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Effects of a functional training program in the activities of daily life and functional capacity of elderly persons of UATI: a clinical test

Efeitos de um programa de treinamento funcional nas atividades da vida diária e capacidade funcional de idosos da UATI: um ensaio clínico

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RESUMO | INTRODUÇÃO: O envelhecimento humano provoca alterações biopsicossociais que interferem nas atividades da vida diária (AVD) e o treinamento funcional pode atuar como um recurso terapêutico para prevenir, minimizar ou reverter esses quadros. **OBJETIVO:** testar a hipótese de que o treinamento funcional melhora a capacidade de realização das AVD e a capacidade funcional de idosos sedentários. **MATERIAIS E MÉTODOS:** Ensaio clínico de braço único, do tipo antes e após a intervenção no mesmo grupo. Foram incluídas idosas da Universidade Aberta da Terceira Idade, com 60 anos ou mais, a mais de três meses sem realizar exercício físico, com indicação médica e fisioterapêutica para exercícios e, como exclusão, apresentar declínio cognitivo de acordo com o Mini Exame do Estado Mental (MEEM) e frequência menor que 70%. Coletados dados sociodemográficos, antropométricos, morbidades autorreferidas, capacidade funcional e de realização das AVD. O treinamento funcional ocorreu duas vezes na semana com duração de 60 minutos por sessão, durante quatro meses. Os dados foram submetidos à estatística descritiva e teste t. O projeto foi aprovado pelo comitê de ética com CAAE 02585813.0.0000.0057. **RESULTADOS:** Participaram 16 idosas, todas do sexo feminino, média da idade de 69,6 + 6,6 anos, a maioria com baixa escolaridade (52,5%) baixa renda (56,3 < um salário mínimo), viúvas (50%) e 75,1% acima do peso. Dentre as morbidades, prevaleceu dor crônica (25%). Os testes de capacidade funcional e AVD, demonstraram resultados positivos da intervenção com $p < 0,05$ e constatou-se que a melhora funcional foi maior nos idosos de 60 a 69 anos ($p < 0,05$). **CONCLUSÃO:** Treinamento funcional melhora a capacidade funcional e realização das AVD de idosos, independente da faixa etária, porém, essa melhora é mais pronunciada entre os idosos com menos idade.

PALAVRAS-CHAVE: Idoso. Exercício físico. Atividades da vida diária.

ABSTRACT | INTRODUCTION: Human aging causes biopsychosocial changes that interfere with the activities of daily living (ADL) and functional training can act as a therapeutic resource to prevent, minimize or reverse these clinical features. **OBJECTIVE:** To test the hypothesis that functional training improves the ability to perform ADL and the functional capacity of sedentary elderly. **METHODS:** Single-arm trial with before and after intervention analysis in the same group. Elderly of the 'Universidade Aberta da Terceira Idade', aged 60 years and older, with more than three months without physical exercise, with a medical and physiotherapeutic indication for exercise, were included in the study, and were excluded the ones who presented cognitive decline according to the Mini Mental State Exam (MMSE) and frequency less than 70%. Sociodemographic and anthropometric data, self-reported morbidities, functional capacity and ADL performance were collected. Functional training occurred twice a week, 60 minutes per session for four months. Data were submitted to descriptive statistics and t test. This study was approved by the ethics committee with number 02585813.0.0000.0057. **RESULTS:** Participants were 16 elderlies, with mean age 69.6 ± 6.6 years, the majority with low schooling (52.5%), low income (56.3 <one minimum wage), widows (50%), and overweight (75.1%). Among the morbidities, chronic pain prevailed (25%). The functional capacity and ADL tests showed positive results from the intervention with $p < 0.05$ and it was verified that the functional improvement was higher in the elderly of 60 to 69 years ($p < 0.05$). **CONCLUSION:** Functional training improves the functional capacity and performance of the ADL of elderlies, regardless of age, but this improvement is more pronounced among the elderlies with less age.

KEYWORDS: Elderly. Exercise. Daily life activities.

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Introduction

With the increase in life expectancy there has been a progressive increase in the number of elderly people[1,2], and it is necessary to emphasize that human aging is a natural, progressive and irreversible process that brings biopsychosocial modifications, favoring the appearance of diseases, especially the sensorial, osteomioarticular, cardiovascular and metabolic ones[3]. These modifications make the elderly gradually more dependent to perform the activities of daily living (ADL), which may interfere with their self-esteem[4,5].

The ADL's are divided in basic activities of daily living, which are characterized as self-care tasks such as feeding or bathing, and instrumental activities of daily living, which indicate the ability to be independent within the community such as shopping, take medications or even practice sports[6]. The progressive reduction of functional capacity tends to generate dependence causing a feeling of incapacity, which can compromise their well-being and develop a pessimistic view of life, having emotional consequences that lead to social isolation[4,7]. However, dependence is not a permanent state, but a dynamic process whose evolution can be modified and prevented, reduced or even reversed if there is adequate environment and assistance[8].

As an alternative to attenuate the effects of aging, physical exercise provides the elderly with many benefits by acting on the main organic systems improving their performance through strength, flexibility, balance, coordination, endurance and agility, leading to a decrease in the risk of falls and fractures[9-11]. In view of the above, the present study has the objective of testing the hypothesis that a functional training program improves the capacity to perform ADL's and the functional capacity of sedentary elderlies, in addition to comparing the effect of this training program on the functional capacity in different age groups of elderlies of the Universidade Aberta da Terceira Idade (UATI).

Methods

This is a single-arm trial with before and after intervention analysis in the same group. The sampling procedure used was non-probabilistic for convenience, and the sample consisted of elderlies of the UATI of the Universidade do Estado da Bahia – UNEB, DEDC-VII, from Senhor do Bonfim, Bahia, Brazil. The research was carried out from August to November 2014, after the approval of the research ethics committee involving human beings of UNEB, with CAAE number: 02585813.0.0000.0057. All participants agreed to participate and signed the informed consent form. The inclusion criteria were: have 60 years of age or older; both genders; with more than three months without physical exercise; have medical and physiotherapeutic indication to perform physical exercises. As exclusion criteria: present cognitive decline according to the Mini Mental State Exam (MMSE) and frequency less than 70% of predicted for the physical exercise program. It was performed training sessions of two assistants (students of the 2nd year of the Nursing undergraduate course) linked to the UNEB group of studies and research on quality of life and healthy aging (QUALES) exclusively for evaluations, and two other assistants for the intervention application. The entire evaluation process occurred one week before and one week after the intervention time. Initially, the elderlies participated in a 50-minute talk with explanations about the experimental procedure. The data were collected in an appropriate room, through an interview in which the information was obtained regarding sociodemographic, anthropometric, self-reported morbidities and cognitive ability characteristics.

The clinical evaluation, the application of the instruments of measurement of activities of daily living and functional capacity, were performed before and after the intervention of four months in all participants. The analysis of cognitive impairment occurred through the Mini Mental State Exam (MMSE). This instrument is composed of questions in five dimensions: concentration, language/praxis, orientation, memory and attention, containing a maximum score of 30 points. The cut-off points adopted were: 20 points for illiterates, 25 points for one to four years of study, 26.5 points for five to eight years of study, 28 points for nine to eleven years of

study and 29 points for those who had more than eleven years of study[12].

In the evaluation of the anthropometric variables, the body mass was obtained using a Welmy® scale with a capacity of 150 kilograms (kg); the height in meters (m) was measured by a vertical stadiometer fixed to the scale and the Body Mass Index (BMI) was calculated from the weight in kilograms divided by the height in meters squared.

The evaluation of the ADL was based on the study of Andreotti and Okuma[13], which validates the tests to evaluate ADL of physically independent elderlies. Among these tests, the ones selected for this study was the ADLs that are performed with the highest frequency and which present a greater degree of difficulty in their execution, which are: rising from the floor, putting on socks, stair-climbing, and sitting-rising from a chair and walking around the house. To evaluate the functional capacity used was the six-minute walk test (6MWT)[14].

The tests used as an assessment tool were previously performed twice with all the elderlies, guaranteeing the learning in the accomplishment of the same and, thus, minimizing the damages of the first data collection due to the lack of knowledge in the execution of the tests.

"Rising from the ground" test

The participant should be placed in the supine position on an exercise mat, with arms along the body and legs extended. The evaluator standing to the right of the evaluated and using the command "Ready! Go!" starts the test, simultaneously triggering the timer. The subject should get up as quickly as possible and in the most comfortable way, assuming the standing position, with lower limbs together and arms extended along the body. The stopwatch is stopped at the moment the evaluated is standing. Three attempts are made, with an interval of 60 seconds or more between each and the best value is considered.

"Putting on socks" test

Starting from a sitting position on a chair with knees flexed, feet resting on the floor, arms along the body, and with a sock on one of the thighs, the evaluated shall, at the signal "Ready! Go!" spoken by the evaluator, put the stocking as fast as possible on the foot of preference. The stopwatch must be started at the same time the signal is given and finalized when the elderly gets back to the starting position. Three attempts are made, with an interval of 60 seconds or more between each and the best value is considered.

"Stair-climbing" test

The subject must be in the standing position at the beginning of a stair with 15 steps and, at the sign "Ready! Go!" the elderly should climb the stair as quickly as possible, whether using the handrail. Only one attempt is made, in which the climb time will be measured. The stopwatch should be triggered when the foot is placed on the first step and finished when one foot reaches the fifteenth step. The evaluator should position himself at the top of the stair.

"Sitting-rising from a chair and walking around the house" test

Two cones should be placed diagonally to a chair maintaining a distance of 4 meters back and 3 meters to both sides of the chair. The subject begins the test sitting on the chair and lifting up the feet from the floor. At the sign "Ready! Go!", the evaluated must stand up and move to the right, go around the cone and return to the chair where he/she should sit and lift up the feet from the floor again. Then immediately get up and perform the same movement but to the left direction, and again sit and lift up the feet from the floor. This circuit consists of walk around each cone twice and the timer must be started at the moment the elderly places the foot on the floor for the first time and is interrupted when sitting for the fourth time and lifting up the feet from the ground. The participant must be instructed to complete the test as fast as possible and the time is recorded in seconds. Two attempts are made, with an interval of 60 seconds or more between each and the best value is considered.

6-minute walk test

The 6-minute walk test (6MWT') followed the guidelines established by the American Thoracic Socie[14]. This test is often used in the assessments of physical performance of clinical trials because it is a validated test that is simple, inexpensive, safe, easy to administer and uses an important activity of daily living: walking. The test consists of self-paced walking, and as fast as possible during the six minutes. The walk was performed in a flat location with pleasant temperature. The length of the area covered was 15 meters, delimited by cones, and demarcated every three meters by adhesive tapes fixed on the floor. The participants performed the walk going around the cones, and the distance was recorded in meters, that they walked during six minutes. The heart rate, respiratory rate, blood pressure, peripheral oxygen saturation (SpO2) and the Borg's rating of perceived exertion were measured before and immediately after the 6MWT'15. The tests were performed before the volunteers start the systematic program of physical exercises and after four months of exercises practice, allowing the comparison of the performance while sedentary and after the accomplishment of the program.

Intervention

The physical exercise program was based on the recommendations of the American College of Sports Medicine for exercise and physical activity with elderlies[16]. The program consisted of a combination of aerobic exercises, muscle strengthening, balance, coordination and flexibility, prioritizing exercises involving large muscle groups, with a duration of four consecutive months, frequency of 2 weekly sessions, with a 60-minute execution time, and 2 to 3 sets with 5 to 15 repetitions for each exercise at a target effort rate of 13-15 ("a little difficult" to "difficult") in the Borg's rating of perceived exertion from 6 to 20 points[15]. The exercises were performed using the participant's own body weight and low cost instruments such as recyclable plastic bottles and wooden sticks.

- Warm-up exercises – Active-free exercise of upper and lower limbs, shoulder rotation movements associated with breathing exercises and walking on flat surface;

- Aerobic exercises – Displacement of a stick, with both hands starting from the knees, going through the hip and stretching it above the head, as high as possible, then returning to the knees; ambulation bending the thighs as high as possible, approaching the knee to the contralateral hand; Jumping Jacks adapted for the elderly, starting from the standing position with the arms along the body and feet together, abduct the upper limbs up above the head and simultaneously abduct the right lower limb approximately 50 centimeters, return to the initial position and then repeat the movement with the lower left limb;

- Resistance training – Perform diagonal movements with the upper limbs, starting with the elbow extended and the hand resting on the hip on the opposite side, move the diagonal member up and then return to the initial position; squatting exercise, starting from the sitting position on a chair and with the arms crossed in front of the body, raise to the standing position, maintaining semi-flex of the knees and then return to the sitting position; plank and bridge exercises on a mat.

- Balance and coordination exercises – Walk on a straight line, touching the heel of one foot on the toes of the other foot; walk dodging obstacles lined up; walk performing crossed movements of the lower limbs on a marked line on the floor; lateral march; walking on mats; exercises of reaching, rotation and extension of trunk and execution of synchronic and simultaneous movements of upper and lower limbs.

- Stretching exercises – Active stretching: Sitting on a mat and with knees extended, perform trunk flexion to reach the tip of the feet; standing on tiptoes and stretch the upper limbs above your head as high as possible. Passive stretching: in pairs and with the aid of a supervisor.

The exercise program was guided and supervised by a specialist in physical exercise for the elderly, with the assistance of previously trained volunteers. The exercises were performed twice a week, in the four-month period, with sessions of 60 minutes each day, being 10 minutes of warm-up and stretching, 15 minutes of aerobic exercises, 15 minutes of resisted exercises, 10 minutes of balance and coordination exercises and 10 minutes of cool down and relaxation. The exercise sessions were performed with songs suitable for the type of physical exercise performed, such as stimulating songs during aerobic and resisted, and relaxing songs during the cool down.

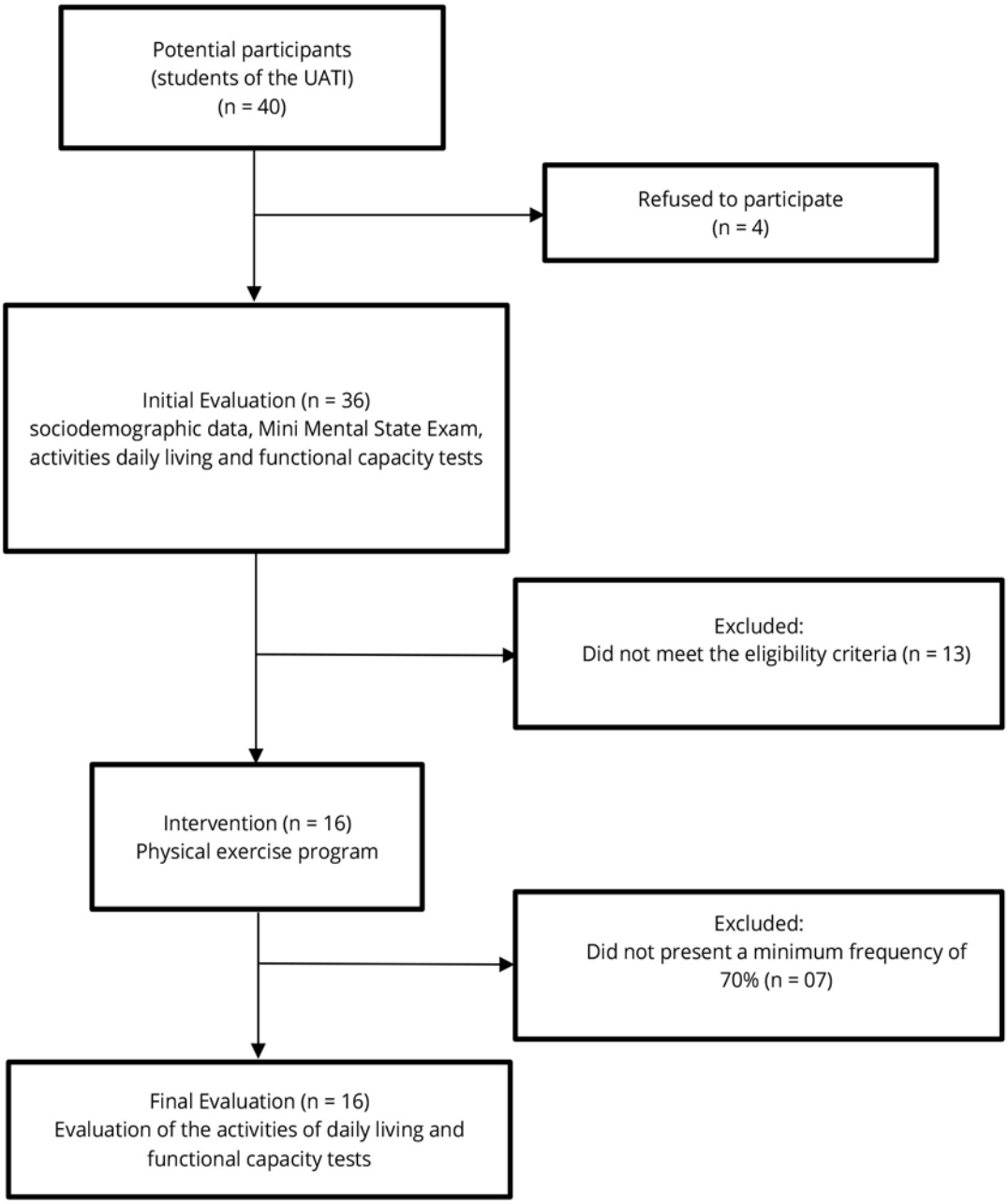
Statistical Analysis

To test the normality of the data, the histogram, mean and median, standard deviation, asymmetry and kurtosis were analyzed, and the Shapiro-Wilk normality test was used to confirm the data. Data were then subjected to descriptive analysis using absolute and percent frequencies for categorical variables and measures of central tendency and dispersion for numerical variables. Due to the normal distribution of variables, parametric statistics were used, and intragroup comparisons of the means between paired data (before and after the intervention) were performed using Student's t-test for paired samples and Student's t-test for independent samples in the comparison of means between two groups. The significance level established for all analyzes was $p < 0.05$ and statistical procedures were analyzed and processed in the Statistical Package of the Social Sciences (SPSS 21.0). IBM® SPSS version 21 (IBM, Armonk, NY, EUA).

Results

Of the 40 potential participants, four refused to participate in the study, 13 were excluded because they did not meet the eligibility criteria and seven because they did not present a minimum frequency of 70%. Thus, 16 elderlies participated in intervention and final data evaluation. A summary of participants' flow over the study is presented in Figure 1.

Figure 1. Flow diagram of participants throughout the study



The sample of the present study consisted exclusively of women, with a mean age of 69.6 ± 6.6 years, ranging from 60 to 87 years, the majority with low schooling (52.5%), with a income per capita less than a minimum wage (56.3%), mostly widows (50%) and 75.1% presenting above normal weight. Among the morbidities, chronic pain was reported by 25% of the elderlies, being the most prevalent (Table 1).

Table 1. Sociodemographic and clinical characteristics of the participants involved in the study

Sociodemographic characteristics	n (%)	Mean ± SD*
Age (years)		69.6 ± 6.6
60 to 69	8 (50)	
70 to 70	7 (43.8)	
≥ 80	1 (6.3)	
Schooling		
Illiterate	02 (12.5)	
Elementary	08 (50)	
High school	06 (37.5)	
Monthly income per capita (MW)		
< 1 MW	09 (56.3)	
1 to 2 MW	06 (37.5)	
> 2 to 3 MW	01 (6.3)	
Marital status		
Married	07 (43.8)	
Widow	08 (50)	
Divorced	01 (6.3)	
Self-reported morbidities		
No disease	7 (43.8)	
Hypertension	2 (12.5)	
Diabetes	3 (18.8)	
Chronic pain	4 (25)	
Weight (Kg)		63.6 ± 12
BMI (Kg/m²)		
Normal (18.5 to 24.9)	4 (25)	
Overweight (25.0 to 29.9)	7 (43.8)	
Obesity (≥ 30)	5 (31.3)	

Note: MW (minimum wage) at the time of the survey (in reais) = R$ 678.00 and *SD = Standard Deviation.

Table 2 presents the results of the tests that were used to evaluate the activities of daily living and the functional capacity of the elderlies, in which it is possible to observe that in all four ADL tests, when the moments before and after the intervention were compared, there was a significant reduction in their execution time and in relation to the six-minute walk test there was a significant increase in the distance walked, with p <0.05 for all analyzes.

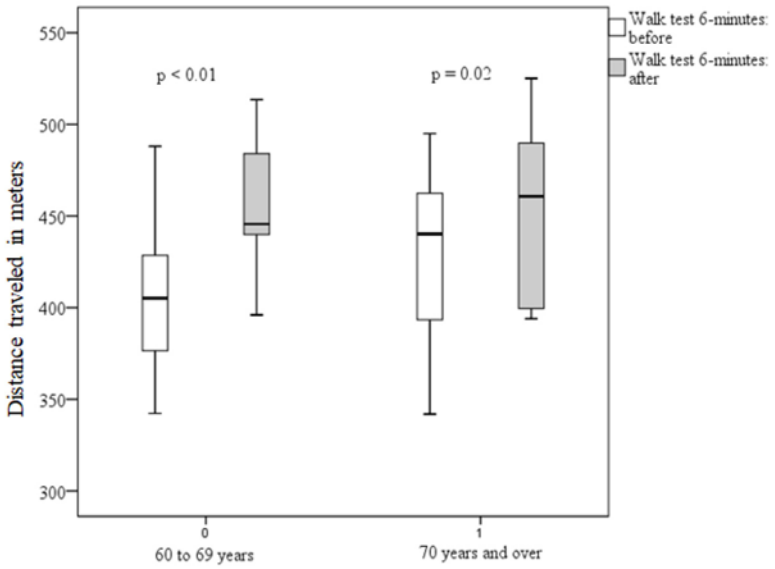
Table 2. Measurement of the Activities of Daily Living and functional capacity tests of the study participants

ADL tests	Before the intervention (Mean ± SD)	After the intervention (Mean ± SD)	p*
"Rising from the ground" test (in seconds)	7.69 ± 5	4.31 ± 2	0.026
"Putting on socks" test (in seconds)	7 ± 4	3.8 ± 1.8	< 0.01
"Stair-climbing" test (in seconds)	10.7 ± 4.4	8.7 ± 2.5	< 0.01
"Sitting-rising from a chair and walking around the house" test (in seconds)	21.4 ± 2	19.2 ± 2	< 0.001
6-minute walk test	417.4 ± 48	454.2 ± 44	< 0.001

Note: ADL = Activities of Daily Living; SD = Standard Deviation; *t test for paired samples (p < 0.05).

As shown in figure 2, dichotomizing the sample in two age groups (60 to 69 and ≥ 70) and performing intragroup analysis, it was possible to identify that, regardless of the age group of the elderly, functional capacity showed a statistically significant improvement with $p < 0.05$ in both strata studied. However, through the intergroup analysis it was found that the improvement was greater in the stratum of 60 to 69, being this difference statistically significant with $p < 0.01$.

Figure 2. Boxplot distribution of the functional capacity, intra and intergroup comparisons of two age groups of the participants of the study



Discussion

The results of the present study are consistent with the research hypothesis and indicate that sedentary elderlies participating in a functional training program show a significant improvement in functional capacity and ability to perform activities of daily living, in addition to demonstrating that the evolution is statistically significant independent of the age group of the elderly (60 to 69 or ≥ 70), although it is more intensified in the group of younger people. Through the 'Rising from the ground' test, it was found that the elderlies acquired agility, flexibility, balance and strength to perform similar activities in their daily lives, being consistent with previous studies, in which it was found that a resistance training program was effective in increasing balance, functional mobility and physical dominance[3,10,17,18].

The 'Putting on socks' test showed that the elderlies acquired greater speed and flexibility, which was evidenced by the greater ability to perform the proposed activity easily, as well as in the study of Hernandes and Barros[18] who, by means of a similar methodology, obtained equivalent results in relation to this test. However, in relation to the 'Stairs-climbing' test, the elderlies in our study demonstrated increased muscular strength, agility and resistance, diverging from the results found in the Hernandes and Barros[18] study, which did not present significant data. Regarding the six-minute walk test, the participants also obtained positive and statistically significant results, proving the increase of the resistance, balance and muscular strength of the lower limbs, converging with previous studies in which it was they demonstrated that elderlies practicing physical exercise presented greater resistance and better balance in gait execution, with a higher proportion of independent elderly in the ADL[3,19,20], contributing to reduce the risk of falls[22].

Corroborating with the findings of the present study, previous research verified that after performing physical exercises, the elderly men acquired a greater functional capacity for the ADL, in relation to the group of sedentary elderly women[20,22]. Similarly, studies have shown that aerobic exercise associated with resistance training provides a positive effect on ADL by improving the functional capacity of the elderlies[23-25].

When the elderlies were divided into two age groups (60 to 69 and ≥ 70), it was found that the functional training performed over a period of four months, provided a statistically significant improvement in the ability to perform ADL and functional capacity, independent of age group of the elderly. However, when comparing the two age groups, it was possible to perceive that the positive result was more pronounced in the group of younger elderlies, as well as identified by other studies[26,27].

The results of this study should be interpreted considering some limitations as: absence of control group; small sample size, as a result of UATI having few participants due to its incipient infrastructure; sample composed exclusively of women, which is justified by the feminization of old age[28]. Future studies are needed to evaluate the effects of functional training programs, through randomized clinical trials, with adequate sample size and performed for long periods of follow-up, making the results clinically more reliable.

Conclusion

In view of the above, it is possible to conclude that a supervised functional training program performed twice a week with a duration of four months and with regularity, improves the capacity to perform activities of daily living and the functional capacity of the elderlies. Although this improvement was more intense among the younger elderlies, it was statistically significant independent of the age group of the elderly (60 to 69 or ≥ 70), making it possible to perform their habitual activities more actively, with autonomy and independence.

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Author contributions

Galvão DG participated in the conception of the study, the creation of the hypotheses, wrote the original proposal, participated in the collection and analysis of the data, prepared the manuscript and wrote the final version. Oliveira LVF participated in writing and critical analysis of the final version of the manuscript. Brandão GS was responsible for designing and delineating the study, creating the hypotheses, wrote the original proposal and obtained ethical approval, participated in the collection and analysis of the data, prepared the manuscript and wrote the final version.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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