EFFECTS OF A MULTICOMPONENT EXERCISE PROGRAM ON THE FUNCTIONAL FITNESS IN ELDERLY WOMEN

EFEITOS DE UM PROGRAMA MULTICOMPONENTE DE EXERCÍCIOS SOBRE A APTIDÃO FUNCIONAL DE IDOSAS

EFECTOS DE UN PROGRAMA MULTICOMPONENTE DE EJERCICIOS SOBRE LA APTITUD FUNCIONAL DE ANCIANAS

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ABSTRACT

Introduction: Aging is inevitable and irreversible, but with the advancement of technology, life expectancy is increasing every year, bringing proposals for various interventions to improve the quality of life. One such intervention is physical exercise programs. Objectives: To investigate the impact of multicomponent training in circuits on functional autonomy parameters in elderly women. Methods: Elderly were recruited and distributed in two groups: trained (N = 16) and non-trained (N = 15). Those in the trained group performed 75-minute training sessions twice a week over a 56-week period. The resistance training included upper and lower limbs with a relative intensity of 70% of 1RM, exercises using body weight, stretching and specific tasks for agility, performed in a circuit form and totaling three passages. Participants underwent functional autonomy (FA) assessment by the protocol of the Latin American Developmental Group for Maturity, the 6-minute walk test (T6M), and the sit-and-reach (SR) test. Results: The trained group had a significant decrease in body weight (p=0.02) and body mass index (p=0.015). Significant improvements (p=0,009) were also observed in FA, SR, and T6M after the intervention Compared with the untrained group, the trained group also obtained significant differences in all functional parameters analyzed. Conclusion: A long-term multicomponent training program conducted on a circuit and applied twice a week was enough to improve multiple components of the functional autonomy of elderly women. ***Level of Evidence II; Prognostic studies - Investigating the effect of a patient characteristic on the outcome of disease.***

Keywords: Aging; Resistance training; Aged; Physical exercise.

RESUMO

Introdução: O envelhecimento é inevitável e irreversível, porém, com o avanço da tecnologia, a expectativa de vida está aumentando a cada ano, trazendo propostas de diversas intervenções para melhorar a qualidade de vida. Entre elas, encontram-se os programas de exercício físico. Objetivos: Investigar o impacto do treinamento multicomponente realizado em circuitos sobre os parâmetros de autonomia funcional em mulheres idosas. Métodos: Idosas foram recrutadas e distribuídas em dois grupos: treinado (N = 16) e não treinado (N = 15). As idosas do grupo treinado realizaram sessões de treino de 75 minutos, duas vezes por semana, durante um período de 56 semanas. Os exercícios resistidos abrangeram membros superiores e inferiores com intensidade relativa de 70% de 1RM, exercícios usando peso corporal, alongamento e tarefas específicas para agilidade, realizados em forma de circuito e totalizando três passagens. As participantes foram submetidas à avaliação da autonomia funcional (AF) pelo protocolo do Grupo de Desenvolvimento Latino-Americano para a Maturidade, ao teste de caminhada de seis minutos (T6M) e ao teste de sentar e alcançar (SA). Resultados: O grupo treinado teve diminuição significativa do peso corporal (p = 0,02) e do índice de massa corporal (p = 0,015). Foram observadas também melhoras significativas (p = 0,009) no AF, no SA e no T6M após a intervenção. Em comparação com o grupo não treinado, o grupo treinado também obteve diferenças significativas em todos os parâmetros funcionais analisados. Conclusão: Um programa de longa duração de treinamento multicomponente realizado em circuito e aplicado duas vezes por semana foi suficiente para melhorar múltiplos componentes da autonomia funcional de idosas. ***Nível de Evidência II; Estudos prognósticos – Investigação do efeito de característica de um paciente sobre o desfecho da doença.***

Descritores: *Envelhecimento; Treinamento de resistência; Idoso; Exercício físico.*

RESUMEN

Introducción: El envejecimiento es inevitable e irreversible, pero con el avance de la tecnología la expectativa de vida está aumentando cada año, trayendo propuestas de diversas intervenciones para mejorar la calidad de vida. Entre ellas, se encuentran los programas de ejercicio físico. Objetivos: Investigar el impacto del entrenamiento multicomponente realizado en circuitos sobre los parámetros de autonomía funcional en mujeres ancianas. Métodos: Las ancianas fueron reclutadas y distribuidas en dos grupos: entrenado (N = 16) y no entrenado (N = 15). Las ancianas del grupo entrenado realizaron sesiones de entrenamiento de 75 minutos, dos veces por semana, durante un período de 56 semanas. Los ejercicios resistidos abarcaron miembros superiores e inferiores con intensidad relativa del 70% de 1RM, ejercicios usando el peso corporal, estiramiento y tareas específicas para agilidad, realizados en forma de circuito y totalizando tres pasajes. Las participantes fueron sometidas a la evaluación de la autonomía funcional (AF) por el protocolo del Grupo de Desarrollo Latinoamericano para la Madurez, a la prueba de *caminata de seis minutos (T6M) y a la prueba de sentarse y alcanzar (SA). Resultados: El grupo entrenado tuvo una disminución significativa del peso corporal (p = 0,02) y del índice de masa corporal (p = 0,015). Se observaron también mejoras significativas (p = 0,009) en el AF, en el SA y en el T6M después de la intervención. En comparación con el grupo no entrenado, el grupo entrenado también obtuvo diferencias significativas en todos los parámetros funcionales analizados. Conclusión: Un programa de larga duración de entrenamiento multicomponente realizado en circuito y aplicado dos veces por semana fue suficiente para mejorar múltiples componentes de la autonomía funcional entre las mujeres mayores.* ***Nivel de Evidencia II; Estudios prognósticos - Investigación del efecto de características de un paciente sobre el desenlace de la enfermedad.***

Descriptores: *Envejecimiento; Entrenamiento de resistencia; Anciano; Ejercicio físico.*

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INTRODUCTION

Steady increases in life expectancy are associated with improved medical attention, social conditions and alternative lifestyle approaches for prevention of age-related health problems.[1,2] Physical activity is considered an integral component of healthy aging,[3] and regular participation of moderate physical activity can delay or prevent functional declines, and reduce the risk of chronic disease.[4]

The aging process is frequently associated with declines in muscular strength,[3] balance,[5] postural control,[6] muscular endurance, and increased energy cost and fatigue with ambulation.[7]

Several studies[8,9] have showed increments muscle function after exercise programs in older. The necessary frequency of training to elicit fitness adaptation in older adults has been evaluated in numerous previous studies,[3,10] and collectively; suggest a minimum three sessions per week.

Despite the known effectiveness of training 3 or more sessions per week, a large majority of older adults are highly sedentary.[11] Therefore it is necessary to establish the viability and efficacy of alternative approaches to intervene in this population. For example, studies using full-body, circuit training program approaches only twice-weekly have also shown improvements in lipid profiles,[12] cardiorespiratory fitness,[13,14] quality of life,[15] mobility,[16] physical autonomy[17] cognitive function,[14] flexibility[18] and decreases in fall incidences[16] among aging adults.

However, the most of the previous studies presented short duration, therefore, it is necessary to know if interventions with longer duration provide more expressive results in this population. Thus, the aim of this study was to evaluate the effectiveness of a twice-weekly multicomponent training program on anthropometric indicators of adiposity, flexibility and functional autonomy of older women.

METHODS

After approval by the Research Ethics Committee of Nove de Julho University (466/2012), fifty older women (>60 years) were recruited to participate at institutional physical exercise program. The following exclusion criteria were used to determine subject eligibility: previous knee surgery, current or previous participation in regular exercise programs in the past six months, recent hospitalization, existing cardiorespiratory disease, severe hypertension, metabolic syndrome and liver or kidney disease, cognitive impairment, or progressive conditions with debilitating inability to exercise, recent bone fractures, any knee surgery earlier and any other medical contraindications for training. As inclusion criteria, women had to be physically independent and insufficient active according to international physical activity questionnaire. A total of 36 women were recruited and distributed in two groups: Untrained (n: 15, Un) and Trained (n: 16, T). All participants were instructed to maintain normal dietary intake and not carry out other modalities of physical activity.

The exercise program consisted of 75-minute exercise sessions two times per week on nonconsecutive days for 56 weeks. After 5 minutes of aerobic warm-up performed on a treadmill at 60% of predicted maximum heart rate. The neuromotor fitness was developed through whole body exercises, accessories (dumbbells, anklets, batons and elastics) either in an integrated or isolated way. The following resistance exercises (RE) were performed according to a previously used protocol from our group[19] in a circuit format: (1) knee flexion, (2) lateral raise, (3) shoulder abduction, (4) shoulder adduction, (5) shoulder rotation, (6) squat, (7) biceps curl, (8) triceps extensions, (9) calves raise, (10) push-up, (11) abdominal crunch, and (12) hip extension. In each exercise, the participants performed 8-12 repetitions at predetermined 70% of 1RM[20,21] and rest between exercises was 40 seconds. In each training session, the circuit was repeated 3 times. To the whole body and stretching (through active and static passive) exercise were monitorated perceived effort Borg scale. The agility exercises were performed according previously publications.[3]

The anthropometric measures used in this study were similar to those previously reported by our group.[19] Height was measured to the nearest 0.1 cm using a Cardiomed® WCS stadiometer (Curitiba, Brazil). Body mass was measured to the nearest 0.1 kg using a Filizola Personal Line 150 scale (São Paulo, Brazil). Body mass index (BMI) was calculated as follows: BMI = weight/height^2(kg/m^2). Waist circumference was recorded using a retractable tape measure with a precision of 0.1 cm.

Functional fitness was assessed using the Functional Autonomy of the Latin American Development Group Maturity (GDLAM) protocol. This protocol was proposed by Dantas, & Vale,[22] and had been used in others studies.[23] The protocol consists of walking 10m (C10m), getting up from a seated position (LPS), rising from the prone position (LPDV) and get up from the chair and move around the house (LCLC). All tests were performed in the order described above, in a single day using 3-minute interval between them to allow good recuperation between the tests. All were measured in seconds, which integrate forms a weighted score called the General Index GDLAM. The sit and reach test (SRT) was used to evaluate the posterior chain flexibility.[24] Additionally, functional exercise capacity was measured by the 6-minutewalk test (6MWT), in accordance with the guidelines of the American Thoracic Society.[25]

Statistical analyses

All statistical analyses were carried out using the SPSS for Windows software (version 12.0; SPSS, Chicago, IL, USA). All data are expressed as means and standard errors. The D'Agostino–Pearson test was used to determine normality. Analysis of comparisons between groups along the time periods were carried out using two-way ANOVA with repeated measures, followed by Bonferroni post-hoc test. Statistical significance was established at $\alpha \leq 0.05$.

RESULTS

During the 56-week exercise program, 6 women dropped out of study due to excessive absences. Therefore, sixteen sedentary women completed the training protocol. The table 1 presents the changes in anthropometric measures between baseline and after 56-week of exercise program.

No difference were found on height; however, significant differences were found for changes in body mass (p= 0.021) and BMI (p=0.015,) after intervention on trained group. No differences were found on untrained group.

Every functional fitness outcome and the SRT improved after the training intervention (p < 0.05) as showed at table 2. No differences were found on untrained group.

For the 6MWT, the untrained group made no improvements (pre: 295 ± 91; post: 290 ± 88; m); whereas, the exercise intervention group demonstrated 34% improvement (p=0.002) after intervention (pre: 310 ± 43; post: 474 ± 59; meters) as showed at Figure 1.

Table 1. Anthropometric alterations after circuit training program.

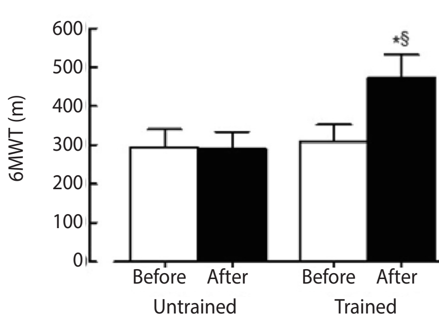
	Untrained		Trained	
	Baseline	**Post-Intervention**	**Baseline**	**Post-Intervention**
Height (cm)	150 ± 7	150 ± 8	153 ± 7	153 ± 8
Body mass (kg)	68 ± 6	69 ± 8	69 ± 10	65 ± 9†‡
BMI (kg/m²)	29 ± 3	29 ± 9	29 ± 3	27 ± 4†‡

Values expressed as the mean ± standard deviation before and after 56 weeks of multicomponent exercise program. BMI: body mass index. †Statistically significant (p < 0.05) differences between baseline. ‡ Statistically significant (p < 0.05) differences between Untrained.

Table 2. Functional fitness alterations after circuit training exercise program.

	Untrained		Trained	
	Baseline	**Post-Intervention**	**Baseline**	**Post-Intervention**
SRT (cm)	15 ± 7	15 ± 4	16 ± 8	22 ± 10†‡
C10m (sec)	8 ± 4	8 ± 6	8 ± 1	6 ± 1†‡
LPDV (sec)	55 ± 11	56 ± 7	56 ± 16	44 ± 5†‡
LCLC (sec)	6 ± 5	7 ± 2	6 ± 3	4 ± 2†‡
LPS (sec)	13 ± 1	12 ± 3	12 ± 2	10 ± 1†‡
GDLAM Index	36 ± 4	37 ± 6	36 ± 7	29 ± 5†‡

Values expressed as the mean ± standard error deviation before and after 56 weeks of multicomponent exercise program. SRT: Sitting and reaching test; C10m: walk 10 meters; LPDV: rising from the prone position; LCLC: stand up from a chair and walk around the house; LPS: getting up from a seated position; GDLAM Index. †Statistically significant (p < 0.05) differences between baseline. ‡ Statistically significant (p < 0.05) differences between untrained.



* Statistically significant differences to baseline (P < 0.001); * Statistically significant (p < 0.05) differences between baseline. § Statistically significant (p < 0.05) differences between untrained.

Figure 1. Figure 1. Values expressed as the mean ± SDs of 6MWT distance.

DISCUSSION

The aim of this study was to investigate the impact of long-term, twice-weekly, of multicomponent training program on outcomes related to health, functional autonomy, mobility and flexibility in elderly subjects. Our primary findings demonstrated that the exercise regimen was exceedingly effective for improving all measures of function and promoted weight loss, as compared to a non-intervention control group.

Current recommendations regarding exercise for older adults includes a minimum frequency of 3 to 5 days/week for moderate intensity exercise, or a minimum of 3 days/week for moderate or vigorous intensity,[21,26] However, considering the high proportion of Brazilian older adults that engage in no regular physical activity, alternative options are needed that might allow for health preservation with less frequent or through smaller doses of exercise.[27] Our results showed that even a twice-weekly program could promote significant improvements in physical and functional capacity. Our work corroborates several previous studies that also demonstrates effectiveness of twice-weekly physical exercise programs on older adults.[28,29]

The positives effects of circuit training for reducing of body fat is well established.[30] Moreover, circuit training is a time-efficient approach, and can elicit substantial improvements in numerous health and fitness outcomes.[31]

Marques et al.,[12] also performed a relevant study to assess the beneficial effect of a twice-weekly circuit training program on cardiorespiratory fitness on 77 older women aged 60-79 years. Their resistance training protocol was very similar to ours, and demonstrated that after 6 months of training, the resistance exercise intervention group showed significant improves on 6-min walk test.

Results from the Strong Women Program[13] also revealed significant decreases in body composition after only 12 weeks of a twice-weekly exercise protocol. Collectively, our results and these studies confirm the viability and effectiveness of this protocol.[32,33]

Our findings also demonstrated the effectiveness of twice-weekly exercise for improving performance in the 6MWT and hip range of motion. These results contribute in a relevant way for this population since even small improvements in physical condition and autonomy, in this age group, have positives repercussions on the difficulty to carry out activities of daily life, thus improving their mobility, reducing the risk of falls and for early all cause mortality.[34]

Some studies have also demonstrated a robust cardiovascular response to circuit resistance training.[30,31] Hence, a circuit resistance training program can improve cardiovascular health and the energy efficiency may help to prevent cardiovascular disease and improve movement economy in older individual.[29]

To the best of our knowledge, this is one of the first studies that used the protocol of GDLAM to assess improvements in functional capacity among elderly women after participation in a long-term circuit resistance training program. Due to the comprehensive nature of GDLAM, it represents an interesting tool to be considered in terms of further investigations associating exercise and daily living activities.

Finally, some limitations of this study must be appointed. The lack a group that trained three times a week, not allowed better comparisons of the variables analyzed. Besides, we didn't randomize subjects to the control group (but, even so, they served as a control nonetheless). Finally, some variables (as possible alterations in strength) could be inserted in the study to improve the discussion about daily living activities and functional capacity. However, despite this, the results reported here may assist professionals in prescription and control of training variables for elderly individuals who have limited or restricted time to train during the week.

CONCLUSION

The results from this study strongly support the viability and effectiveness of a twice-weekly, multicomponent training program for improvements in functional autonomy and flexibility in elderly women. This is important information for people who have a lack of time to engage in a training program and may have limited experience training. In addition, the GDLAM can be used as a parameter for assessing the functional autonomy for the translation to the activities of daily living. Future research is needed to better understand the dose-response relationships between various forms of exercise and health outcomes among older adults.

All authors declare no potential conflict of interest related to this article.

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