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Hand grip strength and functionality in the long-lived elderly: a cross-sectional study

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ABSTRACT

Aim: to analyze the relationship between the manual grip strength and the functional independence measure of long-lived elderly. **Method**: a cross-sectional quantitative study, developed with 72 patients from primary care in Curitiba, PR, Brazil. Data were collected between August and December 2015. Descriptive and association analyzes were performed between variables. **Results**: 22 (30.6%) had a decrease in manual grip strength; and regarding functional independence, 51 (70.8%) were independent and 21 (29.2%) were moderately dependent. There was a significant association between the manual grip strength and the cognitive functional independence measure (p=0.021). **Discussion:** the gerontological care related to the practice of physical activity and participation in workshops of cognitive stimulation adapted to the schooling of the long-lived elderly people is fundamental. **Conclusion**: considering the association between the functionality and the manual grip strength, it is recommended to evaluate these aspects in the nursing consultations of the long-lived elderly, in different contexts of care.

Descriptors: Hand Strength; Geriatric Nursing; Aged, 80 and over; Activities of Daily Living; Health Centers.

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INTRODUCTION

The aging process comprises the reduction of muscle mass, as well as muscle function, a process known as sarcopenia, which favors the development of fragility, causes physical limitations and disability in the elderly[1]. In addition to negative outcomes, sarcopenia may contribute to falls and/or fractures, malnutrition, cachexia, limitations in activities of daily living, increased risk of hospitalization and death[2].

Sarcopenia, from the molecular point of view, results from a reduction in the synthesis of proteins in skeletal muscle and an increase in the degradation of muscle proteins, which can be seen in the reduction of the hand grip strength (HGS), which refers to one of the components of the phenotype of physical fragility[2]. HGS is recognized as an increasing variable that reaches a peak around the age of 30 and, after 50 years, presents a marked decline that can compromise the sensory-motor functions that affect the basic activities of daily living[3].

HGS, a component of the fragility phenotype, is an important measure for the evaluation of total muscle strength, since it has a direct relation with the capacity and independence of the elderly. It is an effective, simple and easy to apply test[4]. The choice of the HGS component analyzed together with the functional evaluation aims to investigate the relationship between motor performance and longevity functional independence.

One of the instruments used to evaluate the functionality is the Functional Independence Measure (FIM), one of the most widespread tools for the functional evaluation of the elderly, validated in Brazil[5]. This instrument assesses the functionality of the elderly through tasks involving the motor, cognitive and social domains[5]. Early identification of elderly individuals with a risk of functional decline enables gerontological nursing to plan targeted interventions, aiming to increase autonomy and reduce dependence[6].

The investigation of the HGS and the FIM of the long-lived elderly is important because these are admittedly powerful instruments for nurses in the evaluation of the functional capacity of the elderly. It is believed that, in this way, they can intervene in advance, delaying or slowing the development of the elderly's dependence on activities of daily living, which interferes in the quality of life and, consequently, in their longevity.

In view of the above, the objective of this study was to analyze the relationship between HGS and FIM of elderly people.

METHOD

This is a cross-sectional quantitative study based on two research databases developed by the authors, which occurred concurrently from January 2013 to December 2015, in basic health units (UBS) of Curitiba, PR, Brazil. The study population includes long-lived elderly people who were enrolled in two UBS and participated in the aforementioned surveys, entitled: "Effects of fragility on the long-lived elderly in the community" and "Follow-up on the functional independence measure of long-lived elderly people living in a community". The sample, in turn, consisted of 72 elderly people aged ≥80 years, who participated in both surveys.

The inclusion criteria of the participants were to have performed the HGS test, and have

responded to the FIM assessment instrument. The excluded participants were those whose records were not accessible, illegible or incomplete in the data collection instruments. Data collection for the sample in question was performed between August and December 2015, using an elaborated instrument. The variables of interest were gender, age, marital status, people, with whom they reside, schooling and financial situation, and the results of HGS and FIM.

In order to measure the HGS, a hydraulic dynamometer measuring the force in kilograms (Kgf) was used, followed by the technique recommended by the American Society of Hand Therapists (ASHT)[7]. After adjusting for sex, values that were in the lowest quintile were considered markers of fragility, indicating the long-lived elderly with decreased HGS[2].

In turn, the FIM was applied through an interview with the elderly, with the confirmation of the information by the family caregivers. FIM is divided into two domains, motor and cognitive, and quantitatively evaluates the burden of care that a person demands to perform certain activities of daily living. Motor FIM (FIMm) consists of four categories, which include 15 tasks: feeding, personal hygiene, bathing, dressing above waist, dressing below waist, toilet use, urine control, stool control, bed mobility, chair, wheelchair, toilet and shower/tub, walk/wheelchair and stairs. The cognitive FIM (FIMc) is composed of two categories that include five tasks: comprehension, expression, memory, social interaction, and problem solving[5].

Each task receives a score ranging from 1 (total dependency) to 7 points (complete independence). The elderly were classified according to levels of dependency in each of the tasks, as follows: independent for those who obtained scores 6 or 7; moderately dependent for those who scored between 3 and 5; and dependent elderly for people who scored 1 or 2.

Thus, the total FIM (FIMt) has a maximum score of 126 and a minimum score of 18[5]. This means that the mean MIFt score corresponds to the MIFt score divided by the 18 tasks that make up the instrument. The analysis of scores by domain occurs in a similar way, considering the average score divided by the number of tasks of the respective domain. In this way, the FIMm varies from 13 to 91 points and the FIMc from 5 to 35 points. From the scores of each FIM task, the elderly were classified as independent, moderately dependent or dependent according to the average score obtained, which allows classifying the functionality, since the FIM does not have cut-off points for total scores.

The data were organized in Excel 2007 computer program under double typing to reduce the possibility of error. Data analysis was performed in the Statistical Package for Social Sciences (SPSS) version 21.0, using descriptive statistics and association between variables. For the association between the HGS and the FIM domains the association tests between variables (Fisher's exact test) were used, and the differences and associations were considered statistically significant when the *p*-value of the significance test was ≤0.05. Both studies received a favorable opinion from the Ethics Committee on Research with Human Beings, under the opin-

ions of No. 156.413 and No. 1293.216.11.12, respectively.

RESULTS

A total of 72 long-lived elderly people (n=50, 69.4%), 80-89 years old (n=62, 86.1%) and 85.3 year-old widowed (n=41, 56, 9%), who live with relatives (n=37, 51.4%), have low schooling (n=47, 65.3%) and consider their financial status medium (n=33, 45.8%).

After adjusting for sex, HGS was considered decreased when values were ≤14Kgf for women and ≤20Kgf for men. Values among women ranged from 10 kg to 38 kg and for men from 12 kg to 44 kg. Of the elderly investigated, 68 (94.4%) have the right hand as the dominant one; and 22 (30.6%) had HGS reduction, and the majority were female (n=15, 68.2%).

Table 1 shows the distribution of the frequency of the elderly in terms of levels of dependence, according to the scores obtained in the FIM tasks. Participants were categorized as independent or moderately independent for most tasks. Considering all the sample of participants, the tasks for which the majority of the elderly presented some degree of dependence were: problem solving (37.5%), urine control (40.3%) and climbing stairs up and down (48.6%).

Table 2 shows the distribution of the classification in the FIM tasks, according to the results of the HGS. The tasks to which the elderly with reduced HGS (n=22; 30.6%) presented greater dependence and/or were moderately dependent refer to climb up and down the stairs (n=15; 68.2%) and problem solving (n=11; 50.0%).

In Table 3, it was observed that there was a significant association between the FIM cognitive domain and the HGS of longevity (p=0.021). Among the elderly classified as independent for the cognitive FIM (n=53), 12 (22.6%) presented reduced HGS, while among the moderately dependent (n=19), 10 (52.6%) presented HGS reduction.

DISCUSSION

In the present study, the number of elderly individuals with HGS decreased was considerable (30.5%), and it was even more significant considering that almost 70% of them were female. Similar results were found in the study with the objective of investigating the prevalence of HGS reduction and the associated factors of 157 long-lived elderly in the community of Curitiba/PR, Brazil. Of the participants, 40 (25.5%) had decreased HGS, and the majority were female (n=30; 28.8%), aged 80-89 years (n=29; 21%). The authors related these results to the higher age factors of women and the greater muscle strength frequently observed among men[8].

The deficit evidenced by the reduction of the muscular strength of the elderly has an impact on the activities of daily living, as can be observed in the FIM tasks, due to the difficulty in climbing up and down stairs. The aim of this study was to validate the Activity Limitations in Climbing Stairs scale, which measures limitations in the activity of going up and down stairs, in which the researchers evaluated 22 elderly people (mean 76 years) in outpatient follow-up of a university hospital in Rio de Janeiro, RJ, Brazil. Half of the respondents used the railing support to climb and descend stairs and 32% did not use alternate steps. This task of going up

Table 1. Distribution of elderly people's frequency of dependency levels, according to the scores obtained in the tasks of the Functional Independence Measure. Curitiba-PR, 2015

FIM Tasks	Independent (6-7 Points)		Moderately dependent (3-5 Points)		Dependent (1-2 Points)		Total
	N	(%)	N	(%)	N	(%)	n (%)
Self Care							
Food	64	(88,9)	8	(11,1)	0	(0)	72 (100)
Hygiene	67	(93,0)	5	(7,0)	0	(0)	72 (100)
Shower	63	(87,5)	9	(12,5)	0	(0)	72 (100)
Dressing upper body	59	(81,9)	13	(18,1)	0	(0)	72 (100)
Dressing lower body	55	(76,4)	16	(22,2)	1	(1,4)	72(100)
Toilet use	68	(94,4)	4	(5,6)	0	(0)	72 (100)
Sphincter control							
Urine control	43	(59,8)	23	(31,9)	6	(8,3)	72 (100)
Stool control	69	(95,9)	2	(2,7)	1	(1,4)	72 (100)
Mobility							
Transfer to chair	69	(95,9)	3	(4,1)	0	(0)	72 (100)
Transfer to toilet	69	(95,9)	3	(4,1)	0	(0)	72 (100)
Transfer to shower	69	(95,9)	3	(4,1)	0	(0)	72 (100)
Locomotion							
Walk/Wheelchair	52	(72,2)	20	(27,8)	0	(0)	72 (100)
Stairs	37	(51,4)	30	(41,6)	5	(7,0)	72 (100)
Communication							
Comprehension	57	(79,1)	14	(19,5)	1	(1,4)	72 (100)
Expression	58	(80,5)	13	(18,1)	1	(1,4)	72 (100)
Social cognition							
Social interaction	61	(84,8)	10	(13,8)	1	(1,4)	72 (100)
Problem-solving	45	(62,5)	24	(33,4)	3	(4,1)	72 (100)
Memory	60	(83,4)	12	(16,6)	0	(0)	72 (100)

Note: FIM = Functional Independence Measure.

and down stairs can still be hampered by visual impairment, pathological processes of the locomotor and/or neurological system, fatigue and dyspnea, or even environmental conditions, such as inadequate lighting and non-symmetrical steps[9], making the elderly dependent or moderately dependent.

In addition to the task of going up and down stairs, an important quantitative of elderly people with moderate dependence or dependence for the task of urine control was identified. Regarding sphincter control, it is worth mentioning that this situation affects 15% to 30% of the elderly in the community, and urinary incontinence becomes frequent with advancing age, compromising the functional independence of the elderly[10].

This study was carried out with the objective of analyzing the determinants of an active aging and its relation with functional independence in 100 elderly (≥60 years) of the community, in João Pessoa, PB, Brazil[11]. The lower means obtained in the FIM were related to the categories memory and problem solving, a fact that can be justified because they require more of the psychological capacity and the intellect and depend, in part, on the schooling of the participants.

Table 2. Distribution of the classification in the tasks of the Functional Independence Measure, according to the results of manual grip strength of the longevity. Curitiba-PR, 2015

FIM Tasks	Decreased HGS			Preserved HGS		
	Dep. n (%)	Mod. Dep. n (%)	Ind. n (%)	Dep. n (%)	Mod. Dep. n (%)	Ind. n (%)
Food	0 (0)	2 (2,8)	20 (27,7)	0 (0)	6 (8,3)	44 (61,2)
Hygiene	0 (0)	2 (2,8)	20 (27,7)	0 (0)	3 (4,1)	47 (65,2)
Shower	0 (0)	2 (2,8)	20 (27,7)	0 (0)	7 (9,7)	43 (59,7)
Dressing upper body	0 (0)	5 (7,0)	17 (23,6)	0 (0)	8 (11,1)	42 (58,3)
Dressing lower body	0 (0)	5 (7,0)	17 (23,6)	1 (1,4)	11 (15,2)	38 (52,7)
Toilet use	0 (0)	1 (1,4)	21 (29,1)	0 (0)	3 (4,1)	47 (65,2)
Urine control	4 (5,6)	6 (8,3)	12 (16,7)	2 (2,8)	17 (23,6)	31 (43,0)
Stool control	0 (0)	0 (0)	22 (30,5)	1(1,4)	2 (2,8)	47 (65,2)
Transfer to chair	0 (0)	0 (0)	22 (30,5)	0 (0)	3 (4,1)	47 (65,2)
Transfer to toilet	0 (0)	0 (0)	22 (30,5)	0 (0)	3 (4,1)	47 (65,2)
Transfer to shower	0 (0)	0 (0)	22 (30,5)	0 (0)	3 (4,1)	47 (65,2)
Walking/Wheelchair	0 (0)	7 (8,3)	15 (20,8)	0 (0)	13 (19,5)	37 (51,3)
Stairs	3 (4,1)	12 (16,7)	7 (9,8)	2 (2,8)	18 (25,1)	30 (41,6)
Comprehension	1 (1,4)	6 (8,3)	15 (20,8)	0 (0)	8 (11,2)	42 (58,3)
Expression	1 (1,4)	5 (7,0)	16 (22,1)	0 (0)	8 (11,2)	42 (58,3)
Social interaction	1 (1,4)	3 (4,1)	18 (25,1)	1 (1,4)	6 (8,3)	43 (59,7)
Problem-solving	2(2,8)	9 (12,5)	11 (15,2)	1(1,4)	15 (20,8)	34 (47,3)
Memory	0 (0)	5 (7,0)	17 (23,6)	0 (0)	7 (9,7)	43 (59,7)

Note: FIM = Functional Independence Measure; HGS = Hand Grip Strength; Dep. = Dependent; Mod. = Moderate; Ind. = Independent.

Physical and cognitive limitations may still be consequences of aging; therefore, they tend to be progressive and increase with advancing age[11].

The prevalence of cognitive impairment in elderly populations is observed in international studies[12-13]. A survey conducted in Moscow, Russia, aimed at assessing the prevalence of geriatric syndromes evaluated 1,220 elderly in the community, and among them 58.2% had cognitive deficit. These data point to the need for interventions aimed at maintaining the quality of life of the elderly[12]. A similar study, carried out in Switzerland with 85 elderly people, pointed out the prevalence of cognitive impairment in 37.7% of those investigated[13].

It is worth noting the study Fragility in Brazilian Elderly (FIBRA, acronym in Portuguese), with 2,472 elderly (≥65 years), whose objective was to describe variations in chronic diseases, functional capacity, social involvement and satisfaction with memory domains, day to day, social relations, environment, health services and transport. The elderly (65-69 years old) had an average HGS of 26.2 Kgf, while the long-lived ones (≥80 years) had the lowest HGS values, with an average of 22.1 Kgf. The age of the elderly correlated with the social involvement domain (p=0.001), indicating that the social isolation of the long-lived elderly can be attributed to external environment conditions. Thus, these conditions are barriers and jeopardize their safety because they avoid activities that require much of the functional capacity[14].

Table 3. Relationship between the Manual Hold Force of the longevity and the dependency levels per domain of the Functional Independence Measure. Curitiba-PR, 2015

FIM domains	FIM Classification	HGS preserved n (%)	HGS reduced n (%)	Total n (%)	*p*-value*
Motor FIM	Independent	35 (74,5)	12 (25,5)	47 (100)	0,283
	Mod. Dep.	15 (60,0)	10 (40,0)	25 (100)	
Cognitive FIM	Independent	41 (77,4)	12 (22,6)	53 (100)	0,021*
	Mod. Dep.	9 (47,4)	10 (52,6)	19 (100)	
Total FIM	Independent	37 (72,5)	14 (27,5)	51 (100)	0,408
	Mod. Dep.	13 (61,9)	8 (38,1)	21 (100)	
Total		50 (69,4)	22 (30,6)	72 (100)	

Note: FIM = Functional Independence Measure; HGS = Hand Grip Strength; Mod. Dep. = Moderately Dependent.
* Fisher exact test.

A study carried out with 87 long-lived elderly in a city of Santa Catarina, PR, Brazil, investigated the active aging according to its determinants. It was observed that social interaction occurred as follows: 48.28% of them had contact with people at parties, restaurants, bars and houses of neighbors or acquaintances; 27.58% participated in associations, cooperatives and religious movements; 22.99% attended the group of the elderly. Social interaction is an important exercise of citizenship that contributes to the personal valuation of the elderly and this should be stimulated[15].

Another task for which the elderly, with both decreased and preserved HGS, showed greater dependence was the resolution of problems. This refers to the paternalistic behavior of family caregivers who, with overprotective attitudes, often limit the elderly to activities that require displacement beyond the home environment, and which may have the autonomy to solve their daily problems. Another finding of this study is the high number of elderly in the condition of widows, who, despite having muscular strength, no longer feel the same disposition to interact with others and to solve daily problems themselves. It should be noted that the elderly had no functional deficit related to the transfer activities, which are routine tasks that, in addition to muscle strength, also require the adequacy of the space. This result points to the possibility that the elderly can establish the best technique for their execution, in order to maintain their independence even in situations such as reduced strength.

A study conducted with 240 elderly people in Ribeirão Preto, SP, Brazil, aimed to characterize the sociodemographic profile of elderly individuals. It aimed to verify the levels of fragility and to correlate the dimensions of the FIM to the instrumental activities of daily living. The results showed that 153 (63.7%) were fragile and, when analyzing the levels of dependency to perform basic daily activities of these elderly, 123 (80.4%) had partial or complete dependence[16].

These data indicate that both the physical frailty of the elderly and the functionality are often present concomitantly in the elderly, especially among those with old age. An Italian study conducted with 1,030 individuals between 20 and 102 years evaluated the

risk factors for functional disability in old age. The authors observed a significant decline in muscle strength with advancing age, in which the group of elderly individuals over 85 years of age presented 25% of the strength of the group of young people (20-29 years old). The authors emphasize that exercise practice, in addition to increasing muscular endurance, favors the synthesis of muscle proteins in order to reduce age-related sarcopenia[17] and, consequently, improve the mobility and functionality of the elderly. There was a significant association between HGS and FIM cognitive domain (p=0.021) in the sample investigated by this study. These data are reinforced by another longitudinal investigation conducted in Europe that aimed to examine time-dependent predictors of functional impairment. A total of 41,858 elderly people were evaluated, and the researchers observed that functional deficits increased significantly with age, accompanied by cognitive impairment and chronic diseases[18].

Another study that observed 80 elderly people with a mean age of 78.6 years, with the objective of evaluating the conditions that influence HGS in geriatric patients, found a positive association between the HGS and the Mini Mental State Examination (p<0.001). Reduced HGS leads to functional impairment and consequently to disability[19]. Considering that the elderly with reduced HGS already presents a condition of pre-fragility, the importance of the evaluation of the cognitive domain associated to the physical fragility of the elderly is highlighted, with emphasis on the HGS.

A prospective population study was carried out with 555 elderly (≥85 years) residents of the city of Leiden, The Netherlands, whose objective was to analyze the temporal relationship between cognitive performance and hand grip strength in older adults. Participants were observed for the four-year period and the results show association between preserved HGS and higher cognitive performance (p=0.03), stating that cognitive decline precedes muscle weakness[20].

CONCLUSION

HGS was significantly associated with longevity cognitive FIM. This relation evidences the influence of the cognitive aspects in the accomplishment of motor activities and in the global functionality. Functional dependence is an undesirable outcome and may lead to fragility syndrome. Therefore, it is indispensable to support nursing gerontological care in actions that aim to stimulate the practice of physical activities, in order to maintain the mass and muscular strength of longevity. In addition, cognitive stimulation workshops should be considered in primary health care according to the education level of the elderly (schooling), focusing on independence and reducing the effects of fragility.

It is expected that in the practice of gerontological nursing functional care will be developed, based on the nursing diagnosis and the implementation of care aimed at maintaining the functional capacity of the elderly. For such, evaluations such as FIM or HGS can be adopted in the nursing consultation in different contexts of care.

Limitations of the study include reduced sample size and cross-sectional design, which does not allow cause and effect relationships. Still, one of the surveys used as data source

excluded elderly people unable to perform physical tests, thus, it is considered that the number of moderately dependent or dependent long-lived elderly is underestimated in this study population.

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