Association of clinical parameters of sarcopenia and cognitive impairment in older people: cross-sectional study

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Abstract

Objective: To associate clinical parameters of sarcopenia with cognitive impairment in older people. *Method:* Cross-sectional study with 263 older adults (≥60 years) treated at a specialized public health facility. Sociodemographic and clinical variables were used to characterize the sample and the clinical parameters of sarcopenia (muscle strength, muscle mass and physical performance) were assessed based on handgrip strength (HGS), calf circumference (CC) and the Timed Up and Go (TUG) test. The Mini-Mental State Examination (MMSE) was used to evaluate cognitive status. Associations were analyzed by simple and multiple linear and logistic regression considering the clinical parameters of sarcopenia (independent variables) and cognitive status (dependent variable), adjusted for age, sex, years of schooling, number of medications, nutritional status and functional capacity. *Results:* Of participants with cognitive impairment, 59.6% exhibited low muscle strength. In simple linear regression, cognitive status was explained by muscle strength in 21.5% of cases, muscle mass in 12.3% and physical performance in 7.6%, with muscle strength and muscle mass as explanatory variables for cognitive status in non-adjusted multiple regression and muscle strength alone for adjusted analyses. Only muscle strength remained significantly associated with cognitive status in adjusted multiple logistic regression (OR=0.846; [95%CI: 0.774 – 0.924] p<0.001). *Conclusion:* Low muscle strength was the sarcopenia parameter independently associated with cognitive impairment. This information is useful in highlighting the likelihood of cognitive impairment when poor muscle strength is identified in older people.

Keywords: Aged. Sarcopenia. Cognitive impairment. Functional dependence.

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INTRODUCTION

Sarcopenia and cognitive impairment are worrisome issues related to aging and public health due to the high risk of functional disability, hospitalization and death[1,2]. In community-dwelling older people, sarcopenia has a global prevalence ranging from 10 to 27%, with a progressive increase with advancing age and in rehabilitation units[3]. Cognitive impairment, on the other hand, has been experiencing an exponential increase, with estimates that 65 million older people will have dementia worldwide by 2030, also with higher prevalence in advanced age[4].

Sarcopenia is a disease that causes progressive loss of strength and muscle mass in older people[5,6]. It can be explained by the interaction of multiple risk factors, in particular, aging itself, with a reduction in cell metabolism and hormones that participate in myogenesis[5]. Furthermore, the presence of comorbidities, sedentary lifestyle, poor diet and bad habits are risk factors that are involved in the production of high concentrations of inflammatory cytokines, causing apoptosis[6] and reduction in the structure and function of systems involved in both sarcopenia and cognitive impairment[7], with the possibility of coexistence of both[8,9].

Sarcopenia has been shown to be associated with cognitive impairment[8–10]. A systematic review identified a higher prevalence of sarcopenia in participants with cognitive impairment in most of the included studies[8]. It has also been noted that the concomitant presence of sarcopenia and cognitive impairment is a common finding[9]. In addition, researchers have specifically pointed out physical performance and muscle strength as clinical parameters of sarcopenia independently associated with cognitive impairment[11,12]. However, results for muscle mass measurements so far are inconsistent[12–15]. Additionally, there are still uncertainties about this interaction due to the great methodological heterogeneity of the studies[8,12–16].

In this context, the objective of the study was to associate the clinical parameters of sarcopenia with cognitive impairment in older people who use a public specialized care service. The results of this study will contribute to elucidate which clinical parameters of sarcopenia are associated with cognitive impairment. Considering that the clinical parameters of sarcopenia are modifiable outcomes[17], with this information, the entire multidisciplinary team will be able to better direct the investigation for the screening of older people at risk of cognitive impairment and implement interventions aimed at its primary and secondary prevention[8].

METHODS

This is a cross-sectional study. The research is in accordance with Resolution n. 466/2012 and Resolution n. 510/2016. The study was approved by the Research Ethics Committee of the Faculty of Ceilândia of the University of Brasília (UnB) – CEP/FCE (Opinion 3,650,491) and all participants signed the Free and Informed Consent Form (ICF).

Participants were 281 older people selected for convenience and assessed in a public specialized care service in the western health region of the Federal District (DF) between the years 2020 and 2021. This specialized care service is composed of a multidisciplinary team that performs a multidimensional assessment of older people who require geriatric care referred by primary care services. Older people who are 80 years old or older are assisted, regardless of complaint or health condition, and older people under 80 years old who have at least one of the following criteria: dependence on basic activities of daily living; cognitive disability; parkinsonism; urinary or fecal incontinence; partial or total immobility; postural instability, falls or low-impact fractures; polypathology; polypharmacy and clinical decompensations or frequent hospitalizations. In the present study, older people were included and those with missing data on the Mini-Mental State Examination (MMSE) and/or on the three assessments of the clinical parameters of sarcopenia (muscle strength, muscle mass and physical performance) were excluded.

The sample size required for analyzing the variables in this study was estimated by performing a sample calculation based on the *odds ratio (OR)* value found in a meta-analysis of the association

between sarcopenia and cognitive status (OR=2.926 [2.297– 3.728])[9]. Using the Logistic Regression Test and considering an OR of 2.926, a power of 80% and an alpha error of 0.05, it was estimated that a sample size of 138 older people would be sufficient to identify the investigated associations.

Initially, the older people were assessed to collect sociodemographic variables such as age (in complete years), gender (female or male) and education (in years of study). These data were collected through a form prepared by the researchers.

Then, the following clinical data were collected: nutritional status (by means of the Body Mass Index – BMI), amount of continuous use medication (checked by means of a medical prescription), practice of physical exercise, depressive symptoms and functional capacity. Based on the BMI data, the participants were grouped into underweight (BMI<22 Kg/m²), eutrophic (BMI 22–27 Kg/m²) and overweight (BMI>27 Kg/m²)[18]. Regular physical exercise was considered to be those lasting at least 150 minutes per week of moderate-intensity activity[19], with participants categorized as active or inactive. Depressive symptoms were assessed using the *Geriatric Depression Scale (GDS-15)*, and participants were categorized into severe depression (≥11 points), with depressive symptoms (from 6 to 10 points) or without depressive symptoms (<6 points)[20]. Functional capacity was assessed using the Pfeffer questionnaire[21] for the older people with cognitive impairment and the Lawton and Brody scale[22] for the older people without cognitive impairment. Older people who scored between 6 and 30 on the Pfeffer questionnaire[21] and between 7 and 20 on the Lawton and Brody scale[22] were considered dependent. This information was self-reported by the older person and confirmed by the companion.

Cognitive status was assessed using the MMSE and cognitive impairment defined as a score below the recommended level, according to education level. Participants with more than 7 years of schooling who totaled <28 points, between 4 and 7 years of schooling who totaled <24 points, between 1 and 3 years of schooling who totaled <23 points and illiterates who totaled <19 points were classified as having cognitive impairment[23].

The clinical parameters of sarcopenia were evaluated and defined according to Cruz-Jentoft et al.[5]. A Saehan® manual hydraulic dynamometer *(Saehan Corporation, 973, Yangdeok-Dong, Masan, Korea)* was used to obtain muscle strength through handgrip strength (HGS). It is a valid instrument with excellent test-retest reliability for use in older people with questionable to moderate dementia[24]. The collection took place in the dominant upper limb, with the older person sitting, elbow flexed at 90°, forearm in a neutral position, thumb up and feet flat on the floor. Considering the average of three attempts[25], muscle weakness was identified for values <27 Kgf for men and <16 Kgf for women[5].

Muscle mass was obtained by measuring the calf circumference (CC), using a non-elastic measuring tape, with the older person sitting, legs and ankles positioned at 90°, measuring the circumference of the largest diameter of the dominant leg. Measurements smaller than 31 centimeters (cm) characterized low muscle mass[5,13].

The *Timed Up and Go Test (TUG)* was used as a measure of physical performance. The participant got up from an armless chair, walked a distance of three meters at their usual pace, turned 180 degrees and returned the same way until they sat down again. The execution time of the test was timed and those who performed the TUG in ≥20 seconds were considered to have low physical performance[5].

Descriptive analyzes (mean, median, standard deviation, 25 and 75 percentiles, absolute frequency and percentage) were performed with data on sample characteristics and sarcopenia parameters. Data distribution was investigated using the *Kolmogorov Smirnov Test*. Independent Student's t-test (parametric numerical data), U Mann Whitney (non-parametric numerical data) or chi-square test (categorical data) were used to compare sociodemographic, anthropometric, clinical and functional capacity variables including sarcopenia parameters between groups with and without cognitive impairment.

Quantitative measures of sarcopenia parameters were included in simple linear regression analysis with the aim of investigating the existence of a relationship with the output variable (cognitive status - MMSE score). Additionally, multiple

linear regression analysis was performed including the three sarcopenia parameters as independent variables and the MMSE score as a dependent variable. This analysis was carried out with the aim of determining whether the individual importance of these parameters was maintained to explain possible variations in the MMSE score when combined with the others. Next, a multiple linear regression analysis was performed, adjusted for possible confounding variables: sex, years of study, number of medications, nutritional status, practice of physical exercise and functional capacity.

Simple binary logistic regressions were performed between each of the quantitative sarcopenia parameters (independent variables) and cognitive status (dependent variable). Additionally, a multiple logistic regression analysis including the three quantitative sarcopenia parameters was performed to investigate the joint association of these factors with cognitive status. Then, a multiple logistic regression analysis was performed, adjusted for possible confounding variables: age, sex, years of study, number of medications, nutritional status, practice of physical exercise and functional capacity.

In multiple linear regression analyses, variables not identified as predictors were removed and the model with the highest adjusted R^2 value or that explained a greater percentage of the output variable was presented. *Odds Ratios (ORs)* with 95% confidence intervals and *Beta* were calculated for each independent variable. For each linear and logistic regression analysis, the principles of independence between residuals were respected *(Durbin-Watson)*, normality of the residuals, presence of homoscedasticity, absence of multicollinearity between the variables (*VIF* <10 and *Tolerance* >0.1), minimum number of cases in each variable and, therefore, guaranteed the assumptions for carrying out the regression by the *stepwise-forward* method. No imputations were performed for missing data. In cases of participants with missing data, the data were analyzed using *pairwise* exclusion, so that available data could be included in the analyses.

Cohen f values were calculated as a measure of effect size from linear regression and results were interpreted as small (>0.02), medium (>0.15), and large (>0.35) for f^2[6]. A significance level of 5% was considered.

RESULTS

In total, 263 older people were included in the study, of which 234 (89%) had cognitive impairment, as shown in Figure 1.

Study participants were aged between 60 and 98 years, mostly women, with low education, inactive, overweight, depressive symptoms and functional dependence. The characterization of the sample is represented in Table 1.

The comparison of sarcopenia parameters and the diagnosis between older people with and without cognitive impairment is shown in Table 2. It was shown that, on average, older people with cognitive impairment had lower muscle mass than those without impairment [t(247)=3.463; p=0.001]; that the cognitive status had an effect on muscle strength (U=850.50; p<0.001) and physical performance (U=1845.50; p=0.036) of the older people and that there was an association between the cognitive status and the frequency of diagnosis of muscle weakness [X^2(1)=16.646, p<0.001].

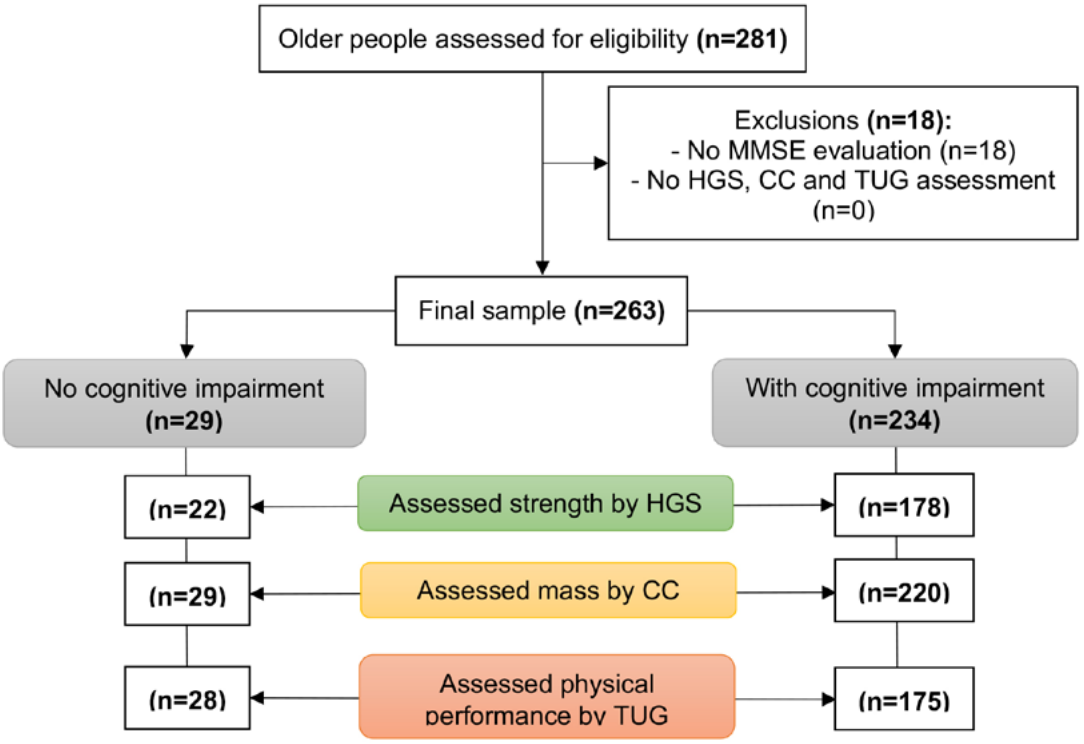

Figure 1. Flowchart referring to the composition of the study sample. Brasilia, DF, 2020-2021.

Table 1. Sample characterization according to sociodemographic and clinical characteristics (N=263). Brasilia, DF, 2020-2021.

Variables	Global Sample	No cognitive impairment (n=29)	With cognitive impairment (n=234)	Mean difference (95% CI)	*p*-value
Sociodemographic Characteristics					
Age (years)[b]	78.40 ± 7.52	77.21 ± 6.11	78.55 ± 7.68	-1.34 (-4.26 to 1.57)	0.365
Sex (female)[a]	197 (73.2%)	21 (72.4%)	172 (73.5%)	-	0.900
Years of schooling[c]	3 (0; 4)	4 (0; 4)	3 (0; 4)	-	0.239
Clinical Characteristics					
BMI (Kg/m²)[b]	27.32 ± 5.32	28.43 ± 5.57	27.17 ± 5.28	1.26 (-0.84 to 3.37)	0.238
Underweight[a]	33 (13.5%)	2 (7.1%)	30 (14.1%)	-	0.179
Eutrophic[a]	95 (38.9%)	8 (28.6%)	85 (39.9%)	-	
Overweight[a]	116 (47.5%)	18 (64.3%)	98 (46%)	-	
Physical activity level (inactive)[a]	245 (91.1%)	27 (93.1%)	212 (90.6%)	-	0.659
Number of medications[c]	5 (3; 7)	6 (5; 7)	5 (3; 8)	-	0.209
MMSE (score)[c]	17 (11; 22)	26 (25; 27)	16 (9; 20)	-	<0.001*
GDS-15 (total score)[c]	6 (4; 8)	5 (3; 7)	6 (4; 8)	-	0.233
Normal[a]	104 (42.3%)	17 (58.6%)	87 (40.1%)	-	0.141
Depressive symptoms[a]	121 (49.2%)	11 (37.9%)	110 (50.7%)	-	
Severe depression[a]	21 (8.5%)	1 (3.4%)	20 (9.2%)	-	
Functional capacity (dependent)[a]	208 (77.9%)	22 (75.9%)	180 (77.6%)	-	0.816

[a]Absolute frequency (percentage) compared with chi-square test. [b]Mean (Standard Deviation) compared with Independent Student's t-test. [c]Median (P25; P75) compared with Mann Whitney U Test. *p<0.05. BMI: Body Mass Index. MMSE: Mini-Mental State Examination. GDS-15: *Geriatric Depression Scale*.

Table 2. Comparison of sarcopenia parameters between older people with and without cognitive impairment (N=263). Brasilia, DF, 2020-2021.

Variables	Global Sample	No cognitive impairment (n=29)	With cognitive impairment (n=234)	Mean difference (95% CI)	*p*-value
HGS (KgF)[c]	17 (11; 20.83)	21.66 (19; 30)	16 (10.3; 20)	-	<0.001*
HGS normal[a]	91 (45.5%)	19 (86.4%)	72 (40.4%)	-	<0.001*
Low HGS[a]	109 (54.5%)	3 (13.6%)	106 (59.6%)	-	
CC (cm) [b]	32.23 ± 4.89	35.12 ± 5.48	31.85 ± 4.68	3.27 (1.41 to 5.13)	0.001*
CC normal[a]	176 (66.9%)	23 (79.3%)	153 (65.4%)	-	0.148
Low CC[a]	87 (33.1%)	6 (20.7%)	81 (34.6%)	-	
TUG (s) [c]	14.32 (11.94; 19.83)	12.44 (10.95; 14.62)	14.96 (12.06; 20.06)	-	0.036*
TUG - good performance[a]	154 (75.9%)	24 (85.7%)	130 (74.3%)	-	0.239
TUG - poor performance[a]	49 (24.1%)	4 (14.3%)	45 (25.7%)	-	

[a]Absolute frequency (percentage) compared with chi-square test. [b]Mean (Standard Deviation) compared with Independent Student's t-test. [c]Median (P25; P75) compared with Mann Whitney U Test.*p<0.05. HGS: Handgrip Strength; CC: Calf Circumference

TUG: *Timed up and Go.*

It was observed that the cognitive status was explained by muscle strength in 21.5%, muscle mass in 12.3% and physical performance in 7.6%. Multiple analysis including the three sarcopenia parameters resulted in a statistically significant model [$F(1.145)=25.379$, $p<0.001$; $R^2=0.261$], maintaining strength and muscle mass as explanatory variables of the cognitive state. Multiple analysis adjusted for possible confounding variables also resulted in a statistically significant model [$F(4.131)=24.412$, $p<0.001$; $R^2=0.427$], maintaining only muscle strength as an explanatory variable of the cognitive state, adjusted for years of study, number of medications and functional capacity. The results of the linear regression analyzes are shown in Table 3.

The results of the simple and multiple binary logistic regression analyzes are presented in Table 4. The simple analyzes showed that muscle strength (in KgF), muscle mass (in cm) and physical performance (in seconds) were associated with the cognitive state. In the multiple analysis including the three quantitative sarcopenia parameters, muscle strength (in KgF) and muscle mass maintained an association with cognitive status ($p=0.005$ and $p=0.038$, respectively). In the multiple logistic regression analysis with the three quantitative parameters of sarcopenia adjusted for covariates, only muscle strength, adjusted for gender ($p=0.018$) remained significantly associated with cognitive status.

Table 3. Single and multiple linear regression analyzes between sarcopenia parameters (independent variables) and cognitive status (dependent variable) (N=263). Brasilia, DF, 2020-2021.

Independent Variable	Simple Regression[a]		Non-adjusted Multiple Regression				Adjusted Multiple Regression			
	R^2 (R^2_{adj})	p-value	R^2 (R^2_{adj})	Cohen's f^2 (power)	Standardized coefficient (ß) (95% CI)	*p*-value	R^2 (R^2_{adj})	Cohen's f^2 (power)	Standardized coefficient (ß) (95% CI)	*p*-value
Muscle strength (KgF)[d]	0.215 (0.211)	<0.001	0.261 (0.250)	0.35 (100%)	0.451 (0.265 to 0.516)	<0.001		0.74 (100%)	0.356 (0.181 to 0.414)	<0.001
Muscle mass (cm)[d]	0.123 (0.119)	<0.001			0.167 (0.031 to 0.430)	0.024			-	-
Physical Performance (s)[d]	0.076 (0.071)	<0.001			-	-			-	-
Age (years)[d]	-	-			-				-	-
Sex[e]	-	-			-				-	-
Years of Education[d]	-	-			-		0.427 (0.410)		0.332 (0.449 to 1.086)	<0.001
Number of medications[d]	-	-			-				0.134 (0.003 to 0.560)	0.047
Nutritional Status (BMI)[d]	-	-			-				-	-
Practice of physical exercise[e]	-	-			-				-	-
Functional capacity[e]	-	-			-				-0.207 (-5.120 a -1.038)	0.003

[a]Simple linear regression analysis between each sarcopenia parameter and cognitive status. [b] Multiple linear regression analysis between the three parameters of sarcopenia (independent variables) and unadjusted cognitive status (dependent variable) (*Stepwise Forward* method). [c] Multiple linear regression analysis between the three sarcopenia parameters and cognitive status (dependent variable) adjusted for possible confounding variables (*Stepwise Forward* Method). [d]Numerical data. [e]Categorical data.

Table 4. Simple, multiple, adjusted and unadjusted logistic regression analysis between sarcopenia parameters (independent variables) and cognitive status (dependent variable) (N=263). Brasilia, DF, 2020-2021.

Variáveis	Simple Logistic Regression[a]			Non-adjusted Multiple Logistic Regression[b]			Adjusted Multiple Logistic Regression[c]		
	OR [95% CI]	ß	*p*-value	OR [95% CI]	ß	*p*-value	OR [95% CI]	ß	*p*-value
Muscle strength (Kgf)[d]	0.898 [0.52 – 0.947]	-0.108	<0.001	0.920 [0.867 – 0.975]	-0.084	0.005	0.846 [0.774 – 0.924]	-0.167	<0.001
Muscle mass (cm)[d]	0.859 [0.784 – 0.940]	-0.152	0.001	0.898 [0.811 – 0.994]	-0.108	0.038	-	-	-
Physical performance (s)[d]	1.080 [1.003 – 1.163]	0.077	0.041	-	-	-	-	-	-
Age (years)[d]	-	-	-	-	-	-	-		-
Sex (ref: male)[e]	-	-	-	-	-	-	7.707 [1.410 – 42.128]	2.042	0.018
Years of Education[d]	-	-	-	-	-	-	-	-	-
Number of medications[d]	-	-	-	-	-	-	-	-	-
Nutritional Status (BMI)[d]	-	-	-	-	-	-	-	-	-
Practice of physical exercise (ref: active)[e]	-	-	-	-	-	-	-	-	-
Functional capacity (ref: dependency)[e]	-	-	-	-	-	-			

[a]Simple logistic regression analysis between each sarcopenia parameter and cognitive status; [b] Unadjusted multiple logistic regression analysis between the three sarcopenia parameters (independent variables) and cognitive status (dependent variable) (*Stepwise Forward* method); [c]Multiple logistic regression analysis between the three sarcopenia parameters (independent variables) and cognitive status (dependent variable) adjusted for possible confounding variables (*Stepwise Forward* Method) [d]Numerical data. [e]Categorical data.

DISCUSSION

This study associated the clinical parameters of sarcopenia (strength, muscle mass and physical performance) with cognitive impairment in older people who use a public specialized care service. Although the three parameters were associated with cognitive status, in the multiple adjusted analyses, only low muscle strength remained independently associated with cognitive impairment.

It was observed that 59.6% of older people in the group with cognitive impairment had low muscle strength, with a significant difference in HGS between groups. HGS explained by 21.5% the cognitive status presented by the older people in the MMSE and 1 KgF of HGS more reduced by 15.4% the chance of the older person to present cognitive impairment at the time of assessment. Our results are consistent with previous studies that identified an association between muscle strength and cognitive status, which demonstrated that low muscle strength almost doubles the risk for cognitive impairment[12,27–29] and that HGS suffers a greater reduction in the simultaneous presence of cognitive and physical impairment[27]. The main mechanism that explains this relationship is the sharing of pathophysiological pathways, involving oxidative stress and chronic inflammation, resulting from aging, physical inactivity, increased visceral fat and chronic diseases[6,7,30]. These factors lead to a metabolic imbalance with the activation of inflammatory pathways, which produce oxidative damage on muscle cells and brain structures[30]. However, it has been discussed that the strength of this association depends on the cognitive tool used[27], the cutoff points to identify muscle weakness and the different HGS measurement protocols, which interfere with its reproducibility[8,25].

In the adjusted analyses, we found no association between low muscle mass, represented by calf circumference, and cognitive impairment. Previous investigations also showed that the individual effect of low muscle mass was not significant for cognitive impairment, even when measured by more specific measurement instruments, corroborating our findings[11,27,31]. However, on the contrary, data indicate an association of low muscle mass (measured by bioimpedance) with specific cognitive domains[31] and that calf circumference was a significant predictor of cognitive impairment using several cognitive tests in a cross-sectional analysis[15]. Meta-analyses[8,9] have argued that the inconsistencies in the association between muscle mass and cognitive impairment may be related to different body composition measurement devices. It has been suggested that not muscle mass, but adipose tissue may be directly related to cognitive impairment[32]. This is because metabolically adipocytes actively participate in the central nervous system, altering insulin sensitivity, responsible for synaptic failure, brain atrophy and cognitive decline, so that infiltration of adipose tissue macrophages causes the activation of a network of inflammatory pathways that results in in apoptosis[30,32].

Physical performance is a third parameter described by Cruz-Jentoft et al.[5] and classifies the severity of sarcopenia. Analyzing the execution time (in seconds) of the TUG, we found that the older people with cognitive impairment took longer to execute the TUG. However, in the adjusted analyses, physical performance was not associated with cognitive impairment. Evaluating physical performance as a sarcopenia parameter also lacks standardization of the tool used and measurement protocols for better reproducibility8. We used the TUG, but the physical performance measure most used in the literature was gait speed, which has been shown to contribute to more than doubling the risk of cognitive impairment[12,16]. Kubicki[33] justifies this predilection for gait speed due to the fact that the test execution commands are simpler than those of the TUG and, in addition, are subject to less measurement bias. Previous studies have found an association between physical performance when assessed using gait speed[12,16,30] and the *Short Physical Performance Battery* tool[11], noting that cognitive impairment is not only associated with, but is preceded by, a reduction in physical function[29,34]. This relationship is not so clear, but it is known that inflammatory markers, hormones, insulin resistance and oxidative stress are negatively correlated with muscle strength, physical performance and cognitive function[11,30,35].

As a strong point, this study used instruments and cutoff points recommended by consensus to

measure muscle strength, muscle mass and physical performance of the older people[5], thus facilitating its reproducibility. However, some limitations can be listed. Due to the cross-sectional design of the study, it was not possible to identify a causal relationship between sarcopenia parameters and cognitive impairment. Considering that the studied population had a medical condition that could affect their ability to self-report, sociodemographic and clinical information was confirmed with the respective caregivers, usually a family member or a trained professional. There was a high prevalence of cognitive impairment in our sample, because the participants were older people referred by primary care services, most of them with complaints of functional dependence and cognitive impairment, and, because of this, this limitation could not have been avoided. We also use calf circumference to measure muscle mass and this tool has been questioned. However, a strong correlation between calf circumference and skeletal muscle mass index was previously observed in both men (r=0.78) and women (r=0.75) and circumference measurement was inversely associated with sarcopenia in both genders (men: OR= 0.62; 95%CI: 0.56 – 0.69 and women: OR= 0.71; 95%CI: 0.65–0.78)[13]. In addition, this measure is considered low-cost and easy to measure, and can be used in environments with limited resources, making it a viable measure for use in older people with cognitive impairment[5].

CONCLUSION

Low muscle strength was the sarcopenia parameter independently associated with cognitive impairment. This information is useful for the team involved in the multidisciplinary care of the older person to pay attention to the probability of cognitive impairment when low muscle strength is identified. In clinical practice, the information from this study reinforces the importance of monitoring the muscle strength of older people in order to prevent adverse outcomes such as sarcopenia and cognitive impairment. When faced with a probable sarcopenic older person, the multidisciplinary team must be attentive to the possibility of cognitive impairment and, when faced with an older person with cognitive impairment, one cannot fail to evaluate the sarcopenia parameters aiming at preventive intervention and control of the pathophysiological mechanisms shared between both illnesses.

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REFERENCES

1. Livingston G, Sommerlad A, Orgeta V, Costafreda SG, Huntley J, Ames D, et al. Dementia prevention, intervention, and care. Lancet. 2017;390(10113):2673–734. Available at: https://doi:10.1016/S0140-6736(17)31363-6
2. Xia L, Zhao R, Wan Q, Wu Y, Zhou Y, Wang Y, et al. Sarcopenia and adverse health-related outcomes: An umbrella review of meta-analyses of observational studies. Cancer Med. 2020;9(21):7964–78. Available at: https://doi.org/10.1002/cam4.3428
3. Petermann-Rocha F, Balntzi V, Gray SR, Lara J, Ho FK, Pell JP, et al. Global prevalence of sarcopenia and severe sarcopenia: a systematic review and meta-analysis. J Cachexia Sarcopenia Muscle. 2022;13(1):86–99. Available at: https://doi.org/10.1002/jcsm.12783
4. Prince M, Bryce R, Albanese E, Wimo A, Ribeiro W, Ferri CP. The global prevalence of dementia: A systematic review and metaanalysis. Alzheimer's Dement. 2013;9(1):63-75.e2. Available at: https://doi.org/10.1016/j.jalz.2012.11.007
5. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, et al. Sarcopenia: Revised European consensus on definition and diagnosis. Age Ageing. 2019;48(1):16–31. Available at: https://doi.org/10.1093/ageing/afy169
6. Cho MR, Lee S, Song SK. A Review of Sarcopenia Pathophysiology, Diagnosis, Treatment and Future Direction. J Korean Med Sci. 2022;37(18):1–10. Available at: https://doi.org/10.3346/jkms.2022.37.e146
7. Boccardi V, Comanducci C, Baroni M, Mecocci P. Of energy and entropy: The ineluctable impact of aging in old age dementia. Int J Mol Sci. 2017;18(12). Available at: https://doi.org/10.3390/ijms18122672

8. Peng TC, Chen WL, Wu LW, Chang YW, Kao TW. Sarcopenia and cognitive impairment: A systematic review and meta-analysis. Clin Nutr. 2020;39(9):2695–701. Available at: https://doi.org/10.1016/j.clnu.2019.12.014

9. Chang KV, Hsu TH, Wu WT, Huang KC, Han DS. Association Between Sarcopenia and Cognitive Impairment: A Systematic Review and Meta-Analysis. J Am Med Dir Assoc. 2016;17(12):1164.e7-1164.e15. Available at: https://doi.org/10.1016/j.jamda.2016.09.013

10. Beeri MS, Leugrans SE, Delbono O, A. D, Bennett, Buchman AS. Sarcopenia is associated with incident Alzheimer's dementia, mild cognitive impairment, and cognitive decline. J Am Geriatr Soc. 2021;69(7):1826–1835. Available at: https://doi.org/10.1111/jgs.17206

11. Moon JH, Moon JH, Kim KM, Choi SH, Lim S, Park KS, et al. Sarcopenia as a predictor of future cognitive impairment in older adults. J Nutr Health Aging. 2016; 20(5):496-502. Disponível em: http://doi.org/10.1007/s12603-015-0613-x

12. Van Kan GA, Cesari M, Gillette-Guyonnet S, Dupuy C, Nourhashémi F, Schott AM, et al. Sarcopenia and cognitive impairment in elderly women: Results from the EPIDOS cohort. Age Ageing. 2013;42(2):196–202. Available at: https://doi.org/10.1093/ageing/afs173

13. Ishii S, Tanaka T, Shibasaki K, Ouchi Y, Kikutani T, Higashiguchi T, et al. Development of a simple screening test for sarcopenia in older adults. Geriatr Gerontol Int. 2014;14(SUPPL.1):93–101. Available at: https://doi.org/10.1111/ggi.12197

14. Kohara K, Okada Y, Ochi M, Ohara M, Nagai T, Tabara Y, et al. Muscle mass decline, arterial stiffness, white matter hyperintensity, and cognitive impairment: Japan Shimanami Health Promoting Program study. J Cachexia Sarcopenia Muscle. 2017;8(4):557–66. Available at: https://doi.org/10.1002/jcsm.12195

15. Won H, Abdul Manaf Z, Mat Ludin AF, Shahar S. Wide range of body composition measures are associated with cognitive function in community-dwelling older adults. Geriatr Gerontol Int. 2017;17(4):554–60. Available at: https://doi.org/10.1111/ggi.12753

16. Kim M, Won CW. Sarcopenia is associated with cognitive impairment mainly due to slow gait speed: Results from the korean frailty and aging cohort study (KFACS). Int J Environ Res Public Health. 2019;16(9). Available at: https://doi.org/10.3390/ijerph16091491

17. Lu L, Mao L, Feng Y, Ainsworth BE, Liu Y, Chen N. Effects of different exercise training modes on muscle strength and physical performance in older people with sarcopenia: a systematic review and meta-analysis. BMC Geriatr. 2021;21(1):1–30. Available at: https://doi.org/10.1186/s1 77-021-02642-8

18. Lipschitz DA. Screening for nutritional status in the elderly. Prim Care. 1994;21(1):55—67.

19. World Health Organization. WHO Guidelines on physical activity and sedentary behaviour. Routledge Handbook of Youth Sport. 2020. 3–5 p. Available at: https://www.who.int/publications/i/item/9789240015128

20. Krishnamoorthy Y, Rajaa S, Rehman T. Diagnostic accuracy of various forms of geriatric depression scale for screening of depression among older adults: Systematic review and meta-analysis. Vol. 87, Arch of Gerontol and Geriatr. Elsevier Ireland Ltd; 2020. 104002 p. Available at: https://doi.org/10.1016/j.archger.2019.104002

21. Assis L de O, de Paula JJ, Assis MG, de Moraes EN, Malloy-Diniz LF. Psychometric properties of the Brazilian version of Pfeffer's functional activities questionnaire. Front Aging Neurosci. 2014;6(SEP):1–7. Available at: https://doi.org/10.3389/fnagi.2014.00255

22. Santos RL dos, Virtuoso Júnior JS. Confiabilidade da versão brasileira da Escala de Atividades Instrumentais da Vida Diária. Rev Bras em Promoção da Saúde. 2008;21(1):290–6. Available at: https://doi.org/10.5020/575

23. Herrera E, Caramelli P, Silveira ASB, Nitrini R. Epidemiologic survey of dementia in a community-dwelling Brazilian population. Alzheimer Dis Assoc Disord. 2002;16(2):103–8. Available at: https://doi.org/10.1097/00002093-200204000-00007

24. Alencar MA, Dias JMD, Figueiredo LC, Dias RC. Força de preensão palmar em idosos com demência: Estudo da confiabilidade. Brazilian J Phys Ther. 2012;16(6):510–4. Available at: https://doi.org/10.1590/S1413-35552012005000059

25. Bohannon RW. Grip strength: An indispensable biomarker for older adults. Clin Interv Aging. 2019;14:1681–91. Available at: https://doi.org/10.2147/CIA.S194543

26. Cohen J. Statistical Power Analysis for the Behavioral Sciences 2nd edn (Erlbaum, Hillsdale, NJ, 1988).

27. Tolea MI, Galvin JE. Sarcopenia and impairment in cognitive and physical performance. Clin Interv Aging. 2015;10:663–71. Available at: https://doi.org/10.2147/CIA.S76275

28. Cui M, Zhang S, Liu Y, Gang X, Wang G. Grip Strength and the Risk of Cognitive Decline and Dementia: A Systematic Review and Meta-Analysis of Longitudinal Cohort Studies. Front Aging Neurosci. 2021;13(February). Available at: https://doi.org/10.3389/fnagi.2021.625551

29. Chou MY, Nishita Y, Nakagawa T, Tange C, Tomida M, Shimokata H, et al. Role of gait speed and grip strength in predicting 10-year cognitive decline among community-dwelling older people. BMC Geriatr. 2019;19(1):1–11. Available at: https://doi.org/10.1186/s12877-019-1199-7

30. Sui SX, Williams LJ, Holloway-kew KL, Hyde NK. Skeletal Muscle Health and Cognitive Function : A Narrative Review. 2021; Available at: https://doi.org/10.3390/ijms22010255

31. Szlejf C, Suemoto CK, Lotufo PA, Benseñor IM. Association of Sarcopenia With Performance on Multiple Cognitive Domains : Results From the ELSA-Brasil Study. J Gerontol A Biol Sci Med Sci. 2019 Oct 4;74(11):1805-1811. Available at: https://doi.org/10.1093/gerona/glz118

32. Li C wei, Yu K, Shyh-Chang N, Jiang Z, Liu T, Ma S, et al. Pathogenesis of sarcopenia and the relationship with fat mass: descriptive review. J Cachexia Sarcopenia Muscle. 2022;13(2):781–94. Available at: https://doi.org/10.1002/jcsm.12901

33. Kubicki A. Functional assessment in older adults: Should we use timed up and go or gait speed test? Neurosci Lett. 2014;577:89–94. Available at: https://doi.org/10.1016/j.neulet.2014.06.014

34. Karr JE, Graham RB, Hofer SM, Muniz-Terrera G. When does cognitive decline begin? A systematic review of change point studies on accelerated decline in cognitive and neurological outcomes preceding mild cognitive impairment, dementia, and death. Psychol Aging. 2018;33(2):95–218. Available at: https://doi.org/10.1037%2Fpag0000236

35. Cesari M, Penninx BWJH, Pahor M, Lauretani F, Corsi AM, Williams GR, et al. Inflammatory Markers and Physical Performance in Older Persons: The InCHIANTI Study. Journals Gerontol - Ser A Biol Sci Med Sci. 2004;59(3):242–8. Available at: https://doi.org/10.1093/gerona/59.3.m242