

# HAND GRIP STRENGTH IN ELDERLY PARTICIPANTS IN COMMUNITY GROUPS

*Força de preensão manual de idosos participantes de grupos de convivência*

*Fuerza de prensión manual en mayores participantes de grupos de convivencia*

Original Article

## ABSTRACT

**Objective:** To analyze the hand grip strength (HGS) in elderly participants in community groups and its relation to gender, physical activity practice, diabetes, systemic arterial hypertension and osteoporosis. **Methods:** This is a descriptive, cross-sectional study with a quantitative approach, performed with 79 elderly people of both genders, participants of community groups in the city of Palhoça-SC. Clinical data and HGS were assessed from July to October 2012, being analyzed the influence of the variables on the HGS. **Results:** The sample comprised 69 women (87.3%) and 10 men (12.7%), where 34.2% (n= 27) of the elderly reported having diabetes, 55.7% (n= 44) systemic arterial hypertension, and 25.3% (n= 20) osteoporosis. The men's HGS ( $63.97 \pm 15.17$  pounds) was higher than the women's ( $40.52 \pm 12.27$  pounds), ( $p=0.001$ ). There was no significant difference between the HGS averages among the elderly practitioners of physical activity and the non-practitioners ( $p=0.99$ ). There was influence of osteoporosis on the HGS, where the elderly without the disease presented more strength than the affected ones ( $p=0.002$ ). **Conclusion:** The elderly showed lower HGS values than expected for their age, being men's HGS higher than the women's. The physical activity practice, systemic arterial hypertension and diabetes did not influence the HGS, however, the elderly with osteoporosis showed diminished HGS.

**Descriptors:** Hand Strength; Aged; Aging.

## RESUMO

**Objetivo:** Analisar a força de preensão manual (FPM) de idosos participantes de grupos de convivência e sua relação com sexo, prática de atividade física, diabetes, hipertensão arterial sistêmica e osteoporose. **Métodos:** Trata-se de um estudo descritivo, transversal, com abordagem quantitativa, realizado com idosos de ambos os sexos, participantes de grupos de convivência do município de Palhoça-SC. Coletaram-se dados clínicos e FPM entre julho e outubro de 2012 e analisou-se a influência das variáveis estudadas sobre a FPM. **Resultados:** Fizeram parte da amostra 69 mulheres (87,3%) e 10 homens (12,7%), onde 34,2% (n=27) dos idosos relataram apresentar diabetes, 55,7% (n=44) hipertensão arterial sistêmica e 25,3% (n=20) osteoporose. A FPM dos homens ( $63,9 \pm 15,1$  pounds) foi maior do que das mulheres, ( $40,5 \pm 12,2$  pounds) ( $p=0,001$ ). Não houve diferença significativa entre as médias da FPM entre os idosos praticantes e não praticantes de atividade física ( $p=0,99$ ). Houve influência da osteoporose sobre FPM, onde os idosos sem a doença tinham mais força que os acometidos ( $p=0,002$ ). **Conclusão:** Os idosos investigados apresentaram baixa FPM, sendo a dos homens maior do que das mulheres. A prática da atividade física, hipertensão arterial sistêmica e a diabetes não influenciaram a FPM, entretanto, os idosos com osteoporose apresentaram FPM diminuída.

**Descritores:** Força da Mão; Idoso; Envelhecimento.

Luana Meneghini Belmonte<sup>(1)</sup>  
Inês Alessandra Xavier Lima<sup>(1)</sup>  
Luiz Augusto Oliveira Belmonte<sup>(1)</sup>  
Viviane Pacheco Gonçalves<sup>(1)</sup>  
Jean Carlos Conrado<sup>(2)</sup>  
Diego Amorim Ferreira<sup>(2)</sup>

1) Laboratório de Pesquisa em Exercício Físico e Saúde - LAPES (Laboratory of Physical Activity and Health Research) Tubarão (SC) - Brazil

2) Universidade do Sul de Santa Catarina - UNISUL (University of the South of Santa Catarina) Tubarão (SC) - Brazil

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## RESUMEN

**Objetivo:** Analizar la fuerza de prensión manual (FPM) en mayores participantes de grupos de convivencia y su relación con el sexo, práctica de actividad física, diabetes, hipertensión arterial sistémica y osteoporosis. **Métodos:** Se trata de un estudio descriptivo, transversal con abordaje cuantitativo realizado en mayores de ambos sexos, participantes de grupos de convivencia del municipio de Palhoça-SC. Se recogieron datos clínicos y FPM de julio a octubre de 2012 y se analizó la influencia de las variables estudiadas sobre la FRM. **Resultados:** La muestra fue de 69 mujeres (87,3%) y 10 hombres (12,7%), de los cuales el 34,2% (n= 27) de los mayores relataron presentar diabetes, el 55,7% (n= 44) hipertensión arterial sistémica y el 25,3% (n= 20) osteoporosis. La FPM de los hombres 63,9 ( $\pm 15,1$ ) pounds, fue más elevada que de las mujeres 40,5 ( $\pm 12,2$ ) pounds ( $p=0,001$ ). **Conclusión:** Los mayores investigados presentaron baja FPM siendo la de los hombres más elevada que de las mujeres. La práctica de actividad física, hipertensión arterial sistémica y la diabetes no han influenciado en la FPM, sin embargo, los mayores con osteoporosis presentaron la FPM disminuida.

**Descriptores:** Fuerza de la mano; Anciano; Envejecimiento.

## INTRODUCTION

Aging triggers natural changes in the organism, translated by the harmonic decline of any organic complex. The elderly respond more slowly and less efficiently to environmental changes, thus becoming more vulnerable<sup>(1)</sup>.

The aging process comprises morphological and physiological changes, such as: progressive muscular atrophy, functional weakness, bone decalcification, increase in vessel wall thickness, increased levels of total body fat, and decrease in the coordinating ability<sup>(1)</sup>. There is a probable influence of age and anthropometric variables on the behaviour of muscle strength in elderly subjects, the age being the factor of greatest relevance<sup>(2,3)</sup>.

The literature shows a reduction in muscle strength associated with aging around 15% per every decade after 50 years of age, liable to reach approximately 30% every decade after the age of 70<sup>(4,5)</sup>, and studies show that healthy individuals aged 70-80 years have 20-40% lower performance (reaching 50% in those even older) in tests of muscle strength compared to the youth<sup>(4,5,6)</sup>.

The physiological mechanisms of loss of muscle strength are multifactorial and arise from damages to neural activation, decreased ability to generate intrinsic muscle strength, and loss of muscle mass, as well as reduced protein synthesis and infiltration of adipocytes into the muscle fibers, representing a physiological vulnerability related to age<sup>(7,8)</sup>.

Sarcopenia is the phenomenon marked by progressive decline in muscle strength with age advance<sup>(9,10,8)</sup>, which is able to cause modifications in the muscular architecture (reduction in the anatomical and physiological cross-sectional area), in the fascicular length, volume and pennation angle of the muscles<sup>(9)</sup>. Due to these characteristics, sarcopenia correlates with functional decline and disability, being considered one of the variables used to define the frailty syndrome, highly prevalent in the elderly, conferring increased risk for falls, fractures, decreased capacity to perform daily activities, dependence, recurrent hospitalization, and risk of death<sup>(11,12)</sup>.

It thus seems that the two main factors responsible for aging-related sarcopenia are the progressive neurogenic process and the decrease in muscle load, leading to hypothesize that muscle atrophy would not necessarily be an unavoidable consequence of the aging process. People who remain physically active presenting only moderate loss of muscle mass are observed but, how much of that muscle wasting is a consequence of aging and/or decreased level of physical activity, is still unknown<sup>(13)</sup>.

Regular physical activity has been recommended in order to minimize the aging effects and improve the functional capacity of the elderly. A greater size of muscle fibers and greater muscle strength are demonstrated in elderly undergoing strength training and resistance training when compared to elderly non-practitioners of physical exercise<sup>(14)</sup>.

There are some ways of assessing the muscle strength, among them, the evaluation of the hand grip strength (HGS). This measure has several clinical applications, being used, for example, as an indicator of total body strength and, in this sense, it is used in physical fitness tests<sup>(14,15)</sup>.

The development of diseases and the progressive loss of functional abilities affect the elderly's quality of life, limiting their ability to perform activities of daily living and impairing their health<sup>(16)</sup>.

Therefore, the knowledge and early detection of declining physical abilities associated with aging, among them the muscle strength, and possible associations with chronic degenerative diseases, are necessary for the development of health programs considering strategies and interventions, in order to minimize such decline, improving the functional capacity and independence of the elderly.

Given the aforementioned aspects that demonstrate the decline in muscle strength associated with aging, this study aims to analyze the hand grip strength (HGS) of elderly participants in social groups, and their relation to sex, physical activity practice, diabetes, hypertension and osteoporosis.

## METHODS

This research was characterized as a descriptive, cross-sectional study with a quantitative approach, performed with participants of elderly community groups in Palhoça-SC. The sample, intentionally selected, had as inclusion criteria: elderly ( $\geq 60$  years old) and not presenting any acute infection. Moreover, as exclusion criteria, presence of neurological or cognitive dysfunction. The study thus comprised 79 patients of both sexes, being 69 women and 10 men.

Data was collected by previously trained researchers, in the months of July to October 2012. Initially, there was a personal contact with the coordinators of the community groups and later with the elderly, for explanation about the purpose of the research, confidentiality and request of the authorization to conduct the study. After authorization, date and time were scheduled to apply the study instruments among the community groups, the assessment being conducted in the places where the group meetings were held.

For the characterization of sample, a diagnostic sheet was used, containing questions relating to personal (age and sex) and clinical data, applied in the form of an individual interview, with the elderly's self-report about the presence of age-related diseases diagnosed by a physician and the physical activity practice.

The measurement of the HGS followed the procedures of the American Society of Hand Therapists (ASHT)<sup>(17)</sup>, the participants being seated in an armless chair, hip and knees positioned at approximately 90 degrees of flexion, with feet flat on the floor. The shoulder of the limb tested (dominant shoulder) was naked and in the following position: adducted and in neutral rotation, elbow flexed at 90 degrees, forearm and wrist in neutral position between 0 and 30 degrees of extension, and between 0-15 degrees of adduction. The hand of the member not being tested rested on the thigh of the same side. The way the test should be conducted was demonstrated for the participants to become familiarized with the equipment and they underwent a simulated test, performing submaximal strength test, followed by a one-minute rest period before the start of the official test. Three consecutive measurements were performed with rest intervals of 15 seconds, being used the average of these measures. Participants were instructed not to look at the dynamometer dial to prevent any visual feedback. There was no verbal command during the test.

To analyze the performance of maximum strength of the elderly's HGS, this study used the reference values, according to gender and age<sup>(18)</sup>, as shown in Table I.

Data was organized in *Microsoft Excel®* software and analyzed in the statistical software SPSS - *Statistical*

*Package for Social Sciences* - version 17.0 for *Windows*. Nominal variables were worked in a dichotomous manner. Diabetes, Hypertension, and Osteoporosis were categorized as "no" (not present) and "yes" (present); physical activity was categorized as "yes" (practitioner) and "no" (non-practitioner); and sex, in "female" and "male". HGS is a numeric variable. The descriptive statistical analysis was performed by simple frequency and percentages. The Kolmogorov-Smirnov test was used for verification of the normality in the data. For the inferential analysis between a dichotomous categorical variable and a numeric one, the independent samples t-test and Mann-Whitney U-test were used. A significance level of 5% was adopted.

This study was approved by the Research Ethics Committee of the University of the South of Santa Catarina (Unisul) under protocol number 11.699.4.08.III. (March 5, 2012).

## RESULTS

The sample consisted of 79 elderly participants of community groups in the city of Palhoça-SC, being 69 women (87.3%) and 10 men (12.7%).

The average age was 70.0 ( $\pm 6.00$ ) years, with no significant difference according to the sex of the participants ( $p=0.09$ ), though men ( $73.4 \pm 6.40$  years) have shown to be older than women ( $70.0 \pm 6.60$  years).

With regard to the presence of disease 55.7% ( $n=44$ ) of the elderly reported having systemic arterial hypertension, 34.2% ( $n=27$ ) reported diabetes and 25.3% ( $n=20$ ) osteoporosis.

Table I presents the HGS average values for the elderly in this study, by age and sex, and the reference values in the literature<sup>(18)</sup>. It is observed that these elderly's HGS was decreased when compared to the reference values.

Table II presents the HGS average values in the sample, according to the variables: sex, physical activity practice, diabetes, hypertension and osteoporosis.

The performance of HGS was associated with sex, the HGS of the men ( $63.9 \pm 15.10$  pounds) being higher than the women's ( $40.5 \pm 12.27$  pounds) ( $p = 0.001$ ).

The HGS was analyzed according to being or not a practitioner of physical activity. There was no significant difference between the mean HGS of the 21 elderly practitioners ( $43.4 \pm 10.30$  pounds) and the mean for the 58 elderly non-practitioners of physical activity ( $43.5 \pm 16.90$  pounds) ( $p = 0.99$ ).

With respect to diseases related to the aged, there was significant difference between the HGS according

Table I - Mean values of hand grip strength (pounds) by age and sex of the subjects of the present study and the reference values. Palhoça -SC, 2012.

| Age range | Female    |              | Male      |              |
|-----------|-----------|--------------|-----------|--------------|
|           | Reference | Study Sample | Reference | Study Sample |
| Years     |           |              |           |              |
| 60-64     | 57.1      | 40.3 (n=15)  | 92        | 0.0 (n=0)    |
| 65-69     | 56.5      | 41.8 (n=22)  | 91.9      | 69.2 (n=2)   |
| 70-74     | 53.4      | 41.7 (n=18)  | 84.3      | 67.5 (n=4)   |
| ≥75       | 39.6      | 37 (n=14)    | 61.7      | 53.8 (n=3)   |

Table II - Mean values of hand grip strength (pounds) of the elderly in the study, according to gender, physical activity practice, diabetes, systemic arterial hypertension and osteoporosis. Palhoça-SC, 2012.

| Variables                      | Hand grip strength (pounds) | p     |
|--------------------------------|-----------------------------|-------|
| Sex                            |                             |       |
| Female                         | 40.5 (± 12.27)              | 0.001 |
| Male                           | 63.9 (± 15.10)              |       |
| Physical activity practice     |                             |       |
| Practitioner                   | 43.4 (±10.30)               | 0.99  |
| Non-practitioner               | 43.5 (±16.90)               |       |
| Diabetes                       |                             |       |
| Present                        | 36.6 (±11.79)               | 0.276 |
| Not present                    | 42.5(±16.03)                |       |
| Systemic arterial hypertension |                             |       |
| Present                        | 40.3 (±12.80)               | 0.957 |
| Not present                    | 40.6 (±16.90)               |       |
| Osteoporosis                   |                             |       |
| Present                        | 36.0(± 10.16)               | 0.002 |
| Not present                    | 46.0(± 15.35)               |       |

to the presence (n = 59) or not (n = 20) of osteoporosis, and the HGS of the elderly who reported the presence of osteoporosis ( $36.0 \pm 10.16$  pounds) was lower than the HGS of the elderly who reported absence of osteoporosis ( $46.0 \pm 15.35$  pounds) ( $p = 0.002$ ).

Likewise, there was significant difference ( $p=0.03$ ) between the HGS of aged women, with and without osteoporosis. The elderly women with osteoporosis (n=20) had lower HGS ( $36.0 \pm 10.16$  pounds) than those without osteoporosis (n=49; HGS= $42.3 \pm 12.67$  pounds).

However, no significant difference was observed in HGS according to the presence of diabetes ( $p = 0.276$ ) and the presence of hypertension ( $p = 0.957$ ).

## DISCUSSION

In the present study, it was observed that the majority of the elderly were female. This result corroborates the

findings in the study held in an elderly community group in Belo Horizonte, Minas Gerais, where the majority of participants were women<sup>(19)</sup>. Similarly, it meets the results of a study in community groups of Santa Cruz do Sul-RS, where 80.5% were women<sup>(20)</sup>. Studies show that the number of women in groups of support programs for the Elderly is often larger in comparison with the number of men<sup>(21,22)</sup>.

A 73.4% majority of the elderly patients evaluated in this study does not practice physical activity, and reported presence of systemic arterial hypertension, followed by diabetes and osteoporosis.

Satisfactory levels of health-related physical fitness can help prevent, maintain, and improve the functional capacity, and reduce the likelihood of developing many chronic degenerative disorders such as obesity, diabetes, cardiovascular disease, and hypertension, among others, thus providing better health and quality of life for the population<sup>(23)</sup>. On the other hand, a sedentary lifestyle



contributes to decreased physical fitness<sup>(24)</sup>, and, combined with other risk factors, contributes to the occurrence of a number of chronic diseases such as diabetes and osteoporosis<sup>(20)</sup>.

The HGS is used in physical fitness tests, for having various clinical applications, and it is used, for example, as an indicator of total body strength, instead of being simply a measure of the hand strength, or even limited to the assessment of the upper limb<sup>(15)</sup>.

As regards to strength, the elderly assessed in this study showed HGS lower than expected for their age in both sexes, the men's HGS being higher than women's. The low value of HGS found in the sample of this study, when compared to the reference values<sup>(18)</sup>, is consistent with the results of a study that evaluated the muscle strength of muscles of the abdomen, upper limbs and lower limbs in the aging process, and found a significant decrease in muscle strength in all the analyzed segments<sup>(25)</sup>. Another study noted that the elderly's HGS was significantly higher among males and found HGS decline with advancing age<sup>(2)</sup>.

The reduction in strength associated with aging is well described in the literature, being justified by the reduction in the number and size of muscle fibers, mainly type II fibers, also called fast-twitch fibers, which produce large amount of strength<sup>(26,27)</sup>.

As for the highest HGS in men, data from this study corroborates the literature<sup>(18,2)</sup>. This difference in HGS between the sexes can be explained by the higher amount of fast-twitch muscle fibers observed in male subjects, producing large amount of strength<sup>(26,27,28)</sup>.

The low HGS can interfere with basic activities of daily living, related to self-care; with instrumental activities of daily living, linked to the management of practical life; and advanced activities of daily living, related to the broader social environment<sup>(29)</sup>.

According to the literature, the aging process, in itself, can cause the decline of physical fitness, which is aggravated by inactivity, rendering the elderly dependent of care from others<sup>(30)</sup> since physical inactivity is one of the factors that contribute to reduce functional ability<sup>(23)</sup>.

In the present study, practicing physical activity did not minimize the decrease in HGS, as practitioners and non-practitioners elderly had lower values in this physical aptitude than the reference values found in the literature<sup>(18)</sup>. These results differ from the literature, which reports that physical inactivity is one of the factors that contribute to reduction of muscle strength<sup>(1,24,31)</sup>, and that exercise training, regardless of the modality, reduces the loss of muscle strength caused by aging and physical inactivity<sup>(32)</sup>.

It was found that resistance training can minimize or delay the process of sarcopenia by obtaining significant

neuromuscular (muscle hypertrophy and muscle strength), through the increase in the contractile capacity of the skeletal muscles<sup>(24,32,33)</sup>.

This divergence between the results found in this study and the literature can be explained by the lack of accurate information about the intensity of physical activity practiced by the elders in the current sample.

It was observed in the present study that the presence of osteoporosis was related to low HGS, in accordance with the results of a study that found that both right and left HGS were lower among elderly patients with osteoporosis compared to subjects without osteoporosis<sup>(34)</sup>. Similarly, other studies observed reduced HGS in elderly with osteoporosis<sup>(35,36)</sup>.

Initially, this result could be explained because 100% of the elderly in this research with the presence of osteoporosis are women, and these had lower HGS compared to men, but, when comparing the HGS only among women with and without osteoporosis, the group with osteoporosis continued presenting lower values of this physical aptitude.

One of the changes resulting from the aging process is the reduction of bone mass, which can lead to osteoporosis, a disease characterized by microarchitectural deterioration of bone tissue and increased mechanical fragility, making the bone prone to fractures by minimal trauma<sup>(37,38)</sup>. It is known that there is a relationship between muscular strength and bone mass. There is a significant correlation between muscle strength and bone density<sup>(39)</sup>, since training with muscle strengthening exercises do prevent osteoporosis<sup>(37,38)</sup>.

In this sense, it is important to adopt preventive measures to minimize the loss of muscle strength associated with aging, and supervised and targeted strategies to maintain muscle strength and/or reacquire this physical aptitude to improve the quality of life of the elderly.

## CONCLUSION

The subjects assessed in the present study showed HGS below the expected for the age range in both sexes, being the men's HGS higher than the women's. The practice of physical activity, diabetes, and systemic arterial hypertension did not influence the HGS; however, elderly patients with osteoporosis showed decreased HGS.

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#### Mailing address:

Luana Meneghini Belmonte  
 Universidade do Sul de Santa Catarina - Campus Tubarão  
 Avenida José Acácio Moreira, 787  
 Bairro: Dehon  
 CEP: 88704-900 - Tubarão - SC - Brasil  
 E-mail: luana.meneghini@unisul.br