6)	184 (41.2)	1.58 (1.38 – 1.81)		1.63 (1.42 – 1.86)	
Alcohol intake						
No	2,562 (84.0)	753 (29.3)	1	0.003	1	0.080
Yes	485 (15.9)	109 (22.4)	0.76 (0.64 – 0.91)		0.85 (0.71 – 1.01)	
Block 3						
Hypertension						
No	1,007 (33.3)	277 (32.5)	1	0.566	–	
Yes	2,010 (66.7)	573 (67.5)	1.03 (0.91 – 1.17)			
Diabetes						
No	2,374 (79.8)	656 (78.3)	1	0.201		–
Yes	602 (20.2)	182 (21.7)	1.09 (0.95 – 1.25)			
Cancer						
No	2,861 (96.1)	795 (27.7)	1	0.119	1	0.248
Yes	114 (3.8)	39 (34.2)	1.23 (0.94 – 1.59)		1.17 (0.89 – 1.52)	
Respiratory disease						
No	2,538 (84.8)	674 (26.5)	1	0.000	1	0.004
Yes	455 (15.2)	171 (37.5)	1.41 (1.23 – 1.61)		1.24 (1.07 – 1.44)	
Rheumatic disease						
No	1,985 (68.4)	522 (26.3)	1	0.002	1	0.396
Yes	914 (31.5)	291(31.8)	1.21 (1.07 – 1.36)		1.06 (0.92 – 1.21)	
Musculoskeletal disease						
No	1,789 (62.3)	477 (26.6)	1	0.025	1	0.385
Yes	1,081 (37.6)	330 (30.5)	1.14 (1.01 – 1.28)		1.0 (0.92 – 1.21)	
Heart disease						
No	2,164 (74.3)	526 (24.3)	1	0.000	1	0.000
Yes	747 (25.6)	286 (38.2)	1.57 (1.40 – 1.77)		1.42 (1.25 – 1.61)	
Kidney disease						
No	2,532 (86.0)	665 (26.2)	1	0.000	1	0.002
Yes	410 (13.9)	155 (37.8)	1.43 (1.25 – 1.65)		1.27 (1.09 – 1.48)	

*Wald's Test; †Minimum wage at the time of the study = R$ 678.

never smoked. Participants suffering from kidney, respiratory and heart diseases were at higher risk of malnutrition than those with no history of such illnesses [(PR = 1.27, 95%CI 1.09 – 1.48); (PR = 1.24, 95%CI 1.07 – 1.44); (PR = 1.42, 95%CI 1.25 – 1.61); respectively]. Age, alcohol intake, cancer, rheumatic and musculoskeletal diseases were not associated with risk of malnutrition.

DISCUSSION

The present findings revealed that female elderly individuals who had no formal education, identified as black-skinned, with lower income levels, not living with a partner, smoker or with respiratory, heart or kidney diseases were more likely to be at risk of malnutrition.

There is no shortage of population-based studies conducted with Brazilian elderly people residing in the community in which the risk of malnutrition was assessed by MAN.

The Health, Well-being and Ageing (SABE) study, for instance, was a multicenter research project performed by the Pan-American Health Organization in several Latin American cities, including São Paulo. In this investigation, 25.6% of a retrospective sample of 1,170 elderly individuals were found to be at risk of malnutrition[14].

Our findings were also similar to those obtained in other countries in investigations such as the *Aging and Malnutrition in Elderly Lebanese* (AMEL) study, by Boulos et al.[23]. The risk of malnutrition was seen in 29.1% of the sample and was especially frequent in women. On the other hand, in a prospective cohort study conducted in the Razavi Khorasan province of Iran involving 2,000 elderly (≥ 60 years) people living in both rural and urban areas, the prevalence of malnutrition risk was 45.3%[8].

The variation in prevalence of malnutrition risk between studies who used the same assessment method can be explained by differences in the age used to define 'elderly' (which is 60 years in Brazil)[24], or by the inclusion of individuals living in urban *vs*. rural areas, subjects with cognitive impairment, and frail elderly persons.

A significant number of studies have identified a negative correlation between socioeconomic status and malnutrition risk in elderly individuals[8,9,25]. In the present study, income (mostly derived from social security) was the socioeconomic variable with the strongest association with malnutrition risk, even after adjustment to potential confounding factors. This association was strongest in lower income brackets. Brazil is a country with many notable cultural, social and economic contrasts, which may influence dietary habits and the risk of malnutrition in the elderly, especially those with lower incomes. A progress in human development was observed in all regions of Minas Gerais, but regional inequality persists[26].

Lower income may restrict access to healthy food and limit dietary options, leading to dietary monotony and inability to maintain adequate nutrition[9]. Additionally, many elderly people provide financial assistance to their children and relatives[10], which may aggravate this situation.

The present study found an especially high prevalence of malnutrition risk among women, which corroborates with previous findings[27]. Female life expectancy exceeds male life expectancy across the world[28]. Thus, aging may expose the elderly to diseases and their complications, predisposing them to the risk of malnutrition[7]. Other possible factors are social issues related to social and financial living[8].

In many societies, women are more likely to have low income and poor social support, both of which can persist and worsen in old age. With the objective of determining the prevalence of food insecurity in Brazilian households whose heads are elderly people, according to sociodemographic characteristics, Rosa et al.[29] found that 29.8% were food-insecure. In gender analysis, women-headed households found themselves in a worse food security situation compared to those headed by men.

Education was also strongly associated with malnutrition risk in the present study, with elderly individuals who had never attended school showing a significantly higher risk of malnutrition. A relationship between low education levels and risk of malnutrition was also demonstrated by Timpini et al.[30] and another study in which elderly individuals with higher education levels were found to have better nutritional status[8].

Moreira et al.[31] found that individuals with higher education levels eat more vegetables, fruit, milk, and fish as compared to those with lower education levels. The authors suggested that a higher education level may be associated with increased access to information and better understanding of the importance of certain foods for nutrition and health, all of which positively impacting nutritional status. Additionally, individuals with higher education levels may have a higher income and, consequently, increased access to more expensive and high-quality food items.

The increased prevalence of malnutrition risk in individuals who identify as having black skin color may be explained by inequality and increased exposure to adverse social conditions. There is a significant racial diversity in Brazil and the percentage of the population with black skin color is 11.7% for men and 12.0% for women over 60[32]. The same study showed that the population of Brazil with black skin is especially susceptible to social inequality and adverse living conditions, in addition to having lower education and income levels. These issues are especially common among women. In a survey of a representative probabilistic sample of 18,684 elderly people from all regions of Brazil, which aimed to analyze the association between skin color/race and health indicators, racial inequality was found to have a significant impact on health, as well as socioeconomic and demographic conditions. Elderly people with brown and black skin color are more numerous in the younger age brackets (65 – 69 years), in populations which rely exclusively on public health, among those with lower education levels, in the lowest income quintile, and in areas with poorer social and health conditions[33].

In the present study, the increased risk of malnutrition in elderly individuals who live alone may represent the influence of social interaction (or lack thereof) on nutritional status. Locher et al.[34] found that, although the presence of family members in the household had no effect on calorie intake, elderly individuals who ate with someone else consumed

an average of more 114.0 kcal per meal than those who ate alone. The authors suggested that this phenomenon may be explained by the increased duration of meals when others are present, which may increase food intake. Romero-Ortuno et al.[35] also observed that the lack of social support was a more significant risk factor for malnutrition than living alone.

The association between smoking and malnutrition risk has also been observed in other studies[36,37]. This may be explained by the fact that nicotine raises the resting metabolic rate without the expected increase in appetite, as well as lipolysis, facilitating weight loss[38]. Additionally, smoking is associated with several health issues, which may increase mortality in underweight elderly people, as shown by Visscher et al.[39].

The chronic illnesses most strongly related to the risk of malnutrition were respiratory (chronic obstructive pulmonary disease, allergies, pulmonary hypertension), heart (ischemic heart disease, congestive heart failure) and kidney disease (kidney failure). The first two are more prevalent and the leading cause of death among the elderly in middle-income countries, such as Brazil[40].

Schilp et al.[7] evaluated the incidence of malnutrition in the elderly (65 – 85 years) during a nine-year follow-up and found an association between two or more chronic diseases and the risk of malnutrition. Malnutrition has also been found to be related to hospital-acquired pneumonia[41] and increased length of hospitalization[42].

Although the association of acute and chronic illnesses with risk of malnutrition is not yet fully understood, it has been documented by several studies in the literature. The relationship between these factors is likely related to the catabolic effects of infection, inflammation or trauma. The release of inflammatory mediators such as cytokines (interleukin – 1, interleukin – 6 and alpha-tumor necrosis factor), glucocorticoids, and catecholamine may cause changes in metabolism, appetite, and in the absorption and assimilation of nutrients[43], resulting in a vicious circle of illness and malnutrition.

The present study shows some points that might be worthy of attention. Firstly, the quality of the data collected, with the exclusion of the elderly who had hearing or severe vision impairments, minimizing the bias of cognition and communication, the bedridden and wheelchair-using elderly people who guaranteed the standardization and measurement of the anthropometric measures, as well as the participants who presented changes of the cognitive state. In order to assess a specific group as to nutritional impairment, it was decided not to include the elderly with cognitive decline. Cognitive decline causes sensorineural alterations that can trigger anorexia and, consequently, decrease food intake and increase the risk of malnutrition[44]. Thus, the early detection of elderly people at risk of malnutrition is extremely important because it aggravates the prognosis of their condition, even though there is no consensus on what determines nutritional deficit in this group [45]. MNA made it easier to compare the present findings to those obtained in different populations[46].

On the other hand, the cross-sectional design of our study may have been a limitation, since it does not allow establishing the direction of associations identified. Additionally, although the sample was made up from individuals living in 24 different cities in south-eastern Brazil, covering an area of 33,594 km^2 with mean human development index of 0.717[16],

our findings may not be entirely generalizable, since the interviews were performed only with individuals who were available on the scheduled dates. Considering that depression is directly related to risk of malnutrition in the elderly, it should also be analyzed in further studies. Finally, the information about health conditions was self-reported, thus misclassifications bias cannot be ruled out.

CONCLUSION

The present study found that the risk of malnutrition was more common among female elderly individuals who had no formal education, identified as black-skinned, with lower income levels, not living with a partner, smokees or with respiratory, heart or kidney diseases. We hope that the identification of biological and social characteristics associated with malnutrition will contribute to the understanding of this phenomenon in elderly populations and turn the spotlight on the need for preventive interventions. The treatment of established malnutrition is far more complex and costly, which may hinder the reversal of this condition in a population as vulnerable as the elderly.

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