



Relationship between functional capacity, nutritional status and sociodemographic variables of institutionalized older adults

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Abstract

Objective: To analyze the relationship between functional capacity, nutritional status, and sociodemographic variables of older adults living in long-term care facilities. **Method:** This is a cross-sectional study conducted with 82 institutionalized older adults. For data collection, we used the Barthel Index to assess the degree of independence in the performance of basic activities of daily living and the Mini Nutritional Assessment (MNA) to assess the nutritional status of older adults. Data were collected in five geriatric long-term care facilities located in southern Brazil. Ordinal regression analyses were performed to identify associations between contextual social factors, and nutritional status with the functional capacity of institutionalized older adults. **Results:** Most participants showed complete independence in performing activities of daily living (39.0%) and poor nutritional status (59.8%). The multivariate ordinal regression analysis showed that older adults with higher scores in the nutritional assessment are associated with better indicators of functional capacity (OR=1.33; 95% CI=1.15 to 1.54; $p<0.001$). We did not find an association between educational level, pressure injuries, body mass index, and functionality. **Conclusion:** Nutritional status is a significant predictor for dependency in institutionalized older adults.

Keywords: Functional Status; Elderly Nutrition; Activities of Daily Living; Homes for the Aged.

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INTRODUCTION

The aging process is characterized by a global and progressive decline in physiological functions. Therefore, the maintenance of functional capacity has to be essential in the health and quality of life of older adults, as it is related to the ability to perform daily activities necessary for an independent life. The characterization of the functional capacity of older adults has great relevance since it is an indicator of the health status of this population and essential for choosing the best intervention and monitoring the clinical status of older adults¹.

Sarcopenia and decreased muscle strength can limit the functional capacity of older adults. The loss of muscle mass, around 1 to 2% per year after the age of 50, occurs mainly due to a decline in protein synthesis, causing the replacement of muscle tissue by adipose and fibrotic tissue^{2,3}. Studies have shown a significant increase in malnourished older adults, with prevalence ranging from 15 to 60%, depending on the older adult's place of residence⁴⁻⁷.

Many families increasingly tend to share the responsibilities of older adult care with the geriatric long-term care facilities, as they need help with health conditions and day-to-day care. Long-term care institutions are a strong trend in health care and are becoming increasingly necessary^{5,6,8}. Studies have identified that functional disability is related to multidimensional factors that reduce the well-being and quality of life of the older adults^{9,10}. However, few studies in Brazil have carried out investigations on functionality, specifically with institutionalized older adults¹⁰⁻¹².

Considering that institutionalized older adults have a higher prevalence of malnutrition and dependence for activities of daily living (ADLs) than community-dwelling^{2,13}, it is essential to identify the factors associated with the decline in functional capacity to support strategies for promotion and health care for this population. In this context, this study aimed to analyze the relationship between functional capacity with sociodemographic variables and the nutritional status of a group of older adults living in long-term care facilities in Curitiba (PR).

METHODS

This cross-sectional study was conducted with 82 older adults in five geriatric long-term care facilities (LTCF) in Curitiba (PR) from 2015 to 2016. The participants, selected for convenience, consisted of institutionalized older adults aged over 60 years. Older adults who presented severe cognitive alterations that affected their perceptive, discernment, and language skills were excluded.

The researchers followed the ethical research aspects set out in the Brazilian Resolution 466/12 of the National Health Council. The study was approved by the Research Ethics Committee of the Pontifical Catholic University of Paraná (no. 80.215.901) and formally authorized by those responsible for the institutions involved. All participants were informed about the research objectives and data confidentiality and signed the Informed Consent Form (ICF).

Initially, the participants' sociodemographic data were collected: age (in years), sex, marital status, education (in years of formal education), institutionalization time (length in LTCF in months), presence of pressure injury, number of medications, and polypharmacy, defined in the present study as more than five medications per patient¹⁴.

The assessment of the functional status of the older adults was performed by the Barthel Index (BI)¹⁵. The level of independence for ten basic activities of daily living was evaluated: feeding, personal hygiene, use of toilets, bathing, dressing, bladder control, walking, transferring from chair to bed, and going up and down the stairs. The total scale score ranges from 0 (complete dependence) to 100 (complete independence). In the present study, the BI was analyzed as a continuous variable and categorized as: totally dependent (0-20), severely dependent (21-60), moderately dependent (61-90), mildly dependent (91-99), and independent (100)¹⁵.

For the nutritional assessment of the older adults, the translated version into Brazilian Portuguese of the Mini Nutritional Assessment (MNA®) (*Société des Produits Nestlé SA, Trademark Owners*) was used. The MNA is a validated, sensitive, and appropriate

instrument for identifying malnourished older adults or those at risk of malnutrition and is widely used with older adult populations in different contexts^{4,16,17}. It consists of 18 items of anthropometric aspects, global clinical assessment, dietary assessment, and nutritional status. The final score is the sum of all items, which allows for identifying the nutritional status and the risks for the older adults. The assumed scores to classify the nutritional status of the participants were: malnutrition (<17), risk of malnutrition (17-23.5), and normal nutritional status (24-30)¹⁶.

Anthropometric measurements of weight, height, and waist, hip, arm, and calf circumferences were collected according to procedures recommended by the Brazilian Ministry of Health¹⁸ and the World Health Organization¹⁹. The classification of the body mass index (BMI) was based on specific cutoff points for the older adults established by the Food and Nutritional Surveillance System, as follows: underweight (≤ 22 kg/m²), eutrophic (> 22 and < 27), and overweight (≥ 27)¹⁸. Interviews and data collection were conducted in a standardized manner by the first author. These data were collected in a single moment, in reserved places in the LTCF, to preserve participants' privacy.

Descriptive statistical analyses were performed to present and summarize the collected data. Absolute and relative frequencies presented categorical variables. Continuous variables were presented as mean and standard deviation (SD) when normally distributed and as median and interquartile range (IQR) when not normally distributed. The variables were tested for normality using the Kolmogorov-Smirnov test. To verify the association between the independent variables and the functional capacity of institutionalized older adults, considering the IB categories as a dependent variable, Fisher's exact test, unidirectional analysis of variance, and Kruskal-Wallis were applied. All independent variables that showed a significant association in the univariate analysis ($p \leq 0.25$) were included in the multivariate model. For the multivariate analysis, the proportional odds ordinal logistic regression model was used²⁰, estimating the odds ratios and the respective 95% confidence intervals (95% CI). The assumptions for ordinal regression of absence of multicollinearity between independent variables

and proportional odds were met. Multicollinearity was assessed using variance inflation factors (VIF) that remained between 1.05 to 1.10. The assumption of proportional probabilities was verified by the parallel line test for the fitted model ($p = 0.065$). Pearson's and deviance tests were used to analyze the goodness of fit of the model. Residuals for each covariate included in the model were calculated using binary logistic regression for all cutoff points of the dependent variable. The significance level of 5% was adopted in all analyses.

RESULTS

Eighty-two older adults participated in the study, with a median age of 74.5 years, ranging from 64 to 92 years old, and a median length of institutionalization of 42.88 months. Most participants were men, single, illiterate, eutrophic, and had no pressure injuries. Polypharmacy was observed in 57.3% of the older adults, with a median consumption of 5.0 medications. The sociodemographic characteristics of the participants are shown in Table 1.

As for the functional capacity of institutionalized older adults, the median BI was 95.0. Most showed complete independence (39.0%) in performing basic ADLs. About 46.0% showed a degree of mild to moderate dependence, and only 14.6% showed a degree of severe to total dependence. Regarding the nutritional assessment of the older adults, the mean MNA score was 22.5 (± 3.19), and most were classified as at risk of malnutrition.

Only MNA was statistically associated with the BI score in univariate analyses (Table 3). Four variables were included in the multivariate model ($p < 0.25$): education, pressure injuries, BMI and MNA.

The multivariate analysis between functional capacity and the variables education, pressure injuries, BMI, and MNA resulted in a statistically significant model (Table 4). After model adjustment, the results indicate that MNA remained significantly associated with functional capacity ($p < 0.001$). The parallel line assumption test was not violated ($p = 0.065$). Institutionalized older adults with higher scores on the MAN are 33.4% more likely to present better functional capacity indicators.

Table 1. Sociodemographic characteristics of institutionalized older adults. (N=82). Curitiba, PR, 2015-2016.

Variables	Frequencies
Sex*	
Male	51 (62.20)
Female	31 (37.80)
Age (years)**	74.50 (70.00 – 80.20)
Age (categories in years)*	
60-69	19 (23.20)
70-79	39 (47.60)
80-89	22 (26.80)
>90	2 (2.40)
Marital status*	
Single	33 (40.30)
Married/living with a partner	2 (2.40)
Separated/divorced	20 (24.40)
Widowed	27 (32.90)
Education*	
Illiterate	49 (59.80)
Elementary School	21 (25.60)
High school	12 (14.60)
Length of institutionalization** (months)	42.90 (2.00 – 96.00)
Length of institutionalization* (categories in months)	
0-11	10 (12.20)
12-59	39 (47.60)
60-119	19 (23.20)
>120	14 (17.10)
Pressure injuries*	
No	61 (74.40)
Yes	21 (25.60)
Number of drugs**	5.00 (3.00 – 8.00)
Polypharmacy*	
No	35 (42.70)
Yes	47 (57.30)
Body Mass Index** (kg/m ²)	23.50 (21.00 – 26.40)
Body Mass Index (categorized)*	
Underweight	27 (32.90)
Eutrophic	36 (43.90)
Overweight	19 (23.20)

*Categorical data are presented with numerical values and percentages.

** Continuous variables are reported with median and 1st and 3rd quartiles.

Table 2. Classification of institutionalized older adults according to Barthel Index and Mini Nutritional Assessment. (N=82). Curitiba, PR, 2015-2016.

Variables	Frequencies
Barthel Index (continuous)	95.00 (80.00 – 100.00)
Barthel Index (categorized)	
Totally dependent	4 (4.80)
Severely dependent	8 (9.80)
Moderately dependent	24 (29.30)
Mildly dependent	14 (17.10)
Independent	32 (39.00)
Mini Nutritional Assessment (continuous)	22.50 ±3.19
Mini Nutritional Assessment (categorized)	
Malnourished	3 (3.70)
At risk of malnutrition	46 (56.10)
Normal nutritional status	33 (40.20)

Note: BI is presented as median and 1st and 3rd quartiles and MNA as mean and standard deviation.

Table 3. Univariate analyses between functional and sociodemographic variables and mini nutritional assessment in institutionalized older adults. (N=82). Curitiba, PR, 2015-2016.

Independent variables	Barthel Index					p-value
	Total (n=4)	Severe (n=8)	Moderate (n=24)	Low (n=14)	Independent (n=32)	
Sex						0.708*
Male	3 (5.9)	5 (9.8)	12 (23.5)	9 (17.6)	22 (43.1)	
Female	1 (3.2)	3 (9.7)	12 (38.7)	5 (16.1)	10 (32.3)	
Age (years)	76.00 (71.0-79.0)	79.50 (72.0-85.0)	75.00 (72.5-79.5)	72.00 (68.0-83.0)	74.00 (68.0-80.0)	0.666**
Marital status						0.496*
Single	0 (0.0)	3 (9.1)	12 (36.4)	4 (12.1)	14 (42.4)	
Married/living with a partner	1 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (50.0)	
Separated/divorced	1 (5.0)	1 (5.0)	6 (30.0)	4 (20.0)	8 (40.0)	
Widowed	2 (7.4)	4 (14.8)	6 (22.2)	6 (22.2)	9 (33.3)	
Education						0.089*
Illiterate	4 (8.2)	4 (8.2)	17 (34.7)	7 (14.3)	17 (34.7)	
Elementary School	0 (0.0)	1 (4.8)	7 (33.3)	3 (14.3)	10 (47.6)	
High school	0 (0.0)	3 (25.0)	0 (0.0)	4 (33.3)	5 (41.7)	
Length of institutionalization	54.0 (24.5-72.0)	36.0 (12.0-36.0)	42.0 (15.0-96.0)	44 (24.0-96.0)	50.0 (24.0-96.0)	0.544**
Pressure injuries						0.130*
No	3 (14.3)	1 (4.8)	8 (38.1)	2 (9.5)	7 (33.3)	
Yes	1 (1.6)	7 (11.5)	16 (26.2)	12 (19.7)	25 (41.0)	
Number of medications	8.00 (6.00-9.00)	6.50 (3.50-8.00)	6.00 (3.50-9.00)	5.00 (2.00-8.00)	4.00 (1.50-6.50)	0.385**

to be continued

Continuation of Table 3

Independent variables	Barthel Index					p-value
	Total (n=4)	Severe (n=8)	Moderate (n=24)	Low (n=14)	Independent (n=32)	
Polypharmacy*						0.569*
No	1 (2.9)	2 (5.7)	9 (25.7)	6 (17.1)	17 (48.6)	
Yes	3 (6.4)	6 (12.8)	15 (31.9)	8 (17.0)	15 (31.9)	
Body Mass Index	19.8 (17.74-22.12)	22.56 (20.80-26.71)	25.55 (21.50-29.86)	23.11 (19.90-28.70)	23.66 (22.04-25.75)	0.139**
Mini Nutritional Assessment	17.37 ± 4.76	21.50 ± 1.75	21.52 ± 3.22	23.32±2.99	23.81±2.43	<0.001***

Categorical values presented as absolute numbers and percentages; continuous variables presented as medians and 1st and 3rd quartiles or mean and standard deviation; *Fisher's exact test; **Kruskal Wallis test; *** One-way ANOVA.

Table 4. Multivariate ordinal regression model between functional capacity as a dependent variable and education, pressure injuries, body mass index, and nutritional assessment in institutionalized older adults. (N=82). Curitiba, PR, 2015-2016.

Independent variables	Barthel Index		
	OR	95% CI	p-value
Education			
Illiterate	1.18	0.34 to 4.10	0.792
Elementary School	2.15	0.52 to 8.89	0.290
High school	1.00		
Pressure injuries			
No	0.75	0.28 to 1.99	0.569
Yes	1.00		
Body Mass Index	0.97	0.90 to 1.05	0.537
Mini Nutritional Assessment	1.33	1.15 to 1.54	<0.001*

OR, odds ratios; 95% CI, 95% confidence interval adjusted for the other variables included in the ordinal logistic regression model.

Model summary: F(5)=19.42, p=0.002; Pseudo R² Nagelkerke = 0.225; Pearson's test p=0.660; Deviance test p=1,000.

*Statistically significant variables (p≤0.05).

DISCUSSION

The present study demonstrated that nutritional status is a significant predictor for dependency in institutionalized older adults. The multivariate ordinal regression model results indicated that older adults with higher scores in the nutritional assessment are 1.33 times more likely to have higher scores in the IB (low dependence and independence). Deficient nutritional status was identified in 59.8% of institutionalized older adults. Malnutrition is a frequent condition among older adults, but health professionals often underestimate it in diagnostic and therapeutic investigations^{20,21}. The high prevalence of

nutritional risk in older adults was also identified in LTCF in different regions of Brazil, with proportions ranging from 39.6 to 76.2%^{8,22-24}.

Deficient nutritional status decreases muscle strength and increases fatigue, negatively impacting physical capacity and quality of life^{3,7}. Sousa et al.⁸ found that low weight is an important factor associated with functional disability in institutionalized older adults, with a prevalence ratio of 1.2 times compared to eutrophic individuals. In this study, 33.0% of older adults were independent in their ADL, and 67.0% had some degree of dependence. Moreira and Boas¹² evaluated the functional capacity of

54 institutionalized older adults by applying the scales of basic activities of daily living (BADL) and instrumental activities of daily living (IADL). The authors found that the reduced ability for BADL was directly related to low weight, with a prevalence ratio of 2.35.

Our study found no association between the number of medications and functional capacity. Several medications of continuous use can increase the absorption of nutrients, increasing the risk of malnutrition in older adults²⁵. Several studies have shown an association between functional capacity decline and polypharmacy in older adults, with a consequent increase in the risk of adverse clinical outcomes^{14,25–28}. However, most of these studies were carried out with community-dwelling older adults. There was no association between polypharmacy and functional status in two longitudinal studies carried out precisely with institutionalized older adults^{29,30}. A possible explanation may be that the variable “number of medications” used in the study was measured by self-report. We cannot exclude the possibility that more refined measures for medication use and studies with longitudinal designs may help identify the association between polypharmacy and functionality. Furthermore, we consider that factors related to the health systems and medicine conditions of access may be investigated in greater depth.

In the multivariate ordinal regression analysis, we found no association between length of institutionalization and functional capacity. The majority of the older adults (47.6%) lived in the LTCF between one and five years. Oliveira and Mattos¹³ also did not find this association when assessing the functional capacity of institutionalized older adults in Cuiabá (MT), most of them with a length of stay of less than five years. Likewise, an association between length of stay and nutritional status of institutionalized older adults was not identified in the study conducted in Rio de Janeiro (RJ)²². Lacerda et al.³¹ found that the degree of dependence can vary according to the host institution. The institution starts to assume all the responsibilities that would originally belong to the older adults, increasing their dependence and, consequently, decreasing their functional capacity.

Different instruments are applied to assess the nutritional and functional status of older adults. The lack of standardization in the classification of dependence and different cutoff points for the same instrument make it difficult to compare the results between studies carried out with the older adults¹³. In the present study, we used the Barthel Index and the MNA to diagnose the functional and nutritional status of older adults. The MNA is an essential nutritional screening tool for the early identification of nutritional risk in groups of older adults, and it can be used both in LTCF and in the community in a family environment¹⁶. On the other hand, the BI is an instrument developed to evaluate the degree of independence in the performance of BADL, with consistent reliability and validity and previously applied to older adult populations in LTCF^{1,28,32,33}.

We found that most older adults were independent, with a median BI of 95.0. A study carried out in three LTCFs in Presidente Prudente (SP) evaluated the functional capacity of 115 older adults and found that 75.6% presented independence for ADLs, with an average of 80 points in the BI³. Functional capacity is related to primary, instrumental, and advanced activities of daily living. The effects of aging, added to conditions that cause dependence, reduce the ability of older adults to overcome environmental challenges¹. Physical inactivity can enhance the functional disability of older adults. Consequently, the decline in aspects related to their health can result in an even greater reduction in the level of physical activity and an increase in the risk of falls^{9,35}.

The results of this study must be interpreted with caution. The convenience sample limits the generalization and extrapolation of data, and causal inferences between the functional capacity and the analyzed variables cannot be made due to the cross-sectional design. Therefore, we highlight the need to conduct longitudinal and multicenter studies that assess the risk factors for functional dependence in the context of LTCF, especially to guide strategies for health promotion, reduction of nutritional risk, and independence of the institutionalized older adults.

Institutionalization can be a factor in the functional decline of the older adults⁹. It is noteworthy that the progressive character of functional disability

among older adults concerning increasing age is not only due to chronological factors and is not an inevitable result of aging itself. Instead, what defines the autonomy in the daily life of older adults is the quality of care provided, encouragement and support to carry out tasks, and respect for their eating habits and preferences, especially in an institutional context.

CONCLUSION

This study showed that the nutritional status might be associated with the functional decline of older adults living in long-term care facilities in Curitiba (PR). The largest proportion of older adults participating in this research presented deficient nutritional status, which denotes attention to the nutritional care of this population. Identifying variables associated with the reduction of functional capacity contributes to understanding

this phenomenon and allowing for the guidance of the practices developed in the LTCF that prevent health problems of institutionalized older adults. Based on the results, we highlight the need to invest in actions that promote the functional independence of the institutionalized older adults, giving close attention to the stimulation of levels of functionality and reduction of nutritional risks.

Functionality requires a look beyond chronic diseases; one must seek to understand all the functional aspects of the aging individual. Therefore, a multidisciplinary team in the care of institutionalized older adults is essential to carry out an early diagnosis of nutritional deficiency and working on maintaining autonomy and reducing functional disability, which is essential to guarantee the improvement of the quality of life of this population.

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