



Lower limb physical performance, handgrip strength and quality of life of elderly

Desempenho físico de membros inferiores, força de preensão manual e qualidade de vida de idosos

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ABSTRACT

This study aimed to verify the association between physical performance of lower limbs and handgrip strength (HGS) with the quality of life (QOL) of the elderly. Cross-sectional study carried out with 608 elderly people. The following were used: Short Physical Performance Battery (SPPB); handgrip strength test; World Health Organization Quality of Life-Bref (WHOQOL-BREF) and World Health Organization Quality of Life Olders (WHOQOL-OLD). Descriptive analysis and linear regression ($p < 0.05$) were performed. Lower SPPB and HGS scores were associated with worse QOL in the physical ($p < 0.001$; $p = 0.003$), psychological ($p < 0.001$; $p = 0.001$) and environment ($p < 0.001$; $p = 0.028$) domains and in the facets functioning of the senses ($p = 0.001$; $p < 0.001$) and past, present and future activities ($p = 0.001$; $p = 0.010$). It was found that there are common and specific QOL domains and facets associated with physical performance of lower limbs and HGS.

Keywords: Elderly. Mobility limitation. Quality of life.

RESUMO

Este estudo teve o objetivo de verificar a associação entre o desempenho físico de membros inferiores e a força de preensão manual (FPM) com a qualidade de vida (QV) de idosos. Estudo transversal realizado com 608 idosos. Foi utilizado o *Short Physical Performance Battery* (SPPB); o teste de força de preensão manual, o *World Health Organization Quality of Life-Bref* (WHOQOL-BREF) e o *World Health Organization Quality of Life Olders* (WHOQOL-OLD). Realizou-se análise descritiva e regressão linear ($p < 0,05$). Menores escores no SPPB e na FPM associaram-se a pior QV nos domínios físico ($p < 0,001$; $p = 0,003$), psicológico ($p < 0,001$; $p = 0,001$) e meio ambiente ($p < 0,001$; $p = 0,028$) e nas facetas de funcionamento dos sentidos ($p = 0,001$; $p < 0,001$) e atividades passadas, presentes e futuras ($p = 0,001$; $p = 0,010$). Verificou-se que existem domínios e facetas de QV em comum e específicos que se associaram ao desempenho físico de membros inferiores e a FPM.

Palavras-chave: Idoso. Limitação da mobilidade. Qualidade de vida.

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INTRODUCTION

In the Brazilian scenario, data released by the Informatics Department of the Brazilian Unified Health System (DATASUS) show that people aged 60 or over, in 2019, totaled 28,143,225 individuals¹. However, the increase in longevity is not always accompanied by good health, resulting in years lived with mental and physical declines that have a negative impact on the performance of daily tasks², which can therefore impact on quality of life (QOL).

QOL, according to the World Health Organization (WHO), is defined as “an individual’s perception of their position in life, in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns”³. Transformations in the individual’s QOL occur throughout life, which are associated with advancing age and changes in health status⁴, which makes it a relevant topic of study.

The decrease in QoL can be influenced by several factors such as musculoskeletal, mainly declines in muscle mass and physical performance⁵. It is noteworthy that the musculoskeletal system, due to changes in senescence, can present losses such as the progressive decrease in muscle mass, strength and performance⁶.

The verification of these possible changes in physical limitation can be performed through performance tests, which provide objective, standardized measures, free from environmental influences and with a greater response to clinical changes⁷. The level of physical performance of lower limbs provides functional status and predicts mortality and institutionalization⁸. Another measure that stands out is the handgrip strength (HGS) that can be used by health professionals, due to the ease of application, low cost, non-invasive character and the possibility of monitoring and evaluating results⁹.

Research conducted with elderly people with and without mobility limitations, in the United States of America, found that changes in the physical performance of lower limbs can contribute to the decrease in QOL, measured by the Short Form 36 Health Survey

(SF-36)⁵. An investigation carried out in South Korea among the elderly, aged 65 and over, found that low HGS values were associated with worse health-related QoL values, assessed by EuroQoL-5 (EQ-5D)¹⁰.

A study with Mexican-Americans aged 65 and over found that individuals with higher levels of physical performance of lower limbs had better QOL over time, as assessed by the SF-36 instrument¹¹. In Brazil, research has shown that HGS has positive and statistically significant correlations with all dimensions of the SF-36 instrument, except for vitality and mental health, suggesting that this variable can be considered an association factor in QOL in elderly women aged 60 to 79¹².

Even with these results, it appears that the evidence between QOL, physical performance of lower limbs and HGS is still not clear in the literature⁵ and the studies of existing national and international literature use general populations, without age range specifications, that is, they do not evaluate only the elderly and their possible peculiarities^{13,14}. Still, when the studies include only the elderly, the instruments used are general, not being specific to this population^{11,12}, which indicates the need to conduct research to investigate this association.

Thus, this research proposes to study the elderly population, using instruments specially designed for this audience, which contributes to a better understanding of these variables and the consequent implementation of specific actions.

Given the above, the objective of this study was to verify the association of physical performance of lower limbs and handgrip strength with the quality of life of the elderly.

METHODOLOGY

Quantitative, household and cross-sectional survey conducted with elderly people living in the urban area of the city of Uberaba, state of Minas Gerais. Participants were selected using the multi-stage cluster sampling technique. In this process, there was first the selection of census sectors by means of systematic

sampling, based on the arbitrary draw of 50% of the census sectors in the city, including central and peripheral areas. Subsequently, the selection of households within sectors was made and, finally, the elderly person to be interviewed.

Sample calculation was performed using the PASS (Power Analysis and Sample Size) software, considering the coefficient of determination of $R^2 = 0.02$ in a multiple linear regression model with four predictors; $\alpha = 0.05$ as a level of significance or type I error; $\beta = 0.2$ for type II error and physical domain of the World Health Organization Quality of Life-Bref (WHOQOL-BREF) as the main dependent variable. An a priori statistical power of 80% and a minimum sample size of 590 elderly people were obtained, with an estimated sample loss of 20%, the final number of interview attempts was $n = 738$.

Participants were people aged 60 or over, living in the urban area of a municipality in the interior of Minas Gerais. The elderly who presented cognitive decline, assessed by the Mini Mental State Examination (MMSE)¹⁵ were excluded from the study; severe sequelae of brain stroke, with manifestation of loss of localized strength and aphasia; Parkinson's disease in severe or unstable stage, accompanied by severe impairment of motor skills, speech and/or affectivity. Six-hundred and eight elderly participated in the research.

Data were collected at the elderly's home, from March to July 2016, after signing the Informed Consent Form (ICF). Health professionals and undergraduate students in the health area received prior training on how to approach the participant and correct application of instruments and physical tests. Supervisors were selected to check the correct completion of the questionnaires, and periodic meetings were held with the aim of providing guidance and monitoring possible complications during the collection.

Instruments and tests described below were applied: I) semi-structured questionnaire for socio-demographic and economic characterization; II) the Short Physical Performance Battery (SPPB), which consists of a set of three tests, translated and adapt-

ed to Brazil¹⁶, which assess balance, gait speed and strength of the lower limbs¹⁶. Their score ranges from 0 to 12 points, the lower the worse the performance^{8,16}; III) the HGS test was evaluated with a manual dynamometer, JAMAR, SAEHAN[®]. Three measurements were taken, represented in kilogram/force (kgf), with the elderly dominant hand, adopting the average value found in the three measurements; IV) the World Health Organization Quality of Life-Bref (WHOQOL-BREF) and World Health Organization Quality of Life Olders (WHOQOL-OLD) were used to measure QOL. The first contains 26 questions, two of which are general QOL and the other 24 are distributed among the four domains¹⁷. The WHOQOL-OLD is used to assess the QOL of elderly people through 24 items distributed in six facets¹⁸. The score of both instruments varies from 0 to 100 and the higher the score, the better the QOL.

The study variables were sociodemographic: gender (female and male); age group, in years (60-70; 70-80; 80 years or more); marital status (never married; lives with a partner; widowed or separated/divorced); individual income, in minimum wages (<1; 1-3; 3-5; >5) and education, in years (not studied; 1-4; 4-8; 8 or ≥9); clinical: number of morbidities (none; 1-5 or ≥5), physical performance of lower lower limbs (mean of the final score); HGS (mean value of measures), QOL domains measured by WHOQOL-BREF (physical, psychological, social relations and environment); and facets of QOL measured by WHOQOL-OLD (sensory functioning, autonomy, past, present and future activities, social participation, death and dying and intimacy).

Data were entered in double entry, in an electronic spreadsheet in the Excel[®] software and, after checking the inconsistencies between the two databases, the bank was imported into the Statistical Package for the Social Sciences (SPSS) software, version 20.0, for data analysis.

Assumptions of normality of residuals (inspection of the quantile diagram), homoscedasticity and linearity of the regression model were observed and met. Descriptive analysis was performed by means of frequency, mean and standard deviation. The linear

regression model (enter method) was used to check the association of the physical performance scores of lower limbs and HGS with the domains and facets of QOL, adjusting for the variables: sex, age and number of morbidities ($p < 0.05$).

This study was approved by the Human Research Ethics Committee of the Federal University of Triângulo Mineiro, under opinion 573.833 (CAAE: 26148813.0.0000.5154). Participants were contacted at their homes and received all information about the survey. The interview was carried out after the consent and signature of the ICF.

RESULTS

Of the 608 elderly people evaluated, the female gender predominated (67.8%), aged 60–70 years (43.8%), 4–8 years of study (39.3%), living with a partner (46.5%), individual income of a minimum wage (42.9%) and self-report of five or more morbidities (62.5%) (Table 1).

Table 1. Frequency distribution of the sociodemographic, economic and clinical variables of the community elderly. Uberaba, state of Minas Gerais, 2016

(To be continued)		
Characteristics	N	%
Sex		
Male	196	32.2
Female	412	67.8
Age group (in years)		
60–70	266	43.8
70–80	237	39.0
80 or more	105	17.3
Education		
Did not study	93	15.3
1–4 years	139	22.9
4–8 years	239	39.3
8 years	36	5.9
9 years or more	101	16.6
Marital status		
Never married or lived with a partner	43	7.1

Characteristics	(Conclusion)	
	N	%
Lives with spouse or partner	283	46.5
Widowed	220	36.2
Separated, legally separated or divorced	62	10.2
Individual income (in minimum wages)		
No income	55	9.0
Less than 1	10	1.6
1	261	42.9
1+3	226	37.2
3+5	37	6.1
More than 5	19	3.1
Morbidities		
None	12	2.0
1–5	216	35.5
5 or more	380	62.5

Regarding the physical performance of lower limbs, it was found in the SPPB that the mean score was 8.11 ± 2.76 and, in the HGS, 24.63 ± 8.66 kgf.

The social relations domain (72.72) and the death and dying facet (77.10) had the highest mean QOL scores among the elderly; in contrast, the lowest values were observed for the environmental domain (61.34) and in the social participation facet (64.81) (Table 2).

Table 2. Distribution of QOL scores for the WHOQOL-BREF domains and WHOQOL-OLD facets of community elderly. Uberaba, state of Minas Gerais, 2016

WHOQOL-BREF domains	Mean	Standard deviation
Physical	61.84	17.99
Psychological	65.30	14.71
Social relations	72.72	14.51
Environmental	61.34	12.68
WHOQOL-OLD facets		
Sensory functioning	72.29	23.86
Autonomy	65.24	15.91
Past, present and future activities	66.29	14.64
Social participation	64.81	37.64
Death and dying	77.10	34.54
Intimacy	73.20	37.61

The worst physical performance of lower limbs was associated with lower QOL scores in the domains: physical ($p < 0.001$); psychological ($p < 0.001$), social relationships ($p < 0.001$) and environmental ($p < 0.001$) and in the facets: sensory functioning ($p = 0.001$); autonomy ($p < 0.001$), past, present and future activities ($p = 0.001$) and social participation ($p = 0.001$). The low HGS score was associated with lower QOL scores in the domains: physical ($p = 0.003$), psychological ($p = 0.001$) and environmental ($p = 0.028$) and in the facets: sensory functioning ($p < 0.001$), past, present and future activities ($p = 0.010$) and intimacy ($p = 0.013$) (Table 3).

Table 3. Adjusted linear regression analysis for the WHOQOL-BREF domains and WHOQOL-OLD facets with the SPPB and HGS scores. Uberaba, state of Minas Gerais, 2016

QOL scores	SPPB scores		HGS scores	
	Standardized β	p	Standardized β	p^*
WHOQOL-BREF				
Physical	0.405	$< 0.001^\dagger$	0.135	0.003 [†]
Psychological	0.280	$< 0.001^\dagger$	0.176	0.001 [†]
Social relations	0.173	$< 0.001^\dagger$	0.060	0.294
Environmental	0.190	$< 0.001^\dagger$	0.122	0.028 [†]
WHOQOL-OLD				
Sensory functioning	0.142	0.001 [†]	0.194	$< 0.001^\dagger$
Autonomy	0.198	$< 0.001^\dagger$	0.100	0.075
Past, present and future activities	0.149	0.001 [†]	0.144	0.010 [†]
Social participation	0.143	0.002 [†]	0.022	0.704
Death and dying	-0.023	0.613	0.033	0.572
Intimacy	-0.035	0.440	0.144	0.013 [†]

*Adjusted for sex, age and number of morbidities; [†] $p < 0.05$.

SPPB: Short Physical Performance Battery; HGS: Handgrip Strength.

DISCUSSION

From the results of the present study, it was possible to observe the common association of the lower scores of physical performance of lower limbs and HGS with lower scores of QOL in the physical, psycho-

logical and environmental domains and in the sensory functioning of the senses and past activities, present and future facets. In addition, the physical performance of lower limbs was associated with the social domain and the autonomy and social participation facets; HGS, on the other hand, with the intimacy facet.

The findings of the present study referring to the profile of the evaluated elderly people corroborate with the scientific literature regarding gender^{4,10,11,14}; age group^{6,19}; marital status^{6,20}, individual income⁶ and number of morbidities^{5,19,21}. The characterization of the elderly population can assist in proposing interventions that aim to contribute to improve the physical performance of lower limbs and HGS and, consequently, QOL.

The SPPB mean value found indicates that there is already a reduction in the physical performance of lower limbs. The mobility assessed by this test can predict changes in QOL throughout life²¹, which confirms the need for actions to improve and maintain the function of lower limbs, such as the practice of physical activity. A study carried out in Vancouver²¹ found a similar mean and a bibliographic review reaffirms the role of actions, since the cutoff point ≤ 10 points in the SPPB was a predictor for the loss of the ability to walk 400 meters²².

The mean value found for HGS did not show a remarkable decrease, but it is a variable that should be prioritized, as it tends to decrease with age¹² and its preservation facilitates independent life and minimizes the demand for formal or informal support for carrying out daily activities²³. National¹² and international²³ studies found similar mean values.

In QOL, the highest score in the domain of social relationships can be explained by the fact that most elderly people live with a partner, which contributes to the improvement of the items evaluated in this domain, such as personal relationships, social support and sexual activity¹⁷. National research differs from the present finding, presenting the psychological domain with the highest score²⁰.

The death and dying facet obtained the highest score, which can derive from control over the worries and fear of death, acting positively in the QOL of the elderly, who experience the passage of years and the loss of friends and family²⁴. The finding confirms the study conducted in Montes Claros, state of Minas Gerais²⁴.

The lower score found in the environmental domain can be justified by the low income of the

elderly in the current study. Financial resources interfere with the power of choice, which includes the preferences of the elderly and the control of issues involving the environment, such as home, neighborhood and community². A similar score was reported in a study in the state of Acre²⁰.

The facet with the lowest score was social participation, which suggests the dissatisfaction of the elderly regarding participation in activities, especially those in the community¹⁸. Thus, instigating, inclusive activities that respect the particularities of this population should be encouraged¹⁹. A study in Montes Claros, state of Minas Gerais, found a lower score on the autonomy facet²⁴, which differs from the findings of the present study.

Physical limitations caused by impaired physical performance of lower limbs and HGS act as predictors for adverse health events such as the demand for care, occurrence of falls, fractures, hospitalizations and deaths²², which may explain the association of these variables with the lowest scores in the physical domain. Members of the study group on sarcopenia and fragility in the European society suggest that physicians insert the evaluation of these measures into their routines, through tests that are widely applicable and have good response capacity, such as SPPB and HGS²².

The association of the worst physical performance of lower limbs and the low score on the HGS with the psychological domain may be related to the aging process itself, which is marked by the accumulation of molecular and cellular damage that progressively cause losses in physiological reserves and general decline in intrinsic capacity². This often creates the stereotype of age discrimination that considers the elderly as a synonym for dependence or social burden². It is suggested that the occurrence of such losses and labels may generate negative feelings about body image and appearance, in addition to impairing the ability of the elderly to think, learn and concentrate.

Regarding the association of low physical performance of the lower limbs and the domain of social relationships, it is suggested that the longevity

enjoyed by the elderly may be marked by declines in physical capacity that generate negative repercussions for this population and for society², which may impact on social relationships. Regardless of this scenario, it is possible that supportive environments provide the guarantee of the elderly to live with dignity, therefore, the responses of public health services should consider the losses that occurred in this phase of life, as well as those that prevent the psychosocial growth of the elderly².

The physical component is decisive for the intrinsic capacity of the elderly to carry out their activities in different environments, such as home, neighborhood and community². Thus, the promotion of physical performance⁶, the improvement of muscle strength through educational programs focused on nutrition and physical exercise¹⁰ and the creation of environments favorable to the elderly² should be encouraged. This is because, it is assumed that the relationship between the low physical performance of lower limbs and the HGS with the QOL score in the environmental domain can be explained by the physical limitation that can prevent or hinder the performance of activities in environments in which the elderly are inserted.

The worst physical performance of lower limbs and low scores on the HGS were associated with lower scores in the sensory functioning facet and, with the aging process, motor changes occur and accompany sensory losses, such as hearing and visual², which may explain this finding. The need to investigate such declines is highlighted, in order to understand the possible associations and impacts on the elderly's QOL.

The association of the worst physical performance of lower limbs and the lowest QOL score in the autonomy facet may be related to motor losses, which compromise the physical performance of lower limbs². In this context, the family can understand it pertinent to make decisions by the elderly²⁵, affecting their autonomy, that is, their ability to decide about their lives². The implementation of support groups, for the elderly and family members, with the aim of improving autonomy in this population is an alter-

native²⁴ for maintaining the rights acquired in adulthood² and, thus, a better QOL.

Past, present and future activities are related to satisfaction with achievements and future hopes¹⁸. From the results found, it is assumed that the changes in the physical performance of lower limbs and HGS can cause discontent among the elderly about their achievements and future perspectives, given the current situation. Considering this issue, the investigation of the purposes and expectations of the elderly should be included in the dialogue with health professionals.

Physical changes can restrict the participation of the elderly in daily activities, especially in the community, expressing the association obtained of the worst physical performance of lower limbs and the lowest QoL scores in the social participation facet. Research carried out with elderly people in the state of Rio Grande do Sul reported that autonomous, community, domestic, paid and social activities are indispensable for the elderly's QOL¹⁹. Thus, it is necessary to develop policies that allow the elderly to age without limiting continuous social participation² associated with the strengthening of family and social ties²⁰.

The lowest values of HGS in the present study were associated with the intimacy facet, possibly due to the appearance of physical limitations resulting from this decrease²² that cause loss of motor skills in aging². This situation can often lead the elderly to have to live with family members, causing a feeling of discomfort in the new environment²⁵, which possibly interferes with relationships and feelings about companionship and love in life. It is necessary to emphasize that the elderly have the right to choose and control over aspects of their life, including the relationships they maintain².

The scarcity of research in the national and international literature that investigates the relationship between physical performance of lower limbs, HGS and QOL in the elderly, made it difficult to compare the study's findings. The cross-sectional design does not allow temporal direction between exposures and outcome⁶, and should be pointed out as a limitation of the present study. Findings were clarified

that should be considered and worked on; however, it was not possible to establish a causal relationship between the associations found.

CONCLUSION

There was an association of lower physical performance scores of lower limbs and HGS with lower QOL scores in the physical, psychological and environmental domains, and in the sensory functioning and past, present and future activities facets. The physical performance of lower limbs was also related to QOL, in the social domain and in the autonomy and social participation facets; the HGS was related to the intimacy facet.

Our results contribute to the knowledge about the physical performance of lower limbs, HGS and QOL, considering the specificities involved in the aging process, which can assist in the planning and implementation of specific care directed to these conditions.

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