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RELATION BETWEEN FUNCTIONAL MOBILITY AND MUSCLE STRENGTH OF THE ELDERLY IN A PUBLIC PHYSICAL ACTIVITIES PROGRAM

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ABSTRACT

Objective: to verify the relationship between functional mobility and muscle strength in a group of elderly people participating in a public program of physical activities, called "Programa Mexase", in the Joinville/SC city. **Methods**: This was a quantitative, correlational descriptive study, carried out in a non-probabilistic, intentional type. Included a random sample of 42 elderly people (27 women and 15 men), aged between 60 and 75 years, to whom two balance tests were applied: the Sit and Stand Test (TSL) and the Timed Up and Go Test (TUGT). The elderly also answered a questionnaire about sociodemographic factors, health and physical activity. **Results**: Statistically significant ($p<0.05$) relationships were found for TUGT, evidencing that there is astatistically significant correlation between TUGT and TSL ($p <0.022$). Regarding the values obtained for TSL with TVM, it also observeda significant correlation ($p <0.000$), as well as toTUGT and TVM ($p <0.003$). **Conclusion**: This study showeda correlation between the functional mobility of the elderly through TSL and TVM tests result. Alsodemonstrated that the group participating in the program had positive resultsregarding the level of physical activity practiced. This results indicates the importance of optimization in the prevention and rehabilitation programs for the elderly, to maintain the functional mobility of elderly community members and reduce the body mass index.

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INTRODUCTION

Aging is a natural process for humans and, as a result of time, changes and deterioration, such as: deficits in functional capacity and physiological alterations, start to occur in the entirehuman body system. These changes occur in an idiosyncratic way, evolving progressively (BRASIL, 2014). In this sense, Motta (2004) emphasizes that chronological aging begins in childhood, and is easily measurable, while biological changes associated with age are difficult to measure. Fechine and Tompieri (2012), observing the aging process and the main changes that happen to the elderly over the years, highlight thatit is possible to noticethat the primary aging is genetically defined or pre-programmed, andit is present in all the people of the world. On the other hand, the secondary aging is the resultof external influences, that is, the variable between individuals in different environments, influenced by characteristics resulting from cultural, geographical and chronological factors. Estimates project that the number of elderly people by 2025 will exceed 30 million in Brazil, and old age may be accompanied by high levels of chronic diseases, reducing the health and well-being (DEBERT, 1999; LIMA, 2003; LIMA; SILVA; GALHARDONI, 2008). This increase in the elderly portion of the population pyramid bringing more notoriety to the demands of the group, such as the diseases that affect them. Thus, challenges for health professionals involved in the care of the elderly become more frequentas the group increases. It is noteworthy that the aging process compromises the ability of the central nervous system to process vestibular, visual and proprioceptive signals, that are responsible for maintaining body balance, as well as reducing the ability to modify reflexes (BARIN, 2011). It is also interesting to note that, with aging, chronic-degenerative disordersbecome more frequent. These diseases affect their autonomy and independence to perform daily tasks, therefore, affect the life quality of this population (CARDOSO et al., 2012). In the search for actions to improve the elderly life quality, studies have shown that the regular practice of physical activities is essential to improve and maintain their functional capacity.Making the elderly maintain and improve their

independence and autonomy, in addition to reducing the risk of non-communicable diseases, depression and cognitive decline (WHO, 2006; 2015).According to Maciel (2010), the practice of physical activity, such as aerobic, associated with muscle strength and enduranceexercises, is a factor in preventing and monitoring illnesses caused by old age. Lins and Corbucci (2007) report in their study the reasons that lead individuals aged 60 years and over to exercise regularly. The main reason identified was for pleasure, followed by the intention to improve health. This shows that information about thehealth benefits of physical activity as a form of prevention to the bio psychosocialpsychosocial problems of the elderly is widespread (MACIEL, 2010). The present research aimed to verify the relationship between functional mobility and muscle strength in a group of elderly people who participated in a public physical activity program "Programa Mexa-se" in the Joinville city.

METHODS

This is a quantitative comparative descriptive study, part of a larger one. The research project was approved by the "Comitê de Ética em Pesquisas em Seres Humanos da Faculdade IELUSC" under the numbernº. 3.275654/2019. All participants signed an Informed Consent Form.

Study Participants: From a total of 42 elderly people who participated in the "Programa Mexa-se", held at Arena, Bucarein neighborhood of Joinville-SCcity, 27 elderly women and 15 men aged 68 years or more, randomly selected, were evaluated. One participant over the age of 84 years was excluded. All participants had been attending the "Programa Mexa-se" for more than three months, carried out by the "Secretaria de Esportes de Joinville" (SESPORTE). TheSESPORTE, concerned with the health, leisure, well-being andpopulation'slife quality, implemented in august 2014 the "Programa Mexa-se". it is a programthat performs systematic physical activities in groups for free, involving: gymnastics, dances, monitored walking, postural and breathing exercises, stretching and relaxation.There is always a professional from the physical education area who supervises the actions, in addition the program has the participation of physical education monitors, who teach the practices of physical activities. The activities offered take place from march to November with two (2) weekly classes with an average duration of one (1) hour. The "Programa Mexa-se", which is configured as a continuous activity, proposes an action aimed at the practice of regular physical activity, the incorporation of healthy habits, social inclusion and serves the community in adulthood. It works in four axes:"Mexa-se RUN", "Mexa-se Funcional", "Mexa-se Esportes Adaptados" and "Mexa-se ginásticas e ritmos". The last one was evaluated and is part of this study.

According to the American College of Sports Medicine (ACMS) and American Heart Association (AHA) guidelines the recommendation for older adults is similar to the updated ACSM/AHA adult recommendation, but has several important differences.Amongst them: the recommended intensity of aerobic activity takes into account the aerobic fitness of the adult; activities that maintain or increase flexibility are recommended; and balance exercises are recommended for seniors at risk of falling. In addition, seniors must have an activity plan to achieve the recommended physical activity that integrates preventive and therapeutic recommendations. The promotion of physical activity in the elderly should emphasize aerobic activity of moderate intensity, muscle-strengthening activity, reduction of sedentary behavior and risk management (NELSON et al, 2007). According to Malafaia et al. (2019), during the aging process, physical and metabolic changes are observed. The reduction in aerobic capacity, changes in body constitution and the emergence of complications resulting from chronic diseases can lead to reduced independence and a significant increase in morbidity and mortality. Therefore, the importance of a structured plan with exercise prescription is based on four fundamental points that must be addressed in an integrated and continuous way: aerobic exercises, flexibility, balance and muscle strength (NELSON et al., 2007). It is worth noting that only the group of gymnastics from the Núcleo da Arena participated in this study, and that they participate in the gymnastics program (with coordination exercises, agility, balance muscle strength and fundamentally with rhythms, this happens for female elderly and for the male elderly the activities performed are: functional conditioning, upper and lower limb strength exercises, coordination, balance and walking.

Measuring Instruments: The assessments were initiated through a questionnaire, in an interview form,covering sociodemographic, health and physical activity aspects. The following study instruments were also used to assess the functional mobility of the elderly: The Timed Up and Go Test (TUGT) by Schoene et al. (2013), which is part of Rikli's Senior Fitness Test (SFT) battery; and Jones (2008) to assess lower limb strength. To classify the participants physical activity level(low, moderate orhigh), the International Physical Activity Questionnaire - short version form (VALIM-ROGATTO; CANDOLO, 2011) and (NAHAS, 2013) was used. To assess muscle mass, a predictive equation was used (SOARES; MARCELINO; MAIA, 2017) establishing the Total Muscle Mass Index ranging from 5.9 to 9.5 kg.m2, calculated by equation (1), where the Index of Total Muscle Mass is expressed as IMMT (kg.m2) = MMT / E2. Total Muscle Mass (MMT) = 0.244 PC + 7, 80.E1 - 0.098.I + 6, 6.S + Et - 3.3. Where PC is the body weight, in kg; E1 is the height, in meters; I age, in years; S is the sex (male = 0 and male =1); Ethnic ethnicity (Cauasians = 0, Asians = -1.2 and Afro-descendants = 1.4). It was also used a digital scale, with a resolution of 50g, to measure the body mass (Model OMRON), with a capacity of 150 kg, a Stadiometer with a resolution of 1 mm to measure the height (Model ES2020 Brand Sanny®, BR). After determining the Body Mass Index (BMI), the participants were classified into three groups: Low weight <22 kg/m2; Eutrophic 22 to 27 kg/m2; and Overweight >27 kg/m2. This classification of nutritional status based on BMI was proposed by the Nutrition Screening Initiative. These cutoff points were adopted for the elderly in Brazil according to recommendations of "Sistema de Vigilância Alimentar e Nutricional" (SISVAN).

Data Analysis

Data tabulation and analysis was performed using the GraphPad Prism 6® software. Descriptive statistics data were obtained. To verify the relationship between functional mobility and the other variables (BMI, age, TGUT, TSL and TVM), the Pearson Correlation Test was used, with a significance level of 95% ($p<0.05$).

RESULTS

All study participants were classified as having a good level of physical activity, only the maximum age grouppresented an overweight classification in the anthropometric assessment, as shown in Table 1 with the descriptive statistics data (means and standard deviations) for each controlled variable. As the BMI was used as a reference to classify the participants involved in the study, a correlation analysis was also performed between this variable and the others, as shown in Table 1.

Table 1. Results of the variables Age, BMI TSL x TUGT and TSL x TVM

	AGE	BMI	TUG	TVM	TSL
M	68.0	28.9	6.43	1.79	19.7
DP	5.08	3.41	0.9	0.24	4.4
Min	60	20	5.08	1.19	11
Max	79	35.8	10.2	2.43	29

Caption: BMI, Body Mass Index (kg/m2); Age, in year; Total Muscle Mass Index (5.9 to 9.5 kg.m². TUGT (TimedUpandGo Test); TVM (Gait Speed Tests); TSL (Sit and Stand Test). All variables have mean M and deviation standard (SD) * significant difference ($p<0.05$).

Table 2 shows that there was a correlation between TUGT and TSL, TUGT and TVM the values obtained TSL with TVM.

Table 2. Relationship between functional mobility and variables (TGUT, TSL and TVM)

	r value	p value
TUGT X TSL	r -0.35	p 0.022*
TUGT x TVM	0.45	p 0.003*
TSL x TVM	r 0.68	p 0.00*

* Pearson Correlation Test

Caption: BMI, Body Mass Index (kg/m2); Age, in year; Total Muscle Mass Index (5.9 to 9.5 kg.m². TUGT (TimedUpandGo Test); TVM (Gait speed tests); TSL (Sit and Stand Test). All variables have mean M and deviation standard (SD).* Significant correlation coefficients (p<0.05).

During the test, the elderly person was instructed to get up, walk a linear course of three meters, make a 180º turn and return and sit down again, supporting arms and back in the same chair, the entire test period has been timed. The timing starts when the elderly person takes the column from the chair and ends when it leans back. A digital stopwatch was used and the exact location of the chair, as well as the return point, three meters ahead, were clearly marked with yellow gold adhesive tape. All seniors belonging to the program were evaluated in a single month, in a large sports training room at Arena Joinville. According to the results indicated by PODSIADLO and RICHARDSON(1991): (1) TUGT up to ten seconds - elderly with no change in balance and with low risk of falls; (2) TUGT between 11 and 20 seconds - elderly without significant change in balance, but with some frailty and medium risk of falls; (3) TUGT greater than 20 seconds and less than 30 seconds - elderly in need of intervention; (4) TUGT greater than 30 seconds - elderly at high risk of falls and dependent individuals in activities of daily living (ADLs) and with altered mobility. In this study, parameters of muscle strength and functional mobility of the lower muscle limbs were investigated. In the analysis of Pearson's correlation, it is possible to notice a high correlation between the tests TUGT (r>0.35),for TSL and TUGT (r>0.45) above all, and for TVM; TSL(r>0.68) TVM as the value (p 0.003), respectively, in which it presents a sign of significant validity (p<0.05) (GARCIA, 2007).

To assess the degree of functional mobility, the timed stand up and walk test (TUGT) was used. In its result, no statistical difference was detected between the TUGT means presented by genders, both in the community (p>0.05) and in the LSIE (p>0.05). Men and women living in the LSIE had a significantly higher mean TUG than men and women in the community (p<0.01). A significant difference was detected between the TUG means, when compared in terms of age group (p=0.003). Functional mobility is greater among the elderly living in the community, and that men and women have a similar level of performance in functional mobility, which decreases with age, in all age groups. In comparison with this study, although (n <) the participants obtained a very expressive result in the TUG Test (p 0.0022), thus attributing that the practice has brought benefits in the muscle strengthening of the elderly. In the study carried out by Souza et al. (2013) the aim is to evaluate and compare a measure of functional mobility in elderly people living in the community and in a long-term care institution for the elderly (ILPI), and verifying its relationship with age and gender in different locations. A total of 413 elderly people participated in this study, 72 of whom were institutionalized (80.9 ± 8.1 years; 53 women) and 341 from the community (69.8 ± 7.5 years; 269 women).

DISCUSSION

As age advances, structures related to locomotion are also altered. Bones become more fragile and thus there is a greater risk of fractures.There is a loss of muscle mass and strength, with difficulties in maintaining balance and, as a consequence, the elderly may show decreased agility, walk slower and dragged (SANTOS, 2010). The present study observed that functional mobility presents a correlation withTUGT, age and other variables. Although the literature shows that aging can cause several structural and functional changes in the elderly for this study, the particularities of the individuals and socioeconomic data were not taken into account. The group has a good level of physical activity. In the present study, the TUGT, TSL and TVM tests were correlated with each other and with BMI and Age. Lemos et al. (2006) highlight that the loss of functional independence, resulting from the inability to walk in the elderly, whether due to functional limitation or fear of falling,has been the main cause of the occurrence of hip fractures. Another factor is physical inactivity, which worsens osteoporosis and thus increases the risk of falls and, consequently, new fractures. Based on studiesperformed by MACIEL et al. (2005), SIQUEIRA et. al. (2007) and ALVARES et al. (2010), regarding a higher prevalence of falls in the elderly, they concluded that: the older the person gets, the greater it is the risk of falling. This is due to the reduction in the quality and quantity of information necessary for efficient postural control. Groisman (2002) explains that the rate of decline of physiological functions is exponential, that is, during the aging process, there are functional losses that are accelerated with increasing age. In this sense, there is a cumulative effect of functional changes, with progressive degeneration of the mechanisms that regulate the responses of cellular and organic phases. Associated with it, external aggressions lead to a functional imbalance in the body, in general, showingthe importance of actions aimed at evaluation and prevention inthe elderly health (BRASIL, 2009). During the stages of life, the individual undergoes the main biological changes: decreased muscle mass and bone density; loss of muscle strength; impaired agility, motor coordination and balance; impaired joint mobility, greater rigidity of cartilage, tendons and ligaments; decreased thermoregulatory capacity; greater ventilatory work on exertion; impaired liver and kidney function; smaller number and size of neurons; decreased reaction time and nerve conduction (LIMA, 2014). Moura et al. (2012) analyzed the effects of strength, balance and stretching training on the functional mobility of the elderly and observed benefits in elderly women with low bone mass in both the control and trained groups.

Kemmler et al. (2003; 2007) mention, regarding the prevention of bone loss, high impact exercises proved to be more efficient, as this type of exercise requires greater bone strength.Thus, exposing these bones to episodes of stress can have positive effects on the rigidity of these bones, althoughmay cause fractures, when they are exposed to extreme stress. Based on the data obtained in the study carried out by Santos et al. (2010),it is possible to state that physical exercise is considered an important factor in both the prevention and treatment of osteoporosis. It was possible to verify that the exercises have specificities. Those most used in the treatment of osteoporosis were characterized as low and medium intensity since the bones of the elderly affected by osteoporosis can be fractured if exercises that produce great impacts are used. It is also noteworthy that the exercises that act to improve balance and coordination are efficient in the treatment, as they can reduce the risk of falls that could cause fractures for those affected by the disease. It was also observed that the exercises used to prevent osteoporosis were characterized as high intensity, as they significantly increase bone mineral density and because, as in prevention, the person does not have osteoporosis, the risk of fractures is lower (SANTOS et al., 2010). Therefore, pointing out the aspects of functional mobility and muscle strength in the elderly, it is correct to state that, as the mechanical properties of the muscle-tendon complex and the muscle capacity to produce strength leading the elderly to a predisposition to fall and possible bone fractures, studies point out that stretching exercises, sometimes associated with other types of activities, allow for the increase and maintenance of a joint range of motion, as they alter the viscoelastic characteristics of the musculature and modify its behavior in dynamic activities. According to the proposed objective of this study, which was to verify if there is a relationship between strength and functional mobility, thus contribute to the planning of physical activity actions in the program. it was possible to realize that strength training is one of the therapeutic conductsto alleviate muscle weakness with advancing age. A sport that is capable of providing very expressive gains in muscle strength, which can be performed with the help of some materials, such as dumbbells, rings, bars, elastic devices, in rehabilitation clinics and physical activity gyms (MEDEIROS, 2010).

Final Considerations

This study found a correlation between functional mobility in muscle function of the elderly's lower limbs, through TSL and TVM,and demonstrated that the group participating in the program had positive results. This indicates the importance of optimizing prevention and rehabilitation programs for the elderly, including activities such as strength, coordination, and balance exercises, besidesmaintaining the functional mobility of community elderly people. We also highlight that the participating group is overweight, it is suggested to intensify activities to reduce the BMI.

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