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Sarcopenic indices in community-dwelling older adults

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Abstract

Background—Sarcopenic indices are used to estimate loss of skeletal lean mass and function, and to determine the prevalence of sarcopenia in older adults. It is believed that older women and men with lower skeletal lean mass will be weaker and have more functional limitations.

Purpose—1) To classify community-dwelling older adults using two common sarcopenic indices: appendicular lean mass/height² (ALM/ht²) and skeletal muscle index (SMI), and 2) to determine each indices value as indicators of lower extremity strength and physical function.

Methods—The sample consisted of 154 community-dwelling older adults (111 women, 43 men; mean age=82.4 SD=3.6 years; mean BMI=25.8 SD=4.4 kg/m²). Each underwent whole-body dual-energy x-ray absorptiometry (DXA) to assess lean mass. The 9-item modified physical performance test (PPT) and self-selected walking speed were used to evaluate function. Lower extremity strength was measured bilaterally using isokinetic dynamometry.

Results—The ALM/ht² index classified 75 participants (49%) as sarcopenic (SP) and 79 (51%) as non-sarcopenic (NSP). The SMI classified 129 participants (84%) as SP and 25 (16%) as NSP. There were no differences in functional measures between groups by gender using either index after classification. The ALM/ht² index was more strongly correlated with peak torque of all lower extremity muscle groups ($r=.276-.487$) compared with the SMI ($r=.103-.344$). There was no relationship between either sarcopenic index and physical function.

Discussion—There were marked differences in how two sarcopenic indices classified community-dwelling older adults. Lower extremity strength was lower in older women classified as sarcopenic compared to non-sarcopenic using the ALM/ht² index, but LE strength was not different in older men. However, no lower extremity strength differences were observed between sarcopenic and non-sarcopenic men or women using the SMI classification. Neither sarcopenic index uniformly identified community-dwelling older adults with functional or strength deficits.

Conclusions—Detection of strength deficits using sarcopenic indices alone may be gender-specific, and may not reflect strength or functional decline in community-dwelling men 80 years of age or older. Given associations between lower extremity strength and physical function,

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strength measures remain a better predictor of physical performance than sarcopenic indices for community-dwelling older men and women.

Keywords

older adults; physical function; strength; lean mass

INTRODUCTION

Sarcopenia, an age-related loss of skeletal muscle mass and strength, has been well-established as a prominent feature of currently existing paradigms that characterize physical frailty in older adults.¹⁻⁶ Sarcopenic indices were developed to: 1) establish a critical threshold of age-related muscle loss associated with functional decline and disability, and to 2) estimate the prevalence of sarcopenia in older adults.^{5,7-9} The appendicular lean mass/height² (ALM/ht²) and skeletal muscle index (SMI) are two commonly used sarcopenic indices. ALM/ht² is an estimate of appendicular lean mass adjusted for stature, whereas SMI is an estimate of total body lean mass adjusted for stature and non-skeletal tissue mass (fat, organ, and bone).^{5,8} Both indices have previously been shown to predict disability and functional limitations in large, epidemiologic studies of older adults.^{5,7,8} However, it has been suggested that the cutoff values for ALM/ht² used to classify individuals as sarcopenic or non-sarcopenic in the New Mexico Elder Health Survey overestimates the prevalence of sarcopenia in a variety of older populations.¹⁰ Because previous evidence suggests a highly variable relationship between skeletal muscle mass, strength, and physical performance,¹¹⁻¹³ neither sarcopenic measure has been firmly established as the index that best reflects decrements in muscle performance and functional decline in community-dwelling older adults. This lack of consensus may be due in part to the diversity of measures used to describe physical function and to the variety of muscle groups assessed.¹⁴

Muscle strength and power are frequently used by physical therapists and rehabilitation specialists as prognostic indicators of functional decline, and to discriminate functionally independent, community-dwelling older adults from functionally dependent older adults.¹⁵ Lower extremity muscle strength and power decrease with age, with the decline in lower extremity power having an earlier onset and more precipitous decline than upper extremity muscle power.^{16,17} Furthermore, several studies support the relationship between loss of lower extremity muscle strength and power and decline in physical functional performance.¹⁶⁻¹⁸ However, the value of classifying older adults using any sarcopenic index for predicting lower extremity strength decline, power loss, and functional limitations in community-dwelling older adults has yet to be fully examined.

PURPOSE

The purposes of this study were to 1) classify community-dwelling older adults using two indices of sarcopenia, ALM/ht² and SMI, and 2) determine the relationship of these indices to measurements of lower extremity strength and physical function. Based on previous studies, we hypothesized: 1) the two sarcopenic indices would classify community-dwelling older adults as sarcopenic or non-sarcopenic similarly, 2) there would be differences in muscle strength, walking speed, and physical performance between participants classified as sarcopenic versus non-sarcopenic for both ALM/ht² and SMI and, 3) there would be strong associations between sarcopenic indices and select lower extremity strength and functional performance measures in community-dwelling older women and men.

METHODS

Subjects

We studied 154 community-dwelling older adults (111 women, 43 men, mean BMI=25.8 SD=4.4) who were recruited to participate in a randomized, controlled study of supervised exercise training. Inclusion and exclusion criteria have been described previously.^{14,19} Briefly, participants were included in the study if they: a) were 78 years or older, b) achieved a composite score between 18 and 32 on the modified Physical Performance Test (modified PPT), c) self-reported a need for assistance or difficulty with at least one basic activity of daily living (BADL) or two or more instrumental activities of daily living (IADLs), and d) had a measured VO_2 peak, a measure of peak aerobic power, between 10 and 18 ml of $\text{O}_2/\text{kg}/\text{min}$. These inclusion criteria reflect mild to moderate physical frailty.^{14,19} For the purposes of this investigation, sarcopenic indices and classifications were derived from body composition assessments, and all strength and functional measures reported were obtained at baseline before being assigned to an exercise training group or participating in any exercise sessions. To our knowledge, none of the participants reported being actively involved in recreational activities prior to the study. Subjects volunteered for participation, were not provided remuneration, and signed an informed consent approved by the university Institutional Review Board.

Assessments

Sarcopenic indices—Each participant had a whole-body, dual energy x-ray absorptiometry (DXA) (Hologic QDR 1000/W, software version 6.2 OD; Waltham, MA) scan to assess composite and regional lean and fat mass. Bilateral upper and lower extremity fat-free masses were summed to calculate appendicular lean mass (ALM) and expressed in kilograms (kg).⁹ Appendicular lean mass was divided by height in meters (m) and squared to calculate each subject's ALM/ht^2 index score.⁵ Using the cutoff values for ALM/ht^2 developed by Newman et al,²² women with scores above $7.23 \text{ kg}/\text{m}^2$, and men with scores above $5.67 \text{ kg}/\text{m}^2$ were classified as non-sarcopenic.^{5,21,22}

We also calculated the skeletal muscle index (SMI), where $\text{SMI} = \text{total body skeletal muscle mass (TBSM, in kg)} / \text{total body mass (kg)} \times 100$.^{8,20} Total body skeletal muscle mass was determined using the formula, $\text{TBSM} = (1.13 \times \text{ALM}) - (0.02 \times \text{age \{years\}}) + (0.61 \times \text{sex \{0=female; 1=male\}}) + 0.97$ for DXA-derived measurements.²⁰ For the SMI sarcopenic index, we used the cutoff values proposed by Janssen et al (2002) where scores above 37% for men and above 28% for women were considered non-sarcopenic.⁸ Body weight (kg) and height (m) were assessed while standing without footwear using a balance scale with stadiometer (Detecto, 203 East Daugherty Street, Webb City, MO).

Physical Performance—Physical function was evaluated using the 9-item modified Physical Performance Test (modified PPT).¹⁴ Additionally, self-selected walking speed was determined by having subjects perform two timed walking trials over a 50-foot distance (15.24m). We report the average walking speed determined from two trials (m/min).¹⁴

Strength Measures—Lower extremity peak torque values were averaged over three (3) trials for knee extension (KE), knee flexion (KF), ankle dorsiflexion (DF) and ankle plantarflexion (PF) at 0, 60, 120, and 180 deg/sec, using the Cybex II isokinetic dynamometer (Cybex, Division of Lumex, Inc, 2100 Smithtown Ave, Ronkonkoma, NY). Participants were positioned as previously described by Brown et al (2000).¹⁴ Values are reported in Newton-meters (Nm).

Analysis

Of 182 potential subjects, 85% of participants who had a complete complement of baseline measures of lean mass, modified PPT scores, walking speed, and lower extremity peak torque were included in the statistical analysis (N=154). Classifications of sarcopenic (SP) and non-sarcopenic (NSP) were derived using cutoff values for the ALM/ht² and SMI described above. We first determined the percentages of those classified as SP and NSP for each sarcopenic index (ALM/ht² and SMI) for all subjects together, as well as for men and women separately. These percentages were compared using Chi-square with Yates correction. Data were tested for normality using the Shapiro-Wilk test. Once the percentages of participants classified as SP and NSP for each sarcopenic index were determined, we tested for group differences in anthropometric, body composition, functional performance, and lower extremity peak torque measures using an ANOVA (Group $\times$ Measure). This was done for the entire group and then for groups separated by sex. The relationships between sarcopenic indices, strength, and functional performance measures were determined using Pearson Product Moment correlation coefficient. All data were analyzed using Systat 11.0 statistical package (Systat Software Inc, 225 W. Washington St., Suite 425, Chicago, IL).

RESULTS

Participant Characteristics and Sarcopenic Indices

Table 1 summarizes key participant characteristics. The mean age for all participants was 82.4 (SD 3.6) years (range: 78–95 years), with an average modified PPT score of 28.2 (SD 4.4) points out of a maximum of 36. The mean walking speed for all participants was 65.5 (SD14.1) m/min. The NSP group had greater appendicular lean mass than the SP group when using the ALM/ht² index (Table 2), but there were no group differences observed in appendicular lean mass using the SMI index (Table 3).

Sarcopenic Classification

Cutoff values using the ALM/ht² index for the NSP classification were >7.23 and >5.67 kg/m² for men and women, respectively. Using the ALM/ht² cut-off scores, seventy-five participants (49%), were classified as SP; seventy-nine participants (51%) classified as NSP (Figure 1; Table 2). When analyzed by sex, 47% of women were classified as SP, whereas 53% of men were classified as SP (Figure 1; Table 2).

When using the SMI cut off values for NSP, which was a score above 37% for men and above 28% for women, only 16% of subjects were classified as NSP (Figure 1; Table 3). The SMI classified 78% of women and 98% of men as SP versus 22% of women and 2% of men as NSP when analyzed by sex (Fig. 1; Table 3). There were significant differences in body weight and BMI between SP and NSP groups for men and women for both sarcopenic indices ($p<.05$) (Tables 2 and 3).

Sarcopenic Indices and Physical Function

As summarized in tables 2 and 3, there were no significant differences between SP and NSP groups in mean values for the modified PPT or for walking speed in women or men using either sarcopenic index (Tables 2 and 3). As summarized in Table 4, neither SMI nor ALM/ht² indices correlated with the modified PPT or with walking speed. A similar trend was observed for both sexes.

Sarcopenic Indices and Lower Extremity Peak Torque

There were group differences in peak torque values for select lower extremity muscle groups. For ALM/ht² index, the NSP group, considered as a whole, had significantly greater

peak torque for the knee extensors (KE). In women, the NSP group demonstrated greater peak torque in two of the four selected muscle groups (knee extensors and ankle dorsiflexors) at all speeds. However, in men there were no group differences in peak torque for any of the selected muscle groups at any speed using the ALM/ht² index ($p>.426$). No group differences in peak torque for most of the selected muscle groups were found at any speed using SMI ($p>.198$) when analyzed by sex. Because a similar trend was observed for all muscle groups at each speed, values at select speeds for each group are given in Table 2.

The ALM/ht² index and lower extremity peak torque demonstrated a small but statistically significant relationship with knee extensor peak torque in women ($r=.289$ to $.423$) but not in men ($r=.059$ – $.230$). Data from select lower extremity peak torque measures is shown in Table 4.

DISCUSSION

The primary purposes of this study were to classify community-dwelling older adults using two commonly used sarcopenic indices, and to determine the relationship of these indices to objective measures of lower extremity strength and physical function. To our knowledge, this is the first study to examine how well validated sarcopenic indices reflect lower extremity strength and physical function in community-dwelling older adults. In our study, the SMI and ALM/ht² sarcopenic indices were markedly different in how they classified community-dwelling older adults as sarcopenic or non-sarcopenic. The ALM/ht² index yielded similar percentages of those classified as sarcopenic versus non-sarcopenic in older adults 80 years of age or older to those of Baumgartner et al (1998), where 53–57% of men and 43–60% of women 80 years of age or older were classified as sarcopenic when stratified by age and ethnicity.⁵ Interestingly, the SMI classified significantly more community-dwelling older adults as sarcopenic than the ALM/ht² index, a trend more profound in men than women. The percentages of women over 80 years of age classified as sarcopenic in this study (78%) are similar to those of Janssen et al (2002) in which 72% were classified as sarcopenic.⁸ However, the percentages of men classified as sarcopenic contrast with findings from Janssen et al (2002) in which 50% of men older than 80 years of age were classified as sarcopenic compared with 98% in our study. One possible explanation for this is the difference in measurement technique for body composition measures between studies. Janssen and colleagues (2002) used bioelectrical impedance to obtain body composition measurement, whereas we used DXA to determine lean mass. Cut-points for sarcopenic classification of SP or NSP often differ based on the measurement technique used to obtain measures of fat and lean mass¹⁰. These findings affirm the significance of how the classification of older adults as either SP or NSP is highly influenced by the method used to assess body composition, particularly lean mass.¹¹

Sarcopenic Indices and Physical Function

Our findings suggest that neither sarcopenic index is strongly associated with common functional measures that physical therapists routinely use, and, therefore, may be insufficient determinants of baseline physical function in community-dwelling older adults. This occurs despite small group differences in appendicular lean mass. These observations differ from those of Baumgartner et al (1998) and Janssen et al (2002) in which both groups concluded that ALM/ht² index and the SMI are associated with risk for functional limitation and disability, with adjustment for confounding variables such as age, race, and comorbidities.^{5,8} However, the established relationship between sarcopenic classification, physical function, and disability in these previous studies was based on self-reported measures of functional limitation and disability. The modified PPT used in the current study represents an objective, performance-based functional measure which we used to evaluate the relationship between sarcopenic classification and physical function in community-dwelling older adults.

Furthermore, since sarcopenic indices serve primarily to describe lean mass characteristics, the fact that ALM/ht² and SMI are poorly correlated with function is consistent with previous findings that lean mass measures are inadequate predictors of functional decline.^{11–13}

Sarcopenic Indices and Lower Extremity Peak Torque

In this study, the ALM/ht² index more effectively showed differences in LE strength in women compared with men 80 years of age or older. However, no lower extremity strength differences were observed between sarcopenic and non-sarcopenic men or women using the SMI classification. These results suggest the detection of strength differences using sarcopenic indices alone could be sex-specific, and may not reflect strength *or* functional decline in community-dwelling men 80 years of age or older.

Recent literature advocates for a more expansive definition of sarcopenia that includes the loss of measureable variables such as strength and physical performance, the influence of increasing adiposity with decreasing appendicular lean mass, termed “sarcopenic obesity,” on declines in lower extremity strength and physical performance²³, the loss of composite and regional lean mass, and more definitive cutoff values.^{10, 11, 24} In addition, some propose the incorporation of the term ‘dynapenia,’ the age-related decline in muscle performance (strength and power) independent of decreases in lean mass, into gerontological discourse because it is thought to create a clear distinction between decrements in muscle mass and muscle performance in older adults^{25, 26}. Our results indicate that dichotomized sarcopenic classifications using commonly used sarcopenic indices (ALM/ht² and SMI) have a variable relationship to lower extremity strength, confirming the potential dissociation of decreases in appendicular lean mass and strength of major lower extremity muscle groups. Therefore, use of a sarcopenic classification alone as a proxy indicator of mass, strength, and functional deficits may not accurately reflect functional decline in community-dwelling older adults. Given the established association of lower extremity strength and power, functional performance, and disability, lower extremity strength may continue to have greater utility as an indicator of physical functioning in community-dwelling older adults than appendicular or total body lean mass.^{24, 17, 14, 25}

There are limitations to this study. First, we studied community-dwelling older adults with relatively few functional limitations, the majority (~82%) of whom had a BMI less than 30 kg/m² which would not classify them as obese. Older adults who are more functionally compromised may exhibit different relationships between sarcopenic indices and physical function. Furthermore, the inclusion of a larger number of older adults with a BMI > 30 would allow for an additional classification of sarcopenic-obesity, and for an analysis of the influence of this classification on physical function and lower extremity strength²⁹. Secondly, we examined the utility of two sarcopenic indices. It is possible that other sarcopenic indices may better relate to function and strength in older adults than those included in this study. Third, our research design and analysis was cross-sectional so it is difficult to firmly establish a causal relationship between sarcopenic classification and its impact on lower extremity strength and physical function. Future studies should continue to explore the relationships between sarcopenic indices and classifications (with consideration of the impact of fat mass), lower extremity strength, and physical performance in more functionally compromised older adult populations and after therapeutic exercise interventions to determine how sarcopenic indices are impacted.

CONCLUSIONS

The SMI and ALM/ht² are markedly different in how they classify community-dwelling, older adults as sarcopenic or non-sarcopenic. Neither index was strongly associated with

modified PPT score or walking speed. Given previously described associations between lower extremity strength and physical function, strength measures remain a better predictor of physical performance than sarcopenic indices for community-dwelling older men and women.

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Figure 1.

Classification of subjects as being sarcopenic or non-sarcopenic by skeletal muscle index (SMI) and by appendicular lean mass/height² index, for the entire sample, and then by gender.

SP % classified with sarcopenia

NSP % classified without sarcopenia

Table 1

Subject Characteristics

Mean (SD)	Total (N=154)	Women (N=111)	Men (N=43)
Age (years)	82.4 (3.6)	82.4 (3.9)	82.4 (2.9)
Range (78–95 years)			
%, female/male		72.1%	27.9%
Height (m)	1.6 (0.1)	1.6 (0.1)	1.7 (0.1)
BMI	25.8 (4.4)	26.3 (4.7)	26.5 (3.7)
modified PPT	28.2 (4.4)	28.0 (4.8)	28.6 (3.3)
Walking speed (m/min)	65.5 (14.1)	64.8 (14.4)	67.4 (13.4)

modified PPT: modified Physical Performance Test Score

Table 2

Differences in mean strength and function for subjects classified as sarcopenic or non-sarcopenic using the ALM/ht² index (N=154) for the entire sample, and by gender

ALL SUBJECTS				
Measures	Non-sarcopenic	Sarcopenic	Mean Difference	P-value
N	79	75		
BMI	28.1 (5.4)	23.4 (4.9)	4.7	.00
Weight (kg)	75.6 (13.3)	65.1 (11.1)	10.5	.00
Height (m)	1.6 (0.1)	1.6 (.1)	0.0	.68
ALM (kg)	18.4 (3.8)	14.7(3.6)	3.7	.00
ALM/ht	7.0 (1.0)	5.5 (0.8)	1.5	.00
modified PPT Score	28.4 (3.6)	28.0 (4.8)	0.4	.49
Walking Speed(m/min)	65.4 (12.3)	66.0 (15.5)	0.6	.73
KE60	84.5 (17.4)	69.9 (18.3)	14.6	.01
KF60	55.2 (12.3)	49.2 (14.1)	6.0	.27
ADF60	9.5 (4.7)	7.5 (4.1)	2.0	.10
APF60	27.1 (12.6)	22.7 (10.7)	4.4	.16
WOMEN				
Measures	Non Sarcopenic	Sarcopenic	Mean Difference	P-value
N	59	52		
BMI	28.5 (4.6)	23.8 (3.3)	4.7	.00
Weight (kg)	72.4 (12.1)	60.5 (8.4)	11.9	.00
Height (m)	1.6 (.1)	1.6 (.1)	0.0	.79
ALM (kg)	16.8 (2.7)	12.6 (1.4)	4.2	.00
ALM/ht ²	6.7 (0.9)	5.0 (0.4)	1.6	.00
modified PPT Score	28.4 (3.8)	27.7 (5.2)	0.6	.52
Walking Speed (m/min)	64.8 (11.7)	64.8 (16.3)	0.0	.79
KE60	79.4 (15.4)	60.9 (14.8)	18.5	.00
KF60	51.5 (10.1)	44.3 (11.6)	7.2	.20
ADF60	8.6 (4.0)	5.1 (2.2)	3.5	.01
APF60	25.7 (12.0)	19.0 (7.3)	6.7	.07
MEN				
Measures	Non Sarcopenic	Sarcopenic	Mean Difference	P-value
N	20	23		
BMI	28.5 (3.8)	24.7 (2.5)	3.8	.00
Weight (kg)	85.0 (12.6)	75.4 (9.6)	9.6	.00
Height (m)	1.7 (.1)	1.7 (.1)	0.0	.68
ALM (kg)	23.2 (2.3)	19.5 (1.9)	3.7	.00

ALL SUBJECTS				
Measures	Non-sarcopenic	Sarcopenic	Mean Difference	P-value
ALM/ht ²	7.9 (0.6)	6.6 (0.4)	1.4	.00
modified PPT Score	28.7 (3.1)	28.7 (3.7)	0.0	.43
Walking Speed (m/min)	67.0 (14.1)	68.7 (13.2)	1.7	.08
KE60	100.3 (18.5)	89.9 (16.9)	10.4	.36
KF60	66.4 (15.1)	60.0 (16.0)	6.4	.49
ADF60	12.3 (5.9)	12.8 (4.5)	0.5	.44
APF60	31.1 (13.9)	30.8 (14.3)	0.3	.58

*
p<.05;

KE60: Knee extensor peak torque in Newton-meters at 60°/sec;

KF60: Knee flexor peak torque in Newton-meters at 60°/sec;

ADF60: Ankle dorsiflexor peak torque in Newton-meters at 60°/sec;

APF60: Ankle plantarflexor peak torque in Newton-meters at 60°/sec.

modified PPT: modified Physical Performance Test;

ALM: appendicular lean mass;

ALM/ht²: appendicular lean mass/height²;

Table 3

Differences in mean strength and function for subjects classified as sarcopenic or non-sarcopenic using the SMI (N=154)

ALL SUBJECTS				
Measures	Non-sarcopenic	Sarcopenic	Mean Difference	P-value
n	25	129		
BMI *	23.7 (3.7)	26.2 (5.9)	2.5	.00
Weight (kg) *	60.8 (10.9)	72.4 (13.1)	11.6	.00
Height (m)	1.58 (.1)	1.63 (.1)	0.1	.08
ALM (kg)	16.1 (2.9)	16.7 (4.3)	0.6	.11
SMI *	30.0 (1.9)	25.9 (4.4)	4.1	.00
modified PPT Score	27.7(5.1)	28.3 (4.3)	0.6	.52
Walking Speed(m/min)	60.5 (14.5)	66.5 (13.9)	6.0	.12
KE60	72.8 (13.2)	78.2 (19.6)	4.0	.21
KF60	48.7 (9.9)	53.1 (14.0)	4.4	.26
ADF60	7.2 (4.5)	9.0 (4.6)	1.8	.13
APF60	20.0 (9.2)	26.5 (12.6)	6.5	.06
WOMEN				
Measures	Non-sarcopenic	Sarcopenic	Mean Difference	P-value
N	24	87		
BMI *	23.4 (3.5)	27.0 (4.6)	3.6	.00
Weight (kg) *	59.3 (8.1)	68.8 (12.2)	9.5	.00
Height (m)	1.6 (.1)	1.6 (.1)	0.0	.98
ALM (kg)	15.8 (2.4)	14.5 (3.1)	1.3	.34
SMI *	30.1 (1.9)	23.4 (3.1)	6.2	.00
modified PPT Score	27.7 (5.1)	28.0 (4.7)	0.3	.56
Walking Speed (m/min)	60.5 (14.5)	66.0 (14.2)	5.5	.10
KE60	72.8 (13.2)	70.3 (17.5)	2.5	.94
KF60	47.3 (8.7)	48.4 (11.8)	1.1	.75
ADF60	6.3 (2.8)	7.2 (3.7)	0.9	.27
APF60	18.8 (8.0)	24.0 (11.0)	5.2	.09
MEN				
Measures	Non-sarcopenic	Sarcopenic	Mean Difference	P-value
n	1	42		
BMI	30.0 (0)	26.4 (3.7)	#	#
Weight (kg)	96.6 (0)	79.8 (11.7)	#	#
Height (m)	1.8 (0)	1.7 (.1)	#	#

ALL SUBJECTS				
Measures	Non-sarcopenic	Sarcopenic	Mean Difference	P-value
ALM (kg)	24.5 (0)	21.1 (2.7)	#	#
SMI	28.7(0)	30.3 (3.4)	#	#
modified PPT Score	33.0 (0)	28.5 (3.3)	#	#
Walking Speed (m/min)	94.2 (0)	66.8 (12.9)	#	#
KE60	113.9 (0)	94.7 (17.9)	#	#
KF60	81.4 (0)	63.1 (15.5)	#	#
ADF60	30.5 (0)	12.5 (5.1)	#	#
APF60	50.1(0)	31.6 (14.8)	#	#

* P < .05

Insufficient data for analysis

KE60: Knee extensor peak torque in Newton-meters at 60°/sec;

KF60: Knee flexor peak torque in Newton-meters at 60°/sec;

ADF60: Ankle dorsiflexor peak torque in Newton-meters at 60°/sec;

APF60: Ankle plantarflexor peak torque in Newton-meters at 60°/sec.

modified PPT: modified Physical Performance Test;

ALM: appendicular lean mass;

SMI: skeletal muscle index

Table 4Correlation (r) between sarcopenic indices (ALM/ht² and SMI) with strength and functional measures

Measures	Women ALM/ht ² r	Women SMI r	Men ALM/ht ² r	Men SMI r
modified PPT Score	.018	.085	-.011	.094
Walking Speed (m/min)	-.012	.037	-.129	-.039
KE60	.395 *	.187	.230	.076
KF60	.289 *	.096	.138	.183
ADF60	.423 *	.178	.064	-.148
APF60	.250	.068	.059	-.240

*
p<.05;

KE60: Knee extensor peak torque in Newton-meters at 60°/sec;

KF60: Knee flexor peak torque in Newton-meters at 60°/sec;

ADF60: Ankle dorsiflexor peak torque in Newton-meters at 60°/sec;

APF60: Ankle plantarflexor peak torque in Newton-meters at 60°/sec.;

modified PPT: modified Physical Performance Test;

ALM: appendicular lean mass;

ALM/ht²: appendicular lean mass/height²; SMI: skeletal muscle index;