Association between sarcopenia and health-related quality of life in community-dwelling older adults

Associação entre sarcopenia e qualidade de vida relacionada à saúde em idosos comunitários

Relación entre sarcopenia y calidad de vida respecto a la salud de adultos mayores de una comunidad

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Abstract

Objective: This study aimed to compare quality of life between sarcopenic and non-sarcopenic older adults and to verify the association of sarcopenia and quality of life in community-dwelling older adults.

Methods: This was a cross-sectional study conducted in community-dwelling older adults (n = 378) from Macapá, Amapá, Brazil. Quality of life was assessed using the Short Form (36) Health Survey. The algorithm proposed by the European Working Group on Sarcopenia in Older People (EWGSOP) was used to assess sarcopenia. Descriptive, inferential analyses and linear regression model were performed.

Results: Sarcopenic older adults presented significantly lower quality of life scores in the domains of physical functioning, bodily pain, general health status, and social functioning. After adjustment, sarcopenia was inversely associated with physical functioning (β = -0.125; p = 0.010) and general health status (β = -0.112; p = 0.028).

Conclusion: The results of this study suggest a probable decline in the quality of life in sarcopenic older adults, especially in the physical functioning and general health status domains.

Resumo

Objetivo: O objetivo deste estudo foi comparar a qualidade de vida entre idosos sarcopênicos e não sarcopênicos e verificar a associação entre sarcopenia e qualidade de vida em idosos residentes na comunidade.

Métodos: Estudo transversal conduzido com idosos residentes na comunidade (n = 378) de Macapá, Amapá, Brasil. A qualidade de vida foi avaliada por meio do Short Form (36) Health Survey. O algoritmo proposto pelo Grupo de Trabalho Europeu sobre Sarcopenia em Pessoas Idosas (EWGSOP) foi usado para avaliar a sarcopenia. Foram realizadas análises descritivas, inferenciais e modelo de regressão linear.

Resultados: Os idosos sarcopênicos apresentaram escores de qualidade de vida significativamente mais baixos nos domínios função física, dor corporal, estado geral de saúde e função social. Após o ajuste, a sarcopenia associou-se inversamente ao funcionamento físico (β = -0,125; p = 0,010) e ao estado geral de saúde (β = -0,112; p = 0,028).

Conclusão: Os resultados deste estudo sugerem um provável declínio na qualidade de vida em idosos sarcopênicos, principalmente nos domínios funcionamento físico e estado geral de saúde.

Resumen

Objetivo: El objetivo de este estudio fue comparar la calidad de vida entre adultos mayores con sarcopenia y sin sarcopenia y verificar la relación entre sarcopenia y calidad de vida en adultos mayores residentes de la comunidad.

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Métodos: Estudio transversal llevado a cabo con adultos mayores residentes de la comunidad (n = 378) de Macapá, estado de Amapá, Brasil. La calidad de vida fue evaluada mediante el Short Form (36) Health Survey. El algoritmo propuesto por el Grupo Europeo de Trabajo sobre la Sarcopenia en Personas de Edad Avanzada (EWGSOP) fue utilizado para evaluar la sarcopenia. Se realizaron análisis descriptivos, inferenciales y modelo de regresión lineal.

Resultados: Los adultos mayores con sarcopenia presentaron una puntuación de calidad de vida significativamente más baja en los dominios función física, dolor corporal, estado general de salud y función social. Luego del ajuste, la sarcopenia se relacionó inversamente con el funcionamiento físico (β = -0,125; p = 0,010) y con el estado general de salud (β = -0,112; p = 0,028).

Conclusión: Los resultados de este estudio sugieren un probable deterioro en la calidad de vida de adultos mayores con sarcopenia, principalmente en los dominios funcionamiento físico y estado general de salud.

Introduction

Aging is a process characterized by the lifelong accumulation of molecular and cellular damage that ultimately leads to a progressive decrease in physiological reserves, muscle mass, and functional capacity.[1] Ultimately, these processes associated with aging result in a higher risk of many diseases and death.[1] Loss of muscle mass is an especially severe change associated with aging.[2] In young adults, lean muscle mass comprises up to about 50% of total body weight but declines to approximately 25% upon entering the age range of 75-80 years.[3] Age-related muscle loss is a downward spiral that may lead to decreased muscle strength and functionality.[2,4] The simultaneous loss of muscle mass and strength that occurs with advancing age has been termed sarcopenia.[2,4]

Sarcopenia is a widespread phenomenon with a complex and multifactorial etiology.[5] The most likely involved factors are nutritional status, physical activity, hormonal changes, changes in circulating pro-inflammatory cytokines, and genetic heritability.[5] Although sarcopenia has long been studied[5] and numerous tools for evaluating muscle mass and function are currently available,[6] the multiple pathophysiological mechanisms underlying sarcopenia's etiology have not been fully described. Early detection of sarcopenia remains challenging, and several definitions have been proposed to facilitate detection and diagnosis.[2,7,8]

The prevalence of sarcopenia depends on its definition and varies between 5 and 13% in 60-70 year-olds, and 11 and 50% in people over 80 years of age.[9] Besides its high prevalence in older adults, numerous effects of sarcopenia are prognostic indicators of public health burden.[2] Sarcopenia is independently associated with functional impairment, physical disability, falls, fractures, hospitalization, frailty, increased health care expenditure, and predicts all-cause mortality among older people.[10] Sarcopenia's prevalence and impact on the health-care system is especially relevant in the face of increasing global life expectancy.[2]

Even though global population aging is a positive phenomenon, it is accompanied by a significant increase in the prevalence of adverse conditions, such as sarcopenia. Therefore, it imposes great public health challenges.[11] As mortality is an impending reality at older ages, the focus of health care should no longer be purely on extending the duration of life but also on improving quality of life.[12] Quality of life in older people includes challenges relating to independence, social interaction, healthcare, and the ability to continue leading a fulfilling life.[13] The World Health Organization emphasizes that maintaining quality of life during aging is a key goal for both individuals and policymakers.[11]

The relationship between sarcopenia and quality of life has been previously studied.[14-17] While some studies have found that sarcopenia is negatively associated with quality of life, especially in physical health domains,[14,15] other studies have not identified the same association.[16,17] Furthermore, a previous systematic review[12] identified only one study on the association between sarcopenia and quality of life that considered a consensus definition of sarcopenia.[18] This systematic review highlighted a need for good-quality studies with large sample sizes using a consensus definition of sarcopenia to clarify the association between the different domains of quality of life and sarcopenia.[12] The relationship between sarcopenia and quality of life has been a concern in different settings, such as in long-term care insti-

tutions,[19] in outpatient clinics,[20] and in the community.[21] Complete comprehension of the quality of life burden arising from sarcopenia will help provide researchers in health area with the necessary evidence to support future intervention studies. Additionally, for health professionals such as physicians, nurses, and physiotherapists, a better understanding of the conditions that may affect older adults' quality of life, may provide useful information upon which to base an appropriate evaluation of this population. Thus, this study aimed to compare quality of life between sarcopenic and non-sarcopenic older adults and to verify the association of sarcopenia and quality of life in community-dwelling older adults.

Methods

Study design and population

This cross-sectional study took place in the urban area of Macapa in 2017, a city in the Brazilian Amazon region. The study was approved (protocol no. 1.738.671) by the local human-research ethics committee. Other results of this study have been previously reported.[22]

To estimate the sample size needed, the information made available by the Brazilian Institute of Geography and Statistics (Portuguese acronym: IBGE) regarding the population living in the urban area of Macapa in 2010 was used.[23] Therefore, considering a population of 19,955 of people aged 60 years or older living in the urban area of Macapa,[23] assuming 50% of prevalence of health problems among this population, accuracy of 5%, and a confidence interval of 95%, 377 individuals were found to be needed to compose a representative sample in this study. Participants were randomly recruited in a two-stage cluster sampling process. First, census tracts with information also provided by IBGE regarding the districts and streets were considered, which were then drawn for later identification of older adults in the residences. Participants were enrolled and evaluated at their respective homes. Properly trained undergraduate physiotherapy students monitored by field supervisors (researchers and professors) conducted the face-to-face interviews.[24]

Individuals aged 60 years or older who were able to walk [with or without walking assistance devices] were included. Individuals not located after three attempts, who moved away from the city, hospitalized, had neurological sequelae, were unable to answer interview questions or perform the tests, or presented cognitive decline were excluded. The Mini-Mental State Examination was used to screen all possible participants for cognitive decline. The translated Mini-Mental Examination validated for use in Brazil was used,[25] which adjusts the cut-off point for the patient's level of schooling.

Quality of life (dependent variable)

The 1992 version of the Short Form (36) Health Survey that had been translated and validated for use in Brazil[26] was used to assess quality of life. The Short Form-36 is made up of 36 items divided into eight domains: physical functioning, role limitations due to physical health (abbreviated "role physical"), role limitations due to emotional problems ("role emotional"), bodily pain, general health status, vitality (also known as "energy/fatigue"), social functioning, and mental health (or "emotional well-being"). The scores range from 0 to 100 in each component, with higher scores representing better health status.[26]

Sarcopenia (independent variable)

The definition proposed by the European Working Group on Sarcopenia in Older People (EWGSOP) was used to assess sarcopenia.[7] The muscle mass was evaluated using the total muscle mass equation proposed in a previous study[27] validated for use in Brazilian older adults.[28] The muscle mass index was calculated by dividing a person's total muscle mass by their height. Low muscle mass was defined as those within the bottom 20th percentile of the sample on the body mass index,[29,30] which corresponded to values below 9.61kg/m^2 for men and 6.92 kg/m^2 for women. The evaluation of muscle strength and physical performance were performed us-

ing methods recommended by the EWGSOP.[7] For the muscle strength assessments, a hydraulic hand dynamometer (model SH5001, SAEHAN®) was used. The average of three measures taken at one-minute intervals in the handgrip strength test was used for statistical analysis. Low muscle strength was categorized as values below 30 kilograms/force [kg/f] for men, and below 20kg/f for women, and physical performance was evaluated based on the time to walk a four-meter distance in a gait speed test.[7] Physical performance was considered impaired if the participant completed the test at a comfortable walking speed at 0.8m/s or slower.[7]

Data Analysis

Descriptive analysis was performed using frequencies and percentages for categorical variables; and means and standard deviations for the continuous ones. To compare sarcopenic and non-sarcopenic participants, a chi-squared test was used for categorical variables, and a Student t-test was used for continuous ones. To evaluate the association between the quality of life domains and sarcopenia, crude and adjusted analyses were performed using a linear regression model. The models were adjusted for age, gender, schooling, and number of diseases, and 95% confidence intervals (CI) and 5% significance level were used. The minimum prerequisites of normality, linearity, and homoscedasticity of residuals, as well as the absence of multicollinearity, were considered. All data were analyzed using version 21.0 of the Statistical Package for the Social Sciences program (SPSS).

Table 1. Characteristics of community-dwelling older adults with and without sarcopenia and total sample (n=378)

Variables	Sarcopenic (n=48)	Non-sarcopenic (n=330)	p-value*	Total sample (n=378)
Age (years)	77.31±7.95	68.98±6.59	<0.001	70.04±7.31
Gender (n/%)				
Male	14(29.16)	116(35.15)	0.415	130 (34.39)
Female	34(70.84)	214(64.85)		248 (65.61)
Schooling (years)	4.16±4.04	6.08±5.34	0.005	5.83±5.23
Height (m)	1.51±0.86	1.54±0.88	0.006	1.54±0.89
Weight (Kg)	50.69±7.66	68.99±12.37	<0.001	66.67±13.34
BMI (kg/m²)	22.19±2.29	28.85±4.64	<0.001	28.01±4.94
MMI (kg/m²)	6.99±1.42	9.18±1.61	<0.001	8.91±1.74
HGS (Kgf)	18.84±5.26	25.52±9.19	<0.001	24.67±9.06
Walking speed (0.8 m/s)	0.79±0.30	1.03±0.29	<0.001	0.99±0.31
Number of diseases	5.50±2.32	5.33±2.95	0.713	5.35±2.87

Data are expressed as n = number of subjects; mean+standard deviation; m = meters; Kg = kilogram; BMI = body mass index; MMI = Muscle mass index; HGS = handgrip strength; Kg/f = kilogram/force; *p<0.05; Chi-square and Student t-tests.

Results

Three hundred seventy-eight participants made up the final sample. In this study, most participants (65.61%) were female. The prevalence of sarcopenia in the included participants was 12.7% (n = 48). Sarcopenic participants were older and presented lower mean years of schooling than non-sarcopenic older adults (Table 1).

Sarcopenic older adults presented lower quality of life scores in the domains of physical functioning, bodily pain, general health status, and social functioning (p<0.05) (Table 2).

After adjustment, sarcopenia was inversely associated with physical functioning (β = -0.125; p = 0.010) and general health status (β = -0.112; p = 0.028) (Table 3).

Table 2. Quality of life domains in community-dwelling older adults with and without sarcopenia (n=378)

Variables	Sarcopenia		p-value*	Total sample	Cronbach's alpha
	Yes	No			
Short Form-36 (SF-36)	mean±sd				
Physical functioning	68.02±26.15	81.32±21.99	<0.001	79.63±22.96	0.799
Role physical	65.63±41.45	71.29±38.34	0.345	70.57±38.74	0.810
Bodily pain	60.27±28.76	69.01±27.16	0.040	67.89±27.49	0.806
General health status	59.04±19.27	64.12±14.93	0.035	63.47±15.61	0.810
Vitality	71.35±23.19	75.68±23.47	0.233	75.13±23.45	0.795
Social functioning	79.68±27.36	87.99±21.51	0.017	86.94±22.47	0.796
Role emotional	73.61±40.06	77.87±37.87	0.469	77.34±38.01	0.809
Mental Health	81.92±22.98	84.36±19.16	0.422	84.05±19.67	0.798

Data are expressed as mean+standard deviation; *p<0.05; Student t-test

Table 3. Association between sarcopenia and quality of life in community-dwelling older adults (n=378)

Variable	Sarcopenia							
						95% CI		
Short Form-36	B	Standard Error	β	T	p-value*	Lower bound	Upper Bound	R^2
Physical functioning								
Unadjusted	-13.297	3.485	-0.193	-3.816	<0.001	-20.149	-6.445	0.037
Adjusted	-8.638	3.353	-0.125	-2.576	0.010	-15.231	-2.044	0.248
Role functioning/ physical								
Unadjusted	-5.663	5.985	-0.049	-0.946	0.345	-17.431	6.105	0.002
Adjusted	-2.988	6.046	-0.026	-0.494	0.621	-14.877	8.901	0.141
Bodily pain								
Unadjusted	-8.735	4.229	-0.106	-2.066	0.040	-17.050	-0.421	0.011
Adjusted	-7.878	4.225	-0.096	-1.865	0.063	-16.186	0.430	0.167
General health status								
Unadjusted	-5.083	2.401	-0.109	-2.117	0.035	-9.804	-0.361	0.012
Adjusted	-5.239	2.380	-0.112	-2.202	0.028	-9.918	-0.560	0.181
Vitality								
Unadjusted	-4.328	3.621	-0.062	-1.195	0.233	-11.447	2.792	0.004
Adjusted	0.145	3.578	0.002	0.041	0.968	-6.890	7.180	0.179
Social functioning								
Unadjusted	-8.305	3.449	-0.123	-2.408	0.017	-15.087	-1.523	0.015
Adjusted	-6.161	3.537	-0.091	-1.742	0.082	-13.116	0.794	0.126
Role functioning/ emotional								
Unadjusted	-4.268	5.888	-0.037	-0.725	0.469	-15.845	7.309	0.001
Adjusted	-2.229	6.187	-0.020	-0.360	0.719	-14.395	9.936	0.069
Mental Health								
Unadjusted	-2.447	3.041	-0.041	-0.805	0.422	-8.427	3.533	0.002
Adjusted	-3.151	3.034	-0.053	-1.039	0.300	-9.118	2.815	0.161

B = unstandardized coefficient; β = standardized coefficient; T = t test; CI = Confidence Interval; R^2 = Coefficient of determination; *p<0.05; Adjusted for age, gender, schooling and number of diseases

Discussion

This study identified that sarcopenic older adults presented lower quality of life scores in the domains of physical functioning, bodily pain, general health status, and social functioning. Sarcopenia was inversely associated with physical functioning, bodily pain, general health status, and social functioning. After adjusting for age, gender, schooling, and number of diseases, sarcopenia was inversely associated with physical functioning and general health status.

In our sample, 12.7% of participants had sarcopenia according to the EWGSOP definition.[7] This finding is in accordance with a previous systematic review that estimated a prevalence of sarcopenia of 16% in Brazil, based on both low muscle mass and function criteria.[31] The prevalence of sarcopenia and its characteristics may vary according to the setting and to which diagnostic criterion is applied in different study samples. To our knowledge, only three previous studies[15,18,32] used a consensus definition of sarcopenia to examine the association of sarcopenia and the physical and mental components of quality of life in older adults. These studies applied the EWGSOP definition[7] to community-dwelling older adults.

In our sample, physical functioning, bodily pain, general health status, and social functioning scores were worse in sarcopenic than in non-sarcopenic older adults, and these scores were inversely associated with sarcopenia. Nevertheless, after adjustment, only physical functioning and general health status scores were inversely associated with quality of life, suggesting that these components may be critical in older adults' quality of life. More specifically, an important amount of the worst quality of life scores (24.8% in the physical functioning and 18.1% in the general health domain) were related to sarcopenia. In line with our results, a previous study identified that, after adjusting for potential baseline characteristics, sarcopenic persons had worse self-reported physical functioning than their non-sarcopenic peers.[15] Another study found that sarcopenic participants had also poorer physical

functioning and general health status scores than their non-sarcopenic peers[18] although the analyses were not adjusted for confounding variables.[18]

In a cross-sectional analysis, the study authors perceived that, after adjustments, severe sarcopenia was inversely associated with both physical and mental components of quality of life[32], although the results of the associations of specific domains of quality of life were not reported. The association of severe sarcopenia with the mental component of quality of life in this study[32] suggests that this component may deteriorate as sarcopenia progresses. Overall, these findings suggest that sarcopenia is inversely associated with general health and physical functioning and may impact mental health as the condition advances.

Of note, two studies[16,17] have not identified associations between sarcopenia components and quality of life. Nevertheless, these studies had small sample sizes and did not classify sarcopenia based on a previous consensus. Together, these results suggest that the use of an operational consensus-based definition of sarcopenia seems to be useful to accurately classify sarcopenic older adults with different severity levels.

Interestingly, in our study, the poorer scores in sarcopenic older adults were those related to the general health status domain. General health status in the Short Form-36 assesses participants' perception of their own health status and their beliefs on whether it is likely to worsen.[33] This evaluation correlates both with physical and mental components of quality of life,[33] suggesting that sarcopenia has a global impact on health-related quality of life in older adults.

In our sample, sarcopenic participants were older and had less years of schooling compared to non-sarcopenic participants. These results are not surprising, since there is a well-known loss of muscle mass and strength during the aging process [2] and older adults with low-educational level have been found to be at higher risk for sarcopenia.[34] However, little is known regarding the relationship between schooling and sarcopenia. It seems reasonable that individuals with higher educational level may be more prone to adhere to healthy lifestyle habits that may prevent the loss of muscle mass and strength. Nevertheless, further studies are needed to clarify the role of schooling on sarcopenia.

Some limitations of our study should be considered. First, its cross-sectional design limits the ability to establish a causal relationship between sarcopenia and reduced quality of life. Second, most participants included in this study were female and there were differences between participants with and without sarcopenia. Sarcopenic participants were older and presented lower mean years of schooling than non-sarcopenic older adults. We also did not limit our sample to individuals without diseases. To minimize these limitations, analyses adjusted for age, gender, schooling, and number of diseases were performed. Third, the equation used to calculate muscle mass, Lee's equation, is not the gold standard for evaluating sarcopenia. However, as this equation offers an estimated calculation without requiring expensive equipment, it is widely used and easy to apply. Finally, our quality of life assessment tool is not older-age specific, while certain other countries now have more specific older-age quality of life questionnaires. However, the questionnaire we used is particularly useful by virtue of its simplicity and is the most commonly used measure of health-related quality of life in older patients,[35] also allowing comparisons between people at different ages and the detection of declines in quality of life in older versus younger adults.

This study also has a number of strengths. First, it was conducted in a representative sample of well-characterized community-dwelling older adults. Second, it ratified that the use of a standardized consensus definition of sarcopenia is of particular importance and practical use. Third, it highlights the possible relevance of detecting sarcopenia early in older adults to prevent the progression of sarcopenia and further deterioration in quality of life. Further studies aiming at assessing the effect of early diagnosis of sarcopenia on the quality of life are needed. Finally, it showed that specific domains of quality of life should be considered in the evaluation, prevention, and treatment of sarcopenia in older adults. Owing to the consequences of sarcopenia on physical functioning, general health, and

ultimately on mental health, further studies should consider the importance of screening strategies for early identifying sarcopenia in older adults and should focus on preventative strategies for its management. Although there is strong evidence that older people are living longer, determining whether the added years of older age are dominated by rapid declines in physical and mental health and which individuals are at risk of experiencing limitations in capacity is crucial for policy development.[1]

Conclusion

Sarcopenic older adults presented lower quality of life scores in the domains of physical functioning, bodily pain, general health status, and social functioning. After adjustment for age, gender, schooling, and number of diseases, sarcopenia was inversely associated with physical functioning and general health status. Specific domains of quality of life, such as physical functioning and general health status, should be considered in the evaluation, prevention and treatment of sarcopenia in older adults.

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Collaborations

All authors collaborated in the conception and design of the study, interpretation of data, elaboration of the article, critical revision of its intellectual content and approval of the final version to be published.

References

1. Rudnicka E, Napierała P, Podfigurna A, Męczekalski B, Smolarczyk R, Grymowicz M. The World Health Organization (WHO) approach to healthy ageing. Maturitas. 2020;139:6-11.
2. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, Cooper C, Landi F, Rolland Y, Sayer AA, Schneider SM, Sieber CC, Topinkova E, Vandewoude M, Visser M, Zamboni M; Writing Group for the European Working Group on Sarcopenia in Older People 2 (EWGSOP2), and the Extended Group for EWGSOP2. Sarcopenia: revised European consensus on definition and diagnosis. Age Ageing. 2019;48(1):16-31. Erratum in: Age Ageing. 2019;48(4):601.
3. Short KR, Nair KS. The effect of age on protein metabolism. Curr Opin Clin Nutr Metab Care. 2000;3(1):39-44. Review.
4. Cruz-Jentoft AJ, Sayer AA. Sarcopenia. Lancet. 2019;393(10191):2636-46. Erratum in: Lancet. 2019;393(10191):2590.
5. Fielding RA, Vellas B, Evans WJ, Bhasin S, Morley JE, Newman AB, et al. Sarcopenia: an undiagnosed condition in older adults. Current consensus definition: prevalence, etiology, and consequences. International working group on sarcopenia. J Am Med Dir Assoc. 2011;12(4):249-56.
6. Beaudart C, Rolland Y, Cruz-Jentoft AJ, Bauer JM, Sieber C, Cooper C, et al. Assessment of Muscle Function and Physical Performance in Daily Clinical Practice: a position paper endorsed by the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases (ESCEO). Calcif Tissue Int. 2019;105(1):1-14. Review.
7. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, Boirie Y, Cederholm T, Landi F, Martin FC, Michel JP, Rolland Y, Schneider SM, Topinková E, Vandewoude M, Zamboni M; European Working Group on Sarcopenia in Older People. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. Age Ageing. 2010;39(4):412-23.
8. Muscaritoli M, Anker SD, Argilés J, Aversa Z, Bauer JM, Biolo G, et al. Consensus definition of sarcopenia, cachexia and pre-cachexia: joint document elaborated by Special Interest Groups (SIG) "cachexia-anorexia in chronic wasting diseases" and "nutrition in geriatrics". Clin Nutr. 2010;29(2):154-9.
9. Mayhew AJ, Amog K, Phillips S, Parise G, McNicholas PD, de Souza RJ, et al. The prevalence of sarcopenia in community-dwelling older adults, an exploration of differences between studies and within definitions: a systematic review and meta-analyses. Age Ageing. 2019;48(1):48-56.
10. Liu P, Hao Q, Hai S, Wang H, Cao L, Dong B. Sarcopenia as a predictor of all-cause mortality among community-dwelling older people: a systematic review and meta-analysis. Maturitas. 2017;103:16-22.
11. World Health Organization (WHO). Ageing. Geneva: WHO; 2021 [cited 2021 Feb 20]. Available from: https://www.who.int/ageing/en/
12. Woo T, Yu S, Visvanathan R. Systematic Literature Review on the Relationship Between Biomarkers of Sarcopenia and Quality of Life in Older People. J Frailty Aging. 2016;5(2):88-99. Review.
13. Esteve-Clavero A, Ayora-Folch A, Maciá-Soler L, Molés-Julio MP. Factors associated with the quality of life of older people. Acta Paul Enferm. 2018;31:542-9.
14. Silva Neto LS, Karnikowski MG, Osório NB, Pereira LC, Mendes MB, Galato D, et al. Association between sarcopenia and quality of life in quilombola elderly in Brazil. Int J Gen Med. 2016;9:89-97.
15. Beaudart C, Reginster JY, Petermans J, Gillain S, Quabron A, Locquet M, et al. Quality of life and physical components linked to sarcopenia: the SarcoPhAge study. Exp Gerontol. 2015;69:103-10.
16. Silva Neto LS, Karnikowiski MG, Tavares AB, Lima RM. Association between sarcopenia, sarcopenic obesity, muscle strength and quality of life variables in elderly women. Rev Bras Fisioter. 2012;16(5):360-7.
17. Sartor-Glittenberg C, Lehmann S, Okada M, Rosen D, Brewer K, Bay RC. Variables explaining health-related quality of life in community-dwelling older adults. J Geriatr Phys Ther. 2014;37(2):83-91.

18. Patel HP, Syddall HE, Jameson K, Robinson S, Denison H, Roberts HC, et al. Prevalence of sarcopenia in community-dwelling older people in the UK using the European Working Group on Sarcopenia in Older People (EWGSOP) definition: findings from the Hertfordshire Cohort Study (HCS). Age Ageing. 2013;42(3):378-84.

19. Chang SF, Chiu SC. Effect of resistance training on quality of life in older people with sarcopenic obesity living in long-term care institutions: a quasi-experimental study. J Clin Nurs. 2020;29(13-14):2544-56.

20. Tan LF, Lim ZY, Choe R, Seetharaman S, Merchant R. Screening for Frailty and Sarcopenia Among Older Persons in Medical Outpatient Clinics and its Associations With Healthcare Burden. J Am Med Dir Assoc. 2017;18(7):583-7.

21. Verlaan S, Aspray TJ, Bauer JM, Cederholm T, Hemsworth J, Hill TR, et al. Nutritional status, body composition, and quality of life in community-dwelling sarcopenic and non-sarcopenic older adults: a case-control study. Clin Nutr. 2017;36(1):267-74.

22. Ohara DG, Pegorari MS, Oliveira Dos Santos NL, de Fátima Ribeiro Silva C, Monteiro RL, Matos AP, et al. Respiratory Muscle Strength as a Discriminator of Sarcopenia in Community-Dwelling Elderly: A Cross-Sectional Study. J Nutr Health Aging. 2018;22(8):952-8.

23. Instituto Brasileiro de Geografia e Estatística (IBGE). Síntese de Indicadores Sociais: uma análise das condições de vida da população brasileira 2010. [Série: Estudos & Pesquisa. Informação Demográfica e Socioeconômica, 27]. Rio de Janeiro: IBGE; 2010 [citado 2021 Fev 21]. Disponível em: https://biblioteca.ibge.gov.br/visualizacao/livros/liv45700.pdf

24. Silva CF, Pegorari MS, Matos AP, Ohara DG. Dyspnea is associated with poor physical performance among community-dwelling older adults: a population-based cross-sectional study. Sao Paulo Med J. 2020;138:112-7.

25. Bertolucci PH, Brucki SM, Campacci SR, Juliano Y. O Mini-Exame do Estado Mental em uma população geral: impacto da escolaridade. Arq Neuro-Psiquiatr. 1994;52(1):1-7.

26. Ciconelli RM, Ferraz MB, Santos W, Meinao I, Quaresma MR. Tradução para a língua portuguesa e validação do questionário genérico de avaliação de qualidade de vida SF-36 (Brasil SF-36). Rev Bras Reumatol. 1999;39(3):143-50.

27. Lee RC, Wang Z, Heo M, Ross R, Janssen I, Heymsfield SB. Total-body skeletal muscle mass: development and cross-validation of anthropometric prediction models. Am J Clin Nutr. 2000;72(3):796-803. Erratum in: Am J Clin Nutr. 2001;73(5):995.

28. Rech CR, Dellagrana RA, Marucci MD, Petroski EL. Validity of anthropometric equations for the estimation of muscle mass in the elderly. Rev Bras Cineantropom Desempenho Hum. 2012;14(1)23-31.

29. Delmonico MJ, Harris TB, Lee JS, Visser M, Nevitt M, Kritchevsky SB, Tylavsky FA, Newman AB; Health, Aging and Body Composition Study. Alternative definitions of sarcopenia, lower extremity performance, and functional impairment with aging in older men and women. J Am Geriatr Soc. 2007;55(5):769-74.

30. Newman AB, Kupelian V, Visser M, Simonsick E, Goodpaster B, Nevitt M, Kritchevsky SB, Tylavsky FA, Rubin SM, Harris TB; Health ABC Study Investigators. Sarcopenia: alternative definitions and associations with lower extremity function. J Am Geriatr Soc. 2003;51(11):1602-9.

31. Diz JB, Leopoldino AA, Moreira BS, Henschke N, Dias RC, Pereira LS, et al. Prevalence of sarcopenia in older Brazilians: A systematic review and meta-analysis. Geriatr Gerontol Int. 2017;17(1):5-16.

32. Manrique-Espinoza B, Salinas-Rodríguez A, Rosas-Carrasco O, Gutiérrez-Robledo LM, Avila-Funes JA. Sarcopenia Is Associated With Physical and Mental Components of Health-Related Quality of Life in Older Adults. J Am Med Dir Assoc. 2017;18(7):636.e1-636.e5.

33. Ware JE Jr, Gandek B. Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. J Clin Epidemiol. 1998;51(11):903-12.

34. Brennan-Olsen S, Vogrin S, Balogun S, Wu F, Scott D, Jones G, et al. Education, occupation and operational measures of sarcopenia: Six years of Australian data. Australasian J Ageing. 2020;39;4(498-505.

35. Hickey A, Barker M, McGee H, O'Boyle C. Measuring health-related quality of life in older patient populations: a review of current approaches. Pharmacoeconomics. 2005;23(10):971-93. Review.