Factors associated with nutritional risk and appetite loss in long-aged older people

Fatores associados ao risco nutricional e à perda de apetite em idosos longevos

Mariana de Paula SANTANA[1] ID 0000-0003-1086-0808

Nadine Motta FIGUEIREDO[1] ID 0000-0002-8984-8213

Sergio CHOCIAY JUNIOR[2] ID 0000-0001-8209-3834

Tainá Aparecida SILVA[1] ID 0000-0002-4723-0909

Rosimeire Aparecida Manoel SEIXAS[2] ID 0000-0002-0864-1756

Bruna Moretti LUCHESI[3] ID 0000-0002-0508-0818

ABSTRACT

Objective

To analyze the factors that are associated with the nutritional risk and appetite loss of long-aged older people with two assessment instruments.

Methods

A cross-sectional and quantitative study was developed in *Três Lagoas*, a city in the Brazilian state of *Mato Grosso do Sul*. The household data collection was conducted with 87 long-aged older adults (≥90 years) living in the community. The risk of malnutrition, malnutrition, and the risk of weight loss were the dependent variables, assessed by the Simplified Nutritional Appetite Questionnaire and by the Mini-Nutritional Assessment – Short Form. The association

[1] Universidade Federal de Mato Grosso do Sul, Curso de Medicina. Três Lagoas, MS, Brasil.

[2] Universidade Federal de Mato Grosso do Sul, Faculdade de Medicina. Campo Grande, MS, Brasil

[3] Universidade Federal de Mato Grosso do Sul, Programa de Pós-Graduação em Enfermagem. *Campus* de Três Lagoas, Av. Ranulpho Marques Leal, n. 3484, Distrito Industrial, 79613-000, Três Lagoas, MS, Brasil. Correspondence to B.M. LUCHESI. E-mail: <bruna.luchesi@ufms.br>.

with independent sociodemographic, general health, psychological, cognitive, and physical variables was analyzed using logistic regressions.

Results

Most of the older adults were female (55.2%), with an average age of 93.3 years, and 1.4 years of schooling. According to the Simplified Nutritional Appetite Questionnaire, 34.5% of the older individuals were at risk of losing weight. As for the results of the Mini-Nutritional Assessment, 19.5% were classified as malnourished, and 39.1% at risk of malnutrition. A greater nutritional risk in both instruments was associated with the individual's poorer self-perceived health, lower calf circumference, and presence of depressive symptoms. The greater the number of medications used, the lower the chance of weight loss. The agreement between the two instruments was low.

Conclusion

There was an association connecting malnutrition and appetite/weight loss with lower calf circumference, worse self-perceived health status, and presence of depressive symptoms. These results can assist in interventions planning to reduce the nutritional risk and improve the life quality of older adults.

Keywords: Aging. Geriatric Assessment. Longevity. Nutrition Surveys.

R E S U M O

Objetivo

Analisar os fatores associados ao risco nutricional e à perda de apetite de idosos em extrema longevidade, utilizando dois instrumentos de avaliação.

Métodos

Estudo transversal e quantitativo, desenvolvido em Três Lagoas-MS, por meio de coleta domiciliar de dados com 87 idosos em extrema longevidade (≥90 anos), residentes da comunidade. O risco de desnutrição, a desnutrição e o risco de perda de peso foram as variáveis dependentes obtidas pelo Questionário Nutricional Simplificado de Apetite e pela Mini Avaliação Nutricional – Forma Curta. A associação com variáveis independentes sociodemográficas, de saúde geral, física, psicológica e cognitiva foi analisada por meio de regressões logísticas.

Resultados

A maioria dos idosos era do sexo feminino (55,2%), com média de 93,3 anos de idade e 1,4 anos de escolaridade. No Questionário Nutricional Simplificado de Apetite, 34,5% dos idosos apresentaram risco de perda de peso. Na Mini Avaliação Nutricional, 19,5% foram classificados com desnutrição e 39,1% com risco de desnutrição. Maior risco nutricional em ambos os instrumentos foi associado a uma pior saúde auto percebida, à menor circunferência da panturrilha e à presença de sintomas depressivos. O maior número de medicamentos utilizados por dia foi associado a menor chance de perda de peso. A concordância entre os dois instrumentos foi baixa.

Conclusão

Identificou-se associação entre desnutrição e perda de peso/apetite e menor circunferência da panturrilha, pior saúde auto percebida e presença de sintomas depressivos. Os resultados podem auxiliar no planejamento de intervenções para redução do risco nutricional, visando à melhoria da qualidade de vida de idosos em extrema longevidade.

Palavras-chave: *Envelhecimento. Avaliação Geriátrica. Longevidade. Inquéritos Nutricionais.*

I N T R O D U C T I O N

Old age can be divided into phases, with extremely old age encompassing individuals aged 90 and over [1]. The age group comprising the oldest people (80 years or older) is the fastest growing in the world, presenting challenges for public policies since long-lived older people show greater susceptibility to morbidities [2]. In addition, older adults use health services more frequently, which can involve prolonged treatments and high costs [3].

Brazil presents a great decline in birth and mortality rates, changing its profile from a predominantly young population to an older population [4]. In 2010, the country had a contingent of 19.6 million older people, a number that is expected to increase to 66.5 million in 2050 [5]. It is estimated that in 2025 the country will become the sixth with the highest number of older adults in the world, and the age group with the greatest projected growth will be that of very long-lived population [6].

The subjective assessment of the nutritional status is an important aspect of growing old. Healthy eating is necessary for health, influencing the individual's lifestyle and supplying the body with conditions to provide energy. Therefore, the inadequate consumption of food can bring consequences to older adults such as the increased loss of muscle mass and strength, which can affect the ability to perform daily activities and the degree of independence, decreasing the quality of life [7]. The nutritional status is the result of the balance between food intake and the caloric expenditure to satisfy the physiological needs of the body [8]. When it is at risk, it is associated with an increased risk of diseases and functional changes [9].

Older adults are prone to develop malnutrition, characterized by: an involuntary weight loss greater than 4% annually or 5% every six months; Body Mass Index (BMI) $<22kg/m^2$; the presence of hypoalbuminemia and hypocholesterolemia. Physiological factors also contribute to the onset of this disease, such as decreased taste and olfactory sensitivity, delayed gastric emptying speed, early satiety, and deterioration of the regulation of food intake [8].

The prevalence of malnutrition among older adult ranges from 2% to 60%, being influenced by factors like the place of residence, age, and social situation of the individuals [9]. In Brazil, in 2019, according to data obtained from the Food and Nutrition Surveillance System, 12.2% of the older population was underweight, considering only the BMI [10]. Data regarding the long-lived population are scarce. A study that evaluated the nutritional status of 128 nonagenarians and centenarians living at home in *Porto Alegre*, in the Brazilian state of *Rio Grande do Sul*, identified that 24% were at nutritional risk [11].

A systematic review and meta-analysis evaluated the relationship between socioeconomic factors and malnutrition or the risk of malnutrition in older adults. The study found that low-income levels, living alone, being single, widowed or divorced, and low education, were related to malnutrition [12]. However, there is a gap in the assessment of the nutritional status of long-aged older people.

As a practical and minimally invasive measuring instrument, the Mini Nutritional Assessment – Short Form (MNA-SF) encompasses the various dimensions necessary for the nutritional assessment of the individual and is a useful tool for drawing nutritional profiles in older people in different healthcare settings [13-15]. Another option for assessing the nutritional risk is the Simplified Nutritional Appetite Questionnaire (SNAQ), which is recommended for clinical use, in addition to being simple and quick to apply [16].

Effective measures to reverse malnutrition and appetite loss should be implemented early, since compensating for nutritional deficiencies is one of the major challenges in older adults' care. Identifying factors related to the risk of malnutrition can be of assistance when planning these interventions. The present study aimed to analyze the factors associated with the nutritional risk and appetite loss of long-aged older people, using two assessment instruments that investigate the risk of malnutrition, the prevalence of malnutrition, and also loss of appetite/weight through subjective evaluation. Both instruments (SNAQ and MNA-SF) were used, as both assess the subjective perception of the nutritional status, and the results indicate possible similarities and divergences between them.

METHODS

This is a cross-sectional quantitative study developed in the city of *Três Lagoas*, in the state of *Mato Grosso do Sul*, mid-western Brazil. According to the Brazilian Census, the city had 101,791 inhabitants in 2010. The number of older adults in 2010 was 10,067 (9.88%), and only 1.54% of them were 90 years

or older. In Brazil, the proportion of older adults in the population was 10.5%, of which 2.18% were older individuals [17].

The study's population was composed of long-aged older people (90 years or more) assisted by the *Sistema Único de Saúde* (SUS, Unified Health System) in the year before the data collection (November 2018 to November 2019). The criteria for inclusion in the sample were: being ≥90 years old, having been assisted by the SUS *Rede de Atenção à Saúde* (RAS, Health Care Network) in the previous year, being able to answer the interview questions (assessed by the perception of the interviewer) and live in the municipality's urban area. Older adults who were not found in their homes after two visits were excluded from the sample.

The search in the SUS electronic system of user registration in the city identified 345 older adults over 90 who were assisted in the previous year. The following were excluded: 10 due to errors in the registration, 57 due to death, 14 who lived in the rural area, and 102 due to problems in the address (address changes, not found or nonexistent). Researchers visited 162 older adults in their homes, 62 of whom refused to participate. Four were unable to answer the questionnaire, and seven were unable to answer due to the pandemic of the new coronavirus. The final sample included 89 older people; however, two did not complete the nutritional assessment questionnaires and were not included, resulting in a sample of n=87 older adults.

The study was approved by the Ethics Committee in Research with Human Beings of the *Universidade Federal do Mato Grosso do Sul* (CAAE: 21397119.0.0000.0021). We verified that all participants read and signed the Informed Consent Form. For those who were illiterate, the Consent Form was read by third parties, and in cases where the interviewee was unable to sign, the fingerprints were collected.

Data collection was carried out in their households and individually by seven trained evaluators, between December 2019 and February 2020, using data on the following issues:

(1) Sociodemographic variables: sex (male/female), age (in years), schooling (in years), marital status (with partner / without a partner), and family income (in local currency – Brazilian Reais, BRL).

(2) Health: self-rated health status (Very good/Good, Fair, Poor/Very poor), number of medications per day (continuous use), hospitalization in the last six months (yes/no), falls in the last year (yes/no), the presence of self-reported visual and hearing deficits (yes/no), hours of sleep per night (continuous), current smoking habit (yes/no), and alcohol use (yes/no). For the physical health evaluation, we also measured the Calf Circumference (CC), that is, the maximum perimeter in the plane perpendicular to the longitudinal line of the calf with an average of three measurements (in centimeters) [18]. Corrected visual and hearing deficits (with glasses or hearing aids) were considered as positive answers.

(3) Psychological health: assessments in this sense included: (a) Social isolation: "Do you consider yourself socially isolated?" (yes/no). (b) Symptoms of depression: assessed by the Patient Health Questionnaire-9 (PHQ-9), as adapted and validated in Brazil. It evaluates symptoms of depressed mood, anhedonia (loss of interest or pleasure in doing things), sleep disorders, tiredness or lack of energy, changes in appetite or weight, feeling guilty or worthless, problems with concentration, feeling slow or restless, and suicidal thoughts. The final score ranges from 0 to 27, with results ≥9 indicating the presence of depressive symptoms [19]. (c) Anxiety: assessed through the Geriatric Anxiety Inventory (GAI), adapted Brazilian version, which assesses concerns, decision-making, feeling nervous and bored, in addition to the physiological effects triggered by stressful situations. It has 20 statements, with "agree" or "disagree" as possible answers. The 10/11 cutoff point was defined to indicate generalized anxiety [20]. (d) Cognition: assessed by the verbal fluency test, which covers semantic memory, the retrieval of information from memory, and the processing of executive functions. The individual must remember as many words as possible in one minute, all of which belong to the category "animals" [21]. The data were analyzed continuously.

(4) Subjective assessment of nutritional status: two instruments were used for the dependent variables (malnutrition, risk of malnutrition, and appetite/weight loss): (a) SNAQ: contains four questions that assess the quality of the patient's appetite; the number of meals; their satisfaction after completing them; and the taste of the food. The score varies from 4 to 20, and the lower the results, the greater the risk of the patient

to present weight loss. A score ≤14 indicates a risk of losing at least 5% of their weight in six months, which implies nutritional risk [16]. (b) MNA-SF: contains six questions that assess food intake, involuntary weight loss, mobility, psychological stress, neuropsychological problems, and anthropometry. The total ranges from 0 to 14, with scores <8 corresponding to malnutrition; between 8 and 11, risk of malnutrition; and greater than 11 normal nutritional status [13,14,15]. The questionnaire was developed by the researchers according to important variables to be evaluated in long-aged older people and including instruments validated in Brazil.

The data were analyzed in the Statistical Package for the Social Sciences (SPSS) version 25.0. The risk of malnutrition, malnutrition, and the risk of weight loss, were taken as dependent variables. The prevalence of these conditions was estimated with a 95% Confidence Interval (CI). Independent variables were described for the total sample (mean, standard deviation / percentage). Binomial logistic regression was conducted to identify the factors associated with the risk of weight loss assessed by the SNAQ, as well as a multinomial logistic regression to identify the factors associated with the risk of malnutrition and malnutrition by the MNA-SF. The variables with $p \leq 0.20$ in the univariate analysis were selected for the multiple analysis and inserted into the model by the forward stepwise selection method. Variables with $p \leq 0.05$ in the adjusted model were considered significant.

The Kappa coefficient (k) was calculated to determine the degree of agreement between the MNA-SF and SNAQ. Kappa ranges from 0.00 to 1.00, and the closer to 1.00, the greater the agreement. To calculate this value, the results were dichotomized in older people with a profile of nutritional risk (malnutrition and risk of malnutrition in the MNA-SF and risk of weight loss in the SNAQ) and those with regular profiles.

RESULTS

The Table 1 presents the data regarding the sociodemographic and health characteristics of the older adults. Most were female, without a partner, had an average of 93.3 years of age and 1.4 years of schooling.

Regarding subjective nutritional assessment, the SNAQ results showed that 34.48% (95% CI: 25.34-44.94%) of the older adults were at risk of weight loss in six months. The MNA-SF results classified 19.54% (95% CI: 12.57-29.08%) as malnourished and 39.08% (95% CI: 29.50-49.59) as at risk of malnutrition.

The Tables 2 and 3 show the data from the regression analyzes with the subjective assessment of the nutritional status variables of the SNAQ and the MNA-SF. The column "univariate" shows the variables in which the p-value was ≤0.2 in univariate analysis. The column "multivariate" shows the results of the logistic regression analysis. The variables with an * were significant ($p \leq 0.05$) and considered in the adjusted model.

In the SNAQ results, the risk of weight loss was associated with: self-perceptions of health status classified as regular (OR=6.82) and very poor/poor (OR=18.81); the number of medications taken per day (OR=0.68) – the more drugs, the smaller the chance of weight loss; Calf Circumference (CC) (OR=0.83) – the larger the circumference, the lower the chances of weight loss; and presence of depressive symptoms (OR=11.26).

In the results of the MNA-SF, the risk of malnutrition was associated with the CC (OR=0.74). Malnutrition was associated with self-perceived regular health status (OR=12.72) and very poor/poor ones (OR=67.50), CC (OR=0.62), and presence of depressive symptoms (OR=7.24). For CC, the larger the circumference, the lower the prevalence of risk of malnutrition and malnutrition itself. In both instruments, there was an association of greater nutritional risk and with lower CC, worse self-perceived health, and presence of depressive symptoms.

Table 4 shows that the agreement in diagnoses of 54 individuals (62.10%), with a Kappa coefficient of 0.12 (95%CI 0.11-0.13; p=0.003), indicating that the agreement between the two instruments is low.

Table 1 – Sociodemographic and health characteristics of long-aged older people (n=87). *Três Lagoas* (MS), Brazil, 2020.

Variables	Categories	n	%	Mean±Standard Deviation
Gender	Male	39	44.83	
	Female	48	55.17	
Age (years)				93.33±2.95
Marital status	With partner	20	22.99	
	Without partner	67	77.01	
Schooling (years)				1.42±1.93
Family income (BRL)				2729.35±1675.39
Self-rated health	Very good/Good	35	40.23	
	Regular	29	33.33	
	Poor/Very poor	19	21.84	
	Missing	4	4.60	
Medications/day				3.48±3.17
Hospitalization in last 6 months	Yes	19	21.84	
	No	68	78.16	
Fall last year	Yes	32	36.78	
	No	55	63.22	
Vision deficits	Yes	59	67.82	
	No	28	32.18	
Hearing deficits	Yes	54	62.07	
	No	33	37.93	
Hours of sleep per night				8.70±2.00
Smoking	Yes	9	10.34	
	No	78	89.66	
Alcohol use	Yes	8	9.19	
	No	79	90.81	
CC (centimeters)				30.54±4.22
Social isolation	Yes	9	10.34	
	No	73	83.90	
	Missing	5	5.76	
PHQ-9	Depressive symptoms	21	24.14	
	Without depressive symptoms	60	68.97	
	Missing	6	6.89	
GAI	Anxiety symptoms	20	22.99	
	Without anxiety symptoms	62	71.26	
	Missing	5	5.75	
VF				8.59±4.49

Note: CC: Calf Circumference; GAI: Geriatric Anxiety Inventory; PHQ-9: Patient Health Questionnaire-9; VF: Verbal Fluency.

DISCUSSION

The study presents data about long-lived older people in the community. The prevalence of appetite/weight loss identified with the SNAQ was 34.48%. Using the MNA-SF, the proportion of risk of malnutrition was 39.08%, and of malnutrition, 19.54%. For both instruments, there was an association of greater nutritional risk and with lower CC, worse self-perceived health status, and presence of depressive symptoms.

The sociodemographic data of this research corroborate the national literature by demonstrating the female majority among the long-lived older people. That can be attributed to less exposure to risk factors, lower prevalence of smoking and alcoholism, greater medical assistance, and women's attitudes in face of health-related adversities [22]. However, concerning the nutritional status, especially that of old-aged women, there is a need for further studies [23]. In addition, states of widowhood, low education, and income of long-lived older women were also observed in a district of the city of Curitiba, in the state of *Paraná* [24].

Table 2 – Binary logistic regression of factors associated with the risk of weight loss by the SNAQ in long-aged older people (n=87). *Três Lagoas* (MS), 2020.

SNAQ	Univariate		Multivariate	
	OR	95%CI	OR	95%CI
Self-rated health				
Very good/Good	1.00		1.00	
Regular	5.37	1.53-18.9	6.92	1.51-31.71*
Poor/Very Poor	1.82	0.56-5.87	18.81	2.73-129.6*
Medications/ day	2.65	0.66-10.73	0.68	0.49-0.93*
Fall last year	2.35	0.94-5.87	-	-
CC (centimeters)	0.82	0.72-0.93	0.83	0.71-0.98*
Social isolation				
No	1.00			
Yes	4.95	1.13-21.7		-
PHQ-9				
Without depressive symptoms	1.00		1.00	
With depressive symptoms	7.23	2.42-21.63	11.26	2.52-50.28*
GAI				
Without anxiety symptoms	1.00			
With anxiety symptoms	4.70	1.62-13.7	-	-

Note: *$p \leq 0.05$. CC: Calf circumference; CI: Confidence Interval; GAI: Geriatric Anxiety Inventory; OR: Odds Ratio; PHQ-9: Patient Health Questionnaire-9; SNAQ: Simplified Nutritional Appetite Questionnaire.

Table 3 – Multinomial logistic regression of factors associated with nutritional risk by the MNA-SF in long-aged older people (n=87). *Três Lagoas* (MS), 2020.

MNA-SF	Malnutrition risk				Malnutrition			
	Univariate		Multivariate		Univariate		Multivariate	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Family income	1.00	1.00-1.01			1.00	0.99-1.01		
Self-rated health								
Very good/Good	1.00		1.00		1.00		1.00	
Regular	1.35	0.35-5.28	2.51	0.52-12.19	28.8	2.89-288.1	12.72	0.98-165.2*
Poor/Very Poor	0.95	0.33-2.72	1.33	0.39-4.52	6.92	0.72-66.51	67.50	4.14-109.60*
Medications/day	1.17	0.98-1.40			1.07	0.86-1.34		
Fall last year								
Yes	1.00				1.00			
No	0.80	0.30-2.19			0.39	0.12-1.28		
CC (cm)	0.75	0.64-0.88	0.74	0.62-0.87*	0.64	0.52-0.79	0.62	0.48-0.82*
Social isolation								
No	1.00				1.00			
Yes	1.76	0.28-11.26			6.80	1.08-42.73		
PHQ-9								
Without depressive symptoms	1.00				1.00		1.00	
With depressive symptoms	1.46	0.43-4.92	1.78	0.41-7.81	6.67	1.69-23.35	7.24	1.10-49.05
GAI								
Without anxiety symptoms	1.00				1.00			
With anxiety symptoms	2.07	0.60-7.13			6.20	1.51-25.4		

Note: *$p \leq 0.05$. CC: Calf circumference; CI: Confidence Interval; GAI: Geriatric Anxiety Inventory; MNA-SF: Mini Nutritional Assessment – Short Form; OR: Odds Ratio; PHQ-9: Patient Health Questionnaire-9.

Table 4 – Agreement in nutritional risk diagnoses between the MNA-SF and SNAQ (n = 87). *Três Lagoas* (MS), 2020.

SNAQ	MNA-SF			
	Nutritional risk		Normal	
	n	%	n	%
Nutritional risk	24	27.6%	6	6.9%
Normal	27	33.4%	30	34.5%

Note: MNA-SF: Mini Nutritional Assessment - Short Form; SNAQ: Simplified Nutritional Appetite Questionnaire;

Most of the evaluated older adults considered their health Very Good or Good. In the city of *Natal*, in the state of *Rio Grande do Norte*, more than 60% of institutionalized older people considered their health bad (a high prevalence when compared to other national and international studies), which was associated, among other factors, with weight loss [25].

Alcohol use is not recommended, especially in the older population, and only 9.19% of the older people interviewed in this research consumed alcoholic beverages. Drinking habits are associated with less social isolation for older people; however, the greater the alcohol intake, the lower the nutritional quality of these individuals, as this substance competes with nutrients obtained from food [26]. The number of older smokers in the survey was also not high, similar to a study with long-lived older people from the state of *Minas Gerais* [27].

Hospitalization also contributes to malnutrition states. In this research, the prevalence of hospitalization in the last six months was 21.4%. In a study in a hospital setting, low MNA scores could predict poor results, such as prolonged hospital stays and increased mortality in older adults [28].

Malnutrition is a complex and multidimensional problem, in which several determinants (psychosocial health, physical state, lifestyle, and eating habits) interact with each other [9,29]. In this study, malnutrition, the risk of malnutrition, and weight and appetite loss in long-lived older people were associated with several health factors. The nutritional status of older adults could be aggravated by malnutrition itself, which causes disinterest in food and lack of appetite [28].

According to the literature, the prevalence of malnutrition varies when using the MNA. A systematic review and meta-analysis with 240 studies with older adults using the MNA identified that the prevalence varies according to the setting, from 3.1% in the community to 29.4% in rehabilitation services and subacute care facilities for malnutrition; and from 26.5% in the community to 49% in long-term care facilities for the risk of malnutrition [15]. In Brazil, studies show a prevalence of 45.3% for risk of malnutrition and 3.1% for malnutrition; 28.3% and 38.76% for risk of malnutrition [9,30,31]. In Italy, 34.2% were at risk and 14.8% malnourished [32].

The use of the SNAQ in older adults is still incipient in Brazil. The study of translation and validation of the instrument identified that 7.6% of the participants were at risk of weight loss [16].

Several causes may be related to the prevalence of malnutrition in older adults. The regular and poor or very poor self-rating of health status was related to the risk of weight loss and malnutrition in both instruments' results. Self-perceived health is a subjective and reliable indicator, and it represents the individual's perception of their health. Knowing issues involved in the older health perception can reveal vulnerable subgroups and anchor health services in health promotion and quality of life initiatives [33]. Good levels of physical and mental health, autonomy, and preservation of functional status are related to positive self-perception of health, and to other variables such as high socioeconomic status, religiosity, and healthy lifestyle habits [34].

Changes in the nutritional status with aging are linked to body changes, such as reduced muscle mass and bone mineral density, which are important for assessing muscle strength and balance in older people. The CC can be used as a measure for muscle mass decrease and is a good indicator of nutritional status [18,35]. This was confirmed in the present study since both for the MNA-SF and SNAQ, there was an

association between malnutrition, nutritional risk, and decreased CC. The data from an Italian study showed that the prevalence of sarcopenia increases progressively with the reduction of the MNA score [32].

Additionally, a review found that sarcopenia is one of the determinants of malnutrition in older adults [36]. The CC measurement can estimate the prevalence of sarcopenia [18]. A disproportion between the body's protein needs and obtaining this substrate with food can lead to a loss of skeletal muscle mass since there will be an imbalance between the synthesis and degradation of protein present in the muscle compartment. In this context, older people tend to eat less protein, which leads to loss of muscle mass and strength, thus characterizing a state of sarcopenia [32]. Sarcopenia is associated with the risk of unfavorable health consequences, such as reduced functional autonomy, increased risk of hospitalization, low quality of life, and increased mortality [37]. Additionally, the literature states that the MNA score is significantly lower in older people with sarcopenia compared to those who do not have this comorbidity [32].

Depressive symptoms were associated with nutritional risk. A previous study demonstrated that depression was associated with malnutrition in older adults [38]. The relationship between depression and malnutrition is interactive. While depression can result in malnutrition due to social isolation and disinterest in daily activities, such as preparing meals and eating, poor nutrition can predispose depressive symptoms [39]. Still, loss of appetite and weight are criteria for the diagnosis of depression [39]. In addition, the eating habits of older adults are also determined by issues of social interaction such as loneliness, social isolation, financial condition, physical diseases, and endocrinal disturbances, creating a vicious circle [39].

A greater amount of medication was related to the lower chance of weight loss in the SNAQ. A systematic review showed conflicting data on whether the intake of medications and/or polypharmacy are determinants of malnutrition [29]. However, frequently, the concomitant use of several medications in addition to changes in the aging process can influence appetite, taste, digestion, absorption of various nutrients, and weight loss [16].

The appetite of the older adults was assessed through the SNAQ. Physiological changes, psychological problems, acute and chronic diseases, and polypharmacy impair the appetite of older adults through different mechanisms [40]. A better appetite promotes adequate and balanced nutrition, which increases energy intake through diet. Furthermore, it was found that a better appetite was positively correlated with quality of life [40].

It is also noteworthy that differences were observed in the two instruments' results, with a greater nutritional risk identified by the MNA-SF. According to a literature review, the MNA-SF is the most used instrument for this purpose in older population, showing good sensitivity and specificity to evaluate the risk of malnutrition in community-dwelling older adults, in addition to being widely recommended [41,42]. The SNAQ was well correlated to the MNA instrument when it was validated, showing that it is applicable and clear [16].

The instruments have different objectives, and although both are used to assess the nutritional status of older adults, their agreement was low in the present study. We believe that they are complementary and useful assessments for the subjective examination of issues related to nutrition, such as appetite, food intake, and weight loss. In addition, both instruments are validated, easy to apply, understandable, and have clinical significance.

Therefore, both are recommended for clinical practice. Subjective nutritional assessment of long-lived older people, early detection, and possible treatment of loss of appetite can prevent weight loss, improve health and quality of life, and reduce mortality. Even though investigations with older adults using the MNA and SNAQ are well documented in previous publications, the absence of literature aimed at the long-aged older adults is a gap to be filled so that these individuals do not lose their independence.

The present study has limitations. Despite having consulted the SUS registry in the municipality to reach a large number of participants, there was a sample loss due to problems in registering the address of the older adults and the deaths. It was not possible to evaluate older people who used private health plans/

services, which may have different characteristics from those identified, making it impossible to generalize the data. Finally, the research has a cross-sectional design, which does not allow the analysis of causality.

CONCLUSION

A high prevalence of risk of malnutrition and malnutrition was identified in the long-aged older people in the evaluation with the MNA-SF. The investigation of appetite through the SNAQ also identified older people at risk of appetite/weight loss, but with a lower prevalence. For both instruments, there was an association with greater nutritional risk and lower CC, worse self-perceived health status, and presence of depressive symptoms. Also, the greater the number of medications used, the lower the chance of weight loss evaluated by the SNAQ.

The factors associated with nutritional risk are related to general, physical, and psychological health, confirming that nutrition is a complex construct for long-lived older adults. The use of both instruments (SNAQ and MNA-SF) is necessary because they did not present high agreement rates. The relationship between risk of malnutrition, malnutrition itself, appetite/weight loss is interconnected and interdependent and should be evaluated together, as in the present research.

The real contribution of the study is to present data on the biopsychosocial aspects involved in the nutritional status of long-lived older adults. We analyzed the individual entirely, covering not only physical aspects but also psychological and social ones.

We also produced evidence about health and longevity, and studies on populations' healthy aging are increasingly necessary due to the process of demographic transition the country faces. The nutritional status is a determinant of quality of life in older adults, especially the long-lived ones, signaling the need to create strategies that make it possible to expand the capacity of these individuals to feel healthier in the environment where they live.

The study aimed to encourage reflections on the need for health professionals and managers to know the nutritional aspects of the long-lived older adults. It is expected that health services can design interventions aimed at improving the quality of life of this population, such as screening for depressive symptoms and the assessment of CC, which are low-cost and can help identify the risk of malnutrition in older people. Also, knowing the health perception of older adults can provide clues about their nutritional status.

The national, state, and municipal managers can act in the propagation of nutritional and biopsychosocial health information of long-lived residents of the community. The municipal health services can articulate health promotion actions and education for family members, friends, caregivers, and the oldest people, aiming at the prevention of malnutrition. Education and health promotion to ensure knowledge about an adequate nutritional status of older adults are also goals of the research group, not only for the ones who live in the community but also for institutionalized people.

CONTRIBUTORS

BM LUCHESI and RAM SEIXAS was responsible for conception, analysis, and interpretation of data, revision of important intellectual content. MP SANTANA, NM FIGUEIREDO, S CHOCIAY JUNIOR and TA SILVA was responsible data acquisition and draft the work. All authors approved the final version and agree to be accountable for all aspects of the work.

REFERENCES

1. Lauretti GR, Mattos AL. Quarta idade e velhice extrema: substituição da polifarmácia por um comprimido de hidromorfona de liberação controlada para o controle da dor crônica. Rev Dor. 2011;12(3):235-9. https://doi.org/10.1590/S1806-00132011000300008

2. Krug RR, Schneider IJC, Giehl MWC, Antes DL, Confortin SC, Mazo GZ, *et al*. Fatores sociodemográficos, comportamentais e de saúde associados à autopercepção de saúde positiva de idosos longevos residentes em Florianópolis, Santa Catarina. Rev Bras Epidemiol. 2018;21:e180004. https://doi.org/10.1590/1980-549720180004

3. Oliveira JAD, Ribeiro JM, Emmerick ICM, Luiza VL. Longevity and cost of care: the challenge of a self-managed health plan. Ciênc Saúde Coletiva. 2020;25(10):4045-54. https://doi.org/10.1590/1413-812320202510.15562018

4. Almeida BL, Souza MEBF, Rocha FC, Fernandes TF, Evangelista CB, Ribeiro KSMA. Qualidade de vida de idosos que praticam atividade física. Rev Online Pesq: Cuid Fundam. 2020;12:432-6. https://doi.org/10.9789/2175-5361.rpcfo.v12.8451

5. Santos VP, Lima WR, Rosa RS, Barros IMC, Boery RNSO, Ciosak SI. Perfil de saúde de idosos muito velhos em vulnerabilidade social na comunidade. Rev Cuidart. 2018;9(3):2322-37. https://doi.org/10.15649/cuidarte.v9i3.542

6. Datasus. Projeção da População das Unidades da Federação por sexo e grupos de idade: 2000-2030. 2021[cited 2021 April 27]. Available from: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?ibge/cnv/projpopuf.def

7. Pereira MM, Filipe EMV. Qualidade de vida e nutrição em idosos participantes de centros de convivência. Rev Baiana Saúde Pública. 2016;40(1):156-68. https://doi.org/10.22278/2318-2660.2016.v40.n1.a1615

8. Masón DFC, Suasnavas GFC, Suasnavas VAC. Relación entre desnutrición y depresión en mujeres adultas mayores en La consulta de un hospital de Quito, 2017. Cambios Rev Med. 2018;17(2):5-11. https://doi.org/10.36015/cambios.v17.n2.2018.292

9. Bandeira GFS, Moreira RS, Silva VL. Nutritional status of elderly assisted in primary care and their relationship with social determinants of health. Rev Nutr. 2019;32:e190042. https://doi.org/10.1590/1678-9865201932e190042

10. Sistema de Vigilância Alimentar e Nutricional (Brasil). Relatório Público de Estado Nutricional. 2019[cited 2020 May 30]. Available from: https://sisaps.saude.gov.br/sisvan/

11. Schirmer C, Camargo L, Safian C, Binotto V, Grigol M, Bós Ângelo. Desnutrição em nonagenários e centenários é um problema médico? Rev Bra Ciênc Envelhec Hum. 2019;64(1):62-8. https://doi.org/10.5335/rbceh.v16i2.10217

12. Besora-Moreno M, Llauradó E, Tarro L, Solà R. Social and economic factors and malnutrition or the risk of malnutrition in the elderly: a systematic review and meta-analysis of observational studies. Nutrients. 2020;12(3):737. https://doi.org/10.3390/nu12030737

13. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Cederholm T, Thomas DR, *et al*. Validation of the Mini Nutritional Assessment Short Form (MNA-SF): a practical tool for identification of nutritional status. J Nutr Health Aging. 2009;13(9):782-8. https://doi.org/10.1007/s12603-009-0214-7

14. Sousa APG, Gallello DC, Silva ALND, Carreira MC, Damasceno NRT. Nutritional screening using the Mini Nutritional Assessment short form: applicability and challenges. Geriatr Gerontol Aging. 2015;9(2):49-53. https://doi.org/10.5327/Z2447-2115201500020003

15. Cereda E, Pedrolli C, Klersy C, Bonardia C, Quarleria L, Cappello S, *et al*. Nutritional status in older persons according to healthcare setting: a systematic review and meta-analysis of prevalence data using MNA®. Clin Nutr. 2016;35(6):1282-90. https://doi.org/10.1016/j.clnu.2016.03.008

16. Sties SW, Gonzáles AI, Viana MS, Brandt R, Bertin RL, Goldfeder R, *et al*. Simplified Nutritional Appetite Questionnaire (SNAQ) for cardiopulmonary and metabolic rehabilitation program. Rev Bras Med Esporte. 2012;18(5):313-7. https://doi.org/10.1590/S1517-86922012000500006

17. Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2010 [citado 2021 abril 30]. Disponível em: https://censo2010.ibge.gov.br/resultados.html

18. Pagotto V, Santos KF, Malaquias SG, Bachion MM, Silveira EA. Calf circumference: clinical validation for evaluation of muscle mass in the elderly. Rev Bras Enferm. 2018;71(2):322-8. https://doi.org/10.1590/0034-7167-2017-0121

19. Santos IS, Tavares BS, Munhoz TN, Almeida LSP, Silva NTS, Tams BD, *et al*. Sensibilidade e especificidade do Patient Health Questionnaire-9 (PHQ-9) entre adultos da população geral. Cad Saúde Pública. 2013;29(8):1533-43. https://doi.org/10.1590/0102-311X00144612

20. Martiny C, Silva ACO, Nardi AE, Pachana NA. Tradução e adaptação transcultural da versão brasileira do Inventário de Ansiedade Geriátrica (GAI). Rev Psiq Clin. 2011;38(1):8-12. https://doi.org/10.1590/S0101-60832011000100003

21. Esteves CS, Oliveira CR, Moret-Tatay C, Navarro-Pardo E, Carli GA, Silva IG, *et al*. Phonemic and semantic verbal fluency tasks: normative data for elderly Brazilians. Psicol Reflex Crit. 2015;28(2):350-5. https://doi.org/10.1590/1678-7153.201528215

22. Rocha JP, Oliveira GG, Cefrin J, Bós AMG, Bós ÂJG. Impacto clínico, socioeconômico e da autopercepção de saúde na funcionalidade de idosos. Geriatr Geront Aging. 2017;11(3):124-32. https://doi.org/10.5327/Z2447-211520171700051

23. Dell'Osbel RS, Zanotti J. Relação entre força de preensão palmar e estado nutricional em idosas de Caxias do Sul/RS. Braspen J. 2018[cited 2021 Apr 25];33(2):111-5. Disponível em: http://arquivos.braspen.org/journal/abr-mai-jun-2018/01-AO-Relacao-entre-forca-de-preensao.pdf

24. Grden CRB, Lenardt MH, Sousa JAVD, Kusomota L, Dellaroza MSG, Betiolli SE. Associação da síndrome da fragilidade física às características sociodemográficas de idosos longevos da comunidade. Rev Latino-Am de Enf. 2017;25:e2886. https://doi.org/10.1590/1518-8345.1770.2886

25. Jerez-Roig J, Souza DLB, Andrade FLJPD, Lima Filho BFD, Medeiros RJD, Oliveira NPDD, Cabral Neto SM, Lima, KC. Autopercepção da saúde em idosos institucionalizados. Ciênc Saúde Coletiva. 2016;21(11):3367-75. https://doi.org/10.1590/1413-812320152111.15562015

26. Caires SDS, Souza AA, Leal Neto JDS, Almeida CBD, Casotti CA. Fatores associados à incapacidade funcional em idosos residentes em comunidade. Rev Bras Ciênc Saúde. 2019;23(4):421-8. https://doi.org/10.22478/ufpb.2317-6032.2019v23n4.42501

27. Jansen AK, Rosa GGG, Lopes Filho JD, Cruz MICD, Moraes END, Santos RRD. Padrão alimentar de idosos longevos não frágeis e sua relação com baixo peso, massa, força muscular e teste de velocidade de marcha. Rev Bras Geriatr Gerontol. 2020;23(4):e200194. https://doi.org/10.1590/1981-22562020023.200194

28. Abd Aziz NAS, Teng NIMF, Hamid MRA, Ismail NH. Assessing the nutritional status of hospitalized elderly. Clinical Interventions in Aging. 2017;12:1615. https://doi.org/10.2147/CIA.S140859

29. O'Keffe M, Kelly M, O'Herlihy E, O'Toole PW, Kearney PM, Timmons S, *et al*. Potentially modifiable determinants of malnutrition in older adults: a systematic review. Clin Nutr. 2019;38:2477-98. https://doi.org/10.1016/j.clnu.2018.12.007

30. Stoffel LMB, Muniz FWMG, Colussi PRG, Rösing CK, Colussi EL. Nutritional assessment and associated factors in the elderly: a population-based cross-sectional study. J Nutrition. 2018;55-56:104-10. https://doi.org/10.1016/j.nut.2018.03.053

31. Damião R, Santos AS, Matijasevich A, Menezes PR. Factors associated with risk of malnutrition in the elderly in south-eastern Brazil. Rev Bras Epidemiol. 2017;20(4):598-610. https://doi.org/10.1590/1980-5497201700040004

32. Liguori I, Cursio F, Russo G, Cellurale M. Risk of malnutrition evaluated by mini nutritional assessment and sarcopenia in noninstitutionalized elderly people. Nutr Clinical Pract. 2018;33(6):879-86. https://doi.org/10.1002/ncp.10022

33. Carneiro JA, Gomes CAD, Durães W, Jesus DR, Chaves KLL, Costa FM, *et al*. Autopercepção negativa da saúde: prevalência e fatores associados entre idosos assistidos em centro de referência. Rev Ciênc Saúde Coletiva. 2020;25(3):909-18. https://doi.org/10.1590/1413-81232020253.16402018

34. Manso MEG, Jesus LS, Gino DR. Self-perceived health in a group of older adults covered by a health insurance plan. Geriatrics, Gerontoly and Aging. 2020;14(2):91-7. https://doi.org/10.5327/Z2447-212320202000040

35. Mello FS, Waisberg J, Silva MLN. Calf circumference is associated with the worst clinical outcome in elderly patients. Geriatr Gerontol Aging. 2016;10(2):80-5. https://doi.org/10.5327/Z2447-211520161600011

36. Corcoran C, Murphy C, Culligan EP, Walton J, Sleator RD. Malnutrition in the elderly. Sci Progr. 2019;102(2):171-80. https://doi.org/10.1177/0036850419854290

37. Rossi AP, Caliari C, Urbani S, Fantin F, Brandimarte P, Martini A, *et al*. Sarcopenia risk evaluation in a sample of hospitalized elderly men and women: combined use of the Mini Sarcopenia Risk Assessment (MSRA) and the SARC-F. Nutrients. 2021;13(2):635. https://doi.org/10.3390/nu13020635

38. Gündüz E, Eskin F, Gündüz M, Bentli R, Zengin Y, Dursun R, *et al*. Malnutrition in community-dwelling elderly in Turkey: a multicenter, cross-sectional study. Med Sci Monit. 2015;21:2750-6. https://doi.org/10.12659/MSM.893894

39. Al-Rasheed R, Alrasheedi R, Johani RA, Alrashidi H, Almaimany B, Alshalawi B, *et al*. Malnutrition in elderly and its relation to depression. Int J Community Med Public Health. 2018;5(6):2156-60. https://doi.org/10.18203/2394-6040.ijcmph20181974

40. Tek NA, Karaçil-Ermumcu MŞ. Determinants of health related quality of life in home dwelling elderly population: appetite and nutritional status. J Nutr Health Aging. 2018;22(8):996-1002. https://doi.org/10.1007/s12603-018-1066-9

41. Isautier JMJ, Bosni M, Yeung SSY, Trappenburg MC, Meskers CGM, Whittaker AC, *et al*. Validity of nutritional screening tools for community-dwelling older adults: a systematic review and meta-analysis. JAMDA. 2019;20(10):13-25. https://doi.org/10.1016/j.jamda.2019.06.024

42. Reber E, Gomes F, Vasiloglou MF, Schuetz P, Stanga Z. Nutritional risk screening and assessment. J Clin Med. 2019;8(7):1065. https://doi.org/10.3390/jcm8071065