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Evaluation of dynapenia in the elderly in São Caetano do Sul, São Paulo, Brazil

Avaliação da dinapenia em idosos de São Caetano do Sul, São Paulo, Brasil

Evaluación de la dinapenia em adultos mayores de São Caetano do Sul, São Paulo, Brasil

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Abstract

Introduction: Aging is characterized by psychological, social, nutritional and biological changes, among which dynapenia stands out. **Objective:** To analyze the presence of dynapenia and associated factors in elderly people living in the city of São Caetano do Sul. **Method:** A cross-sectional study was carried out with 295 elderly individuals aged 60 years or older, who were users of public health units in the city of São Caetano do Sul. Dynapenia was assessed by handgrip strength, and its associations were investigated using multivariate logistic regression, according to sociodemographic variables, nutritional status, protein consumption, presence of diseases, and

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physical activity. Statistical analysis was performed using the IBM-SPSS (Statistical Package for Social Science) software. The adopted level of significance was $p < 0.05$. **Results:** Most of the participants were female (n = 251), with mean age of 70.6 years (± 7.0). The presence of dynapenia was observed in 24.07% (n = 71), among which 47 were women (18.73%) and 24 were men (54.55%). Observed associations concerned older age, male sex, lower circumference of the arm and calf, and lower triceps skinfold ($p < 0.05$). **Conclusion:** Approximately one-fourth of the elderly studied presented dynapenia, which represents a higher risk of morbidity and mortality. The inclusion of PPF alongside other anthropometric measures for assessing nutritional status is recommended. It is important for public policies to be directed towards health promotion and risk prevention in this age group.

Keywords: Aging. Nutritional Status. Muscle Strength.

Resumo

Introdução: *O envelhecimento é marcado por alterações psicológicas, sociais, nutricionais e biológicas, entre as quais destaca-se a dinapenia.* ***Objetivo:*** *Avaliar a presença de dinapenia em idosos residentes no município de São Caetano do Sul e os fatores a ela associados.* ***Método:*** *Estudo transversal, realizado com 295 idosos com idade igual ou maior a 60 anos, de ambos os gêneros, usuários de unidades de saúde no município de São Caetano do Sul. A dinapenia foi avaliada pela força de preensão palmar (FPP) e foi investigada sua associação com variáveis sociodemográficas, estado nutricional, consumo protéico, presença de doenças e prática de atividade física, através de regressão logística multivariada. Para análise estatística foi utilizado o software IBM - SPSS (Statistical Package for Social Science), o nível de significância adotado $p < 0,05$.* ***Resultados:*** *A maioria dos idosos estudados era do sexo feminino (n = 251), idade média 70,6 anos (± 7,0). A presença de dinapenia foi observada em 24,07% (n = 71), sendo 47 mulheres (18,73%) e 24 homens (54,55%), sendo observada associação com maior idade, sexo masculino, menor circunferência do braço, circunferência de panturrilha e dobra cutânea triciptal ($p < 0,05$).* ***Conclusão:*** *Aproximadamente um quarto dos idosos estudados apresentaram dinapenia, o que representa maior risco de morbimortalidade. Entre as medidas antropométricas para avaliação do estado nutricional recomenda-se a inclusão da FPP. É importante que políticas públicas sejam direcionadas para promoção de saúde e prevenção de riscos neste grupo etário.*

Palavras-chave*: Idoso. Estado Nutricional. Força Muscular.*

Resumen

Introducción: *El envejecimiento está marcado por alteraciones psicológicas, sociales, nutricionales y biológicas, entre las que destaca la dinapenia.* ***Objetivo:*** *Evaluar la presencia de dinapenia en adultos mayores (AM) residentes en el municipio de São Caetano do Sul (Brasil) y los factores asociados a esta alteración.* ***Método:*** *Estudio transversal, que evaluó un grupo de 295 AM, de ambos generos, usuarios de centros de salud de São Caetano do Sul. La dinapenia fué evaluada por la Fuerza de Prensión Manual (FPM) y se investigó su asociación con variables sociodemográficas, estado nutricional, consumo proteico, presencia de enfermedades y práctica de actividad física, a través de regresión lineal multiple. Para el análisis estadístico se utilizó el software IBM - SPSS (Statistical Package for Social Science), con un nivel de significancia menor a 0,05.* ***Resultados:*** *La mayoría de los AM estudiados era del sexo femenino (n = 251), edad media 70,6 años (± 7,0). La presencia de dinapenia se observó en el 24,07% (n = 71), de los cuales 47 eran mujeres (18,73%) y 24 eran hombres (54,55%), siendo observada asociación con edad mayor, sexo masculino, menor perímetro del brazo, perímetro de la pantorrilla y pliegue cutáneo tricipital ($p < 0,05$).* ***Conclusión:*** *Aproximadamente un cuarto de los AM estudiados presentaron dinapenia, lo que representa un mayor riesgo de morbimortalidad. Entre las medidas antropométricas para evaluación del estado nutricional se recomienda la inclusión de la prueba de FPM. Es importante que las políticas públicas se dirijan a la promoción de la salud y la prevención de riesgos en este grupo de edad.*

Palabras clave*: : Adulto Mayor. Estado Nutricional. Fuerza Muscular.*

Introduction

The world population's age groups have undergone visible changes in the last few decades due to the extension in lifespan and consequent increase in the number of older people [1]. In 2025, Brazil is estimated to rank sixth regarding the number of elderly in its population [2].

Aging is marked by transformations affecting an individual's biological, physiological, cognitive and social functions. Despite being a natural process, these transformations might affect health conditions, nutritional aspects and general quality of life [3]. They provoke alterations in body composition, with increases in fat and decreases in lean body mass, resulting in loss of strength and compromised physical capability [3, 4].

The term dynapenia has been used to describe the decrease in muscle strength related to aging [5]. The European Working Group on Sarcopenia in Older People (EWGSOP) has put forward some criteria to define sarcopenia based on the evaluation of muscular mass reduction, complemented with the evaluation of loss of muscle strength and physical performance. The EWGSOP recommends the use of dynapenia as a screening for sarcopenia, since it is able to indicate future functional damage, in addition to being considered a reliable and accurate method [5, 6].

Dynapenia is diagnosed when handgrip strength is < 30kg/f for men and < 20 kg/f for women [7, 8]. Studies have uncovered several factors associated to dynapenia, such as sex, advanced age, low weight, smoking and the presence of three or more illnesses [9-12].

Due to the importance of the early diagnosis of this health risk, this study aimed at evaluating the presence of dynapenia and associated factors in elderly living in the municipality of São Caetano do Sul, São Paulo.

Methods

This was a transversal study carried out with 295 older people, aged ≥ 60 years, of both sexes, residents in the municipality of São Caetano do Sul, in the state of São Paulo, Brazil. The data was collected in health centers and third age centers in São Caetano do Sul, a city with a territory of approximately 15.0 km^2, divided into 15 neighborhoods, whose population aged 60 years or over corresponds to 19.1%. This is equivalent to approximately 28 thousand older people (IBGE, February 2014 to February 2015).

A sample of 288 individuals was estimated for the multivariate regression analysis, considering a 95% level of confidence and a 5% sampling error. In the application of Multiple Regression, the sample had a 99.9% power, with 0.1 effect size, considered a medium effect size by Cohen [13].

The researchers approached the elderly to invite them to participate, explaining the study's goals and procedures. Those interested provided their name and telephone number, and an appointment was made on the date and time of their preference. Additionally, at the health centers, some older individuals were appointed by health agents, and the interview was carried out at their own homes (n = 60). This allowed for a more diversified sample of the municipality's elderly.

Participants answered a structured questionnaire containing sociodemographic and anthropometric data as well as information regarding food consumption. The questionnaire was based on the Survey on Health, Well-being and Aging in Latin America, by the Pan American Health Organization (SABE/OPAS) [14], and on the Survey on Health, by the Municipality of São Paulo (ISA) [15].

To assess the sociodemographic profile, the following variables were investigated: sex, schooling, marital status, individual's monthly income, family composition, living alone or with someone, smoking, diagnosed illnesses, clinical background, and physical activity level. Elderly's income was calculated as number of minimum wages, considering monthly income in relation to current minimum wage at the time of data collection (BRL 724.00). Elderly who had stopped smoking over 15 years ago were considered non-smokers, since that was the mean time without smoking obtained from those who reported having quit. Anthropometric measures were: weight, height, arm, calf and abdomen circumference, triceps skinfold, and handgrip strength. Standardized measurement techniques were employed.

A Crown dynamometer was used to assess dynapenia following the standardized technique recommended by the *Sociedade de Terapeutas de Mão* (Hand Therapists Society) – SATM [16]. The

parameter proposed by Lauretani et al. considers suitable a handgrip strength of ≥ 20kg/f (kilogram-force) for women, and of ≥ 30 kg/f for men [8].

A 24-hour Recall (R24h), developed by the Food Consumption Group (GAC, Brazilian acronym) of the Public Health College of São Paulo was used to evaluate protein consumption. The R24h is comprised of a survey to quantify the food and drink ingested one day previous to the interview, including details such as mode of preparation and portion size [15, 17].

The R24h was replicated with a maximum interval of two weeks, using a sub-sample (30%), with the aim of eliminating intra and interpersonal variance. This allowed for an estimation of each older person's usual consumption. After collection, a critical analysis of the recall was carried out, converting amounts into grams or milliliters and including foods used as ingredients in the preparations. The measures were standardized based on the "Food Consumption Evaluation in Home Measurements Chart" and the "Handbook of Recipes and Home Measurements for the Calculation of Food Surveys" [15]. The obtained R24h data were converted into energy and nutrients amounts via the Nutrition Data System for Research (NDS-R) 2013 software [18], nowadays considered to have the highest accuracy for the calculation of food ingestion. The NDS-R aggregates the values of 139 nutrients from over 18 thousand types of food and 8 thousand trademarks, extracted from several sources, such as the chart provided by the United States Department of Agriculture (USDA), scientific literature, and the food industry itself. For regional food, other foreign charts were used. After typing, data consistency was evaluated, and the elderly who reported an energy consumption lower than percentile 5 and higher than percentile 95, in the consumption distribution curve for the population under study, were marked to have their R24h reevaluated. Marked entries were not, however, excluded from the sample.

The classification of protein consumption was carried out in relation to the elderly's body weight, using the following cut off points: 1) less than 0.8 grams protein per kg of body weight per day (g/kg weight/day); 2) more than or as much as 0.8, but less than 1.2 g/kg weight/day; 3) more than or as much as 1.2 g/kg weight/day [19]. With the purpose of preventing an overestimation of protein consumption among underweight elderly, or an underestimation among overweight elderly, ideal weight was estimated based on a Body Mass Index (BMI) of 25.5. For eutrophic elderly, the measured weight was considered as is, while for overweight elderly, the weight was adjusted per the following formula: Adjusted weight = Ideal weight (Weight measured – Ideal weight) × 0.25. Ideal weight was calculated based on BMI = 25.5. A BMI value of 25.5 was chosen due to being the mean point of the eutrophication interval (BMI between 23 and 28) [14].

To verify the nutritional status, body weight and height were measured and body mass index (BMI) was calculated. Body weight was measured using a portable digital balance with 0.1 kg accuracy, capable of withstanding up to 150 kg. Height was measured using a portable stadiometer with 1 mm divisions. The measurement standardization techniques proposed by the Food and Nutrition Surveillance System [20] were employed. To calculate BMI, the predictive equation was used, in which the subject's weight in kilograms is divided by the height in m^2 (weight/height^2). The obtained result was classified according to SABE/OPAS [14].

The abdominal circumference was measured using a measuring tape with millimeter variation, positioned at the midway point between the last rib and the iliac crest, in anatomic position with the abdomen relaxed and loose arms at the sides of the body. Cut off points were chosen according to the *World Health Organization* guidelines for adults, since there are no specific values for older people [21].

In order to gauge the circumference of the arm, the evaluator was positioned laterally to the elderly and the measurement was made with the tape measure between the acromion and the olecranon of the right arm [22]. The measure was classified in tertiles, with different values depending on sex. For women: 1st tertile between 8.3 and 22.7 mm, 2nd tertile between 23.0 and 29.7 mm, and 3rd tertile between 30.0 and 45.0 mm. For men: 3.9 to 14.0 mm, 14.3 to 22.0 mm, and 22.3 to 39.7, respectively.

The triceps skinfold was measured following the longitudinal axis of the right arm, with an adipometer on the back of the arm, positioned between the upper-lateral edge and the acromion and the lower edge of the olecranon [22]. An Cescorf adipometer with 0.1 mm sensitiveness and 80 mm reading amplitude was used. Again, the measures were classified in tertiles, with different values depending on sex (see above).

To measure calf circumference (CC), participants were positioned sitting with the knees bent at 90°, with their legs slightly apart and the evaluator positioned at the side of the calf. The measure was performed on the right calf's largest circumference of the proximal third, using a flexible and inextensible measuring tape perpendicular to the leg axis [21]. CC was used to identify muscle depletion in the elderly. Cut off points used were based on Barbosa-Silva et al. (≤ 33 cm for women and ≤ 34 cm for men [12]).

Physical activity was self-reported, with older people being asked to inform their levels of regular physical activity. They were asked how often they performed each type of activity, and for how long. Later on, the time spent in minutes per week was calculated, and elderly who performed at least 150 minutes of physical activity per week were considered physically active, in accordance with the American College of Sports Medicine (2003) [23].

Statistical analysis was performed using the IBM-SPSS (Statistical Package for Social Sciences) software version 21.0 [24]. A $p < 0.05$ level of significance was adopted [24]. The association between the presence or absence of dynapenia and the study's variables was verified using the Chi-square test.

To analyze the association between all studied variables—namely, sociodemographic and economic characteristics, nutritional status, health conditions and protein consumption adjusted by energy—and the presence of dynapenia, logistic regression was performed. In the simple logistic regression analysis, independent variables obtaining a p value ≤ 0.20 were selected for multiple regression, and subjected to stepwise forward selection. Variables presenting significance ($p < 0.05$) were kept in the final model.

This study was approved by the Research Ethics Committee (CEP, Brazilian acronym) of the São Caetano do Sul Municipality, pursuant to the Opinion n^0 71/2013. It also obtained an approval letter from the same municipality. The research participants signed an informed consent form – TCLE (Brazilian acronym), in accordance with the Resolution by the *Conselho Nacional de Saúde* (National Health Council) (CNS 466/12 December 2012). Elderly included in the study agreed to take part in the research. Both sexes were present in the final sample. Participants were approached at the CISE, health centers or their own homes, and had an age of ≥ 60 years. Initially, the decision was made that elderly who had difficulties to understand or answer the study's questionnaire would be excluded. However, no participant had this type of problem, and thus there were no exclusions.

Results

The sample under study was mainly comprised of female elderly (n = 251). The mean age was 70.6 years (60 to 93 years old). The presence of dynapenia was observed in 24.07% elderly (n = 71), including 47 women (18.73%) and 24 men (54.55%).

Among evaluated sociodemographic characteristics, male sex and age were the variables associated with dynapenia ($p < 0.001$) (Table 1).

Table 1 – Sociodemographic characteristics of elderly with and without dynapenia. São Caetano do Sul, 2015

Sociodemographic characteristics	Dynapenia		p
	Without dynapenia n (%)	With dynapenia n (%)	
Sex			
Female	204 (81.3)	47 (18.7)	< 0.001
Male	20 (45.5)	24 (54.5)	
Marital status			
With a partner	101 (76.5)	31 (23.5)	0.472
Without a partner	123 (75.5)	40 (24.5)	
Work activity			
Active	203 (75.7)	65 (24.3)	0.514
Inactive	21 (77.8)	6 (22.2)	
Smoking habit			
Non-smoker	215 (76.2)	67 (23.8)	0.384
Smoker	09 (69.2)	04 (30.8)	
Physical activity			
> 150 minutes	106 (74.6)	36 (25.4)	0.472
< 150 minutes	118 (77.1)	35 (22.9)	

In regards to morbidity, most of the participants (88.44%) presented at least one noncommunicable chronic disease, as shown in Table 2.

Table 2 – Distribution of elderly with and without dynapenia, according to the presence of morbidities. São Caetano do Sul, 2015

Morbidities	Dynapenia		p
	Without dynapenia n (%)	With dynapenia n (%)	
Hypertension			0.390
No	101 (77.1)	30 (22.9)	
Yes	123 (75)	41 (25)	
Diabetes Mellitus			0.268
No	173 (74.9)	58 (25.1)	
Yes	51 (79.7)	13 (20.3)	
Dyslipidemia			0.039
No	123 (71.9)	48 (28.1)	
Yes	101 (81.5)	23 (18.5)	
CVA			0.259
No	217 (76.4)	67 (23.6)	
Yes	7 (63.6)	4 (36.4)	
CVD			0.317
No	199(76.5)	61 (23.5)	
Yes	25(71.4)	10 (28.6)	
Cancer			0.181
No	203 (76.9)	61 (23.1)	
Yes	21 (67.7)	10 (32.3)	
Osteoporosis			0.092
No	160 (73.7)	57 (26.3)	
Yes	64 (82.1)	14 (17.9)	
Depression			0.510
No	212 (76)	67 (24)	
Yes	11 (73.3)	4 (26.4)	
Other diseases			0.551
Present	209 (76)	66 (24)	
Not present	15 (75)	5 (25)	

Regarding elderly's anthropometric measurements, arm and calf circumference, as well as smaller triceps skinfold, presented some association with dynapenia ($p < 0.05$). This can be seen in Table 3.

Table 3 – Distribution of the elderly with and without dynapenia according to anthropometric measures and protein consumption. São Caetano do Sul, 2015

Anthropometric measures	n	mean rank	p*
BMI			
Without dynapenia	224	153.64	0.106
With dynapenia	71	130.21	
AC			
Without dynapenia	224	154.11	0.029
With dynapenia	71	128.73	
TS			
Without dynapenia	224	155.06	0.012
With dynapenia	71	125.74	
AC			
Without dynapenia	224	150.01	0.473
With dynapenia	71	141.67	
CC			
Without dynapenia	224	153.95	0.005
With dynapenia	71	129.23	
Ptn consumption			
Without dynapenia	224	144.75	0.244
With dynapenia	71	158.27	

No significant difference between protein consumption categories and the presence of dynapenia was found in either sex. Among elderly with dynapenia, approximately 50% of the women presented a consumption of 0.8 to 1.2 grams' protein per kg of body weight, and approximately 50% of the men presented a consumption higher or equal to 1.2 grams' protein per kg of body weight, as shown in Table 4.

Table 4 – Distribution of elderly with and without dynapenia according their protein consumption (adjusted by energy). São Caetano do Sul, 2015

Protein consumption g/kg					
Sex	**< 0.8**	**≥ 0.8 to < 1.2**	**≥ 1.2**	**Total**	**p***
Female	**n (%)**	**n (%)**	**n (%)**	**n (%)**	
Without dynapenia	46 (22.55)	94 (46.08)	64 (31.37)	204 (100)	
With dynapenia	07 (21.22)	22 (46.81)	18 (38.30)	47 (100)	0.444
Total	53 (21.22)	116 (46.22)	82 (32.67)	251 (100)	
Male					
Without dynapenia	01 (5.00)	08 (40.00)	11 (55.00)	20 (100)	
With dynapenia	07 (16.67)	09 (37.50)	11 (45.83)	24 (100)	0.471
Total	08 (11.36)	17 (38.64)	22 (50.00)	44 (100)	

Note: Chi-square test ($p \leq 0.05$).

In the handgrip evaluation, men presented statistically higher mean strength (28.2 kilogram-force) than women (22.6 kilogram-force) ($p < 0.001$).

The multivariate regression analysis showed that older age, male gender, smaller arm and calf circumferences, and smaller triceps skinfold were associated with dynapenia ($p < 0.05$).

Table 5 – Distribution of elderly according to factors associated with dynapenia, in the multivariate analysis. São Caetano do Sul, 2015

	Dynapenia		
	Without dynapenia n (mean rank)	With dynapenia n (mean rank)	p*
Age	224 (138.81)	71 (177)	0.001
Schooling	224 (150.82)	71 (139.11)	0.305
Income**	217 (145.27)	68 (135.76)	0.406
Arm circumference	224 (154.11)	71 (128.73)	0.029
Triceps skinfold	224 (150.01)	71 (141.67)	0.012
Abdomen circumference	217 (145.27)	68 (135.76)	0.473
Calf circumference	224 (153.95)	71 (129.23)	0.033
Body Mass Index	224 (153.64)	71 (130.21)	0.044
Protein consumption	224 (144.75)	71 (158.27)	0.244

Note: * = Multivariate ($p \leq 0.05$); ** = Current minimum wage in 2014 = BRL 724.00.

Discussion

There was a greater participation of women in the study. Data from the last National Household Sample Survey (NHSS) showed that over half the individuals aged 60 years or over are women [25]. Also, the literature has been showing that women are more present in health actions, since they live longer and traditionally use the health service more often than men [1]. Regarding the participants, 74.5% reported that they lived with somebody else (a spouse, children, relatives, or others). This is also in accordance with the general profile of Brazilian older people, since 85% of the elderly interviewed in the NHSS stated that they lived with somebody [25, 26].

In this study, 88.44% of the elderly reported at least one chronic illness. This result was expected, since aging leads to a decrease in the body's functional capacity. However, when older people are diagnosed with NCDs and receive suitable treatment, they can continue carrying out their daily activities, without becoming dependent or losing autonomy. The high prevalence of arterial hypertension (55.5%), dyslipidemias (42.0%) and diabetes mellitus (21.7%) in the elderly in São Caetano do Sul confirms data by Vigitel (a telephone survey for the surveillance of risk factors and protection against chronic illnesses) [26], which demonstrated a 50.2% prevalence of arterial hypertension in individuals aged between 55 and 64 years, and 59.9% in individuals over 65 years old. For dyslipidemia, prevalences were 35.5% and 34.7%,, and for diabetes mellitus, 18.2% and 24.4%.

Nutritional status presented no association with dynapenia. This was expected, since BMI is not able to ascertain body composition or amounts of lean mass, an impact factor for PPF [27].

The prevalence of dynapenia found in Brazilian elderly of both sexes assisted by the primary care system was 30.9% [28]. A study carried out with elderly in the city of São Paulo identified the prevalence of dynapenia in 29.5% [29]. The prevalence of dynapenia found here was lower (24.07%) than in the studies above. However, considering that dynapenia is a predictive factor for functional disability in the elderly and death [30] – and that it reaches approximately a fourth of the older people in the municipality with the highest proportions of elderly when compared to the other cities in the country – the development of prevention and control actions in the health assistance service seems more than relevant.

PPF results showed that men had higher mean strength (28.2 kg/f) than women (22.6 kg/f). This can be explained by physiological and hormonal characteristics that increase muscular protein turnover in men [31, 32]. The respective PPF cut off points (< 30 for men and < 20 for women) indicate that mortality risk is higher in men than in women. Thus, despite the PPF mean being higher for men than for women, the obtained mean still classifies men as part of the risk group. The same is not true, however, for the female PPF mean [33, 34]. From the total number of men taking part in the study, 63.6% reported not practicing any physical activity, suggesting higher susceptibility to muscular losses.

For both men and women, the reduction in PPF associated to aging is related to higher deficiency, as well as functional disability in the elderly and future risks [32, 35]. To prevent muscle strength loss, elderly should do exercises to strengthen their muscles at least twice a week, according to recommendations

from *Centers for Disease Control and Prevention* (CDC) and the *World Health Organization* (WHO) [21, 36].

Age was also associated to dynapenia: the older a person, the higher the chance of strength loss. This is in agreement with the literature, which has shown a strong inverse association between PPF and age. Other studies also verified an increase in the prevalence of dynapenia with advanced age [5, 27, 29].

In the multivariate regression analysis, other variables associated with dynapenia were male sex, advanced age, smaller arm and calf circumference, and smaller triceps skinfold ($p < 0.05$). Regarding sex, men had the greatest risk of dynapenia. Several factors might contribute to strength loss. With aging, physical activity is reduced, muscular mass is lost, body fat percentages and muscular fibers change, hormone levels decrease and chronic diseases appear. Another factor is that older men have lower participation in health actions [37-42].

Finally, CC presented a strong association with muscle reserves, confirming it as a sensitive indicator of muscle depletion in the elderly [21, 29, 34, 35]. The results of this study showed that the chance of older people with smaller CC having dynapenia were 50% higher when compared to those with a CC above the ideal cut off point.

However, unlike CC, there is no consensus in the literature regarding the criteria for malnutrition diagnosis, given that BMI is not enough to carry out such evaluation. This might justify the fact that the nutritional status variable was not kept in the final regression model, suggesting once again that dynapenia cannot be explained by alterations in the BMI. This was also observed in other studies developed with Brazilian elderly [31, 34].

Some limitations of this study can be pointed out. One of them lies in the fact that the practice of physical activity was self-reported, with no specific questionnaire applied for this evaluation. Furthermore, the scarcity of studies correlating nutritional status and PPF in older people makes such a correlation difficult and limits the comparability of this study's results. Finally, since this was a transversal study, it was impossible to analyze cause and effect relationships. However, our findings can contribute to the knowledge produced so far, advancing the identification of important factors in elderly's health assessment.

Conclusion

Approximately one fourth of the studied elderly presented dynapenia, which was mainly associated with male sex, advanced age, smaller arm and calf circumference, and smaller triceps skinfold. Dynapenia represents the highest risk of morbidity-mortality in older people, and with the increase of this age group in respect to the overall population, it is important for public policies to be directed towards their health promotion and risk prevention. We also recommend the inclusion of PPF alongside other anthropometric measurements used to evaluate nutritional status, due to its predictive risk-identification ability. Additionally, the evaluation of muscle strength might help with intervention procedures to prevent or retard future limitations or functional disability in the elderly.

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