

# Relationship between Muscle Strength and Body Composition in Active Community Elderly

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Received: 28 April 2021;

Received in revised form:

30 May 2021;

Accepted: 11 Jun 2021;

Available online: 19 Jun 2021

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**Keywords—** Elderly, Muscle mass, Muscle strength.

**Abstract—** Demographic data, not only from Brazil, suggests a significant increase in the elderly population for the next decades. Based on this fact, interest in the body composition and strength of this population arises. This study is a quantitative cross-sectional study, originated from a primary project called “Programa Interdisciplinar de Atenção à Saúde do Idoso”. Thus, data from the initial phase of this project were used for this descriptive correlational study in order to assess the relationship between muscle strength and body composition in elderly community members aged 60 years and over, participants in the “Programa Mexa-se” by Sports Department of Joinville/SC City Hall (PMJ). This research consisted of an evaluation form, containing personal identification, sociodemographic and clinical data, besides physical evaluation. The results of the analysis showed a significant correlation between the handgrip strength (HGS) and the total muscle mass index ( $r$  0.637), strong correlation with total muscle mass ( $r$  0.806) and a weak correlation ( $r$  0.102) with the body mass index (BMI) and age ( $r$  -0.242). It is possible to conclude that HGS is related to the body composition, being an option for a better and more assertive assessment of the physical state and functional independence of the elderly. Finally, that is an accessible measure and could be used routinely in the physical evaluation of seniors.

## I. INTRODUCTION

Worldwide, the elderly population has gained more visibility due to the decrease in the population's mortality level in relation to aging and associated pathologies. According to data presented by World

Population Ageing (UNITED NATIONS, 2019) there were 703 million people aged 65 and over in the world in 2019. The projected number of elderly people will double to 1.5 billion in 2050. Globally, the participation of the population aged 65 years or older jumped from 6%, in

1990, to 9%, in 2019. The population profile will probably change in the coming decades, as said by the UN (2019).

The Brazilian population has maintained ascension in the number of elderly individuals in recent years and has gained 4.8 million since 2012, surpassing the mark of 30.2 million in 2017, according to the “Pesquisa Nacional por Amostra de Domicílios” (IBGE, 2018). In Santa Catarina, the number of elderly people, according to the “Instituto Brasileiro de Geografia e Estatística” - IBGE (2018), reaches over a third of the population, with a considerable increase over the years, even in the midst of the COVID-19 pandemic. In the city of Joinville/SC, the elderly population aged 65 and over is close to 2% of the population and has been increasing (IBGE, 2018).

With the projection of an increase in the number of elderly people in the coming years, dated by the UN (2019), the search for quality of life has increased. Thus, conducts to prevent diseases associated with aging and improve muscle quality have been the target of studies. Therefore, it is expected some advances in the treatment of diseases that may affect the elderly, even the frailty syndrome of the elderly and the pathology that most afflicts them, the loss of muscle quality (sarcopenia).

The International Classification of Diseases ICD-10 (2019) classifies sarcopenia as an internationally recognized muscle disease with the diagnostic code M62.84. And as a disease, attention to the most affected public is needed with government assistance and more research on the topic.

Dos Santos Martins, 2012, observed that physical activities performed in the gym of the best age favor, in addition to physiological gain, increased strength and cardiopulmonary capacity, as well as improved flexibility in the elderly.

In carrying out a literature review, dos Anjos (2019) pointed out physical exercise as an ideal strategy against sarcopenia, in prevention or treatment. The studies reported in the screening showed that sarcopenic elderly people respond well to physical exercise and are able to improve mass, muscle strength and physical performance. Physical activity can prevent possible frailties improving functional and cognitive abilities (OLIVEIRA, 2020).

In view of these arguments, the aim of this study was to evaluate the relationship between muscle strength and body composition in community elderly.

## II. METHODS

### TYPE OF RESEARCH

This is a prospective cross-sectional study with a one-year (12 months) segmentation. The sample was constituted in a non-probabilistic way of the intentional type.

The sample consisted of 88 elderly people aged  $\geq 60$  years old, 62 women and 26 men, participants of the “Programa Mexa-se” by Sports Department of Joinville/SC, composed of elderly people from the five main regions of the city (north, south, center, east and west). These elderly people practice the following physical activities: choreographed dance called “rhythms” and functional aerobic activities.

For its development, all ethical principles of research involving human beings were met, in accordance with the “Resolução do Conselho Nacional de Saúde” No. 466 of December 12, 2012, and the participants received the free and informed consent form in duplicate, one way to the participant and the other to the researcher.

### RESEARCH AND COLLECTION INSTRUMENT

The project used as an instrument the functional assessment protocol developed by the authors, based on measurement instruments already validated and used internationally. It contemplated the most relevant aspects of the physical assessment. For this study, the following measurement data were used, detailed below.

Physical assessment; Anthropometric measurements: weight, height, Body Mass Index, Total Muscle Mass Index; for checking body composition; dynamometry for measuring HGS. Test with protocol according to the American Society of Hand Therapists (ASHT) considered simple, economical and verified, known as 'gold standard'. A portable device (dynamometer) is used for measurement (MIJNARENS et al., 2013).

Data tabulation and analysis was performed using the GraphPad Prism 6® software, and descriptive statistics data such as means, standard deviations and confidence intervals were obtained. To test the normality of the data, the Shapiro-Wilk test was used. To verify the differences between the pre- and post-test measures over time, ANOVA for repeated measures was used, and Student's t test was used between each phase, with a significance level of 95% ( $p < 0.05$ ). To verify the relationship between the study variables, the Pearson or Spearman Correlation Test (according to the classification of variables) was used, with a significance level of 95% ( $p < 0.05$ ).

### III. RESULTS AND DISCUSSION

Community elderly aged  $\geq 60$  years old, who are part of a physical activity program of the PMJ, participated in 62 women and 26 men. Descriptive statistics of the variables controlled in the study are presented in tables 1 (women) and 2 (men).

*Table 1. Descriptive statistics of the controlled variables in the study, women.*

	AGE	BMI	MMT	IMMT	FPM
<b>M</b>	69.2	29.1	19.5	8.03	22.6
<b>DP</b>	6.0	4.8	3.3	1.2	5.1
<b>Minimum</b>	60.0	18.6	12.0	5.4	11.0
<b>Maximum</b>	90.0	44.6	27.8	11.7	32.5

**Subtitle:** Age years; BMI, Body Mass Index (kg/m<sup>2</sup>); MMT, Total Muscle Mass; IMMT, Total Muscle Mass Index (5.9 to 9.5 kg.m-2); FPM, handgrip strength (kgf).

*Table 2. Descriptive statistics of the controlled variables in the study, men.*

	AGE	BMI	MMT	IMMT	FPM
<b>M</b>	70.2	28.9	29.1	10.5	37.3
<b>DP</b>	5.3	3.7	3.8	1.0	8.8
<b>Minimum</b>	60.0	20.0	20.6	8.0	15.0
<b>Maximum</b>	80.0	35.0	39.4	12.6	57.0
<b>Maximum</b>	80.0	35.0	39.4	12.6	57.0

**Subtitle:** Age years; BMI, Body Mass Index (kg/m<sup>2</sup>); MMT, Total Muscle Mass; IMMT, Total Muscle Mass Index (5.9 to 9.5 kg.m-2); FPM, handgrip strength (kgf).

*Table 3. Correlation analysis between HGS and body composition variables in the study*

	AGE	BMI	MMT	IMMT
<b>r</b>	-0.242	0.102	0.806	0.637
<b>P</b>	0.023	0.343	0.000	0.000

**Subtitle:** Age years; BMI, Body Mass Index (kg/m<sup>2</sup>); MMT, Total Muscle Mass; IMMT, Total Muscle Mass Index (5.9 to 9.5 kg.m-2); FPM, handgrip strength (kgf).

It is observed that BMI and age do not present a strong correlation with HGS, however, even if weak, the correlation exists and points to a moderate degree on this

variable. MMT and IMMT showed a strong, significant correlation with HGS. In this study the levels in correlation of the strength of hand grip are high, when compared to total muscle mass, and index of muscular mass evidencing the importance to combine the two evaluation data to measure the profile of the elderly and indicate possible weaknesses. According to data presented, HGS is a very relevant way of analyzing the functional profile of the elderly when combined to the studied variables. Although, more assertive due to the high correlation profile between them, thus being an accessible measure to the body composition and functional quality of the elderly.

For the maintenance of muscle mass, studies point to strength training, as they promote an improvement in the levels of functional autonomy of active elderly people, even considering the practice of other modalities associated with the routine. (LIMA, 2020). Physical activity not only improves the physical condition but can also prevent possible weaknesses, as evidenced by Oliveira(2020). The author investigated the relationship of the duration and frequency of physical activity practice with the indicators of sarcopenia in the elderly, had as one of the main findings that with the higher level of physical activity of mild moderate intensity, there were less trends towards indicative of sarcopenia. Oliveira(2019), concludes, in his study about deficits in cognition and physical performance, that physically active elderly people have a greater chance of maintaining their cognitive functions during the aging process, and notably adequate levels of physical activity may be related to better cognitive function scores in elderly subjects.

Data show the benefits of HGS as a predictor of capacity functional and its importance to verify the muscle quality of the elderly when combined with other variables, as studied by Medeiros et al. (2016), evaluating the handgrip strength in community elderly, identified that there are no high significant differences in strength comparing the active and inactive groups. Concluding then that the handgrip test alone does not indicate signs of frailty in the elderly and/or lack of muscle quality.

Mendes (2016) in an investigative study on the prevalence of sarcopenia in a group of sedentary elderly and its relationship with physical strength, identified a high number of sarcopenic elderly, these being sedentary with an association of loss of muscle mass associated with loss of muscle strength in both sexes.

Pereira(2015) when evaluating the relationship between body composition and handgrip strength of 46 elderly Brazilian men, found that the levels of handgrip strength depend not only on lean mass, but also on adipose tissue, and also noticed that the correlation between lean

mass and fat percentage may indicate an improvement or worsening in performing the isometric handgrip effort.

Nascimento(2019) in an observational, analytical study with a sampling of women aged between 40 and 80 years found that changes in body composition during female aging are associated with decrease muscle mass and a drop in physical performance in middle-aged and elderly women. Given the importance of the findings on the subject and due to the beneficial impact that the practice of physical activities can have on body composition and, consequently, on the life quality of the elderly, it is important to carry out further studies in the area.

#### IV. FINAL CONSIDERATIONS

The data obtained in this study showed the relationship between HGS and body composition of community elderly, which are important variables for a more assertive physical assessment of this population. As well as adequate guidance for the proposed activities taking into account the physical and functional independence. Emphasizing the importance of physical activities, even if moderate, as a factor to prevent frailties.

The main limitations of the study are the small number of participants, and the exclusion of non-physical variables, which, although they were evaluated, were only considered in the screening of participants.

The benefit of strength assessment through dynamometry associated with the IMMT is also highlighted, as both are accessible and can be used frequently by the target audience of this study. It is considered the importance of understanding the measures to better control the health of the elderly.

With the findings of this study will be possible, from the measurement of FPM, identify changes in skills, according to gender, promoting subsidies so that physical educators and other health professionals can intervene in physical exercise programs, so that the elderly improve these skills and body composition.

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