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Original

LOS EFECTOS DE TRES TIPOS DIFERENTES DE ENTRENAMIENTO EN LA APTITUD FUNCIONAL Y LA COMPOSICIÓN CORPORAL EN MUJERES MAYORES

THE EFFECTS OF THREE DIFFERENT TYPES OF TRAINING IN FUNCTIONAL FITNESS AND BODY COMPOSITION IN OLDER WOMEN

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RESUMEN

Objetivos: El objetivo fue evaluar los efectos de tres protocolos de entrenamiento con 8 meses en condición funcional y la composición corporal de mujeres ancianas. Material y métodos: Ochenta mujeres fueron divididas en cuatro grupos: grupo de control (68,55 ± 5.24 años); grupo de entrenamiento de componentes múltiples (68.70 ± 6,51 años), grupo de fuerza (66,30 ± 3,87 años) y grupo de resistencia (67,10 ± 5,46 años). Se usó un DXA para evaluar la composición corporal. La aptitud funcional (ff) se evaluó mediante la prueba de aptitud funcional. Se utilizó una ANOVA para detectar diferencias en cada grupo. La prueba de bonferroni permitió encontrar los efectos de tiempo. Anova no reveló ningún efecto significativo en el tiempo x la intercepción en las variables de composición corporal. Resultados: Se encontraron efectos significativos sobre el tiempo en las pruebas de flexibilidad de la parte superior del cuerpo en grupo de control (p = 0,028), grupo de entrenamiento de componentes múltiples (p = 0,001) y grupo de fuerza (p = 0,002) y en la flexibilidad de la parte inferior del cuerpo grupo de entrenamiento de componentes múltiples (p <0,001), grupo de fuerza (p = 0,003); y grupo de resistencia (p = 0,002); resistencia aeróbica en grupo de entrenamiento de componentes múltiples (p <0,001); la fuerza del cuerpo superior en MG (p = 0,005), grupo de fuerza (p = 0,008) y grupo de resistencia (p = 0,007) y la fuerza del cuerpo inferior en grupo de entrenamiento de componentes múltiples (p = 0,045) y grupo de fuerza (p = 0,006). Discusión: Las mujeres ancianas deben mejorar su desempeño funcional con programas de ejercicio apropiados. Conclusiones: Podemos concluir que los programas de entrenamiento de 8 meses solo indujeron en ff.

Palabras clave: ancianas, mujeres, composición corporal, fitness funcional, entrenamientos.

ABSTRACT

Aim: The aim of this study was to assess the effects of three different training protocols with 8 months in functional fitness and body composition of elderly women. Material and methods: Eighty community-dwelling elderly women were randomly divided into four groups: (i) control group (68.55 ± 5.24 years); (ii) multicomponent training group (68.70 ± 6.51 years), (iii) muscle power training group (66.30 ± 3.87 years) and finally, (iv) resistance training group (67.10 ± 5.46 years). A total body scan in dxa equipment assessed the body composition. The functional fitness (ff) was evaluated with the functional fitness test. A multivariate analysis (anova) with repeated measures on each dependent variable allowed to detect differences in each group and time. The bonferroni test allowed to assess the group x time interaction. Anova revealed no significant effect on time x group interception in body composition variables. Results: A significant effect on intercept time x group in tests of upper body flexibility in control group (p=0.028), multicomponent training group (p=0.001) and muscle power training group (p=0,002) and lower body flexibility multicomponent training group (p<0.001), muscle power training group (p=0.003); and resistance training group (p=0.002); aerobic endurance in multicomponent training group (p<0.001); upper body strength in multicomponent training group (p=0.005), muscle power training group (p=0.008) and resistance training group (p=0.007) and lower body strength in multicomponent training group (p=0.045) and muscle power training group (p=0.006) were founded. Discussion: Our study suggests that, independently of type of training, independent community-dwelling elderly women should improve their functional performance with appropriate exercise programs. Conclusion: We can conclude that 8 months training programs did not induce significant changes to body composition. However, changes in ff were observed.

Keywords: elderly, women, body composition, functional fitness, trainings.

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INTRODUCTION

Aging is related with physical capacity (Bohannon, 1997; Singh, 2002; Wolfson, 2001) and cognitive function (Edland et al., 2002; Launer et al., 1999) reduction and with chronical-degenerative diseases incidence (Dening et al., 1998). However, it is unclear if these age-related changes occur due the aging process per se, or the disuse (Bean, Vora & Frontera, 2004; Miller et al., 2000).

To maintain independency in daily-life tasks, elderlies might preserve the best physical fitness (PF). The daily tasks, such as go shopping, stand from a chair and/or dress up, requires a minimum level of muscular strength, coordination, flexibility and balance (Brill et al., 2000). According to Chodzko-Zajko et al. (2009), the elderlies PF refer to the well-being, as a low risk of premature health risks and multi-tasking capacity in different physical activities. The PF is related to the capacity of autonomous execution of daily tasks, instrumental and mobility tasks without a substantial injury risk in elder women's (Brach & VanSwearingen, 2002). The regular physical activity/ physical exercise (PA/PE) is a noun-pharmaceutical method to prevent the PF weaken (ACSM, 2009), due genetic-determined factors, ageing, diseases and nutritional status (Bouchard & Shephard, 1994).

An increasing number of studies analyzed the potential influence of PA/PE in the elderly biological age, PF and health (Andews, 2001; Carvalho, Marques & Mota, 2009; Carvalho et al., 2004). However, most of them are based in specific isolated functions and in intensive training protocols (Carvalho et al., 2004; Lord, Ward, Williams & Strudwick, 1995; Puggaard, Pedersen, Sandager & Klitgaard, 1994) and almost all of them analyzed the aerobic resistance and/or muscular strength training (ACSM, 2009; Cyarto, Brown, Marshall & Trost, 2008; Takeshima et al., 2007).

The muscle power decay due morphologic and functional age-related changes is it a key factor to minimize falls and injuries risk (Bean et al., 2002; Cuoco et al., 2004; Skelton et al., 1994). Even more, several guidelines acknowledge the importance of the aerobic, strength, flexibility and balance training combination to maintain elderlies PF (ACSM, 2006; Nelson et al., 2007; Salem et al., 2009).

There is a non-agreement in literature with the evidence of PA programs effects in body composition (BC). Some authors describe that aerobic training is the most appropriate, with positive effects in reducing the body fat percentage (Chodzko-Zajko et al., 2009; Haskell et al., 2007; Salem et al., 2009). Others, argue that resistance training and muscle power training, is related to muscle mass improvements. Associated with muscle improvement, there are the energy expenditure increase, body fat reduction and elderlies functional mobility upgrading (Deschenes, 2004; Doherty, 2003).

As far as our understanding goes, there is a lack of research in the analysis of multicomponent and muscle power training in elder women. Even more, the effects of the multicomponent training in body composition are unclear. Thus, the present study aimed to observe and compare the effects of a multicomponent, a muscle power and a muscle strength training program throughout 8 months, in the PF and body composition of elder women.

METHODS

Sample

The sample of this study was composed with 80 volunteered elderly women, randomly divided into four groups: (i) the control group (CG; N = 20), not subjected to a regular PA practice; (ii) the group submitted the power strength training (PG; N = 20); (iii) the group submitted to a resistance strength training program (RG; (N = 20) and finally, (iv) the group that submitted to a multicomponent training (MG; N = 20). All the participants were community-living elderlies from the City Council (Bragança, Portugal). The individual invitation to participate in the exercise program was made by telephone. A number of 20 subjects per group were recruited to reach the parametric tests guidelines.

All the participants signed an informed consent prior to the study. Thus, the elderlies were informed about the study objectives, the voluntary contribution of that participation and the absence of any costs or risks. It was also granted the personal data confidentiality and anonymity.

Inclusion and exclusion criteria's

The inclusion criteria were: (i) to be at or above 65 years old; (ii) not being a part of any regular PA session (i.e. moderate to vigorous exercise for at least

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20min twice a week) at least for 1 year; (iii) have no history of any manifestation of chronical neuromuscular, cardiovascular and metabolic diseases that could jeopardize their safety during the classes and/or evaluation periods, and (iv) be available to participate in every 3-times-a-week session of PA as well as in the evaluation periods.

It was stated, as exclusion criteria for the CG, the engagement in any PA training program during the study. Also, for the other groups, a rate of participation lower than 75% of all the sessions and/or and an absence for more than 10 sessions in a row, were stated as exclusion criteria. Finally, it was asked the participants to keep their daily routines regarding the PA levels and nutrition patterns, and not to stop taking any eventual medication.

The main characteristics and constitution of the participants are presented in table 1.

Table 1. Means and standard deviations for of each 4 groups mean characteristics.

	CG (n=20) Mean±SD	MG (n=20) Mean±SD	PG (n=20) Mean±SD	RG (n=20) Mean±SD
Age (years)	68,55±5,24	68,70±6,51	66,30±3,87	67,10±5,46
Weight (kg)	69,62±15,78	71,31±14,28	75,54±10,72	73,31±16,98
Hight (cm)	152,82±5,25	151,07±5,53	164,24±7,97	152,78±5,84

The intervention programs

The overall duration of the PA programs were 8 months, three times a week in non-consecutive days (Monday, Wednesday and Friday). Each session started, for booth RG and PG, with an 8 to 10 minutes walking, cycling (Tectrix, Bike-Max, USA) or rowing (Concept II, Morrisville, VR, USA) warm-up period at low intensity, followed by some stretching exercises.

In the main period of the session, 6 exercises were performed in variable resistance machines (Nautilus Sports/Medical Industries, Independence, VA, USA): leg press, leg extension, leg curl, lat pull down, bench press, arm curl. In both programs, the women also performed some exercises to strengthen the abdominal and lumbar muscles (3 sets of 15 to 20 repetitions).

The RG and PG training programs design followed the ACSM's guidelines (13). The training intensity was gradually increased during the first two weeks according to the linear periodization model. The first week sessions were important to define the individual maximum repetition (1MR) and to familiarize participants with the machines (correct execution and breathing). The individual maximum repetition was performed every two weeks during the first month and then every four weeks until the end of the program. The exercises intensity was maintained at 12-14 of Borg's rating of perceived exertion (RPE) Borg (1998). In the end of each session, some active recovery and stretching exercises for the main muscle groups (5 to 10 minutes).

Muscle power group: The exercises were organized in stations. Due to the great participation of the nervous system in this kind of workout, the most complex exercises were performed first to avoid fatigue in its performance (ACSM, 2009). The exercise execution velocity was fast (<10sec). According with the training adaptations, it was performed 3 to 4 sets of 3 to 6 repetitions and the intensity raged between 40% (first 4 weeks) to 60% of the 1MR. The resting period lasted from 3 to 5 minutes to allow a full muscle recovery.

Muscle resistance program: The exercises were organized in stationsand the resting interval of approximately 1 to 2 minutes between stations. It was performed 2 to 3 sets of 8 to 12 repetitions each, at 60 to 80% of 1MR. For adaptation and training safety, the first week load intensity was only 40-60% of 1MR (between 15 to 20 repetitions). Regarding the PG, these loads were light to moderate, with more repetitions and little resting period.

Multicomponent program: This program was designed according to Carvalho, Marques and Mota (2009) guidelines. Each training sessions with 50 to 60 min consisted in five main parts: 1) 5-8 minutes of general warm-up, including slow walking and stretching exercises; 2) Walking and aerobic exercises, jogging, aerobics or dancing (15-20 min), 2 exercises at least 8-10 minutes per exercise. The training intensity was maintained at 12-14 in the Borg´s RPE (30); 3) 1-3 sets of resistance exercises with rubber bands and free weights in a circuit (the resting periods between sets were 40-60 seconds). The exercises involved the major muscle groups such as knee flexors/extensors, shoulder abductors/adductors, elbow flexor/extensor, pectoral, abdominal, etc. To allow a proper adaptation with the exercises and the correct execution and breathing techniques, the training intensity was lower at the beginning of the month. At the beginning, participants performed 8 repetitions in only one set and gradually progressed to 3 sets of 12-15 repetitions; 4) The static and dynamic balance training was with bats, balls and balloons for 5-8 min; 5) at the end of each session, there was a cool-down period of about 5 min involving breathing exercises and stretches.

Measurements:

The same evaluator performed all measurements. All test stations were organized in a circuit, and the same conditions were maintained for each test at all testing periods. On the test day, subjects first completed 8–10 min warm-up controlled by a physical education instructor and then completed all test items.

Anthropometry and body composition

The weight, was evaluated in light clothing and without shoes. For high evaluation a digital scale with attached stadiometer (SECA ®) was used, the measures were between the vertex and the reference plane of the ground. The body mass index (BMI) reference values were the World Health Organization (WHO, 2006) for BMI (normal weight between 18.50 and 24.99 kg/m2, pre-obese between 25 and 29.99 kg/m2; obese class I from 30 to 34.99 kg/m2 obese class II between 35 and 39.99 kg/m2) were used.

For the evaluation and quantification of BC, a total body scan [total lean body mass - TLBM (kg), fat mass - FM (%) and total body fat mass - TBFM (kg) and Bone Mineral Density – BMD (DP)] by DXA equipment (Hologic QDR - 4500 ®; software for windows XP, version 12.4) was performed.

Functional fitness test

The Functional Fitness Test (FFT) was used to assess functional fitness (Rikli & Jones, 1999). This battery was developed to assess the main physical parameters associated with functional mobility. The FFT consists in 6 items: lower body strength (30-Second Chair Stand), upper body strength (Arm Curl), lower body flexibility (Chair Sit-and-Reach), upper body (shoulder) flexibility (Back Scratch), agility/dynamic balance (8-Foot Up-and-Go) and aerobic endurance test (2-Minute Step Test). The tests were conducted in a circuit in order to minimize the effects of fatigue. On the testing days, subjects first completed an 8 to 10 minutes' warm-up, performed in the morning and in one session. Before the test, participants received instructions and a demonstration of each item.

Statistical analysis

To ensure the normality of the sample, the following conditions were required: (i) the dependent variable was normal distributed, which was confirmed by the Kolmogorov-Smirnov test; and (ii) the population variances were homogeneous, which was confirmed based on Levene´s test.

The significance of each variable for the 4 groups, during the training period, was evaluated by multivariate analysis (ANOVA) with repeated measures. When F values were significant, multiple mean comparisons were made with the Bonferroni test (group x time). Statistical significance was set at $p < 0.05$. The analyzes were performed with SPSS (version 19.0). The percentage of changes (% change) in the analyzed variables were also calculated for each individual.

RESULTS

Table 2, present the mean and standard deviation (SD) for each variable in BC in pre and post-test, and the mean and SD of its change (% of change) for all four groups (CG, MG, RG and PG).

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Table 2. Mean and standard deviation (SD) for each variable in BC in pre-test and post-test, as well as the mean and SD of its change (% of change) for all four groups (CG, MG, RG and PG).

Variable	Grup	Pre-test Mean±SD	Post-test Mean±SD	%Δ	p time	P grup x time
BMI (kg/m^2)	CG	29.67±5.99	29.84±5.73	1.27±11.84	0.025*	0.153
	MG	31.25±5.97	30.53±6.14	-2.40±3.30		
	PG	27.96±2.89	27.76±3.02	-0.64±5.24		
	RG	31.34±6.70	30.49±6.71	-2.86±2.69		
LM (kg)	CG	41.25 ± 7.54	40.77±6.90	-0.85±3.89	0.782	0.187
	MG	39.63±6.34	40.01±5.77	1.27±4.54		
	PG	48.63±8.87	48.87±8.95	0.51±1.90		
	RG	40.86±6.93	40.89±7.03	0.11±3.26		
TFM (kg)	CG	28.12±1.90	29.05±1.95	4.37±8.98	0.737	0.130
	MG	26.98±1.90	26.93±1.95	-0.15±12.10		
	PG	24.01±1.90	23.75±1.95	-1.15±11.67		
	RG	30.52±1.90	29.52±1.95	-3.73±8.23		
%BF (%)	CG	37.77±4.54	38.04±4.4	1.00 ± 7.86	0.091	0.403
	MG	40.37±5.11	39.70±5.27	-1.69 ± 4.05		
	PG	32.24±7.01	31.80±7.46	-1.42 ± 7.01		
	RG	41.89±12.03	40.82±4.93	-0.64 ±12.91		

%Δ - Change between post-teste – pre-test; BMI – Body mass index; LM – Lean mass; TFM – Total fat mass; %FM – Percentage of fat mass; * - p≤0,05.

The ANOVA test results revealed no significance in the time x group interception in any of the variables related to BC. There was a significant change of the BMI in all groups over time, however this change was not different between groups. It can also be seen that elder women had, at the beginning and at the end of the study, a BMI > 27kg/m2, which means overweight.

The mean and SD of the scores of each PF variable in pre- and post-test, as well as well as the mean and SD of its change (% of change) for all four groups (CG, MG, RG and PG) are presented in table 3.

Table 3. Mean and standard deviation (SD) for each variable in PF in pre-test and post-test, as well as the mean and SD of its change (% of change) for all four groups (CG, MG, RG and PG).

Variable	Grup	Pre-test Mean ±SD	Post-test Mean ±SD	% Δ	p time	p grup x time
ULS (rep)	CG	31.65 ± 10.20	27.45 ± 9.00**	-3.12 ± 2.14	<0.001*	<0.001*
	MG	24.60 ± 9.08	29.95 ± 9.01*	4.42 ± 4.70		
	PG	33.05 ± 6.71	38.25 ± 8.04**	3.99 ± 5.21		
	RG	30.60 ± 8.31	34.15 ± 7.80	2.83 ± 4.31		
LLS (rep)	CG	22.75 ± 6.77	20.15 ± 6.87	-12.92 ± 9.69	<0.001*	<0.001*
	MG	19.75 ± 4.35	24.00 ± 4.42*	23.75 ± 18.14		
	PG	23.95 ± 6.27	27.40 ± 7.72**	15.99 ± 21.86		
	RG	21.20 ± 7.23	24.75 ± 7.22**	19.94 ± 23.73		
ULF (cm)	CG	-7.35 ± 10.28	-8.60 ± 11.01	-1.36 ± 4.26	<0.001*	<0.001*
	MG	-11.68 ± 8.62	-7.95 ± 9.38**	4.25 ± 4.12		
	PG	-14.05 ± 12.03	-10.55 ± 12.18**	4.43 ± 5.81		
	RG	-12.10 ± 12.75	-8.53 ± 12.70**	4.42 ± 6.36		
LLF (cm)	CG	6.78 ± 7.48	5.10 ± 8.00	-1.60 ± 1.48	<0.001*	<0.001*
	MG	4.85 ± 6.92	7.82 ± 7.03**	2.89 ± 3.36		
	PG	6.65 ± 9.56	10.20 ± 7.93**	3.57 ± 4.69		
	RG	8.99 ± 7.36	11.00 ± 7.53	1.98 ± 5.35		
AR (rep)	CG	139.90 ± 41.04	130.30 ± 36.13	-5.98 ± 6.96	<0.001*	<0.001*

	MG	114.50 ± 53.56	136.60 ± 52.94*	25.41 ± 36.19		
	PG	183.20 ± 57.34	221.30 ± 62.94	23.07 ± 17.96		
	RG	127.35 ± 46.33	137.50 ± 46.62	19.71 ± 50.58		
TUG (sec)	CG	4.74 ± 0.75	4.99 ± 0.81	6.19 ± 15.17	0.256	0.061
	MG	4.87 ± 0.91	4.60 ± 0.45	-4.17 ± 8.38		
	PG	4.41 ± 0.58	4.22 ± 0.85	-4.68 ± 12.94		
	RG	4.87 ± 1.09	4.76 ± 0.97	-1.38 ± 11.91		

ULS - Upper limbs strength; LLS - Lower limbs strength; ULF – Upper limbs flexibility; LLF – Lower limbs flexibility; AR – Aerobic resistance; TUG – Agility and dynamic balance; %Δ - Change between pre and post-teste; * - p ≤0,01; ** - p <0,05.

Regarding the variables of the PF (31), in can be seen in table 3 that there is a significant effect in the interaction time x group in ULS tests (F = 13.562, p <0.001), LLS (F = 14.228, p <0.001); ULF (F = 6.664, p <0.001), LLF (F = 6.677, p <0.001), AR (F = 7.941, p <0.001). No significant effects were found on the TUG test (F = 2.560; p = 0.061) though.

Regarding the ULS, it was found time x group significant differences in CG (p = 0.028; -3.12%) and experimental groups MG (4.42%, p = 0.001) and PG (3, 99%; p = 0.002). In LLS test, all experimental groups showed statistically significant values (MG: 23.75%, p <0.001; PG: 15.99%, p = 0.003; and RG: 19.94%, p = 0.002). The same results were also found for ULF test (MG: 4.25%, p = 0.005; PG 4.43%, p = 0.008; and RG: 4.42%, p = 0.007). For the LLF test, significant differences were found in MG (2.89%, p = 0.045) and PG (3.57%, p = 0.006). In RA test, there were only significant differences in MG (25.41%; P <0.001).

DISCUSSION

This study presented no significant effects on the interception time x group in BC after eight months of intervention with physical exercise, regardless the type of training used. However, the results indicated a significant effect on PF evaluated by FFT (Rikli & Jones, 1999) on the group X time interception in all groups (CG, GM, GS and GR). These results suggest that, a population of independent elderly women, with no history of sporting practice, improved in functionality with a supervised training program. Thus, the results of the present study suggest that, the training programs are an important stimulus to improve the functional and physical capacity of older women, despite the absence of significant changes in BC.

The effects of different workout types on the BC, are not consensual. Some authors have reported increases in lean body mass (Campbell et al., 1999; Chilibeck et al., 2002; Janzen, Chilibeck & Davison, 2006; Treuth et al., 1994)) and decreases in fat mass (Campbell et al., 1999; Chilibeck et al., 2002). Others, found no significant effects in BC (Kallinen, Sipila, Alen & Suominen, 2002; Takeshima et al., 2007; Toraman, Erman & Agyar, 2004; Tsuzuku et al., 2007), as in our study. The training specificity and intensity may be a possible explanation (Pedersen & Saltin, 2006). In our study, none of the experimental groups had large amounts of aerobic workout, which is recommended for weight and/or fat loss (Pedersen & Saltin, 2006). In exercise, the main energy subtract varies according to the intensity and duration. However, the mobilization of lipids from adipose tissue contributes significantly as a source of energy in aerobic prolonged exercise (Bouchard & Shephard, 1994). Thus, the endurance training seems to be the most recommended for adipose tissue lipids mobilization, eventually leading to a body weight and fat mass reduction (Bouchard & Shephard, 1994).

Changes in muscle mass was expected after the strength training. However, it did not happen in our study. The differences in the training protocols and evaluation methods may explain this conflict of results. According to several authors, high intensity strength training (> 70% of 1RM), seem to be the recommended for the increasing in muscle mass (Docherty & Sporer, 2000; Hunter, McCarthy & Bamman, 2004; Kalapotharakos et al., 2005). However, this type of intensities were not adopted in our study. According Kalapotharakos et al. (2005), to promote hypertrophy, the intensity load may be near 60 to 85% of 1MR, exceeding 3 sets of 8 to 15 repetitions per exercise and muscle group. Even more, each muscle group may be exercised between 2 and 3 days a week, with a resting time of 30 seconds to 1 minute between sets. A slow execution may also be adopted and the tension time is an important stimulus to induce muscle hypertrophy. However, in our study, the execution speed of the power training was fast (<10 sec). The number of sets and repetitions ranged between were 3 to 4 sets and 3 to 6 repetitions at 40% to 60% of 1MR. The frequency was 3 times a week with and the resting period between sets varied from 3 to 5 minutes. In the resistance strength training, the execution speed was slow to moderate, with 2 to 3 sets of 8 to 12 repetitions at 60% to 80% of 1RM and with a resting periods were 1 to 2 minutes. I.e., both resistance strength training and power training in our experimental groups did not meet the intensity loads, sets and execution speed recommended for muscular hypertrophy (Kalapotharakos et al., 2005). Additionally, this increase in muscle mass depends on various other factors, such as the training individual response, the intensity and duration of the training program (ACSM, 2009b). It is thus possible, that the training duration also justifies our results, suggesting the possibility of increases in muscle mass if the workout were prolonged over time.

Concerning to the BMI, there is no unanimity; most studies report that, as found in this study, BMI remains unchanged after the intervention period (Carmeli, Reznick, Coleman & Carmeli, 2000; Toraman, Erman & Agyar, 2004) even when other functional parameters show significant improvements. Thus, in accordance with these authors (Carmeli, Reznick, Coleman & Carmeli, 2000; Toraman, Erman & Agyar, 2004), the ineffectiveness of our training protocols may be associated with a low total weekly energy expenditure by exercise sessions. It is possible thatsessions with particular emphasis on aerobic work changes BMI (Carmeli, Reznick, Coleman & Carmeli, 2000). The recommended exertion time to induce significant alterations in body weight is about 60 minutes of aerobic exercise (Carmeli, Reznick, Coleman & Carmeli, 2000; Puggaard, Pedersen, Sandager & Klitgaard, 1994). Thus, it is possible that the reduced aerobic activities in the multicomponent training protocol (about 15 to 20 minutes with periods of 8 to 10 minutes) and the use of aerobic exercise just on the warm up period of the strength training protocol, has been insufficient to induce significant changes in BC.

Additionally, weight loss requires a negative caloric balance between energy expenditure during exercise and food intake, often overcompensated in these age groups (Pedersen & Saltin, 2006). In the present study, the participants were asked to maintain their nutritional habits. Consequently, this is a limitation of our study, which does not allow a more critical analysis of the influence of different types of training and diet in BC (Rall & Roubenoff, 2004; Rydwik, Lammes, Frandin & Akner, 2008). The nutritional control has been pointed, alongside with regular exercise, as an important non-pharmacological therapy in the prevention and treatment of obesity (Spirduso, Francis & MacRae, 2005).

The BMI indicator has been seen as less adjusted to elderlies; hence, the numerator and denominator are affected by ageing/disuse, underestimating the amount of body fat (Heiat, Vaccarino & Krumholz, 2001; Wassertheil-Smoller, et al., 2000). In other words, even without changes in body weight, the elderly tend to have a higher percentage of fat and less muscle mass compared to the younger counterparts. Thus, according to several authors (Folsom et al., 2000; Janssen, Katzmarzyk & Ross, 2005) special caution is needed when extrapolating the results assessed by BMI in these older age groups.

Regarding BC, in addition to the nutritional factors, the present experimental programs (MG, PG and RG) were more oriented to muscle building and/or global PF training. The exercises were not designed and selected specifically for weight loss, BF and %BF. However, the effect on the BC was not significant. It is possible to verify a positive influence of the different types of training on elderlies PF. There is no agreement in the literature about the effects of training on the different components of the elderlies PF. Some studies, such as ours, reported improvements in the aerobic endurance after multicomponent training (Carvalho, Marques & Mota, 2009) but not after strength specific training (Cavani, Mier, Musto & Tummers, 2002; DiBrezzo, Shadden, Raybon & Powers, 2005; Henwood & Taaffe, 2006; Takeshima et al., 2007). Possibly, stimulation of the cardiovascular and respiratory capacity in multicomponent training sessions for 15 to 20 minutes was enough to induce significant changes in the aerobic capacity, even without evident

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changes in BC. On the other hand, the warm up period included in strength training sessions, seems to have been insufficient. Thus, our results show the need for training overload and specificity (Carvalho et al., 2004).

Concerning to the upper limbs (ULF) flexibility of the upper limbs, there were significant differences between the pre- and post-test in all experimental groups. The lower limbs flexibility (LLF) only presented significant differences in the MG and PG group. The literature shows no consensus regarding the effects of muscle strength training in flexibility; some authors, contrary to our study, found significant improvements (Takeshima et al., 2007). Others, in agreement with our results, observe best performances, in older womens upper and lower limbs flexibility (Cavani, Mier, Musto & Tummers, 2002; Fatouros et al., 2006; Kalapotharakos et al, 2005). Other studies only reported improvement in the upper body flexibility (DiBrezzo, Shadden, Raybon & Powers, 2005). In our study the positive results may become from the fact that, a specific flexibility training was included in our strength training groups. The flexibility training occurred during the warm up and cool down, with stretching exercises to major solicited muscle groups. In addition, there was a constant concern to perform the maximal amplitude during the muscle strength training sessions (PG and RG), as recommended by the ACSM (2009). This fact may have also contributed to the positive effect of this type of training in the elderlies flexibility levels (Barbosa et al., 2006; Fatouros et al., 2006; Holland, Tanaka, Shigematsu & Nakagaichi, 2002). Although, similar results to those found in MG were observed in other studies, after submitting their samples to multicomponent training (Carvalho, Marques & Mota, 2009; Toraman, Erman & Agyar, 2004). Here too, specific flexibility training for the upper and lower body was performed. Static and dynamic techniques were used to stretch the muscles throughout the individual maximum amplitude. Thus, numerous studies state the need of inclusion specific flexibility training (Fatouros et al., 2006; George, 2008; Spirduso, Francis & MacRae, 2005). This study results suggest that in independent elderly women, both strength and multicomponent training, seem to be favourable strategies to increased flexibility. However, the exercises must be performed at the individual maximum range of motion.

Regarding the upper limb strength, only the PG and MG induced positive effects. The MG did not show significant improvements, as opposed to other studies (Cavani, Mier, Musto & Tummers, 2002; DiBrezzo, Shadden, Raybon & Powers, 2005; Fiatarone et al., 1994; Hakkinen et al., 2002; Kalapotharakos et al., 2005). This may be related to the high levels of strength in the initial evaluation of these older women. Thus, it is possible that this group had a smaller "adaptation window" since they had a higher level of strength at the beginning of training, i.e., their strength change potential after training was possibly lower (Kraemer & Hakkinen, 2002). However, the gains after a resistance strength training protocol were not statistically significant. It is important to note that the CG inactivity induced adverse effects in muscle strength. Thus, comparing with the CG, it can be suggested a trend towards improvement after training, or at least a maintenance of the muscle strength indexes. We might suggest that any of these training types seem to be enough to, at least, soften the age-related losses. The effect was more evident in muscle power and multicomponent training. As for the low limb strength, all the three experimental groups (RG, PG and MG) achieved significant results. As expected, resistance training programs induced positive effects on muscle strength.

Some studies showed significant strength gains in upper (UL) and lower limbs (LL) after multicomponent training (Carvalho, Marques & Mota, 2009; Toraman, Erman & Agyar, 2004). Therefore, considering the lack of specificity associated with this activity, it difficult to apply and combine both training volume and load. This limit the measurement of these variables and the training control. In our study, multicomponent training proved to be effective in creating positive changes in both upper and lower body strength, even at a moderate intensity. This fact reinforces the importance of multicomponent training with combination of endurance, strength, balance and flexibility exercises. The multicomponent training has been recommended as one of the most appropriate method to elderly people training

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(Carvalho, Marques & Mota, 2009; Carvalho, Marques, Soares & Mota, 2010).

On the agility and dynamic balance tests, as in our study, some authors showed that the isolated training of muscle strength has a little or no effect in these variables (Barbosa et al., 2002). Others have demonstrated significant gains on these functional capacities (Cavani, Mier, Musto & Tummers, 2002; DiBrezzo, Shadden, Raybon & Powers, 2005; Takeshima et al., 2007). In multicomponent training, no consensus was found regarding the effect of this type of training in agility and dynamic balance. Some authors found, as in the present study, no significant differences (Kraemer & Hakkinen, 2002); whereas others report positive effects (Carvalho, Marques & Mota, 2009; Tsuzuku et al., 2007). A justification for this lack of effect may be related with the initial TUG values of each experimental group, which revealed to be higher than the FFT average (Rikli & Jones, 2001). Thus, after 8 months of training, the decrease in the execution time was not statistically significant.

To summarize, after 8 months of training, it was observed that the different training programs (MG, PG and RG) did not induce significant changes in body composition. However, significant changes were found in functional capacity, particularly to muscular strength, endurance and flexibility, which are critical to the functionality, autonomy and quality of life in the elderly population (Chodzko-Zajko et al., 2009; Takeshima et al., 2007; Tsuzuku et al., 2007; Barbosa et al., 2002). Our study suggests that, depending on the kind of training, greater improvements are observed in some PF components. The multicomponent training seems to be more favourable to improve the lower and upper limbs flexibility and strength as well as aerobic endurance. The resistant strength group, significantly improved PF in LL strength and UL flexibility. Finally, the muscle power training, significantly improved the PF in strength and flexibility (both UL and LL). Thus, our results suggest that the multicomponent practice seems to induce favorable improvements.

This study showed no significant effect of any one of the implemented training programs in BC. This suggests the need to increase the aerobic workout load, (to about 60 minutes) to induce a decrease in fat mass (Pedersen & Saltin, 2006), possibly increase the load (to 70-80% of 1 MR), increase the exertion time of the muscle building movements, and/or increase the training volume by increasing the number of sets (> 3). Then, increases in the lean mass may be observed (ACSM, 2009; Hunter, McCarthy & Bamman, 2004; Kalapotharakos et al., 2005).

Some significant limitations to this study may influence the extrapolation of our results. Regarding the BC, as mentioned above, there was no dietary control, which does not allow a more critical analysis of the effect of different types of exercise and diet on BC (Rall & Roubenoff, 2004; Rydwik, Lammes, Frandin & Akner, 2008). On the other hand, the present sample consisted in voluntary and independent elderly, thus limiting the generalizability of these results to the elderly population in general. Another limitation came with the fact that, despite the participants were asked to continue with their daily routines, the daily PA was not controlled. Considering these limitations, it seems important to highlight the results of this study as they provide some guidelines about the training efficacy in elderlies. Independent elderlies may seek PA programs in order to improve or maintain their PF. Future studies should be carried out to confirm (or reject) the present data and analyze other variables

CONCLUSIONS

No significant changes were observed in body composition with the three types of training programs. However, the elderly's fitness improved after eight months of training, namely in upper and lower limbs strength. Coaches and sports instructors may use this information to define the type of training in independent elderly women's. This work also allowed coaches and sports instructors to better understand the effects of different types of training in independent elderly women's.

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