ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 13, Issue, 02, pp. 61806-61812, February, 2023
https://doi.org/10.37118/ijdr.26292.02.2023

RESEARCH ARTICLE

OPEN ACCESS

RELATIONSHIP BETWEEN ADDUCTOR POLLICIS MUSCLE THICKNESS AND FUNCTIONAL CAPACITY IN OLDER PEOPLE

E'lida de Andrade Barboza Souza*[1], Shirley Tavares de Oliveira[1], Renata Reis de Lima e Silva[2], Andréia Lira Santos[3], Keila Fernandes Dourado[4], Edilson Fernandes de Souza[5] and Rogerio Dubosselard Zimmermann[6]

[1]Postgraduate Program in Gerontology, Federal University of Pernambuco – Recife, Pernambuco, Brazil; [2]Master in Nutrition, Hospital Otávio de Freitas – Recife, Pernambuco, Brazil; [3]Master in Surgery, Hospital Otávio de Freitas – Recife, Pernambuco, Brazil; [4]Associate Professor, Department of Nutrition,Federal University of Pernambuco –Vitória de Santo Antão, Pernambuco, Brazil; [5]Professor-Doctor, Department of Physical Education,Federal University of Pernambuco – Recife, Pernambuco, Brazil; [6]Professor-Doctor, Postgraduate Program in Gerontology,Federal University of Pernambuco – Recife, Pernambuco, Brazil

ARTICLE INFO

Article History:

Received 09th January, 2023
Received in revised form
29th January, 2023
Accepted 02nd February, 2023
Published online 28th February, 2023

KeyWords:

Adductor pollicis muscle thickness;
Activities of daily living; aged;
Nutrition assessment.

Corresponding author:
E'lida de Andrade Barboza Souza

ABSTRACT

Adductor pollicis muscle thickness (APMT) has been used as a marker of muscle mass, which is influenced by the physiological changes of aging, and it is interesting to investigate its relationship with functional capacity in older people. The objective was to analyze the relationship APMT and functional capacity. Men and women $\geq$ 60 years of age were recruited from a geriatric clinic. Data were collected on sociodemographic characteristics, anthropometric measures and APMT, dependence on activities of daily living. A p-value <0.05 was considered indicative of a statistically significant association. One hundred thirty-nine older people participated. Mean APMT was 12.96 ± 3.20 mm for the dominant hand and 12.09 ± 3.11 mm for the non-dominant hand and was larger in men. Most (58.3%) of the participants were independent regarding the performance of activities of daily living. Lower functional capacity score was found in individuals with APMT below the cutoff point ($p = 0.019$). The findings lend strength to the use of APMT as a complementary measure for nutritional assessments and the importance of preserving muscle mass and preventing malnutrition in older people.

Citation: ***E'lida de Andrade Barboza Souza, Shirley Tavares de Oliveira, Renata Reis de Lima e Silva, Andréia Lira Santos, Keila Fernandes Dourado, Edilson Fernandes de Souza and Rogerio Dubosselard Zimmermann. 2023.*** "Relationship between adductor pollicis muscle thickness and functional capacity in older people*", International Journal of Development Research*, 13, (02), 61806-61812.

INTRODUCTION

The human aging process is dynamic, progressive, closely linked to biological, psychological and social factors and manifests in a peculiar, individual way (de Araújo *et al*., 2019). The transformations inherent to the aging process contribute to a decline in functional capacity, which is the capacity to plan and execute the activities of daily living necessary for an independent life and self-care (Poubel *et al*., 2017). The apex of functional capacity is reached at the onset of adulthood, when muscle strength and cardiorespiratory functions are optimal. Subsequent decline is evitable and the rate of decline is influenced by age as well as modifiable factors, such as lifestyle, and external variables (Degens, 2007). Changes due to aging occur in all systems and organs and exert a significant effect on nutritional status (Santos *et al*., 2010).

Progressive metabolic changes in body composition are among the most important, such as the accumulation of fat, especially in the abdominal region, and the loss of lean mass (Al-Sofiani *et al*., 2019). Such conditions can lead to greater susceptibility to illness and the need for adjustments in nutrient intake in older people (Moreira & Villas Boas, 2011). Nutritional status plays an important role in the health and quality of life. Specifically in this age group, malnutrition is strongly associated with the increase in functional disability and number of hospitalizations, a reduction in quality of life, greater susceptibility to infections and, consequently, an increase in mortality (De Sousa *et al*., 2014). The notable age-related loss of muscle mass contributes to other changes, such as reductions in bone density, insulin sensitivity, aerobic capacity, basal metabolic rate, muscle strength and levels of daily physical activities (Mantovani *et al*., 2018). Thus, nutritional changes characteristic of the aging process are closely linked to functional capacity. Different tools with different degrees of precision – from anthropometrics to magnetic resonance – are used to measure body composition to evaluate muscle and/or fat mass. Lameu *et al*. (2004a) suggest the measurement of adductor pollicis muscle thickness (APMT), which is a simple, noninvasive, low-cost procedure. Due to its anatomic configuration, this is the only measure that can be determined directly without the need for equations or adjustments for the estimate of its real value, which distinguishes APMT from other anthropometric measures for the evaluation of muscle mass. This measure also is only minimally affected by subcutaneous fat (Pereira *et al*., 2018). The loss of tonicity of the adductor pollicis muscle as a result of the reduction in labor activities, muscle atrophy, underlying disease or a critical health state directly affects its thickness (de Melo & Silva, 2014). Therefore, the APMT has been used as a promising marker of muscle mass and can assist in the early diagnosis of malnutrition (Valente *et al*., 2016). Low APMT values have been associated with an increase in hospital stay and infectious complications, which demonstrates its association with malnutrition (El Kik *et al*., 2017). Despite the relevance of the studies cited above, investigations involving a sample composed specifically of older people are scarce. As APMT is a simple measure with a proven relationship to muscle mass and reliable for the diagnosis of malnutrition, the primary aim of the present study was to analyze the relationship between APMT and functional capacity in older people recruited from an outpatient clinic. The secondary aim was to assess the nutritional status of the sample using other nutritional indicators and determine the relationship with functional capacity.

MATERIAL AND METHODS

Study and sample: A cross-sectional study with a quantitative approach was conducted at the geriatric clinic of a public hospital in northeast Brazil. Data collection took place between January and June 2021. The sample was composed of male and female individuals 60 years of age or older. Individuals with physical or cognitive incapacity to answer the questionnaire and without an accompanier to answer for them were excluded. Those with impairment of the upper or lower limbs that impeded the measurements were also excluded. Considering a population of 229 outpatients registered at the clinic, an expected 37% rate of dependence regarding the performance of basic activities of daily living (BADLs) (Minosso *et al*., 2010), a 5% acceptable error rate and 95% confidence level, a minimum of 140 individuals was needed for a representative sample.

Data collection: Data collection was performed using a questionnaire completed by the patient or accompanier (if the patient did not have adequate physical or cognitive capacity). The data of interest were sociodemographic characteristics (sex, age, self-declared race/skin color, family income, schooling, marital status and occupation), nutritional status, APMT and functional capacity.

Measures of nutritional status : The measures of nutritional status were calf circumference (CC), arm circumference (AC), tricipital skinfold (TSF) and corrected arm muscle area (AMAc). CC was measured at the broadest part of the muscle using a flexible, non-extensible metric tape, with the leg flexed at a 90° angle; reference values for adequate nutrition were ≥ 33 cm for women and ≥ 34 cm for men (Pagotto *et al*., 2018). AC was measured with the participant in the standing position and the elbow of the non-dominant upper limb flexed at 90°. The midpoint between the acromion and olecranon was marked. The arm was then extended parallel to the body with the palm turned toward the thigh. The measurement was made in centimeters on a horizontal plan of the marked point without extreme compression (Harrison *et al*., 1988). On the same point where AC was measured, TSF was measured in millimeters with the aid of analog calipers (brand: Cescorf®), considering the mean of three measurements (Harrison *et al*., 1988). This value was then used for the determination of AMAc in cm2 using the formulas proposed by Heymsfield *et al*. (1982):

Men	[AC (cm) – π × TSF (mm) ÷ 10]2 ÷ 4π - 10
Women	[AC (cm) – π × TSF (mm) ÷ 10]2 ÷ 4π – 6.5

AC and AMAc values were compared with standard values published in the US National Health and Nutrition Examination Survey (NHANES III, 1988 – 1994) (Kuczmarski *et al*., 2000) displayed in percentile tables and classified according to Blackburn and Thornton (1979).

Adductor pollicis muscle thickness: For the determination of APMT, the participant remained in the sitting position with the upper arm flexed at approximately 90° to the forearm and the hand relaxed and supported on the knee. Analog calipers were used to pinch the adductor muscle at the vertex of an imaginary triangle formed by the extension of the thumb and index finger, as described by Lameu *et al*. (2004a). APMT was measured on both the dominant and non-dominant hand three times and the mean of each hand was considered in the analysis. The cutoff points for low APMT were those suggested by AnjosVaez *et al*. (2021): < 17.63 mm for women and < 18.51 mm for men.

Functional capacity: Functional capacity was evaluated using the Barthel Index, which has been validated for use in Brazil. This index is used to determine the degree of dependence (any need for physical or verbal assistance) on the performance of ten BADLs: bathing, dressing, personal hygiene, using a toilet, moving from wheelchair to bed and vice versa, bladder control, bowel control, feeding, walking, and going up and down stairs (Mahoney &Barthel, 1965; Minosso *et al*., 2010). The accompanier could answer the questionnaire if the participant was unable to do so. The score ranges from 0 to 100 points and is used for the classification of dependence: < 20 points = complete dependence; 20 to 35 points = severe dependence; 40 to 55 points = moderate dependence; 60 to 95 points = mild dependence; > 95 = independence (Mahoney &Barthel, 1965).

Statistical analysis: Normality of continuous variables was analyzed using the Kolmogorov-Smirnov test. Variables with normal distribution were expressed as mean and standard deviation and those with non-normal distribution were expressed as median and interquartile range. For the description of proportions, binomial distribution was approximated to normal distribution using the 95% confidence interval. Comparisons between two means were performed using the Student's t-test when the criteria of homoscedasticity and normal distribution were met. The Mann-Whitney U test and Kruskal-Wallis test were used for the comparison of two and three medians, respectively, when the criteria of homoscedasticity and/or normal distribution were not met.

Ethical aspects: This research was approved by the Researchs Ethics Committee and data collection was only initiated after the signing of the statement of informed consent by the participant or legal guardian.

RESULTS

The sociodemographic characteristics of the participants are displayed in Table 1. The sample was composed of 139 individuals with a mean age of 74.3 ± 8 years and a predominance (77%). Due to the pandemic caused by the new coronavirus SARS-CoV-2 (COVID-19), the scheduling of further patients was suspended and many individuals did not appear for the evaluation. Among the participants, 58.7% hadself-declared brown skin color, 43.9% were married, 59% reported having between five and eight years of schooling, 40% had a family income of less than the monthly minimum wage and 74.2% were retired or received pension benefits. Mean APMT was 12.96 ± 3.20 mm for the dominant hand and 12.09 ± 3.11 mm for the non-dominant hand. These values were significantly higher for men: 14.60 ± 3.85 for the dominant hand (p = 0.001) and 13.23 ± 3.89 mm for the non-dominant hand (p = 0.018) (Table 2).

The Barthel Index score for the evaluation of functional capacity was higher than 95 points among 58.3% of the participants, corresponding to independence on the performance of BADLs. A total of 35.3% of the participants had mild dependence, with impairment on at least one of the activities evaluated (Table 3).

Table 1. Sociodemographic characteristics of participants (n=139)

Sociodemographic characteristics	n	%	$CI_{95\%}$
Sex			
Female	107	77.0	70.0 – 84.0
Male	32	23.0	16.0 – 30.0
Self-declared race			
White	35	25.4	18.1 – 32.6
Black	13	9.4	4.6 – 14.3
Yellow	6	4.3	1.0 – 7.8
Brown	81	58.7	50.5 – 66.9
Indigenous	3	2.2	0.0 – 4.6
Marital status			
Married	61	43.9	35.6 – 52.1
Single	28	20.1	13.5 – 26.8
Widowed	41	29.5	21.9 – 37.1
Divorced/separated	9	6.5	2.4 – 10.6
Schooling (years of study)			
<5	23	16.5	10.4 – 22.7
5-8	82	59.0	50.8 – 67.2
9	10	7.2	2.9 – 11.5
10-11	2	1.4	0.0 – 3.4
12 years of study	19	13.7	8.0 – 19.4
>12	3	2.2	0.0 – 4.6
Employment status			
Homemaker	27	19.4	12.2 – 26.0
Employed	7	5.0	1.4 – 8.7
Unemployed	2	1.4	0.0 – 3.4
Retired/pension recipient	103	74.2	66.8 – 81.4
Family income			
< monthly minimum wage	56	40.3	32.1 – 48.4
1-2 xmonthly minimum wage	50	36.0	28.0 – 44.0
2-3 xmonthly minimum wage	23	16.5	10.4 – 22.7
>3 xmonthly minimum wage	6	4.3	0.9 – 7.7
Not reported	4	2.9	0.1 – 5.7

Note: $CI_{95\%}$= 95% confidence interval

Table 2. Adductor pollicis muscle thickness of dominant and non-dominant hand

		Sex		p*
	Sample (n=139) Mean ± SD (mm)	Women (n=107) Mean ± SD (mm)	Men (n=32) Mean ± SD (mm)	
APMT-dominant	12.96 ± 3.20	12.46 ± 2.81	14.60 ± 3.85	0.001
APMT - non-dominant	12.09 ± 3.11	11.75 ± 2.77	13.23 ± 3.89	0.018

Note: SD = standard deviation; APMT = adductor pollicis muscle thickness; *Student's t-test

Table 3. Classification of dependence on basic activities of daily living according to Barthel Index

Classification	n	%	$CI_{95\%}$
Complete dependence (<20 points)	2	1.4	0.0 – 3.4
Severe dependence (20-35 points)	4	2.8	0.1 – 5.7
Moderate dependence (40-55 points)	3	2.2	0.0 – 5.6
Mild dependence (60-95 points)	49	35.3	27.3 – 43.2
Independence (>95 points)	81	58.3	50.1 – 66.5

Note: $CI_{95\%}$= 95% confidence interval

The classification of nutritional status according to each anthropometric measure is displayed in Table 4. A predominance of adequate nutritional status was found for all measures (CC = 62.6%; AC = 47.5%; AMAc = 78.4%), except APMT for both hands, which was classified as low based on the established cutoff point. In the analysis of the association between the Barthel Index score and nutritional status, individuals classified as malnourished by the CC (p = 0.024) and those with low APMT on the dominant hand (p = 0.019) had lower scores on the performance of BADLs compared to those with adequate CC and normal APMT. No association was found between the median score for BADLs and nutritional status using the other nutritional indicators (Table 5).

Table 4. Classification of nutritional status according to different anthropometric measures

Anthropometric measures	n	%	$CI_{95\%}$
Calf circumference[a]			
Malnutrition	52	37.4	29.4 – 45.4
Adequate	87	62.6	54.5 – 70.6
Arm circumference[b]			
Severe malnutrition	4	2.8	0.1 – 5.7
Moderate malnutrition	10	7.2	2.9 – 11.5
Mild malnutrition	30	21.6	14.7 – 28.4
Adequate	66	47.5	29.2 – 55.8
Overweight	14	10.1	5.1 – 15.1
Obesity	15	10.8	5.6 – 15.9
Corrected arm muscle area[c]			
Severe malnutrition	14	10.1	5.1 – 15.1
Mild/moderate malnutrition	16	11.5	6.2 – 16.8
Adequate	109	78.4	71.6 – 85.3
APMT – dominant hand			
Low[d]	131	94.2	90.4 – 98.1
Normal	8	5.8	1.9 – 9.6
APMT - non-dominant hand			
Low[d]	134	96.4	93.3 – 99.5
Normal	5	3.6	0.5 – 6.7

Note: $CI_{95\%}$= 95% confidence interval; [a]Malnutrition (<33 cm for women and <34 cm for men) andadequate (≥33 cm for women and ≥34 cm for men); [b]Severe malnutrition (%adequacy: <70%),moderate malnutrition (%adequacy: 70-80%),mild malnutrition (%adequacy: 81-90%),adequate (%adequacy: 91-110%),overweight (%adequacy: 111-120%),obesity (%adequacy> 120%); [c]Severe malnutrition (<5th percentile),mild/moderate malnutrition (between 5th and 15th percentile) and adequate (>15th percentile);[d]APMT= adductor pollicis muscle thickness (<17.63mm for women and <18.51mm for men).

Table 5. Associations between Barthel Index score and classification of nutritional status using different anthropometric measures

Nutritional indicators	Barthel Index		p*
	n	Median (IQR)	
Calf circumference[a]			
Malnutrition	52	97.5 (86.2 – 100.0)	0.024
Adequate	87	100.0 (95.0 – 100.0)	
Corrected arm muscle area[b]			
Malnutrition	30	97.5 (88.8 – 100.0)	0.155
Adequate	109	100.0 (95.0 – 100.0)	
APMT – dominant hand			
Normal	8	100.0 (100.0 – 100.0)	0.019
Low	131	100.0 (90.0 – 100.0)	
APMT – non-dominant hand			
Normal	5	100.0 (100.0 – 100.0)	0.066
Low[c]	134	100.0 (93.8 – 100.0)	
Arm circumference[d]			
Malnutrition	44	100.0 (90.0 – 100.0)	0.886**
Adequate	66	100.0 (95.0 – 100.0)	
Excess weight	29	100.0 (95.0 – 100.0)	

Note: IQR = interquartile range; [a]Malnutrition (<33 cm for women and <34 cm for men) andadequate (≥33 cm for women and ≥34 cm for men); [b]Severe malnutrition(<5th percentile),mild/moderate malnutrition (between 5th and 15th percentile) and adequate (>15th percentile);[c]APMT= adductor pollicis muscle thickness (<17.63mm for women and <18.51mm for men); [d]Severe malnutrition (%adequacy: <70%),moderate malnutrition (%adequacy: 70-80%),mild malnutrition (%adequacy: 81-90%),adequate (%adequacy: 91-110%),overweight (%adequacy: 111-120%),obesity (%adequacy> 120%); degrees of malnutrition were grouped; overweightand obesity were grouped. * Mann-Whitney U test; **Kruskal-Wallis test.

DISCUSSION

Studies evaluating adductor pollicis muscle thickness (APMT) in a sample composed exclusively of older people in outpatient care are scarce. Studying healthy individuals, Lameu *et al*. (2004) found that the mean APMT among those > 65 was 10.9 ± 2.6 mm (11.73 ± 2.95 mm for men and 10.24 ± 2.16 mm for women). Gonzalez *et al*. (2010) found higher means for healthy older people (≥ 60 years of age): 23.9 ± 4.44 for men and 18.7 ± 3.30 for women. Despite the differences, both studies found higher means among individuals in the adult phase, demonstrating a tendency toward a reduction in APMT with the advance in age. A similar result was reported by El Kik *et al.* (2017), who found an inverse, albeit weak, correlation between age and APMT in hospitalized older people, with higher APMT values in the younger group (60 to 79 years of age). The authors attributed the finding to the reduction in lean mass that occurs during the aging process and malnutrition, which is common among hospitalized patients. Skeletal muscle composition is influenced by testosterone levels. Thus, men often have greater muscle density compared to women, which explains the higher APMT values in the male sex (Pereira *et al*., 2018), as found in studies involving populations of adults and individuals in different clinical situations (Bielemann *et al*., 2016; Freitas *et al*., 2010). Regarding the divergences in the values found in the present investigation and the studies cited above, other variables may exert an influence on APMT, such as bone complexion, the execution of manual labor, race/ethnicity, nutritional status and health of the individuals evaluated as well as methodological inadequacies and differences among the instruments used for the measurement (Bielemann *et al*., 2016; Bragagnolo *et al*., 2009; Cyrino *et al*., 2003; Gonzalez *et al*., 2010; Lameu, Gerude, Corrêa, *et al*., 2004). In the assessment of functional capacity, more than half of the sample (58.3%) was classified as independent for the performance of BADLs. Similar results have been reported in previous studies. For instance, Velasco-Hernández *et al*. (2019) and Ghimire *et al*. (2021) found rates of independence of 59.4% and 91.6%, respectively, in their samples. Previous studies also used the Barthel Index for the evaluation of functional capacity and reported greater independence on activities of daily living (Araya *et al*., 2018; Predebon *et al*., 2021). The greater frequency of independent older people found in these studies may be explained by the fact that the participants were in follow-up on a secondary level of care, with a degree of complexity that did not yet exert an important impact on the execution of tasks. However, a substantial portion of the sample was classified as having mild dependence (35.3%), corresponding to impairment on at least on BADL. Evaluating functional capacity of older people in a geriatric outpatient clinic of a university hospital in the same region of the country at that of the present investigation, Ferreira *et al*. (2019) found that 53.3% had mild dependence and 28% were classified as independent. On the global scale, more than 45% of individuals 60 years of age or older have difficulty performing activities of daily living and this condition has a negative impact on health, quality of life, self-care and self-esteem, with a reduction in the desire to live and an increased risk of falls, violence and institutionalization (Ferreira *et al*., 2019). Thus, the determination of health status in the older population should not only consider the absence of disease, but also a satisfactory degree of functional independence. Thus, adequate functioning is one of the most important components of healthy aging (Pinto Junior *et al*., 2016).

Changes in nutritional status are common among older people and several external factors can exert an influence on this aspect, such as schooling, comorbidities, inadequate food intake and drug treatments (Sagarra-Romero *et al*., 2017). Anthropometric indicators are easy to use and recommended for application on a large scale in clinical practice for the diagnosis of nutritional status and tracking changes over time (Pinheiro *et al*., 2020). Such measures are essential in geriatric evaluations for detecting syndromes, such as frailty and sarcopenia (Cheung *et al*., 2018). The classification of nutritional status varies depending on the method employed. The Mini Nutritional Assessment and body mass index (BMI) are frequently employed in studies involving older people and are validated tools for the identification of the risk of malnutrition and the classification of nutritional status (Alhamadan *et al*., 2019). In this population, however, significant rates of malnutrition may be found with BMI values considered indicative of overweight or obesity (Bahat *et al*., 2012). CC, AC and AMAc were chosen for the present study, as these anthropometric measures have a good relationship with muscle mass, enable the early detection of malnutrition and sarcopenia and are significantly correlated with APMT (Lameu *et al*., 2004; Pagotto *et al*., 2018; Pereira *et al*., 2018; Tey *et al*., 2021). Moreover, these measures can be performed on individuals who are unable to walk, which is a limiting factor for the measurement of body weight. CC is a good indicator of muscle mass because the lower limbs contain more than half of the muscle mass of the body and are indirectly impacted by malnutrition or inactivity, whereas AC better reflects subcutaneous fat and later changes in muscle mass (Bahat *et al*., 2012). However, few studies have used these same anthropometric measures with older people in outpatient care, which hinders comparisons to the present results. Evaluating the nutritional status of Colombian older people, Otero and Estrada (2017) found no significant changes in CC or AC that would indicate malnutrition. Analyzing a sample of patients admitted for elective surgery, 79.1% of whom were older people, Costa *et al*. (2021) found that approximately 90% of the patients had low APMT in both hands, although the BMI indicated that 47.9% of the sample had adequate weight and 41.1% were overweight. The authors also found a significant correlation between APMT and CC, demonstrating the usefulness of these two measures in clinical practice. Regarding the frequency of individuals with APMT below the cutoff point, considerable variability is found in this percentage depending on the type of classification used due mainly to the population studied. As mentioned above, Lameu *et al*. (2004) studied healthy adults and older people and furnished the first estimates for APMT, suggesting a mean of 12.5 mm for men and 10.5 mm for women, whereas Gonzalez *et al*. (2010) found a mean of 26.1 mm for men and 19.8 mm for women in a sample with similar characteristics. In adult candidates for major surgery of the gastrointestinal tract, the best APMT cutoff point for malnutrition was 13.4 mm for the dominant hand and 13.1 mm for the non-dominant hand (Bragagnolo *et al*., 2009). In hospitalized cancer patients, Weschenfelder and Salgueiro(2020) found 13.2 mm and 13.3 mm for APMT of the dominant and non-dominant hand, respectively, whereas Aguiar *et al*. (2018) suggest 12.8 mm. Evaluating the association between APMT and nutritional status in older people undergoing conservative treatment for chronic kidney disease, Pereira *et al*. (2019) proposed cutoff points of 15.3 mm for women and 20.33 mm for men as indicative of the depletion of muscle mass. However, the authors reported that the prevalence of excess weight was high in the sample, which may have led to an overestimation of these values.

The cutoff points proposed by AnjosVaez *et al*. (2021) were used in the present investigation (17.63 mm for women and 18.51 mm for men), as these values were from a recent study conducted with a sample composed exclusively of Brazilian community-dwelling older adults, which as closer to the profile of our sample. Despite this, the mean APMT values found were much lower that the established cutoff points, as demonstrated by the high prevalence of participants classified as having low APMT (> 90%). This underscores the need for further studies that analyze cutoff points for APMT associated with malnutrition in a sample composed exclusively of non-hospitalized older people while respecting regional differences and faithfully reflecting contextual aspects. The divergences in the findings also underscore the importance of performing nutritional assessments of older people using a combination of anthropometric measures to enable the detection of nutritional risk and malnutrition as well as other conditions, such as sarcopenia. Significant associations were found between the AVBD score and the anthropometric measures CC and APMTD. A negative correlation is reported between nutritional status and functional disability (Kanwal *et al*., 2018). Tsai and Chang (2017) found that higher CC values were associated with a better functional performance and reflected functional capacity more precisely than BMI or AC. Sun *et al*. (2017) found a significant inverse association between CC and functional disability in a sample of Americans between 60 and 84 years of age, suggesting its use as a tool for assessing the risk of disability in this population. A longitudinal study involving Brazilian older people found the loss of muscle mass determined based on CC and functional decline during the follow-up period, but the association between the variables was non-significant (Moreira *et al*., 2016). In contrast, Yang *et al*. (2021) found that the likelihood of disability regarding BADLs in a Chinese cohort diminished by 10% for each 1-cm increase in CC. The findings confirm the fact that muscle mass is predictive of the decline in BADLs (Wang *et al*., 2020) and lend strength to the use of CC as a marker of muscle mass in older people. The maintenance of muscle mass (reflected in larger CC values) is important to the prevention of disability regarding activities of daily living. Likewise, APMT has been reported to be a good predictor of lean mass (Bielemann *et al*., 2016; Cobero *et al*., 2012) and has been associated with different clinical conditions (Caporossi *et al*., 2012; El Kik *et al*., 2018). However, no previous studies have evaluated its relationship with functional capacity in older people.

Individuals with lower muscle markers are more likely to be dependent regarding activities of daily living, as more difficult tasks require greater muscle strength. The reduction in muscle mass is explained by different factors, such as the reduction in the innervation of alpha motor neurons, lower protein intake and lower physical activity level (Wang *et al*., 2020). APMT is not influenced only by the quantity of skeletal muscle mass, but also other factors, such as muscle complexion, with a progressive increase in individuals with a small, medium and large body structure (Lameu *et al*., 2004). One's occupation has also been associated with APMT and can exert a positive influence on this measure, whereas muscle atrophy reflects the loss of labor activities (Gonzalez *et al*., 2010). The presence of malnutrition and a base disease can cause a reduction in the performance of daily activities and possible catabolism, resulting in the progressive reduction in APMT (Caporossi *et al*., 2012). The present findings showed that APMT in the dominant hand below the cutoff point was related to a lower median score on BADLs. As the dominant hand is used more in the execution of daily activities, changes in the muscle compartment of this region can exert an influence on performance and dependence regarding these activities in a significant, accentuated manner. Moreover, the reduction in labor tasks and daily activities can contribute to muscle atrophy, consequently leading to a reduction in APMT.

Limitations: The present study has limitations that should be considered. The lack of previous studies on APMT and functional capacity in older people in outpatient care hinders comparisons with the results encountered. Moreover, the cross-sectional design limitedthe evaluation of some of the variables collected and impedes an analysis of possible relationships of causality.

CONCLUSION

Based on an analysis of the current literature, this is the first study to evaluate the relationship between APMT and functional capacity in older people, offering new information on this anthropometric measure. Most participants had an adequate nutritional status and were independent with regards to the performance of basic activities of daily living. Individuals with APMT below the cutoff point had a lower median score for BADLs, underscoring the importance of the prevention of malnutrition and the preservation of muscle mass in this population.

REFERENCES

Aguiar, A. P. N., Araripe, T. S. de O., Dantas, M. C., Ricarte, J. R. O., Cabral, N. de S. G., Silva, L. S., Castro, H. S. de, & Mendonça, P. da S. (2018). Adductor pollicis muscle thickness: A sensitive method in the detection of nutritional risk in onco-hematological patients. *Nutricion Clinica y Dietetica Hospitalaria,* 38(4), 183–188. https://doi.org/10.12873/384 nogueira-aguiar

Al-Sofiani, M. E., Ganji, S. S., & Kalyani, R. R. (2019). Body composition changes in diabetes and aging. Journal of Diabetes and Its Complications, 33(6), 451–459. https://doi.org/10.1016/ j.jdiacomp.2019.03.007

Alhamadan, A. A., Bindawas, S. M., Alshammari, S. A., Al-Amoud, M. M., Al-Orf, S. M., Al-Muammar, M. N., & Calder, P. C. (2019). Prevalence of malnutrition and its association with activities of daily living in older adults attending primary health care centers: A multistage cross-sectional study. Progress in Nutrition, 21(4), 1011–1018. https://doi.org/10.23751/pn.v21i4. 8381

Anjos Vaez, I. dos, da Silva, H. F., de Arruda, W. S. C., Pexe-Machado, P. A., Fontes, C. J. F., de Aguilar-Nascimento, J. E., & Dock-Nascimento, D. B. (2021). Effectiveness of adductor pollicis muscle thickness as risk marker for sarcopenia in Central-West Brazilian elderly communities. *Nutrition,* 83. https://doi.org/10.1016/j.nut.2020.111054

Araya, A. X., Herrera, M. S., Iriarte, E., & Rioja, R. (2018). Evaluación de la funcionalidad y fragilidad de las personas mayores asistentes a centros de día. *Revista Médica de Chile,* 146(8), 864–871. https://doi.org/10.4067/s0034-98872018000 800864

Bahat, G., Tufan, F., Saka, B., Akin, S., Ozkaya, H., Yucel, N., Erten, N., & Karan, M. A. (2012). Which body mass index (BMI) is better in the elderly for functional status? Archives of Gerontology and Geriatrics, 54(1), 78–81. https://doi.org/10. 1016/j.archger.2011.04.019

Bielemann, R. M., Horta, B. L., Orlandi, S. P., Barbosa-Silva, T. G., Gonzalez, M. C., Assunção, M. C., & Gigante, D. P. (2016). Is adductor pollicis muscle thickness a good predictor of lean mass in adults? *Clinical Nutrition*, 35(5), 1073–1077. https://doi.org/ 10.1016/j.clnu.2015.07.022

Blackburn, G.L., & Thornton, P.A. (1979). Nutritional assessment of the hospitalizes patients. Medical Clinics of North America, 63

Bragagnolo, R., Caporossi, F. S., Dock-Nascimento, D. B., & Aguilar-Nascimento, J. E. de. (2009). Espessura do músculo adutor do polegar: um método rápido e confiável na avaliação nutricional de pacientes cirúrgicos. *Revista Do Colégio Brasileiro de Cirurgiões,* 36(5), 371–376. https://doi.org/10.1590/S0100-69912009000500003

Caporossi, F. S., Caporossi, C., Borges Dock-Nascimento, D., & de Aguilar-Nascimento, J. E. (2012). La medición del espesor del músculo aductor del pulgar como un predictor de resultados en pacientes críticamente enfermos. *Nutricion Hospitalaria,* 27(2), 490–495. https://doi.org/10.3305/nh.2012.27.2.5514

Cheung, J. T. K., Yu, R., Wu, Z., Wong, S. Y. S., & Woo, J. (2018). Geriatric syndromes , multimorbidity , and disability overlap and increase healthcare use among older Chinese. *BMC Geriatrics,* 1–8.

Cobero, F., Gomes, M., Silva, A., Bernardi, J., & Mclellan, K. (2012). A medida do músculo adutor do polegar está associada com indicadores antropométricos de avaliação. Nutrire: *Rev. Soc. Bras. Alim. Nutr. = J. Brazilian Soc. Food Nutr., São Paulo,* SP, 37(2), 174–182.

Cyrino, E. S., Okano, A. H., Glaner, M. F., Romanzini, M., Gobbo, A., Makoski, A., Bruna, N., Cordeiro, J., Melo, D., & Neri, G. (2003). Impacto da utilização de diferentes compassos de dobras cutâneas para a análise da composição corporal. *Revista Brasileira de Medicina Do Esporte,* 9, 145–149.

de Araújo, G. K. N., Souto, R. Q., Alves, F. A. P., de Sousa, R. C. R., Ceballos, A. G. da C. de, Santos, R. da C., Lyra, É. V. de V., & Nogueira, R. T. de A. (2019). Capacidade funcional e fatores associados em idosos residentes em comunidade. *Acta Paulista de Enfermagem,* 32(3), 312–318. https://doi.org/ http://dx.doi.org/ 10.1590/1982- 0194201900043

de Melo, C. Y. S. V., & Silva, S. A. (2014). MÚSCULO ADUTOR DO POLEGAR COMO PREDITOR DE DESNUTRIÇÃO EM PACIENTES CIRÚRGICOS. *ABCD Arquivos Brasileiros de Cirurgia Digestiva,* 27(1), 13–17.

De Sousa, K. T., De Mesquita, L. A. S., Pereira, L. A., & Azeredo, C. M. (2014). Baixo peso e dependência functional em idosos institucionalizados de uberlândia (MG), Brasil. *Ciencia e Saude Coletiva,* 19(8), 3513–3520. https://doi.org/10.1590/1413-81232014198.21472013

Degens, H. (2007). Age-related skeletal muscle dysfunction: Causes and mechanisms. *Journal of Musculoskeletal Neuronal Interactions,* 7(3), 246–252.

El Kik, R. M., Dorneles, T. de C., & Schwanke, C. H. A. (2018). Association between adductor pollicis muscle thickness and nutritional parameters in hospitalized elderly patients. *Nutrición Hospitalaria,* 35(5), 1059–1065. https://doi.org/ http://dx.doi.org/ 10.20960/nh.1739

El Kik, R. M., Raasch, J., Da Rosa, M. C., Gomes, I., & Schwanke, C. H. A. (2017). Espessura do músculo adutor do polegar em idosos hospitalizados: relação com sexo e idade. *Ciência & Saúde,* 10(4), 226. https://doi.org/10.15448/1983-652x.2017.4.27082

Ferreira, G. R. S., Costa, T. F. da, Pimenta, C. J. L., Silva, C. R. R. da, Bezerra, T. A., Viana, L. R. de C., & Costa, K. N. de F. M. (2019). Functional Capacity and Stressful Events in Elderly Population. *Reme Revista Mineira de Enfermagem,* 23, 1–6. https://doi.org/10.5935/1415-2762.20190086

Freitas, B. de J. e S. de A., Mesquita, L. C., Teive, N. de J. V., & Souza, S. R. de. (2010). Antropometria Clássica e Músculo Adutor do Polegar na Determinação do Prognóstico Nutricional em Pacientes Oncológicos. *Revista Brasileira de Cancerologia,* 56(4), 415–422. https://doi.org/10.32635/2176-9745.rbc.2010v56n4.1462

Ghimire, S., Paudel, G., Mistry, S. K., Parvez, M., Rayamajhee, B., Paudel, P., Tamang, M. K., & Yadav, U. N. (2021). Functional status and its associated factors among community-dwelling older adults in rural Nepal: findings from a cross-sectional study. *BMC Geriatrics,* 21(1), 1–8. https://doi.org/10.1186/s12877-021-02286-8

Gonzalez, M. C., Duarte, R. R. P., & Budziareck, M. B. (2010). Adductor pollicis muscle : Reference values of its thickness in a healthy population q. *Clinical Nutrition,* 29(2), 268–271. https://doi.org/10.1016/j.clnu.2009.08.012

Harrison, G.G., Buskirk, R.E., Carter, J.E.L., Johnston, F.E., Lohman, T.G., Pollock, M.L., Roche, A.F., Wilmore, J.H. (1988). Skinfold thicknesses. In: LOHMAN, T.G; ROCHE A.F; MARTORELL, R.[editors]. Anthropometric Standardization Reference Manual. Champaign: Human Kinetics, 55-80

Heymsfield, S. B., McManus, C., Smith, J., Stevens, V., & Nixon, D. W. (1982). Anthropometric measurement of muscle mass: Revised equations for calculating bone-free arm muscle area. *American Journal of Clinical Nutrition,* 36(4), 680–690. https://doi.org/10.1093/ajcn/36.4.680

Kanwal, S., Qidwai, W., & Nanji, K. (2018). Relationship of Nutritional Status and Functional Capacity in Elderly Patients Visiting Outpatient Clinics of a Tertiary Care Hospital. *Journal of the College of Physicians and Surgeons Pakistan,* 28(7), 509–513. https://doi.org/10.29271/jcpsp.2018.07.509

Kuczmarski, M. F., Kuczmarski, R. J., & Najjar, M. (2000). Descriptive anthropometric reference data for older Americans. In *Journal of the American Dietetic Association* (Vol. 100, Issue 1, pp. 59–66). https://doi.org/10.1016/S0002-8223(00)00021-3

Lameu, E. B., Gerude, M. F., Campos, A. C., & Luiz, R. R. (2004). The thickness of the adductor pollicis muscle reflects the muscle compartment and may be used as a new anthropometric parameter for nutritional assessment. *Current Opinion in Clinical Nutrition and Metabolic Care,* 293–301. https://doi.org/10.1097/01.mco.0000126349.18989.aa

Lameu, E. B., Gerude, M. F., Corrêa, R. C., & Lima, K. A. (2004). Adductor pollicis muscle: a new anthropometric parameter. *Revista Do Hospital Das Clínicas,* 59(2), 57–62. https://doi.org/10.1590/s0041-87812004000200002

Mahoney, F.I. & Barthel, D. (1965). Functional evaluation: the Barthel Index. Maryland. *State Medical Journal*, 14, 61-65

Mantovani, L. M., Viebib, R. F., & Morimoto, J. M. (2018). Associação entre estado nutricional e vulnerabilidade em idosos institucionalizados. *BRASPEN Journal,* 33(2), 181–188.

Minosso, J. S. M., Amendola, F., Alvarenga, M. R. M., & Oliveira, M. A. de C. (2010). Validação, no Brasil, do Índice de Barthel em idosos atendidos em ambulatórios. *Acta Paulista de Enfermagem,* 23(2), 218–223. https://doi.org/10.1590/s0103-21002010000200011

Moreira, Priscila Lucelia, Correa, C. R., Corrente, J. E., Martin, L. C., Boas, P. J. F. V., & Ferreira, A. L. A. (2016). Anthropometric, functional capacity, and oxidative stress changes in Brazilian community-living elderly subjects. A longitudinal study. *Archives of Gerontology and Geriatrics,* 66, 140–146. https://doi.org/10.1016/j.archger.2016.05.013

Moreira, Priscila Lucélia, & Villas Boas, P. J. F. (2011). Avaliação nutricional e capacidade funcional de idosos institucionalizados em Botucatu/SP. *Geriatrics, Gerontology and Aging*, 5(1), 19–23.

Otero, M. R., & Rosas Estrada, G. M. (2017). Valoración Nutricional De Las Personas Mayores De 60 Años De La Ciudad De Pasto, Colombia. *Ciencia y Enfermería,* 23(3), 23–34. https://doi.org/10.4067/s0717-95532017000300023

Pagotto, V. I., Ferreira dos Santos, K. I., Gomes Malaquias, S. I., Márcia Bachion, M. I., & Aparecida Silveira, E. I. (2018). Circunferência da panturrilha: validação clínica para avaliação de massa muscular em idosos. *Rev Bras Enferm* [Internet], 71(2), 343–350.

Pereira, P. M. L., Neves, F. S., Gomes Bastos, M., & Cândido, A. P. C. (2018). Espessura do Músculo Adutor do Polegar para avaliação nutricional: uma revisão sistemática. *Revista Brasileira de Enfermagem,* 71(6), 3270–3280.

Pereira, P. M. L., Soares, Í. T., Bastos, M. G., & Cândido, A. P. C. (2019). Espessura do múculo adutor do polegar para avaliação nutricional de portadores de doença renal crônica em tratamento conservador. *Jornal Brasileiro de Nefrologia*, 41(1), 65–73. https://doi.org/10.1590 / 2175-8239-JBN-2018-0122

Pinheiro, P. A., Coqueiro, R. da S., Carneiro, J. A. O., Correia, T. M. L., Pereira, R., & Fernandes, M. H. (2020). Anthropometric indicators as screening tools for sarcopenia in older adult women. *Enfermeria Clinica,* 30(4), 269–274. https://doi.org/10.1016/j.enfcli.2018.12.010

Pinto Junior, E. P., Silva, I. T. da, Vilela, A. B. A., Casotti, C. A., Pinto, F. J. M., & Silva, M. G. C. da. (2016). Dependência funcional e fatores associados em idosos corresidentes. *Cadernos de Saúde Coletiva,* 24(4), 404–412. https://doi.org/10.1590/1414-462X201600040229

Poubel, P. B., Lamar, E., Araújo, F. C., Leite, G. G., Freitas, S., Moisés, R., Silva, D. A., Borralho, T. G., Andréa, C., & Pires, A. (2017). Autopercepção de saúde e aspectos clínico-funcionais dos idosos atendidos em uma unidade básica de saúde no norte do Brasil Self-perceived health and clinical-functional of elderly in a basic health unit in northern Brazil. 5(979), 71–78. https://doi.org/10.12662/2317-3076jhbs.v5i1.1054.p.71-78.2017

Predebon, M. L., Ramos, G., Pizzol, F. L. F. D., Santos, N. O. dos, Paskulin, L. M. G., & Rosset, I. (2021). Global functionality and associated factors in the older adults followed by Home Care in Primary Health Care. *Revista Latino-Americana de Enfermagem,* 29. https://doi.org/10.1590/1518-8345.5026.3476

Sagarra-Romero, L., Gómez-Cabello, A., Pedrero-Chamizo, R., Vila-Maldonado, S., Gusi-Fuertes, N., Villa-Vicente, J., Espino-Torón, L., González-Gross, M., Casajús-Mallén, J., Vicente-Rodrígues, G., & Ara Royo, I. (2017). Relación entre el nivel educativo y la composición corporal en personas mayores no institucionalizadas: proyecto multi-céntrico Exernet. *Revista Española de Salud Pública,* 91, 1–15.

Santos, A. C. O. dos, Machado, M. M. de O., & Leite, E. M. (2010). Envelhecimento e alterações do estado nutricional. *Geriatrics, Gerontology and Aging,* 4(3), 168–175.

Sun, Y. S., Kao, T. W., Chang, Y. W., Fang, W. H., Wang, C. C., Wu, L. W., Yang, H. F., Liaw, F. Y., & Chen, W. L. (2017). Calf Circumference as a Novel Tool for Risk of Disability of the Elderly Population. *Scientific Reports,* 7(1), 1–7. https://doi.org/10.1038/s41598-017-16347-9

Tey, S. L., Huynh, D. T. T., Berde, Y., Baggs, G., How, C. H., Low, Y. L., Cheong, M., Chow, W. L., Tan, N. C., & Chew, S. T. H. (2021). Prevalence of low muscle mass and associated factors in community-dwelling older adults in Singapore. *Scientific Reports,* 11(1), 1–13. https://doi.org/10.1038/s41598-021-02274-3

Tsai, H. J., & Chang, F. K. (2017). Associations between body mass index, midarm circumference, calf circumference, and functional ability over time in an elderly Taiwanese population. PLoS ONE, 12(4), 1–11. https://doi.org/10.1371/journal.pone.0175062

Valente, K. P., Silva, N. M. F., Faioli, A. B., Barreto, M. A., Moraes, R. A. G. de, & Guandalini, V. R. (2016). Thickness of the adductor pollicis muscle in nutritional assessment of surgical patients. *Einstein (Sao Paulo, Brazil),* 14(1), 18–24. https://doi.org/10.1590/S1679-45082016AO3596

Velasco Hernandez, B. X., Salamanca Ramos, E., & Velasco Páez, Z. J. (2019). Funcionalidad de los adultos mayores de los Centros Vida de Villavicencio – Colombia. *Revista Ciencia y Cuidado,* 16(3), 72–81. https://doi.org/10.22463/17949831.1556

Wang, D. X. M., Yao, J., Zirek, Y., Reijnierse, E. M., & Maier, A. B. (2020). Muscle mass, strength, and physical performance predicting activities of daily living: a meta-analysis. *Journal of Cachexia, Sarcopenia and Muscle,* 11(1), 3–25. https://doi.org/10.1002/jcsm.12502

Weschenfelder, C., & Salgueiro, S. C. (2020). Correlação entre a Espessura do Músculo Adutor do Polegar e o Estado Nutricional. *Revista Brasileira de Cancerologia,* 66(4). https://doi.org/ https://doi.org/10.32635/2176-9745.RBC.2020v66n4.1044

Yang, S., Wang, S., Tai, P., Jia, W., Han, K., Liu, M., & He, Y. (2021). Central and Peripheral Adiposity Had Different Effect on Disability in Centenarians. Frontiers in Endocrinology, 12(March), 1–10. https://doi.org/10.3389/fendo.2021.635205

Yoshimura da Costa, T., Yukari Suganuma, J., Faria, S. de, & Bernardes Spexoto, M. C. (2021). Association of adductor pollicis muscle thickness and handgrip strength with nutritional status in hospitalized individuals. *Nutrición Hospitalaria,* 0–5. https://doi.org/10.20960/nh.03319

****