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Influence of strength training on variables related to elderly autonomy

Paulo Victor Mezzaroba[1*] and Alessandra Regina Carnelozzi Prati[2]

*[1]Universidade Estadual de Maringá, Av. Colombo, 5790, 87020-900, Maringá, Paraná, Brazil. [2]Departamento de Educação Física, Universidade de Estadual Maringá, Maringá, Paraná, Brazil. *Author for correspondence. E-mail: paulomezzaroba@hotmail.com*

ABSTRACT. The process of aging results in several changes in the organisms, thus, is necessary to search for ways to mitigate the negative effects of this involution process, for this, knowing that the strength improvement represents a greater availability for everyday activities, this study searched at strength training, evidence of possible improvements in variables related to elderly autonomy. Before and after 12 weeks of training, we performed a pre and post-assessment respectively, in which were measured anthropometric variables as body weight, height, body mass index, waist and hip circumference, waist-hip ratio and fat. We also performed a strength test with hand-held and lower-limb dynamometers, besides functional capacity tests as climbing stairs and self-perception performance in activities of daily living. The sample consisted of 12 elderly females without any type of strength training. The results showed a significant improvement in strength and functional capacity, there was also significant reduction of fat, and increase of lean body mass. Concluding, elderly people can enjoy the benefits provided by strength training, especially in autonomy perspective.

Keywords: elderly, strength training, autonomy.

Influência do treinamento de força sobre variáveis relacionadas à autonomia de idosos

RESUMO. O processo de envelhecimento traz consigo diversas alterações no organismo de quem o está sofrendo. Desta forma, se faz necessária a busca por maneiras de protelar os efeitos negativos dessa involução, para tanto, sabendo-se que a melhora da força dos sujeitos representa maior disponibilidade destes para as atividades do cotidiano. Este estudo buscou, no treinamento de força, indícios de possíveis melhoras em variáveis relacionadas à autonomia de idosos. Foram realizadas entre 12 semanas de treino, uma pré e uma pós-avaliação, nas quais foram mensuradas variáveis antropométricas como massa corporal, estatura, índice de massa corporal, circunferência de cintura e quadril, relação cintura-quadril e percentual de gordura; também foram realizados testes de força com dinamômetro manual e de membros inferiores, além de testes de capacidade funcional como subir escadas e autopercepção no desempenho de atividades da vida diária. A amostra foi constituída por 12 idosas do gênero feminino que não realizavam qualquer tipo de treinamento de força. Os resultados apresentaram-se com melhora significativa de força e capacidade funcional, houve também significante redução de gordura e aumento de massa magra na amostra. Conclui-se então que idosos podem usufruir dos benefícios proporcionados pelo treinamento de força, principalmente no quesito autonomia.

Palavras-chave: idosos, treinamento de força, autonomia.

Introduction

The elderly people represent a group of major global significance, since with the increase in life expectancy there was also a population growth. According to Ruipérez and Llorente (2002), over the years, the number of elderly in the world will be enough to make them economically required and also a concern related to the dependence derived from the aging process.

Therefore, an estimate of 7% of elderly in the world was expected for 2000 (VAN DER BIJ et al., 2002), with the progressive increase in this population it is possible to predict, according to IBGE (2000), that in 2020, the elderly will represent 13% of Brazilian population.

The aging process is linked to the characteristics and the lifestyle of the individual, and among them, the sedentary habit has raised discussion in the recent years, since this behavior is largely responsible for the progressive loss of functional capacity and, consequently the autonomy (MAZO et al., 2001).

The regular physical activities could minimize the risks of chronic degenerative diseases and reduce

the mortality and morbidity rate among the elderly (NELSON et al., 2007), which, according to King (2001), mostly have no knowledge about the benefits of physical activities in the prevention and the reduction of dysfunctions caused by the aging process.

Among the changes caused by the aging process, the decrease in muscle mass is one that most influences the strength reduction. Thus, the effect of this sarcopenia and the slower nerve conduction lead to a high commitment of motor functions of the subjects (BARRY; CARSON, 2004; GREENLUND; NAIR, 2003). Doherty (2003) considers the sarcopenia as a major factor contributing to a decrease in the performance of all functional fitness components.

On this point of view, according to the ACSM (2002), the strength training is suggested as an alternative to minimize the changes caused by advancing age, being used as an important tool to mitigate the degenerative processes on the elderly people and obtain positive impact especially over the body composition and strength.

Weineck (2003) relates the strength training with the capacity of maintain the performance of daily life activities, besides pointing out that the muscle maintains the training capacity until the end of life, enabling a positive response, including with elderly people subjected to this sort of training.

The possibility of promoting a strength training program enhances its usefulness to the elderly population, and is even indicated as the most efficient non-pharmacological strategy in preventing and minimizing the negative effects of aging (TORAMAN; AYCEMAN, 2005), enabling the physical and functional ability required to provide greater independence, security and possibilities in their daily activities.

Thus, the aim of this study was to investigate the influence of 12 weeks of strength training on variables related to the autonomy of elderly non-practitioners of strength training, using a resistance training method.

Material and methods

Population and sample

For this study, 12 female individuals were selected with an average age of 62.5 years (± 2.5), active, which did not practice any kind of physical exercise involving strength training prior the start of the study. The participants have presented medical certificate asserting having appropriate health for the practice of physical exercises, and have signed a Consent Form to participate in the developed protocol, following the frequency, approaches and orientations determined by the professionals involved, besides that, they knew they could abandon the project at any time of the study. The project was approved by the Ethics Committee on Research Involving Human of State University of Maringá (Opinion no. 399/2008).

Study variables

The variables analyzed included: anthropometric aspects, functional capacity and strength.

For the anthropometric measurements it was assessed body mass (kg) and height (m) in order to determine the body mass index (BMI) (kg m^{-2}), waist and hip circumference to calculate the waist-hip ratio (WHR) and skinfold measurements to estimate the fat percentage (%F) according to Petroski (2007), using the formula:

$$\%F = 1.19547130 - 0.07513507 \, \text{Log}_{10}(Y4) - 0.00041072 \, (\text{age, in years}),$$

where:

Y4=Sum of folds - axillary, suprailiac, medial thigh and medial calf.

The instruments used were: scientific balance (Caudura), stadiometer in millimeters, anthropometric tape (SANNY) and scientific skinfold caliper (SANNY).

Hand and lower limbs dynamometer tests were applied to evaluate the strength, the instruments used were a and dynamometer (JAMAR) and a back and leg dynamometer (Takei Kiki Kogyo Co. Ltda).

To assess the functional capacity using specific tests for elderly population (MATSUDO, 2000), the participants were evaluated with the stairs-climbing test: they should climb up 15 steps as fast as possible, it was used a timer (KADI brand) to check time in seconds. To test self-perceived performance of daily life activities (DLA), the participants answered a questionnaire with scores classified as "very bad", "bad", "medium", "good" and "very good" according to the activities performed with greater independence. For this purpose, the elderly women listed 40 daily activities in levels of A (cannot perform this activity), B (perform this activity only with the help from others), C (perform this activity alone, but with difficulty), D (perform this activity alone with some difficulty) and E (perform this activity alone and easily), with scores of zero to four, with zero being applied to the A answer and four to the E answer.

Procedures

During the intervention process, it was applied an experimental design made up by pre-test and post-test

with the accomplishment of the strength training scheduled. The process was conducted over 12 weeks, characterized by two assessments, a diagnosis, before the beginning of training and other, formative, after the prescribed period of intervention.

The participants attended two training sessions per week, with duration of approximately 50 minutes. Each training session included exercises for major muscles, in which, the participants held an alternate training per segment, the sequence has included an exercise for the chest, quadriceps, back, back of the thigh, triceps, calves, biceps and abs in three sets of ten repetitions with an interval of 30 seconds, in which the load was increased by 10%, if noticed extreme ease of execution at the end of a set, always with the accompaniment of a physical education professional. The training was preceded by heating and stretching seeking to protect the body from injury and increase performance of the participants (DANTAS, 2003; UCHIDA et al., 2005).

Statistical treatment

Statistical analysis was performed using the SPSS software, version 15.0. The results are presented as mean ± standard deviation (SD), with normality checked by means of the Shapiro-Wilk test. For normal data (stairs-climbing, hand and lower limbs dynamometry, weight, BMI, waist, WHR and %G), the comparison between pre- and post-training was carried out using the dependent Student's t-test, and for the non-normal data (DLA) the comparison was undertaken using the Wilcoxon test. The level of significance was established as $p < 0.05$.

Results

Table 1 presents the data of the characterization of the sample with the anthropometric variables assessed before and after the strength training.

Table 1. Characterization of the samples assessed pre- and post-strength training.

Variables	Pre (n = 12)	Post (n = 12)
Body Mass	66.3 ± 11.5	66.1 ± 12.2
Height	1.55 ± 0.3	1.55 ± 0.3
BMI	27.6 ± 5.0	27.5 ± 5.4
Waist	84.3 ± 11.9	83.5 ± 12.5
HIP	102.5 ± 8.9	102.4 ± 9.5
WHR	0.81 ± 0.06	0.81 ± 0.06
%F	33.8 ± 4.6	31.7 ± 4.8

The Table 2 lists the data for functional and strength assessments performed pre- and post-training.

Table 2. Strength and functional capacity values pre and post test.

Variables	Pre (n = 12)	Post (n = 12)
DLA	143.0 ± 7.8	148.5 ± 7.7
Climbing stairs	7.4 ± 1.8	5.5 ± 0.8
Hand Dynamometry	26.3 ± 3.6	29.1 ± 4.2
Leg Dynamometry	30.5 ± 9.3	38.5 ± 9.4

The Figures 1 and 2 show the comparison of the values found in the assessments pre- and post-training, respectively for the anthropometric variables, and functional and strength variables.

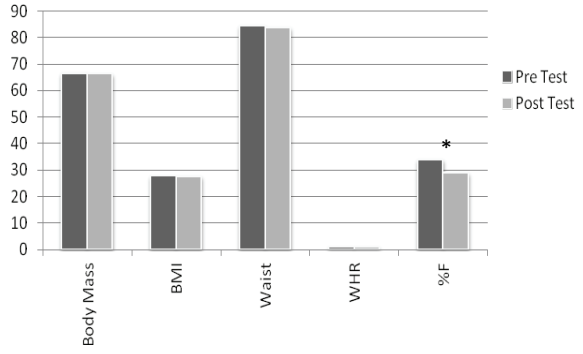

Figure 1. Comparison between the anthropometric variables in pre- and post-test. *Significantly different ($p < 0.05$).

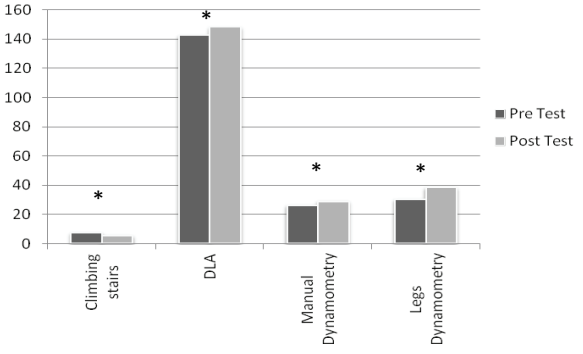

Figure 2. Comparison between the pre- and post-test on the functional and strength variables. *Significantly different ($p < 0.05$).

Discussion

The aim of this study was to investigate the influence of 12 weeks of strength training on variables determinants of autonomy of elderly people, as anthropometry, strength and functional capacity.

Given the measured anthropometric variables (Table 1), the participants had significant reductions only for %F (Figure 1) due to the intervention made.

Weineck (2003) suggests that the peak of obesity occurs between 60 and 70 years for women, an age range covered by this study; and this fact is related to the reduced basal metabolism, the decrease in muscle mass and also to the lower energy

consumption for the performance of activities, increasing the risks related to obesity in elderly population.

Regarding the anthropometric variables, Petroski (2007) highlights the importance of reducing the percentage of fat, since this is one of the measures that represent a great improvement in body composition, especially if related to health implications.

Following this reasoning, Phillips and D'Orso (2000) defend the strength training as a way to keep muscles developed, requiring higher maintenance energy and therefore, greater mobilization of fat at rest conditions, making the weight training as effective as aerobic exercises to lose fat.

Smutok et al. (1993) and Andersen et al. (2003) emphasize the effectiveness of resistance training, especially about their chronic effects on fat loss and consequent reduction in other risk factors such as lipid profile and insulin sensitivity.

In fact, this significant reduction of %F and the maintenance of BMI (Figure 1), after 12 weeks, indicated the gain in muscle mass, since even with lower amount of fat, the participants maintained their weight. A similar result was found by Hunter et al. (2001), applying 25 weeks of strength training to elderly men and women, and as in the present study, the author found significant reductions in the %F with no changes in body mass.

Hunter et al. (2000) and Brochu et al. (2002) found that a resistance training program, with an overload control similar to the present study, is capable to increase muscle mass in elderly people, being fundamental in increasing energy expenditure and decreased fat mass, through both higher metabolic activity and greater amount of possible activities to the subjects who practice this modality.

Thus, Table 2 and Figure 2 show the significant improvement in functional and strength variables herein examined, supporting the studies abovementioned about the greater availability of the elderly for daily activities in response to changes caused by strength training.

After the intervention period, it was observed that the elderly were more likely to perform a higher number of activities by themselves and without great difficulty according to the questionnaire of self perception DLA, even though in both pre- and post-test, the scores have had the best classification: "very good".

Similarly to Morais et al. (2004), who analyzed the functional tests: rise up from the ground and walk, with significant improvement, with 16-week program of strength training, reinforcing the idea that the increase in strength, 10% in hand dynamometry for the study cited, influences the functional capacity of elderly.

Faulkner et al. (2007) establishes a relationship between the improvement in functional variables and increase in strength, given the high need of strength for locomotion, lifting and pushing objects, among other activities. The strength training for upper and lower limbs can increase the functionality of muscles while performing tasks such as those cited. Pu et al. (2001) mention that the resistance training is essential for maintaining endurance for walking and for the overall physical functionality, including for a lower reduction in metabolic activity during the aging process.

In the study conducted by Raso (2000), the strength training in older women was conducted by performing a sole exercise, the Leg Press 45°, in three sets of ten repetitions (similar to the present study), for only five weeks, and it was found statistically significant improvements for tests such as rising up from chair and climbing stairs, and even a case of one individual who reported she could not get out of bed by herself, and after training, declared to be able to perform the activity.

Significant improvement in the capacity of musculoskeletal trunk, arms and legs strength and mobility, in specific movements as getting up from chair and bed were reported by Alexander et al. (2001) after 12 weeks of strength training, representing greater reduction in risk and dependence of the elderly.

In addition, Silva et al. (2002) reported that the muscle strength of lower limbs is essential for sustaining the body mass, showing that a possible improvement could be fundamental in reducing the time of the stairs-climbing test (Figure 2).

Therefore, strength is identified as an extremely important skill for the maintenance of daily activities, and should be the main concern and priority in training targeted to elderly people (FLECK; KRAEMER, 1999).

Even controlling the training variables, this study presents as limitation the lack of control over other variables that could influence the autonomy of the elderly individuals, such as nutrition, commitment degree of chronic disease, and social background, among others.

Conclusion

The study evidenced that 12 weeks of strength training with professional supervision were sufficient to affect variables of body and function in elderly people. The results showed significant increases in strength, reinforcing the strength

training for this purpose. Knowing the importance of strength for several daily activities, the best performance of functional tests had ascertained that the improvement in strength is essential for the maintenance of autonomy throughout life. All the changes in the daily life of elderly individuals are driven from internal changes in their bodies, thus, reducing anthropometric measures as the percentage of fat, provides to this population a safe zone for all negative impacts arising from obesity. Therefore, it is clear that physical exercises, especially strength training, should be encouraged for the elderly population, considering the benefits achieved in the context of promoting improvements in the variables related to autonomy .

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