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MORE TORRES MONTALVÃO

PREDICTORS OF INCREASED FUNCTIONAL MOBILITY IN ACTIVE ELDERLY WOMEN AFTER EXERCISE PROGRAM

BRASÍLIA
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Trabalho de Conclusão de Curso apresentado à Universidade de Brasília – UnB – Faculdade de Ceilândia como requisito parcial para obtenção do título de bacharel em Fisioterapia.
Orientador (a): Professor Dr. Wagner Rodrigues Martins

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Dedico este trabalho a meus pais, que tanto apoiam e incentivam meu crescimento. Vocês são meu maior exemplo de amor e garra.

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“Conheça todas as teorias, domine todas as técnicas, mas ao tocar uma alma humana, seja apenas outra alma humana (Carl Jung). ”

RESUMO

MONTALVÃO, More Torres; MARTINS, Wagner Rodrigues. Preditores do aumento de mobilidade funcional em idosas ativas após programa de exercícios. 2017. 54f. Monografia (Graduação) - Universidade de Brasília, Graduação em Fisioterapia, Faculdade de Ceilândia. Brasília, 2017.

O avanço da idade está associado a um declínio na função de todos os sistemas, resultando em uma capacidade prejudicada para realizar atividades diárias e manter-se funcionalmente independente. Diante disso, o propósito deste estudo é, através de uma regressão linear multivariada, analisar a associação entre o aumento da mobilidade funcional com variáveis preditoras independentes em 47 idosas após 12 semanas participando de um programa de exercícios. O Teste Timed Up and Go (TUG) foi definido como variável dependente e outras 9 variáveis como independentes, constituindo: Idade, Índice de massa corporal (BMI), Peso, Massa Livre de Gordura dos Membros Inferiores (LLFFM), Circunferência da cintura (WC), Pico de torque de joelho a 60º / s (TPK 60), Pico de torque de joelho a 180º / s (TPK 180), Teste de Alcance Funcional e Teste de Sentar e Levantar em 30 segundos (30CST). Os resultados mostraram uma redução estatisticamente significativa no tempo de execução do TUG após as 12 semanas treinamento, e os dados da análise de regressão linear multivariada indicaram que tal melhoria foi predita em 30% por determinadas variáveis analisadas.

Palavras-chave: Mobilidade Funcional, Idosos, Índice de Massa Corporal, Circunferência da Cintura, Programa de Exercício.

ABSTRACT

MONTALVÃO, More Torres; MARTINS, Wagner Rodrigues. Predictors of increased functional mobility of active elderly women after exercise program. 2017. 54f. Monograph (Graduation) - University of Brasilia, undergraduate course of Physicaltherapy, Faculty of Ceilândia. Brasília, 2017.

The advancement of age is associated with a decline in the function of all systems, resulting in an impaired capacity to perform daily activities and to maintain independent functioning.Due to this the purpose of this study is, throught a multivariate linear regression, analyze the association of functional mobility increase with independent predictor variables in 47 ederly woman post 12 weeks of exercise program. The Timed Up and Go Test (TUG) was definde as dependent variable, and other 9 as independent variables, which were: Age, Body mass index (BMI), Weight, Lower limb fat free mass (LLFFM), Waist Circumference (WC), Torque peak knee at 60º / s (TPK 60), Torque peak knee at 180º / s (TPK 180), Functional Reach Test, and 30 Seconds Chair Stand Test (30CST). The results showed a statistically significant reduction in TUG execution time after the 12 weeks of exercise program, and data from the multivariate linear regression analysis indicated that such improvement was predicted in 30% by certain analyzed variables.

Keywords: Functional Mobility, Elderly, Body Mass Index, Waist Circumference, Exercise Program.

LISTA DE ABREVIATURAS

ADLs – ACTIVITIES OF DAILY LIVING

BMI – BODY MASS INDEX

DEXA – DUAL ENERGY X RAY ABSORPTIOMETRY

LLFFM – LOWER LIMB FAT FREE MASS

LMS – LOWER LIMB MUSCLE STRENGHT

MR – MAXIMUM REPETITION

TUG – TIMED UP AND GO

TPK – TORQUE PEAK KNEE

TPK 60 – TORQUE PEAK KNEE AT 60°/S

TPK 180 - TORQUE PEAK KNEE AT 180°/S

WC – WAIST CIRCUMFERENCE

30 CST – 30 SECONDS CHAIR STAND TEST

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SUMMARY

1 – INTRODUCTION

The advancement of age is associated with a decline in the function of all systems involved in physical and cognitive functions (Hill et al., 2016). Your impact is relacionated with declines in muscle mass, strength performance, and cardiorespiratory fitness, resulting in an impaired capacity to perform daily activities and to maintain independent functioning (Fleg and Lakatta, 1988; Izquierdo et al., 2001a, 2003; Christensen et al., 2009; Snijders et al., 2009; Aagaard et al., 2010). Recently, age-related declines in muscle power output have also emerged as an important predictor of functional limitations in older adults (Izquierdo et al., 2003). Mobility is essential for autonomy, independence and a high quality of life and is associated with time spent outside the home and general health perceptions among older adults. Maintaining functional status is an important part of active aging and reducing age-related morbidity; it facilitates independent living, improves quality of life, and reduces health care costs (Chodzko-Zajko et al., 2009).

An excellent functional capacity for the health of the elderly represents maintaining their freedom to live alone and develop activities that provide them with pleasure. It can be understood as the ability of any individual to adapt to everyday problems despite having some physical, mental or social limitation. In this way, functional capacity emerges as a new concept of the elderly's health by the possibility of this self-care, of determining and performing activities of daily living, even with the presence of comorbidities. By the way, functional incapacity can be understood as the "difficulty in performing certain gestures and certain activities of daily life or even in the impossibility of performing them" (Lourenço et al., 2012).

In view of this, preserving the independence of daily activities is an important goal for an elderly population, especially for reducing the risk of falls, mainly hospitalization, because falls among elderly people in or out of their homes are a more common cause of fractures and consequent hospitalization. (Pedersen, 2012; Jessen and Lund, 2017). It is therefore not surprising that mobility assessment tools have been identified as an important component in determining fall risk of older individuals (Schoene et al., 2013).

The Timed Up and Go (TUG) test is a reliable, cost-effective, safe, and time-efficient way to evaluate overall functional mobility (Kear et al., 2016). Is one of a range of measures identified in clinical as a possible screening tool to evaluate gait and balance functions and to identify older people at risk of falling, being recommended as a routine screening test for falls in guidelines published by the American Geriatric Society and the British Geriatric Society in 2010. The National Institute of Clinical Evidence guidelines also advocate the TUG test use for assessment of gait and balance in the prevention of falls in older people; besides that, an unfavorable TUG performance has been associated with poor muscle strength, poor balance, slow gait speed, fear of falling, physical inactivity, and impairments relating to basic and instrumental activities of daily living (ADLs) (Nice, 2013; Schoene et al., 2014).

Therefore, the benefits of physical exercise in improving the functional capacity of frail, older adults have been the focus of considerable recent research (Cadore et al., 2013). Exercise programs tailored to this population have been demonstrated to be effective. These interventions, such as resistance training, balance training, endurance training, coordination training multi-component exercises (i.e., simultaneous strength, endurance, and balance training), and Tai Chi, have yielded beneficial effects on certain functional parameters in frail, elderly subjects. From this perspective, is understood that musculoskeletal health is critical for people's mobility and dexterity, their ability to work and actively participate in all aspects of life, and to maintain economic, social, and functional independence across their life course (Briggs et al., 2016). Moreover, impaired musculoskeletal health, reflected in reduced physical capability (grip strength, walking speed, chair rising, and standing balance times) has been repeatedly and consistently related to increased mortality (Cooper et al., 2010). Therefore, a key component of frailty, being particularly important for maintaining an active, productive, and prolonged working life (Briggs et al., 2016).

2 – OBJECTIVE

The present study aims to analyze the association of increase functional mobility after resistance training, with independent predictor variables in elderly.

3 – MATERIAL AND METHODS

3.1 – Study Design

The present study is classified as cross-sectional, analytical.

3.2 – Ethical Aspects

The procedures of this study were approved by the Ethics Committee of the Faculty of Health Sciences of UnB on July 21, 2011, protocol 081/11 (ANNEX B), in accordance with Resolution No. 196/96 of the National Health Council responsible for regulate research with humans.

The participation in the study was voluntary, and after clarification of objectives, assessments and interventions participants were invited to sign the Informed Consent Form (APPENDIX A).

3.3 – Location

The evaluations were carried out at the Therapeutic Gymnasium of the Faculty of Ceilândia, located at the QNN 14 Special Area, Guariroba, Ceilândia Sul and at the Faculty of Physical Education, Darcy Ribeiro campus, located in Asa Norte; both campus belonging to the University of Brasília.

3.4 – Sample

The recruitment was carried out through the distribution of leaflets in Health Centers, Regional Hospital of Ceilândia, churches and in the centers for elderly cohabitation, by the city of Ceilândia-DF. Then there were 5 lectures at the University of Brasília - Campus Ceilândia, in order to provide clarification on the project. After each talk the contacts of the interested individuals were collected.

3.5 – Inclusion Criteria

To participate of this study, volunteers should be at least 60 years old, live in the Federal District, present a medical certificate that would allow them to perform resistance training and not have done so in the previous 6 months.

3.6 – Exclusion Criteria

Of the exclusion criteria, participants could not present: Joint injury or surgery, heart disease, diabetes, cancer, neuropathies, use of prostheses, without medical authorization to participate; participation in another resistance training program in the last 12 months; use of cardiac pacemaker; hip or knee arthroplasty; presence of osteosynthesis material in joints; orthopedic trauma surgery in the last six months; severe functional limitations or significant cognitive impairment that could affect adherence to the resistance training program.

3.7 – Sample Screening

The elderly who were interested in participate of the study were interviewed for the characterization of the sociodemographic aspects, besides the eligibility of the sample criteria according to the semi-structured questionnaire (APPENDIX B). This questionnaire included: The sample selection criteria and general aspects of health. According to the disclosure of the research, 113 individuals made telephone contact or attended at FCE-UnB, showing interest on participate of the research. However, only 74 presented and were evaluated according to the inclusion criteria. Of these, 10 were excluded by the selection criteria of the sample and 10 dropped out of the training phase due to schedules, location or lack of interest.

Exclusion criteria were: deep venous thrombosis n = 1, resistance training practice n = 1, congestive heart failure n = 1, stroke n = 2, rheumatoid arthritis n = 1, age less than 60 years n = 4. Of the elderly evaluated for eligibility, 54 were selected and randomly assigned to the research groups. During the training, n = 07 did not complete it; reasons were: n = 02, incompatibilities with schedule n = 02, home accidents with sequels n = 01, pneumonia n = 01, and orthopedic surgery n = 01, finalizing the study with 47 participants, all of them female.

3.8 – Instruments and procedures

Each volunteer was submitted to an evaluation protocol before starting the resistance training program, contemplating: Anthropometric analysis (Weight, Body Mass Index, Waist circunference), mobility and balance tests (Timed Up and Go, Funcional Reach Test, 30 Second Chair Stand Test), Lower limb muscle strength evaluation (Torque peak knee at 60°/s and 180°/s), and body composition evaluation (Lower Limb fat-free mass). After the training program end, each volunteer performed the TUG test for evaluation.

The resistance training was accomplished at University of Brasília - Faculty of Ceilândia, located in QNN 14 Special Area, Guariroba, Ceilândia Sul (UnB - FCE). Five exercises for lower limb (hip abduction in two forms, hip extension, lateral gait, knee flexion and knee extension) were selected and four exercises for upper limb (paddling, bench press, biceps curl and triceps curl) were always performed alternating and with one minute of interval recovery. All exercises were performed using elastic tubes (Elastos) and pneumatic machines (EM-Dynamic). In order to control the intensity of the exercises, the OMNI-RES scale was used (with levels of subjective perception of effort varying from one to four points). As the training progressed, the load was gradually increased according to the adaptations to the training.

Previously, the elderly participated for a two-week familiarization period for neuromuscular adaptation, and in both the adaptive and the RT periods, participants performed 9 exercises, twice a week with a rest interval of 48 hours between one training and another. The initial load was determined after the adaptive period; from the control of the number of maximum repetitions (MR) the series were divided into three cycles, at 1-4 weeks with 15 MR, at 5-8 weeks with 12MR, at 9-12 weeks with 8 MR.

3.8.1 – Dependent variable of the study

3.8.1.1 – Functional Mobility

The functional mobility was measured by the TUG test, that is an effective method for assessing mobility and quantifying locomotor performance (Herman et al., 2011). Was measured the time that the subject required to rise from an arm less chair, walk to a cone on floor 3m away, turn, return, and sit down again. The participants were instructed to use not their arms to stand up and no physical assistance was given. The time to complete the task was measured with a stopwatch. Timing commenced on the command ‘go’ and stoped when the subject’s back was positioned against the back of the chair after sitting down. The elderly walked as quickly and safely as possible. A trial run was first performed for the subjects to become familiarized with the test, and then the participants performed the test three times. The variable analyzed was the shortest time taken to perform the test in seconds of the three attempts made (Khazzani et al., 2009).

Podsiadlo and Richardson (1991), admitted as normal performance for healthy adults a time between 10 seconds; between 11 and 20 seconds, is considered to be expected for frail or disabled elderly people, who tend to be independent in most activities of daily living; however, taking more than 20 seconds to perform the task suggests significant mobility impairment, requiring a more detailed assessment. Older people who perform TUG test in a larger time than 13.5 have higher risk for falls.

3.8.2 – Independent variables of the study

Was adopted 9 independent variables, which are: 1) Age, 2) Body mass index (BMI), 3) Weight, 4) Lower limb fat free mass (LLFFM), 5) Waist Circunference (WC), 6) Torque peak knee at 60º / s (TPK60), 7) Torque peak knee at 180º / s (TPK180), 8) Functional Reach, and 9) Lower limb strenght.

3.8.2.1 – Age

Age was calculated from date of birth according data that were collected for the sample selection.

3.8.2.2 – Weight, Body mass index (BMI), and Waist circumference (WC)

Body mass index (BMI) is commonly used to classify obesity. Other anthropometric measures such as waist circumference (WC) are considered strongly associated with important geriatric outcomes including disability (Angleman et al., 2006; Larrieu et al., 2004), institutionalization (Zizza et al., 2003) and death (Flegal et al., 2005).

During the pre-intervention phase for the initial characterization of the volunteers, the body mass was measured using a digital scale, with resolution in grams (model 2006 pp TOLEDO, Brazil), the volunteers were instructed to wear light clothing and remove shoes and other accessories. Stature was measured using the stadiometer, with resolution in centimeters (CARDIOMED, Brazil) fixed to the wall. Body mass index (BMI) was calculated by dividing body mass by height squared (Kg / m^2).

Waist circumference was measured using na inelastic measure tape, at the midpoint between the last rib and the iliac crest, with the abdomen relaxed at the end of expiration, with the individual without shirt in an upright position with arms relaxed at body sides.

3.8.2.3 – Lower Limb Fat Free Mass

Aging is strongly associated with changes in body composition. The percentage of body fat increases until 80 years and then seems to reach a plateau. The increase in percentage body fat is due to an increase in body fat as well as a decrease in lean mass (Ding et al., 2007).

The isolated evaluation of muscle mass can not fully explain the loss of muscle strength and physical function in older adults, however, preservation of mobility and functional abilities depends on multiple components of muscles, bones, tendons, ligaments and joints, and any compromise in some tissue can result in reduced mobility (Mcgregor et al., 2014). The dual energy X-ray absorptiometry (DEXA) equipment is considered a way of indirectly measuring body composition and gold standard, determining an amount of fat and fat-free mass in the body (Toombs et al., 2012). Fat-free mass includes non-fat components of the body: muscles, skin, bones and guts. Is measured by subtracting the fat mass from the total body mass, but the FFM of specific body components can also be estimated. Measurement of body composition in an indirect manner was performed using the Dual energy X-ray Absormetry (DEXA) equipment, from GE Eletric Company (Lunar Prodigy® model). The volunteers were positioned during the measurement procedure in supine position on the table of the equipment, as instructed by the software manual Encore®. Lower limbs were positioned in neutral rotation, wrapped in two bands and upper limbs on the body side, with palms facing downwards. The PRE and POST records were identified as whole body, and with kilograms scale. Individuals wore light clothing without shoes and were instructed to remove all accessories from the body.

3.8.2.4 – Torque peak

Among methods of muscle strength evaluation, the isokinetic dynamometer is indicated, which applies a mechanical resistance in function of exerced force by the person, during joint movement over a given amplitude through a controlled drive (Ernesto et al., 2009).

The evaluations were performed using the Biodex System® isokinetic dynamometer (model III). The lower limb muscle strength was verified by the torque peak of concentric knee extension (TPK) in dominant member. The dominant limb was defined by the preference in kicking a ball.

The protocols used for the strength measurement were randomized by a draw with a computer program.

Protocol 1 – A warm-up series with ten repetitions of knee extension at 300º/s; Two sets of four repetitions at 60º/s of knee extension; Two sets of four repetitions at 180º/s.

Protocol 2 – A warm-up series with ten repetitions of knee extension at 300º/s; Two sets of four repetitions at 180º/s of knee extension; Two sets of four repetitions at 60º/s.

The recovery interval between the series was among one and two minutes (Bottaro et al., 2005), in which was used the highest TP at both speeds for statistical analysis. The positioning is performed according to the instructions contained in the manufacturer's manual; the elderly women are comfortably positioned in the seat of the dynamometer, then the seat belts are fastened.

The following measures were collected in the PRE phase to be used in the other moments of the study: (A) chair height; (B) adjustment of the backrest; (C) position of the chair; (D) position of the dynamometer; (E) position of the resistance arm; (F) height of foot support; (G) height of the armrest. Verbal and visual encouragement was used to try to reach the maximum level of effort.

3.8.2.5 – Funcional Reach

Functional Reach was measured by Functional Reach Test, being used to evaluate the functional range, as a dynamic measure of the stability limits during the displacement of the gravity center inside the support base (Perracini and Fló, 2011).

In the functional reach test, the volunteer was in the orthostatic position with an upright spine, 90º flexion arm and the body near the wall, where a tape measure was attached. From this position, was solicited to the volunteer move anteriorly as maximum as can, without changing the fixed bases of the feet, remaining within the limits of stability. Three attempts was made, and for the purposes of analysis, the largest distance in centimeters reached in the three trials was used.

3.8.2.6 – Lower Limb Strenght

Lower limb strenght was measured through 30 Seconds Chair Stand Test, that was developed to evaluate muscle strength conditioning (Santana et al., 2014).

The 30s Chair Stand test started with the participant sitting in the center of the chair, with the back straight and feet on a surface approximately shoulder-width apart, with arms crossed and fixed at chest height, with an angle of approximately 90° of flexion of hip and knee. At the verbal signal, the participant rised to the full erect position and then returned to the seated started position. The participant was encouraged to complete as many repetitions as possible within a period of 30 seconds, with verbal (aloud) counts of all valid replicates (Jones and Rikli, 1999). The participants then performed the test three times, and the final result was the best value among the three executions.

3.9 – Statistical Analysis

The analysis involved the use of descriptive statistics for sample characterization, and regression statistics to verify the hypotheses of the study. For sample characterization purposes, was tested the data normality through Shapiro-Wilk test. Thus, they were presented using mean and standard deviation or median and interquartile range.

Descriptive data were presented in frequency (absolute and relative) and mean ± SD or median (interquartile range [II]) depending on the distribution of the data. Student's t test for dependent samples was used to evaluate the existence of statistically significant differences between the pre and post intervention moments in functional mobility. Within-group effect size was calculated using Cohen d coefficient (d). According to this ES (d) = preintervention - postintervention score ÷ pooled SD. An effect size greater than 0.8 is considered large, 0.5 moderate, and less than 0.2 small.

The mean of differences (Δ) between pre and post intervention of functional mobility (TUG) was used as dependent variable in linear regression analysis. For the multiple linear regression was attended waste assumptions with normal demeanour in Q-Q Plot graphic representation and in Shapiro-Wilk test. The regression analysis tested predictive models always considering Time Up and Go Test as dependent variable and nine independent variables (age, BMI, weight, LLFFM, WC, TPK 60, TPK 180, Functional reach test and 30 CST). Was used the stepwize regression method to identify the equation with the highest R^2 value and with more independent variables with statistical significance within the tested model. During the analysis, multicollinearity was considered present in the occurrence of Tolerance <0.1 and FIV> of 10.

Statistical significance was set at 5%. All analyzes were performed on IBM-SPSS software, version 21.0 (SPSS, Inc., Chicago, IL, USA).

4 – RESULTS

Of the 47 elderly evaluated, all were female, but this fact is not due the gender restriction according to the inclusion criteria, because the sample selection covered both sexes, however the male participants did not finish the resistance training, therefore their data were excluded from the study.

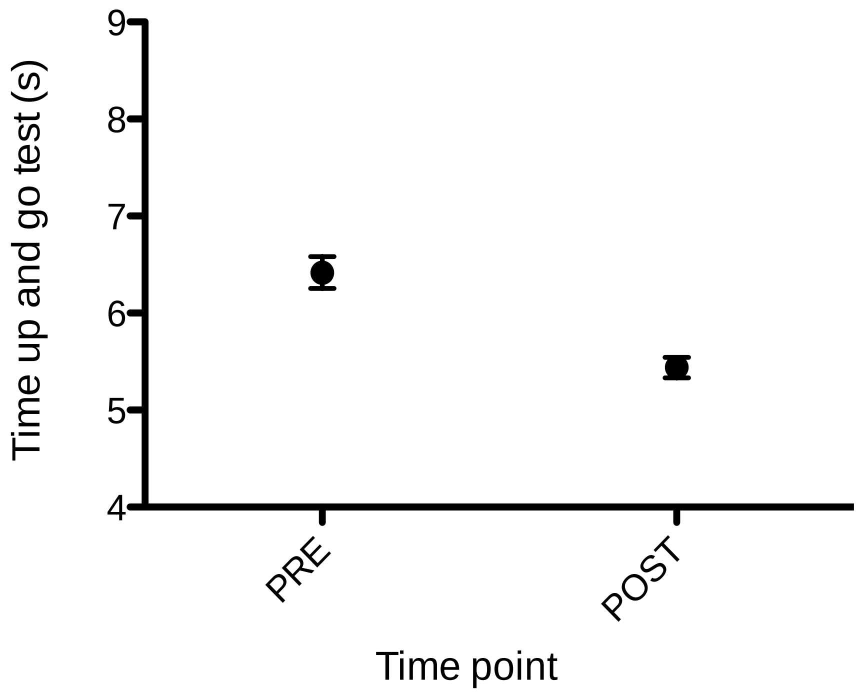
Table 1 presents the descriptive data regarding the study variables. Shows Age, the value of the variables of mobility and balance tests (TUG and 30CST), Lower limbs muscle strength evaluation (TPK60 and TPK180), and body composition Evaluation (LLFFM) before the exercise program. Age, Weight, BMI, WC and TUG were represented by mean and standard deviation, as they maintained the normality pattern, and the PTK 60, PTK 180, 30 CST, Functional Reach Test and LLFFM were represented by median and interquartile range for presenting not normal behavior.

Table 1. Sample characteristic

Characteristics	**Total (n = 47)**
Age (years)	68,11(5,49)
Weight (Kg)	70,76(13,38)
BMI (Kg/m²)	29,24(4,79)
WC (cm)	104,26(9,83)
PTK 60 * (Nm)	88,1 (80,95-10)
PTK 180 *(Nm)	59 (53,1-69,55)
30 CST * (REP)	13 (11 - 14)
Functional Reach * (cm)	37 (34,5-40,5)
LLFFM * (Kg)	10,82 (10,0405-11,82)
TUG (s)	6,41(0,87)

Note: Values in mean ± standard deviation.
*Values presented using median (Interquartile Interval 25-75).
Abreviations: BMI: Body mass index; WC: Waist circumference; PTK: Peak Torque Knee; 30 CST: 30 Seconds chair stand test ; LLFFM: Lower limb fat free mass; TUG: Timed up and go.

Graph 1 demonstrates the behavior of functional mobility values between the period pre- and post-exercise of resistance training. After its conclusion, there was a statistically significant reduction in TUG execution time ($p < 0.0001$). The mean difference (Δ) from the pre-moment (6.41s [0.87]) to the post-time (5.44s [0.56]) was 0.97;js (95% CI = 0.72; 1.2) and the effect size after training period was Of 0.90.



Graph 1. Course of functional mobility values before and after exercise program.

Table 3 presents the Base and Final Model of Multivariate Linear Regression, where 9 predictive models were tested, always considering the TUG as the dependent variable and nine independent variables. The analysis was performed by step wize (backward elimination), which consisted in testing the behavior of independent variables, through a criterion of adjustment of deletion; excluding those that are statistically insignificant. This process was repeated until the variables were eliminated one by one, due to loss of significance of the adjustment, leaving only: Age (ß = 0.28, p = 0.02); WC (ß = 0.62, p = 0.01); And 30 CST (ß = 0.44, p = 0.001). Although the BMI did not present a statistically significant result, it was considered in the final regression model, since it presented a P value close to the threshold of significance adopted in the study, suggesting that such a variable may also be associated with an improvement in TUG execution, and in all, these variables presented R2 = 0.30, corresponding to the predicted improvement in the performance of the Timed Up and Go test.

Still according to Table 3, can be observed that Age demonstrate significant and positive correlation with the decrease in tug execution time, showing that as younger the individual is, better gonna be their performance in the test. Regarding anthropometric characteristics, WC presented significant and negative correlations, in case that BMI presented negative correlation too, suggesting that lower BMI and WC values favor better performance. However, the 30 CST test showed a positive correlation, and the most significant of the final regression model, revealing that how much more repetitions realized in this test, better will be your efficacy in the TUG.

Table 2. Base and Final Model of Multivariate Linear Regression.

Dependent variable	Independent variable	R^2	Standardized ß	*P*
Base Model (backward elimination)		**0.32**		**0.02***
TUG	Age		-0.30	0.06*
	Weight		0.13	0.79
	WC		0.54	0.08
	BMI		-0.54	0.11
	LLFFM		0.10	0.74
	PTK60		0.20	0.59
	PTK180		-0.22	0.55
	30 CST		0.46	0.001*
	FR		-0.90	0.51
Final Model		**0.30**		**0.001***
TUG	Age		0.28	0.02*
	BMI		-0.48	0.06
	WC		-0.62	0.01*
	30 CST		0.44	0.001*

WC: Waist Circumference; BMI: Body Mass Index; LLFFM: Lower Limbs Fat Free Mass; PTK 60: Peak Torque at 60°/s; PTK 180: Peak Torque at 180°/s; 30 CST: 30 seconds chair stand test; FR: Functional Reach Test.* Preditor statistically significant.

5 – DISCUSSION

The present study aims to analyze the association of functional mobility gain with independent predictor variables. The results showed that after the resistance training period, older women presented better performance in the TUG when compared to the moment before joining the program. Data from the multivariate linear regression analysis indicated that such improvement was predicted in 30% by Age, BMI, WC and 30CST.

It is known that mobility dysfunctions in the elderly are generally associated with a combination of age-related factors, such as muscle mass decline and decreased sensorimotor acuity, which are also risk factors for loss of autonomy during the activities of daily living (Guralnik et al., 1995; Myers et al.,1996; Tinetti, 2003; Lord and Ward, 1994; Hoy et al., 2003; Maki et al, 1994). In this way, there are subsidies for the result of the present study, inferring how much older the individual is, worsen TUG performance will be, and to the detriment of this, tends to present lower functional mobility.

In contrast, we found that after the resistance training practice, the Timed Up and Go test execution time decreased, agreeing with the literature in what explains that regular participation in exercise programs proves to be an effective intervention in the reduction and prevention of functional decline associated with aging (Mazzeo et al., 1998), furthermore, there is evidence that lower limb muscle strengthening improves physical function, balance and mobility (Chandler et al., 1998; Ribeiro et al., 2009).

In this context, lower limb muscle weakness has been identified as a risk factor for falls and for the inability to perform lower extremity functional tasks. In function of this, one of the most important functional evaluation clinical tests, is the 30 CST because it measures lower body strength. Moreover, prospective cohort studies have demonstrated that it is a predictor of decreased activities of daily living (ADL) in older people (Jones et al., 1999; MacFarlane et al., 2006; Nakatani et al., 2002). Based on this assumption, it is considered that the 30 CST test can be a functional predictor of mobility, as noted in our results, because as higher number of repetitions in this test better will be the individual performance in TUG, inasmuch as explained previously, the 30 CST test has the capacity to indirectly evaluate the lower limb muscle strength.

BMI and WC in our study also were relevant to predict TUG performance, the first one being related to global obesity, and the second to central fat, respectively (Cabrera et al., 2005). Due to an association between obesity and disability be already well documented in the literature, is know that the measure of abdominal circumference is associated with physical inactivity and is also a predictor of disability in the elderly for certain functional domains such as mobility and agility (Guallar-Castillón et al., 2007; Chen and Guo, 2008; Zamboni et al., 2005; Jensen and Friedmann, 2002; Lang et al., 2008; Imai et al., 2008; Galanos et al., 1994; Rejeski et al., 2010; Gadalla et al., 2010). Moreover, both general and abdominal adiposity are associated with disability and support the use of WC in addition to BMI to assess risk of disability (Nam et al., 2012).

Several researchers are investigating by means of prediction studies to find variables that obtain a significant relation with the performance in the TUG, in order to understand its association with other health indicators and consequent implications mainly in the elderly population, and to extend the application spectrum of the test.

Idland G. and colleagues (2013), described changes in mobility measured with TUG from baseline to follow-up 9 years later, and examined which of variables measured at baseline were predictors of the TUG at follow-up in a sample of women aged 85 or older. The following baseline measurements were used as predictors: demographics, step-climbing ability, functional reach, and health. At follow-up 110 women had decline in the TUG; higher age, higher BMI, poorer results on; functional reach, step-climbing and self-rated health were independent predictors of poorer TUG at the 9-year follow-up, similar to our data, whereas we also found an association between age and BMI to predict TUG performance.

Kwan M. and collaborators (2011) for example, examined the relative contributions of a range of sensorimotor, balance and psychological factors to TUG performance in a large sample of older people. The time required to complete the TUG was significantly related to limitations in instrumental activities of daily living and fear of falling. Findings indicate that stepwise multiple regression analyses identified as significant and independent predictors of TUG performance knee strength, number of medical conditions and age, in addition to cognitive function and health status. These data corroborate with our research results, showing that lower limb strength and age were found as TUG predictors, thus providing greater support for our study.

Another research, by Wu F. and colleagues (2017), made an observational 10-yr follow-up of 470 women aged 25-44 years to examine whether lower limb muscle strength (LMS) and their changes are independent predictors of balance in middle-age. They used linear regression to examine this association with timed up and go test, step test , functional reach test and lateral reach test. Their results shows that baseline and change in LMS were independently beneficially associated with TUG, Functional reach and Lateral reach test. Even following different objectives, our studies are related since both indicated association between LMS and TUG performance.

Bergland A. and collaborators (2017), in recently research study used cox regression to investigate the association between the TUG test and all-cause mortality in a population-based sample of older men and women. Results showed that the oldest participants had poorer TUG score compared to younger participants, increasing 0.25 s per year. There was a significant association between TUG and all-cause mortality, and this association remained significant after adjusting for self-reported health, body mass index, smoking and education. These results, in addition to supporting age and BMI as a predictor of TUG as well as found in our study, cover it not only to be indicative of functional mobility but also mortality index in the elderly, expanding the future prospects of the applicability of the TUG and correlating a low mobility with mortality.

Should be highlighted the limitations of the present study, being the sample absence of males, in addition to the limited number of predictors that were analyzed, although 30% prediction of the Timed Up and Go Test performance was found, remains 70% to be clarified. Due to this, it is suggested that future studies with a higher number and variety of variables be performed, covering besides physical, psychological and social aspects.

6 – CONCLUSION

The present study concluded that the increase in functional mobility measured by the Timed Up and Go Test was predicted by 30% for age, BMI, 30s Chair Stand Test and WC in elderly women after exercise program. Therefore, evaluating such variables together is possible to estimate functional mobility.

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8 – ANNEXES

ANNEX A – NORMS OF THE SCIENTIFIC JOURNAL

EXPERIMENTAL GERONTOLOGY

AUTHOR INFORMATION PACK

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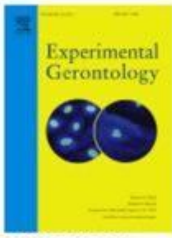

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PREPARATION

NEW SUBMISSIONS

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As part of the Your Paper Your Way service, you may choose to submit your manuscript as a single file to be used in the refereeing process. This can be a PDF file or a Word document, in any format or lay-out that can be used by referees to evaluate your manuscript. It should contain high enough quality figures for refereeing. If you prefer to do so, you may still provide all or some of the source files at the initial submission. Please note that individual figure files larger than 10 MB must be uploaded separately.

References
There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the pagination must be present. Use of DOI is highly encouraged. The reference style used by the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing data will be highlighted at proof stage for the author to correct.

Formatting requirements
There are no strict formatting requirements but all manuscripts must contain the essential elements needed to convey your manuscript, for example Abstract, Keywords, Introduction, Materials and Methods, Results, Conclusions, Artwork and Tables with Captions.
If your article includes any Videos and/or other Supplementary material, this should be included in your initial submission for peer review purposes.
Divide the article into clearly defined sections.

Figures and tables embedded in text
Please ensure the figures and the tables included in the single file are placed next to the relevant text in the manuscript, rather than at the bottom or the top of the file. The corresponding caption should be placed directly below the figure or table.

Peer review

This journal operates a single blind review process. All contributions will be initially assessed by the editor for suitability for the journal. Papers deemed suitable are then typically sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. More information on types of peer review.

REVISED SUBMISSIONS

Use of word processing software
Regardless of the file format of the original submission, at revision you must provide us with an editable file of the entire article. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier). See also the section on Electronic artwork.
To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check' functions of your word processor.

Types of Articles
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SHORT REPORTS: Short reports consist of 1-3 figures, 10 written pages and less than 20 references

REVIEW ARTICLES: Review articles can consist of 25 pages of text, figures and references, if appropriate. Outlines of Review Articles and Mini-Reviews (described below) should be submitted first to the Editor-in-Chief for pre-review before the final manuscript is submitted. Reproduction of color in review articles, if considered functional by the editor, will be free of charge to the author(s).

SHORT-REVIEWS: Mini-Reviews should consist of 9 to 12 double-spaced manuscript pages including a maximum of 30 references.

CORRESPONDANCE: Letters should refer to an article published in a previous issue and not exceed two manuscript pages including one table or figure. They are subject to review and editing. Any editing will be subject to the approval of the author.

DISCUSSIONS are typically points of view concerning some area of aging research. These are often forward looking and may be somewhat controversial.

REPORTS ON SELECTED MEETINGS are published occasionally.

Article structure

Subdivision - numbered sections
Divide your article into clearly defined and numbered sections. Subsections should be numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc. (the abstract is not included in section numbering). Use this numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

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A Theory section should extend, not repeat, the background to the article already dealt with in the Introduction and lay the foundation for further work. In contrast, a Calculation section represents a practical development from a theoretical basis.

Results
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Discussion
This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions
The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Appendices
If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Essential title page information

• ***Title.*** Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
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• ***Corresponding author.*** Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. **Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.**
• ***Present/permanent address.*** If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

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Keywords

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

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Acknowledgements

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Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication.

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A DOI can be used to cite and link to electronic articles where an article is in-press and full citation details are not yet known, but the article is available online. A DOI is guaranteed never to change, so you can use it as a permanent link to any electronic article. An example of a citation using DOI for an article not yet in an issue is: VanDecar J.C., Russo R.M., James D.E., Ambeh W.B., Franke M. (2003). Aseismic continuation of the Lesser Antilles slab beneath northeastern Venezuela. Journal of Geophysical Research, https://doi.org/10.1029/2001JB000884. Please note the format of such citations should be in the same style as all other references in the paper.

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As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

Data references

For reference style 2 Harvard: [dataset] Oguro, M., Imahiro, S., Saito, S., Nakashizuka, T., 2015. Mortality data for Japanese oak wilt disease and surrounding forest compositions. Mendeley Data, v1. http://dx.doi.org/10.17632/xwj98nb39r.1.

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J. van der Geer, J.A.J. Hanraads, R.A. Lupton, 2010. The art of writing a scientific article, J. Sci. Commun. 163,51 59.
Reference to a book:
W. Strunk Jr., E.B. White, 2000. The Elements of Style, fourth ed., Longman, New York.
Reference to a chapter in an edited book:
G.R. Mettam, L.B. Adams, 2009. How to prepare an electronic version of your article, in: B.S. Jones, R.Z. Smith (Eds.), Introduction to the Electronic Age, E-Publishing Inc., New York, 281304.

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There are different ways to link your datasets to your article. When available, you can directly link your dataset to your article by providing the relevant information in the submission system. For more information, visit the database linking page.

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In addition, you can link to relevant data or entities through identifiers within the text of your manuscript, using the following format: Database: xxxx (e.g., TAIR: AT1G01020; CCDC: 734053; PDB: 1XFN).

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ANEXX B – ETHICS COMMITTEE

Universidade de Brasilia
Faculdade de Ciências da Saúde
Comitê de Ética em Pesquisa – CEP/FS

PROCESSO DE ANÁLISE DE PROJETO DE PESQUISA

Registro do Projeto no CEP: **081/11**

Título do Projeto: "Efeitos do treinamento resistido com máquinas de peso versus dispositivos elásticos sobre a força muscular de idosos".

Pesquisadora Responsável: Wagner Rodrigues Martins

Data de Entrada: 10/05/11

Com base na Resolução 196/96, do CNS/MS, que regulamenta a ética em pesquisa com seres humanos, o Comitê de Ética em Pesquisa com Seres Humanos da Faculdade de Ciências da Saúde da Universidade de Brasília, após análise dos aspectos éticos e do contexto técnico-científico, resolveu **APROVAR** o projeto **081/11** com o título: "Efeitos do treinamento resistido com máquinas de peso versus dispositivos elásticos sobre a força muscular de idosos", analisado na 1ª reunião extraordinária realizada no dia 28 de junho de 2011

O pesquisador responsável fica, desde já, notificado da obrigatoriedade da apresentação de um relatório semestral e relatório final sucinto e objetivo sobre o desenvolvimento do Projeto, no prazo de 1 (um) ano a contar da presente data (item VII.13 da Resolução 196/96).

Brasília, 21 de julho de 2011.

Thiago Rocha da Cunha
Vice - coordenador do CEP-FS/UnB

Comitê de Ética em Pesquisa com Seres Humanos - Faculdade de Ciências da Saúde
Universidade de Brasília - Campus Universitário Darcy Ribeiro - CEP 70910900
Telefone: (61) 31071947 Email: cepfs@unb.br

9 – APPENDICES

APPENDIX A – INFORMED CONSENT FORM

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

O (a) Senhor (a) está sendo convidado (a) a participar do projeto: "Efeitos do treinamento resistido no desempenho muscular de idosos comunitários". O objetivo desta pesquisa é: verificar se os exercícios com dispositivos de resistência elástica e com as máquinas pneumáticas podem aumentar a força e a massa muscular em idosos sedentários. Espera-se que os exercícios elásticos e os exercícios nas máquinas possam aumentar a força, massa muscular e melhorar o equilíbrio dos membros superiores e inferiores, como ocorre nos exercícios com máquinas de musculação.

O (a) senhor(a) receberá todos os esclarecimentos necessários antes e no decorrer da pesquisa e lhe asseguramos que seu nome não aparecerá sendo mantido o mais rigoroso sigilo através da omissão total de quaisquer informações que permitam identificá-lo(a). Em relação aos procedimentos da pesquisa, caso o Senhor (a) não tenha um atestado médico próprio para a prática de exercícios resistidos, o Senhor (a), deverá passar por uma consulta médica para avaliar sua saúde hoje e no passado. Caso seja necessário, podemos indicar um médico para tal avaliação, o qual poderá de acordo com a necessidade recomendar exames complementares para o coração com intuito de atestar sua aptidão física para participar de exercícios. No entanto, se for do seu interesse, essa avaliação poderá ser feita com seu cardiologista particular, que deverá lhe fornecer um atestado médico.

A sua participação será através da realização do treino resistido envolvendo a realização de 03 (três) testes: (1º) avaliação do nível de atividade física, (2º) avaliação da mobilidade funcional essa etapa poderá durar de 01 (um) a 02 (dois) dias. Com o término dessa etapa de avaliação tem início a fase de exercícios com o chamado período de familiarização, que consistirá de duas semanas de exercícios leves. Depois dessas 02 (duas) semanas, Senhor (a) realizará mais 12 semanas de exercícios com nível de esforço progressivo. A fase de exercícios será realizada sempre as segundas e quartas feiras, ou terças e quintas, no período matutino. Será realizado um sorteio eletrônico para definir de qual grupo o Sr.(a) fará parte, grupo elástico ou máquina. A avaliação da força muscular dos membros, a capacidade funcional e o controle postural na 14ª semana de exercícios. Considerando o total de (28) dias de exercícios (12 semanas efetivas após familiarização), o senhor (a) (necessitará comparecer no mínimo em (25) sessões de exercício, podendo assim ter no máximo 3 (três) faltas.

Esse projeto será realizado no Ginásio terapêutico localizado na QNN 14 Área Especial, Guariroba, Ceilândia Sul (Antiga Faculdade de Ceilândia) e na data combinada, com um tempo estimado de duas horas para sua realização. O(a) senhor(a) receberá todos os esclarecimentos necessários antes e no decorrer da pesquisa e lhe asseguramos que seu nome não aparecerá sendo mantido o mais rigoroso sigilo através da omissão total de quaisquer informações que permitam identificá-lo(a).

Informamos que o(a) Senhor(a) pode se recusar a responder (ou participar de qualquer procedimento) qualquer questão que lhe traga constrangimento, podendo desistir de participar da pesquisa em qualquer momento sem nenhum prejuízo para o(a) senhor(a). Não há despesas pessoais para o participante em qualquer fase do estudo, incluindo exames e consultas. Também não há compensação financeira relacionada à sua participação. Os resultados da pesquisa serão divulgados nos Centros de Saúde e em eventos e revistas científicas nacionais ou internacionais. Os dados e materiais utilizados na pesquisa ficarão sob a guarda do pesquisador por um período de no mínimo cinco anos, após isso serão destruídos ou mantidos na instituição.

Se o(a) Senhor(a) tiver qualquer dúvida em relação à pesquisa, por favor telefone para: Dr. Wagner Rodrigues Martins, professor adjunto do Curso de Fisioterapia da Faculdade

UnB Ceilândia, telefone: (61) 9943-3865 ou com a discente de mestrado e fisioterapeuta Milene Soares (61) 85953870.Este projeto foi Aprovado pelo Comitê de Ética em Pesquisa da Faculdade de Ciências da Saúde da Universidade de Brasília. As dúvidas com relação à assinatura do TCLE ou os direitos do sujeito da pesquisa podem ser obtidas através do telefone: (61) 3107-1947 ou do e-mail cepfs@unb.br. Todas as folhas deverão ser rubricadas pelo Sr.(a) ou responsável e pelo pesquisador responsável. Este documento foi elaborado em duas vias, uma ficará com o pesquisador responsável e a outra com o sujeito da pesquisa.

____

Nome / assinatura

____

Pesquisador Responsável/Nome e assinatura

Brasília, ___ de _________de _______

APPENDIX B – SEMI STRUCTURED QUESTIONNAIRE

Nome: ___________________________ Data: __________________

Telefone: __________________________________ Idade: ________

Código para preenchimento das perguntas: S = sim ou N = Não.

Critérios de inclusão:

O Sr.(a),

( ) Reside no distrito federal? Bairro? ___________________.

( ) Tem idade igual ou superior a 60 anos?

( ) Tem atestado médico de liberação para exercícios resistidos?

Critérios de exclusão:

O Sr. (a)

( ) Possui algum problema de saúde (doença) ?

Qual(s):____

( ) Tem hipertensão arterial (>150/90 mmHg)?

Medicamento em uso: ____

Algum outro medicamento? ___________________________________

( ) Sofreu infarto do miocárdio nos últimos 6 meses?

( ) Tem marcapasso no coração?

( ) Já fez alguma cirurgia para colocação de prótese?

Local: ____

( ) Tem fez alguma cirurgia para colocação de placa e/ou parafuso?

Local: ____

( ) Fez alguma cirurgia nos últimos 6 meses?

Tipo/região: ____

( ) Sofreu fratura óssea ou lesão muscular nos últimos 6 meses?

Local: ____

( ) Faz algum tipo de treinamento resistido nos últimos 06 meses?

Qual(s): ____

( ) Faz uso de terapia hormonal (mulheres apenas)?

( ) Sofreu fratura óssea ou lesão muscular nos últimos 6 meses?

Local: ____

( ) Faz algum tipo de treinamento resistido nos últimos 06 meses?

Qual(s): ____

( ) Faz uso de terapia hormonal (mulheres apenas)?