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Relationship between Nutritional Status and Functional Capacity for Older People

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Abstract

Functional capacity is the condition of an individual living independently and the lack of it for preparing and eating food, which is a factor that can result in malnutrition and deserves the attention of professionals and his family members. Then, the aim of this work was to evaluate the relationship between nutritional status and functional capacity for older adults using anthropometric measures and questionnaires for activities of daily and instrumental living. It was an epidemiological cross-sectional study using a representative sample of older adults selected from a previous study about quality of life in a Botucatu city, São Paulo. Brazil. The sample size was calculated considering 95% of reliability and 5% of error margin, resulting from a total of 365 individuals of both sexes but only 361 of them completed the protocol. Data included sociodemographic and morbidities questionnaires, activities of daily and instrumental living (ADL and IADL) and anthropometric variables. 62.6% of the older were women, 44.68% were hypertensive, 28.81% were diabetic and 15.51% had hypercholesterolemia. 94.24% and 92.42% of the older were fully independent for ADL and IADL, respectively. Associations between ADL with marital status and schooling were found as well as with IADL. Also, it was found association with IADL and heart disease. Regarding anthropometry most of measures when compared men and women were significant. No significant association was found between nutritional status and ADL. A logistic regression model was fitted considering ADL as a response variable showed BMI as a protection factor and WC as a risk factor for dependence. For IADL, heart disease was a risk factor for dependence. In conclusion, low weight and increased waist circumference have influence in a functional capacity of older adults according to the activities daily living (ADL) and heart disease for IADL.

Keywords

Functional Capacity, Nutritional Status, Older Adults, Brazil

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1. Introduction

Nutritional status affects, and it is affected by many diseases especially in older people [1]. The nutritional diagnostic and the identification of the factors that contributed for such diagnostic are essentials but are complex processes. This complexity is due to the occurrence of many physiological as well as pathological modifications which can be inherent to age process or disease. However, economic factor, social factor, lifestyle and aspects of life quality that provide an adequate and healthy feed can represent important tools to evaluate nutritional risk [2].

An important fact is to understand the health of older people based on nutritional evaluation. At clinical practice and in epidemiological studies, anthropometry is the most utilized method once it is not invasive, economic and easy to apply [3]-[8]. In this way, the nutritional status of the older is considered an important aspect to better understand the nutrition role in promoting and maintaining independence and autonomy of it [9].

Functional capacity is the condition of an individual live independently. Their loss is associated with increased risk of falls and institutionalization [10], being considered, in some cases, for the oldest old, as an independent risk factor for mortality [11] [12]. Its follow up is critical in addressing the preventable dependencies and promoting an active life as much long as possible [13]. Katz first assessed functional capacity and took into account the performance of basic activities of daily living (ADLs) and instrumental activities of daily living (IADL) [14]. The lack of functional capacity of self-care, preparation for and eating food is a factor that can result in malnutrition and deserves the attention of professionals and family members. The decrease of functional capacity evaluation can be an indicator of nutritional risk which is particularly associated with less food intake [15].

According to our knowledge, in Brazil there are some studies that assess the nutritional status of older people [16] [17] and few of them that verify the association between nutritional status and functional capacity were found [18]. Therefore, the aim of this work was to evaluate the relationship between nutritional status and functional capacity for older adults.

2. Methodology

Epidemiological cross-sectional study, conducted between January 2010 and August 2011 with 361 seniors, age 60 or older, both sexes, in order to evaluate the association between nutritional status and functional capacity of older people.

A representative sample of older people of Botucatu city, São Paulo, Brazil was used, obtained from a previous study of quality of life conducted in the city. The sample size was calculated assuming a unknown prevalence of people having a good quality of life (50%), error margin of 5% and confidence interval of 95%, totaling a minimum of 365 older people, who were randomly drawn from the population. In case of refusal to participate or death, a new individual was placed.

Sociodemographic (sex, age, marital status, schooling, if he/her still works or if is retired) and referred morbidities (hypertension, diabetes, heart disease, thyroid, cholesterol, osteoporosis and depression) questionnaires were administered. In addition to these questionnaires, assessment of functional capacity was obtained by applying the scale of activities of daily living through the Katz index (ADL) [14], comprising bathing, dressing, toileting, transferring from bed to do chair and vice-versa, sphincter continence, and feeding [15]; Scale and Instrumental Activities of Daily Living Lawton (IADL) to assess the most complex activities (ability to use the telephone, shopping, food preparation, cleaning, laundry, means of transport, responsibility for taking medications, the ability to handle finances) [19].

To evaluate nutritional status anthropometric variables were measured: weight, height, body mass index (BMI), waist circumference (WC), circumference arm (CA), arm muscle circumference (AMC), corrected arm muscle area (cAMA) and triceps skinfold thickness (TST). All data were collected in the homes of the older by trained interviewers.

Nutritional status of the older people was evaluated according the cutoffs proposed by the Pan American Health Organization [20]: underweight: BMI <23 kg/m^2; adequate weight: BMI 23 - 28 kg/m^2; overweight: BMI >28 kg/m^2. For the evaluation of WC values proposed by Brazilian Guidelines on Obesity 2009/2010 (102 cm for men and 88 cm for women) were used as the cutoff point.

With the obtained data, descriptive analyzes were initially made for demographic variables by calculating mean and standard deviation for quantitative variables and frequencies and percentages for categorized ones. Anthropometric measurements were compared by gender, ADL and IADL by Student's t-test. Associations

between categorized variables were obtained by Chi-square test according to gender, ADL and IADL.

Considering the functional capacity obtained by ADL (≤4—dependent and >4—independent) and IADL (≤17—dependent and >17—independent) as binary response variables, a logistic regression model was fitted considering anthropometric and morbidities as explanatory variables adjusted for possible confounding variables.

All procedures were approved by the Ethics Committee of the Botucatu School of Medicine (Process no. 3111-2009). The research began only after the older or caregiver has been informed about the purpose of the research and agreed to participate, by signature on a consent form.

3. Results

The sample was composed of 368 older people where 361 completed the protocol. **Table 1** shows the sociodemographic data of this population by sex.

Among the illnesses reported by the older, hypertension was the most prevalent (55.98%), followed by diabetes mellitus type 2 (28.53%), hypercholesterolemia (15.22%), osteoporosis (8.97%), cardiovascular diseases (7.39%), thyroid disorders (7.07%).

Related to functional capacity, it was observed that 94.24% and 92.42% of the older were fully independent for ADL and IADL, respectively. **Table 2** shows the association between sociodemographic and morbidity variables with ADL and IADL.

Regarding anthropometry, data are presented in **Table 3**. It can observed that the values of the variables weight, height, AMC, cAMA and WC were higher in men compared to women ($p < 0.05$). The average values of TST behaved in the opposite way, being higher in women ($p < 0.0001$). The average values of AC and BMI were slightly higher among women compared to men, however, without statistical difference.

When evaluated according to BMI, it was observed that 12.23% of the older were underweight (BMI < 23

Table 1. Comparisons and associations of sociodemographic aspects of the older adults by sex. Botucatu, São Paulo, Brazil, 2011.

	Female (n = 226)		**Male (n = 135)**		**p-value**
Age	72.54 ± 7.40		71.38 ± 7.22		p = 0.1461*
Marital status	N	%	N	%	
Married	101	44.69	109	80.74	p < 0.0001**
Divorced	6	2.65	3	2.22	
Single	23	10.18	8	5.93	
Widow	91	40.27	13	9.63	
Separated	5	2.21	2	1.48	
Schooling					
Illiterate	45	19.91	10	7.41	p = 0.0004**
Basic Education	142	62.83	80	59.26	
High school	19	8.41	20	14.81	
Higher education	20	8.85	25	18.51	
Working					
Yes	16	7.08	23	17.04	p = 0.0077**
No	210	92.92	112	82.96	
Retired					
Yes	189	83.63	125	92.59	p < 0.0001**
No	37	16.37	10	7.41	

*t-Student test; **chi-square test.

Table 2. Association between with sociodemographic and morbidity variables with ADL and IADL for older adults. Botucatu, São Paulo, Brazil, 2011.

	ADL						IADL					
Variables	No		Yes		Total	p-value*	No		Yes		Total	p-value*
Sex	n	%	n	%			n	%	n	%		
Female	190	92.7	15	7.3	205	0.1194	188	91.7	17	8.3	205	0.5285
Male	121	96.8	4	3.2	125		117	93.6	8	6.4	125	
Marital Status												
Married	188	97.9	4	2.1	192	0.0007	184	95.8	8	4.2	192	0.0058
Non-married	123	89.1	15	10.9	138		121	87.7	17	12.3	138	
Schooling												
Illiterate	40	83.3	8	16.7	48	0.0032	48	85.7	8	14.3	56	0.0393
Basic Education	197	95.6	9	4.4	206		191	92.7	15	7.3	206	
High school	33	94.3	2	5.7	35		34	97.1	1	2.9	35	
Higher education	41	100.0	0	0.0	41		40	97.6	1	2.4	41	
Hypertension												
No	168	92.3	14	7.7	182	0.943	168	92.3	14	7.7	182	0.9293
Yes	143	96.6	5	3.4	148		137	92.6	11	7.4	148	
Diabetes												
No	86	92.5	7	7.5	93	0.3874	83	89.2	10	10.8	93	0.1719
Yes	225	94.9	12	5.1	237		222	93.7	15	6.3	237	
Heart disease												
No	22	88.0	3	12.0	25	0.1634	18	72.0	7	28.0	25	<0.0001
Yes	289	94.8	16	5.2	305		287	94.1	18	5.9	305	
Thyroid												
No	22	95.7	1	4.3	23	0.7635	23	100.0	0	0.0	23	0.1546
Yes	289	94.1	18	5.9	307		282	69.3	125	30.7	407	
Cholesterol												
No	47	97.9	1	2.1	48	0.0673	47	100.0	0	0.0	47	0.034
Yes	264	93.6	18	6.4	282		258	91.2	25	8.8	283	
Osteoporosis												
No	26	89.7	3	10.3	29	0.2668	23	85.2	4	14.8	27	0.1852
Yes	285	94.7	16	5.3	301		280	93.0	21	7.0	301	
Depression												
No	5	83.3	1	16.7	6	0.247	5	83.3	1	16.7	6	0.3957
Yes	306	94.4	18	5.6	324		300	92.6	24	7.4	324	

*chi-square test.

kg/m^2), 36.41% were classified as normal weight and 53.41% were overweight. When separated by gender, among women has been 11.64% underweight, normal weight 34.48% and 53.88% overweight. Among men, we found 13.24% underweight, normal weight 39.71% and 47.06% overweight. There was no significant association between nutritional status and gender (p = 0.4498).

A logistic model was fitted considering the ADL and IADL classification as a binary response and anthropometric and morbidities variables as explanatory adjusted by age and sex. The results can be seen in **Table 4**.

The data show that people with high value of BMI have lower risk (20%) of being dependent in ADL, while high values of WC, higher risk (12%) of being dependent, corrected for age and sex. Heart disease was found as a risk factor for begin dependent for IADL (OR = 6.15; 95% CI = (1.96 - 19.29)).

Thus, it is observed that the maintenance of a healthy and appropriate weight is associated with a good functional capacity, which was confirmed in this study, with BMI and WC.

4. Discussion

According to the obtained results, 62.6% of the older were women, the majority is married, has basic education and retired. The percentage of older women in the considered sample is a little above at Botucatu city (57.11%) and above to the Brazil Census 2010, that was estimated in 51.5%. Even though we can consider that the sample are representative of the older people in the municipality.

Related to morbidities, hypertension was the most prevalent morbidity among older (55.98%) followed by diabetes mellitus (28.53%). These figures agree with the Brazilian Cardiology Society showing that around 50% of people with 60 year and more are hypertense and with the Brasilian Diabetes Society, around 33% are diabetic.

Table 3. Anthropometric measures (mean and standard deviation) for the older by sex. Botucatu, São Paulo, Brazil, 2011.

	Female (n = 226)	Male (n = 135)	p-value*
Weight (kg)	66.96 (13.7)	76.87 (14.34)	p < 0.0001
Height(m)	1.54 (0.07)	1.68 (0.07)	p < 0.0001
BMI (kg/m²)	28.26 (5.39)	27.24 (4.85)	p = 0.0734
AC (cm)	29.82 (4.73)	29.62 (3.80)	p = 0.6528
AMC (cm)	23.30 (3.49)	25.52 (3.21)	p < 0.0001
cAMC (mm)	44.18 (13.05)	52.68 (13.12)	p < 0.0001
TST (mm)	20.79 (7.52)	13.04 (5.97)	p < 0.0001
WC (cm)	97.13 (13.85)	100.2 (14.18)	p = 0.0472

BMI: Body Mass Index; AC: arm circumference; AMC: arm muscular circumference; cAMC: corrected arm muscular circumference; TST: triceps skinfod thickness; WC: waist circumference. *p-values obtained by t-Student test.

Table 4. Logistic regression for ADL and IADL for anthropometric and morbidity variables for older people adjusted for age and sex. Botucatu, São Paulo, Brazil, 2011.

	ADL		IADL	
Variables	OR	CI95%	OR	CI95%
BMI	0.807	0.667 - 0.978	0.842	0.701 - 1.011
AC	1.007	0.756 - 1.341	1.001	0.750 - 1.338
AMC	0.975	0.357 - 2.661	0.784	0.298 - 2.061
cAMC	0.974	0.731 - 1.297	1.053	0.299 - 1.388
WC	1.123	1.046 - 1.205	1.013	0.967 - 1.072
Heart Disease (yes × no)	1.479	0.334 - 6.559	6.152	1.961 - 19.295

BMI: Body Mass Index; AC: arm circumference; AMC: arm muscular circumference; cAMC: corrected arm muscular circumference; WC: waist circumference.

It was found that 53.41% of the older were overweight and, from that 53.88% were women. Also, it was found 5.76% of older people dependent for ADL and 7.58% dependent for IADL. In Brazil we do not have precise figures about functional capacity because these numbers depend on the region of the country.

Significant associations were found among ADL and marital status and schooling. For IADL, associations were found with marital status, schooling, heart disease and high cholesterol.

According to the logistic regression, BMI and WC were protective and risk factor, respectively, for dependence when we consider ADL as a response variable. The same for IADL, only heart disease is a risk factor for dependence.

Similar results to those described here, finding a relationship between nutritional and functional status of older people once it was found association between malnutrition and functional and cognitive impairment [21]-[24]. It is known that impaired functional status negatively affects food consumption and lack of functional autonomy to take care of yourself and preparing and eating food is a factor that can lead to malnutrition, deserving thus attention from health professionals and family, since the functional capacity may be an indicator of nutritional risk [15].

The association between low weight and decline in functional capacity has been described by other researchers also in Brazil [15] [17] [18] [25]-[28].

Waist circumference also showed association with the functional capacity of the studied population related to ADL. For older people, increased waist circumference is associated with decreased physical function [29] [30] and may cause functional dependence, beyond is associated with an increased risk of mortality. Previous work [31] [32] show that increased waist circumference increases two to three times the risk of functional impairment. The findings of this study are also similar to another [33], which found a relationship between increased waist circumference for older people affected by heart disease.

In the present study, arm circumference (AC) and arm muscle circumference (AMC) did not correlate with functional capacity for older people. These measures are generally used to assess nutritional status and in fat mass. The AC reflects muscle mass and kneads fat and AMC reflects only muscle mass. Many works [34]-[36] that associate low values of these measurements with increased mortality, however does not seem to have any influence on the functional capacity of older people.

The aging process is associated with changes in body composition, among them, the decrease in lean body mass and increase in visceral fat. Despite the decrease in muscle mass is associated with worse physical performance and decreased mobility, that are factors related to frailty [37] [38], anthropometric markers of muscle mass in this work is not significantly associated ADL and IADL.

In a recent study, conducted with the Italian older population [39] was found better functional performance in older adults with higher calf circumference. One limitation of this study is the absence of data on the circumference of the calf, since this measurement provides more sensitive information in relation to muscle mass of older being more accurate than the circumference of the arm.

For other variables related to nutritional status, none was significantly associated with functional capacity. Nevertheless, it was association for some diseases such as type 2 diabetes mellitus, cardiovascular disease and osteoporosis.

In view of the increasing number of elderly dependents since life expectancy is increasing [40], there is clearly a need to improve understanding of the mechanism of nutritional and functional status. The decline in nutritional status can be considered as the first event leading to the increased need for care. Thus, there is the hypothesis of a possible vicious cycle, in which the decrease in food intake can lead to depletion of muscle mass, leading to reduced independence of activities of daily living and also to malnutrition.

5. Conclusion

In conclusion, this study suggests that, among the elderly living in the community, low weight and increased waist circumference influence its functioning for ADL and heart disease for IADL. Our data support the findings by the older people in other countries and even for Brazilians. Thus, note the importance of nutritional assessment, since this can be a predictor of functional capacity of the older people living in the community. We also emphasize the importance of actions that promote the maintenance of healthy weight and prevent underweight, improving the autonomy and quality of life of this population.

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