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Effects of functional and traditional training in body composition and muscle strength components in older women: A randomized controlled trial

Antônio Gomes de Resende-Neto[a,*], Bruna Caroline Oliveira Andrade[a], Edilson Serpelone Cyrino[c,d], David G. Behm[e], Josimari Melo De-Santana[b], Marzo Edir Da Silva-Grigoletto[a]

[a] Department of Physical Education, Center of Biological and Health Sciences, Federal University of Sergipe, Brazil
[b] Department of Physical Therapy, Center of Biological and Health Sciences, Federal University of Sergipe, Brazil
[c] Metabolism, Nutrition, and Exercise Laboratory, Londrina State University, Londrina, Brazil
[d] Paraná State University, UNESPAR, Paranavaí Campus, Paranavaí, PR, Brazil
[e] School of Human Kinetics and Recreation, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, Canada

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ABSTRACT

Background: While traditional resistance exercises have been widely used to promote muscle strength and hypertrophy in the elderly, few studies have reported the use of a functional approach in which common patterns for daily activities are considered the primary stimulus.

Objective: Investigate whether functional training has similar effects the traditional on body composition and muscle strength components in physically active older women.

Methods: Forty-seven older women completed a randomized and crossover clinical trial, distributed in three groups: Functional or Traditional Training (FUNCT/TRAD: n = 32; 65.28 ± 4.96 years) and Stretching Group (STRETCH: n = 15; 64.40 ± 3.68 years). Maximal dynamic strength was verified with the 1 repetition maximum (RM) test in the leg press and rowing machines. Muscular power was analyzed using 50% of the maximum load, speed was determined using a linear encoder, and isometric strength was analyzed with hand and lumbar dynamometers. ANOVA for repeated measures was applied for comparisons.

Results: The FUNCT showed a significant decrease in fat percentage (p = 0.015, 3.51%) and the TRAD a significant increase in lean mass (p = 0.008, 2.92%). Both FUNCT and TRAD generated significant increases in all components of muscle strength compared to baseline whereas STRETCH showed declines in these variables. No statistically significant differences were observed between the experimental groups in body composition.

Conclusion: Functional and traditional training are equally efficient in improving strength components in physically active older women and, therefore, they may be complementary to combat some of the deleterious effects of senescence. This trial was registered at Brazilian Registry of Clinical Trials (RBR-9Y8KJQ).

1. Introduction

Aging is a natural process of the body in which all physiological systems suffer deleterious effects such as progressive loss of muscle and bone mass, as well as decreases in the levels of different components of strength (Hunter, Pereira, & Keenan, 2016), conditions inversely associated with the occurrence of falls and immobility (Byrne, Faure, Keene, & Lamb, 2016). In addition to senescence, the female sex is also considered an independent risk factor for functional capacity decline. Thus, maintaining functions that allow performance of daily tasks is an important goal for individuals who are aging, especially women (Alexandre et al., 2012).

In this perspective, strength training has been widely recommended to attenuate neuromuscular declines and promote adaptations favorable to health and quality of life in older women (Chodzko-Zajko et al., 2009). There is evidence of its effects in the reduction of adipose tissue (Pereira, Medeiros, Santos, Oliveira, & Aniceto, 2012), increase of muscle mass (Pinto et al., 2014), bone mineral density (Zhao, Zhao, & Xu, 2015) and on muscle strength (Pedersen & Saltin, 2015). However, among the commonly applied methods, traditional training (TRAD) performed predominantly in uni-axial and stable machines have been questioned about their potential of transferred the effects for optimize

* Corresponding author at: Rua Projetada III, 189, BL12 AP304, Bairro Rosa Elze, 49100-00, São Cristóvão, SE, Brazil.
E-mail address: neto.resende-edf@hotmail.com (A.G. de Resende-Neto).

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performance in activities daily of elderly (Orr, Raymond, & Singh, 2008). In the quest for greater effectiveness, functional training (FUNCT) emerges as an approach directly focused in the basic functions of the human being based on the principle of training specificity (Stenger, 2018). Aiming to improve performance by means of multi-stage exercises performed at maximal concentric velocity in fundamental movements, associated with moments of destabilization and deceleration (Resende-Neto, Da Silva-Grigoletto, Santos, & Cyrino, 2016).

Cadore, Rodríguez-Mañas, Sinclair, and Izquierdo (2013) reviewed different strength training methods and reported that FUNCT or multicomponent training may be the most efficient method for improving muscle power, gait, and functionality in senior. However, Liu, Shiroy, Jones, and Clark (2014) affirmed in their systematic review that there were no differences between the functional and traditional methods in muscle strength in the elderly. Thus, divergences in the literature are apparent as to the effectiveness of these interventions in promoting adaptations in the components of muscular strength. In addition, there are a lack of investigations integrating FUNCT with traditional methods for robust comparisons between the protocols used and between the responses, mainly in relation to body composition changes.

The results this work will provide support for the health professionals in understanding the effects of differentiated training programs, helping them in the preparation of intervention that are useful and assertive for the elderly population. Thus, the present study is a cross-over clinical trial that sought to determine the dose-response relationship of functional and traditional training on body composition, muscle power, maximal dynamic and isometric strength in movement patterns similar to those of daily activities. Having methodological rigor and the standardization of the protocols, especially with regard to load components, as novelty in relation to previous works.

2. Materials and methods

2.1. Experimental design

This is a randomized, controlled and cross-over trial with two 12-week intervention stages, separated by eight weeks no training (Fig. 1). In that, the participants of the experimental groups (FUNCT and TRAD) went through the two training protocols and were compared to a control (stretching) group. The present investigation was approved by the Research Ethics Committee of the Federal University of Sergipe (nº: 2.897.793/CAAE: 97652918.7.0000.5546) and by the Brazilian Registry of Clinical Trials (RBR-9Y8KJQ).

2.2. Participants

Forty-seven physically active older women were recruited through banner advertising and social networking announcements. Were allocated by block randomization equally distributed according to their strength of lower limbs in three distinct condition: 1- Traditional condition (TRAD); 2- Functional condition (FUNCT); and 3- Stretching group (STRETCH). The inclusion criteria were: female elderly, physically independent, absence of acute and neurological diseases or any other dysfunction that could restrict the practice of high intensity physical exercises, and involvement in regular physical activity practices twice or thrice a week for at least three months before the start of the study.

At the time of enrollment, a survey of the health history was carried out and professionals in physical education analyzed the level of physical fitness. A specialized medical team conducted a complementary diagnosis of functional aptitude and, finally, the elderly women underwent a dietary assessment using a usual 24-h recall (Gomes, Alves Pereira, & Massae Yokoo, 2015), applied once a month to ensure that there were no differences in dietary pattern during the training period. All participants were informed about ethical rules, objectives, procedures and risks related to the study and, after agreement; they signed the informed consent form.

2.3. Data collection procedures

The evaluators were blinded to the intervention performed by the individuals and the battery of tests was applied at five different moments (Fig. 1). To minimize interference between tests were distributed over two consecutive days. Measurements of body composition, maximal dynamic strength and isometric were collected in the first day. Muscle power tests were performed on the second day. During the evaluation of the components of the strength, the participants were verbally encouraged to give their maximum.

2.4. Anthropometry and body composition

Body weight was determined by means of a clinical scale (Filizola®, São Paulo, Brazil), with a maximum capacity of 150 kg. Height (cm) was determined with a stadiometer (Sanny, ES2030, São Paulo, Brazil). Waist and hip circumferences were evaluated according to the World Health Organization protocol (World Health Organization, 2000).

The percentage of fat, muscle mass and basal metabolic rate were determined using bioelectrical impedance (Biodynamic®, BIA 310, New York, United States), and all participants followed guidelines. (a) 12-h fasting; (b) non-performance of physical exercise in the 24 h before the test; (c) ingestion of 2.0 L of water in the preceding 24 h; (d) non-consumption of alcoholic beverages and sources of caffeine on the day before the evaluation.

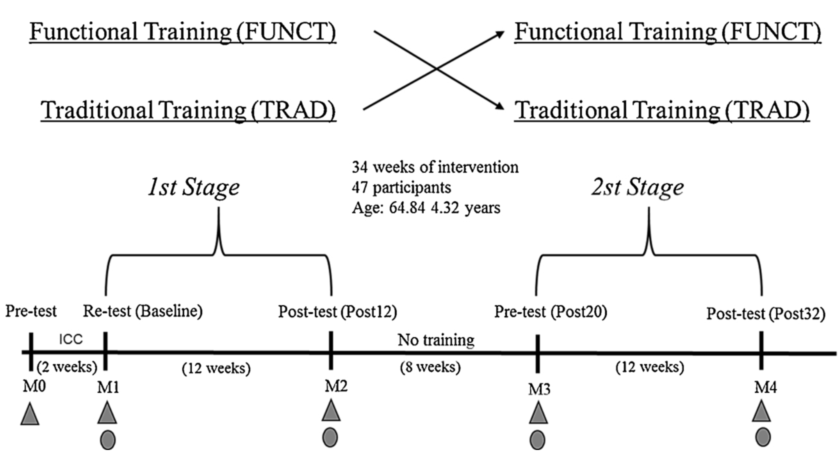

Fig. 1. Experimental design of the study: *Notes*. Pre- to re-test reliability assessed by ICC: Intraclass correlation coefficient. M: Moment, ●: Body composition measurements, ▲: Functionality measurements.

2.5. Maximal dynamic strength and muscle power tests

One repetition maximum (RM) tests were applied on horizontal pull handle and 45° leg press machines (Physicus, PLP, Auriflama, São Paulo, Brazil) (Kraemer & Ratamess, 2004). The same 1RM exercises with an external load of 50% were used for the analysis of muscle power with speed measured by linear encoder connected to the central unit of integrated data analysis software (Musclelab®, 3050e, Oslo, Norway). The volunteers performed 10-repetition warm-up exercises with a load of 10 kg in the horizontal pull handle and 70 kg in the leg press machine, at moderate speed. Three minutes after this warm-up, they performed 3–5 repetitions at maximal concentric velocity (Feitosa Neta et al., 2016). The highest performance was used for analysis.

2.6. Maximal isometric strength

Isometric strength was determined by hand (Hand Grip Test - JamarPlus®, Sammons Preston, Bolingbrook, IL) and lumbar (Isometric Dead Lift Test - Crown®, Ribeirão Preto, São Paulo, Brazil) dynamometers. For both, three attempts of five seconds of maximal voluntary contraction were performed, executed slowly and gradually. For the Hand Grip Test, the result was the sum of the highest value obtained in each hand, divided by two (Figueiredo, Sampaio, Mancini, Silva, & Souza, 2007). In the Isometric Dead Lift Test, the participants remained standing, with the trunk erect and the knees flexed at an angle of 130–140°; without flexing the trunk, they slowly extended the legs to maximal muscle contraction (Sagiv, Hanson, Besozzi, & Nagle, 1985). Was used the best score for analysis.

2.7. Intervention

Participants in the experimental groups (FUNCT and TRAD) went through two weeks of familiarization and completed 36 sessions in each of two stages, separated by eight weeks no training. The 45-min sessions were performed three times per week on non-consecutive days. The exercises were performed according to the individual's physical capacity and the effort was monitored and normalized during and after each training block by the OMNI-GSE scale (Da Silva-Grigoletto et al., 2013).

FUNCT participants performed multi-functional exercises specific to their daily needs. Each session was divided into four blocks, namely: (1) five min of mobility for the main joints (ankle, hip and glenohumeral) and general warm-up exercises that included 10 repetitions each of squats and jumps; (2) 15 min of intermittent activities, organized in a circuit that required agility, coordination and muscle power; (3) 20 min of multi-articular exercises for the development of muscular strength of lower and upper limbs and with intense recruitment of spinal stabilizing muscles, also organized in a circuit; (4) five min of intermittent activities.

TRAD participants performed traditional exercises, predominantly machine-based with isolated neuromuscular work. Each session was also divided into four blocks: (1) five minutes of joint mobility and general warm-up exercises; (2) 15 min of continuous walking, requiring, mainly, muscular and cardiorespiratory endurance; (3) 20 min of resisted exercises for lower and upper limbs and (4) five minutes of intermittent activities (Fig. 2).

The present intervention proposal was elaborated according to the concepts presented by La Scala Teixeira, Evangelista, Novaes, Da Silva Grigoletto, and Behm (2017) and was previously tested by Aragão-Santos, Costa, Feitosa-Neta, and Albuquerque (2018).

The 3rd block, consisted of strength exercises performed at maximal concentric velocity. The participants trained in pairs supervised by experienced professionals whose responsibility was to maintain the established protocols and ensure an optimal standard of safety and motivation. The intensity of exercises in the TRAD condition was progressive, with the addition of external loads, increasing from a grade 6 (easy) on the OMINI-GSE scale. The number of repetitions were performed until voluntary fatigue or the inability to sustain the exercise with quality, with a goal of performing 8–10 submaximal repetitions. In the FUNCT condition, the criterion followed was the one previously mentioned, with the addition of external load for the applicable exercises, whereas modifications were adopted for those exercises performed with body mass. Functional exercises were performed according to the participant's skill and comfort level for maintenance 8–10 repetitions. The training density was 30 s of work per 30 s of transition/recovery between stations. In the high-intensity intermittent exercises (4th Block), activities of low motor complexity were used, following a training density of 10 s work per 20 s recovery:

- *Sprint intervals:* In a space of 30 m, groups of five participants were separated. Of these participants, three formed a column behind a cone and the other two formed another column at a distance of 20 m. Working time consisted of walking this distance with maximum speed and recovery allowed while the other participants in the group performed the sprints. The total volume was 8–12 sprints per individual.
- *Rope pulling:* Activity consisted of groups with equal numbers of participants at the ends of the training rope. The groups were oriented to pull at maximal strength. To achieve the maximal effort in the estimated time, two coaches were positioned by the middle of the rope to equalize the forces between the groups. The total volume was eight efforts per individual.

The participants of the STRETCH group performed two sets of 20 s per static stretching exercise for the main body parts (neck, shoulders, back, chest, arms, wrists, hands, lower torso, hips, knees, thighs, feet and calf), with submaximal joint excursion (range of motion) levels (Nelson & Kokkonen, 2007) and relaxation exercises without physical exertion, with a frequency of three weekly sessions and a duration of 45 min per session.

2.8. Statistical analysis

The sample calculation was performed using the G*Power program (version 3.0.10, Universitat Kiel, Germany) for the strength tests and muscle power of lower limbs from the results obtained by Lohne-Seiler, Torstveit, and Anderssen (2013), expecting an average increase of 15% in the performance of the participants. Thus, we considered a power of 0.80 for the performed analyses for the sample size of this study.

The analyzes were performed using the averages of the values obtained by the participants at the time they performed the respective experimental protocols (FUNCT or TRAD), thus forming two groups composed by the same individuals, but which were submitted to different interventions by the crossed design. The control group (STRETCH) performed the same activities in both training periods.

Data were expressed with descriptive statistics with mean, standard deviation and percentage of change. The reproducibility of the measurements was evaluated through the Interclass Correlation Coefficient (ICC), adopting ≥ 0.90 as an acceptance criterion. Data homogeneity was confirmed by applying the Levene test. The bidirectional analysis of variance for repeated measures was used to verify the differences between the interventions. When an F-ratio was significant, the Bonferroni post-hoc test was used to identify where the significance occurred. The comparison between experimental groups for body composition was assessed by a student's dependent t test. Data were tabulated and analyzed using the *Statistical Package for Social Sciences* (SPSS) version 22. All tests were two-tailed and the effect size (ES) was calculated according to the methodological procedures defined by Cohen (2013).

	1sth block	2nd block		3thd block		4th block
		1-18 sessions	18-36 sessions	1-18 sessions	18-36 sessions	
FUNCT	Preparation for movement with mobility exercises for the joints of the shoulder, thoracic cage spine, hip and ankle.	Step-up/step-down movement	Jump under step	Kettle bell Lifting	Lifting with sandbag	Intermittent activities of high intensity through sprint interval and rope pulling.
		Alternating waves (rope)	Alternating waves (rope)	Rowing with suspension tape	Rowing with suspension tape	
				Sit and lift a 40cm bench	Front squatting with kettle bell	
		Medicine ball release on the ground	Medicine ball throws on the wall	Horizontal adduction with elastic	Push-ups on a 60cm bench	
				Farmers walk (kettle bells)	Farmers walk (kettle bells)	
		Displacement between cones	Run and jump between cones	Rowing with elastic	Rowing with knee elevation	
				Bilateral pelvic elevation	Unilateral pelvis elevation	
		Linear agility ladder	Lateral agility ladder	Front plane on a 40 cm bench	Front plank on a 15 cm step	
		Total time: 15 min, 5 activities, 3 passages, 1min per station, density 1/1. OMINI: 6 to 7.	**Total time:** 15 min, 5 activities, 3 passages, 1min per station, density 2/1. OMINI: 6 to 7.	**Total time:** 20 min, 8 exercises, 2 sets of 08-10 repetitions, 1 min per station, density 1/1. OMINI: 7 to 9	**Total time:** 20 min, 8 exercises, 2 sets of 08-10 repetitions, 1 min per station, density 1/1. OMINI: 7 to 9	
TRAD		Continuous walk in a precursor of 100 meters for 15 min.		Smith Squatting	Free Squatting	
				Horizontal articulated rowing	Horizontal Articulated rowing	
				Leg press 45 °	Extending chair	
				Vertical supine	Straight supine	
				Knee flexion at the flexion table	Unilateral knee flexion	
				Pulled forward	Vertical rowing	
				Bilateral standing calf	Leg press calf 45 °	
				Stiff	Abdominal (Sit up)	
	Total time: 5 min, 3-5 exercises per joint, 1 series of 8 seconds.	**Total time:** 15 min, OMINI: 6 to 7.	**Total time:** 15 min, OMINI: 7 to 8.	**Total time:** 20 min, 8 exercises, 2 sets of 08-10 repetitions, 1 min per station, density 1/1. OMINI: 7 to 9	**Total time:** 20 min, 8 exercises, 2 sets of 08-10 repetitions, 1 min per station, density 1/1. OMINI: 7 to 9	**Total time:** 5 min, 5-8 efforts, Density 1/2 and OMINI scale from 8 to 9.

Fig. 2. Short description of the functional training (FUNCT) and traditional (TRAD) sessions.

3. Results

The participant's attendance was 95% (˜68 sessions) for the FUNCT and 85% (˜62 sessions) for TRAD. After the two 12-week periods of training, separated by 8 weeks without training, no statistically significant differences were observed between the experimental groups in body composition. However, compared to initial values, FUNCT showed a significant reduction in fat percentage, whereas TRAD presented a significant increase in lean mass (Table 1).

Regarding the effects of the interventions on the physical tests (Table 2), there were large magnitudes effect sizes for all strength components in both experimental conditions. Both FUNCT and TRAD generated statistically significant increases in maximal dynamic strength, muscular power and isometric strength in relation to the initial values and STRETCH group (control), which showed significantly reduced performances with horizontal pull, and leg press, and no significant changes in other measures.

Table 1
Effects of twelve weeks of functional and traditional training on the body composition of older women.

Evaluation moments	Traditional	Functional	Stretching	*P* Value Group–Time Interaction	Traditional *vs.* Stretching	Functional *vs.* Stretching	Traditional *vs.* Functional
BMI (kg/m²)							
Pre	29.13 ± 5.48	29.12 ± 5.67	26.40 ± 4.65				
Post	28.88 ± 5.30	28.80 ± 5.54	26.27 ± 4.70				
Δ% - ES	0.87–0.05	1.11–0.06	0.49–0.03	0.74	0.15	0.17	1.00
CRH							
Pre	0.89 ± 0.07	0.90 ± 0.07	0.90 ± 0.07				
Post	0.88 ± 0.08	0.88 ± 0.08	0.90 ± 0.06				
Δ% - ES	1.14–0.14	2.27–0.29	0.00–0.00	0.08	0.44	0.64	1.00
Fat (%)							
Pre	38.34 ± 4.51	38.22 ± 4.67	35.73 ± 5.42				
Post	37.38 ± 5.32	36.88 ± 4.72^A	35.47 ± 5.78				
Δ% - ES	2.50–0.21	3.51–0.29	0.73–0.05	0.37	0.47	0.88	1.00
Body fat (kg)							
Pre	26.09 ± 8.51	25.92 ± 7.75	22.33 ± 6.47				
Post	25.45 ± 7.83	25.15 ± 8.23	22.27 ± 6.73				
Δ% - ES	2.45–0.08	2.97–0.10	0.27–0.01	0.49	0.31	0.42	1.00
Lean mass (kg)							
Pre	40.37 ± 6.55	40.55 ± 6.49	39.48 ± 6.19				
Post	41.55 ± 6.08^A	41.34 ± 6.55	39.72 ± 6.12				
Δ% - ES	2.92–0.18	1.95–0.12	0.61–0.04	0.33	0.75	0.93	1.00
Basal Metabolic Rate							
Pre	1245.87 ± 207.58	1254.31 ± 204.79	1211.23 ± 189.23				
Post	1269.87 ± 193.29	1258.50 ± 197.70	1202.86 ± 189.03				
Δ% - ES	1.93–0.12	0.33–0.02	−0.69 to −0.04	0.36	0.52	0.78	1.00

Notes. Values presented are mean and standard deviations. BMI = Body mass index. CRH = Circumference ratio of waist to hip. Δ% = delta percentage between Pre and Post-test. ES = Effect Size. ^{A} $P \leq 0.05$ *vs*. Pre.

Table 2
Effects of twelve weeks of functional and traditional training on the strength and muscle power of older women.

Evaluation moments	Traditional	Functional	Stretching	P Value Group–Time Interaction	Traditional *vs.* Stretching	Functional *vs.* Stretching	Traditional *vs.* Functional
Horizontal Pull 1RM (kg)							
Pre	42.15 ± 8.76	41.65 ± 8.18	40.30 ± 8.49				
Post	50.90 ± 9.17 $^{A.B}$	49.06 ± 9.73 $^{A.B}$	39.73 ± 8.99				
Δ% - ES	20.76–1.00***	17.79–0.91***	−1.41 to −0.01	< 0.001	< 0.001	< 0.001	1.00
Leg-press *45*° 1RM (kg)							
Pre	259.34 ± 63.44	241.03 ± 52.78	227.30 ± 64.69				
Post	316.34 ± 67.83 $^{A.B}$	300.15 ± 60.76 $^{A.B}$	220.43 ± 55.04				
Δ% - ES	21.98–0.90***	24.53–1.12***	−3.02 to −0.11	< 0.001	< 0.001	< 0.001	0.88
Horizontal Pull (W)							
Pre	164.37 ± 38.93	165.96 ± 42.82	164.24 ± 41.72				
Post	190.80 ± 52.97 $^{A.B}$	193.16 ± 51.35 $^{A.B}$	144.95 ± 34.32 ^{A}				
Δ% - ES	16.08–0.68**	16.39–0.64**	−11.75 to −0.47	< 0.001	0.001	< 0.001	1.00
Leg-press *45*° (W)							
Pre	478.25 ± 128.89	468.73 ± 117.77	423.21 ± 117.73				
Post	540.32 ± 122.96 $^{A.B}$	556.29 ± 119.54 $^{A.B}$	395.59 ± 119.48 ^{A}				
Δ% - ES	12.98–0.48*	18.68–0.74**	−6.53 to −0.31	< 0.001	< 0.001	< 0.001	1.00
Hand Grip Test (kgf)							
Pre	17.93 ± 3.40	18.18 ± 3.61	17.96 ± 4.30				
Post	19.94 ± 3.33 $^{A.B}$	20.10 ± 3.63 $^{A.B}$	17.26 ± 3.83				
Δ% - ES	11.21–0.59**	10.56–0.53**	−3.90 to −0.16	< 0.001	0.013	0.008	1,00
Isometric Dead Lift Test (kgf)							
Pre	58.50 ± 11.77^{B}	58.18 ± 9.92^{B}	50.73 ± 12.68				
Post	65.59 ± 11.02 $^{A.B}$	66.28 ± 10.83 $^{A.B}$	48.40 ± 12.49				
Δ% - ES	12.12–0.60**	13.92–0.82***	−4.59 to −0.18	< 0.001	< 0.001	< 0.001	1.00

Notes. Values presented in mean and standard deviation (M ± SD). Δ% = delta percentage between Pre and Post-test. ES = Effect Size: * Small: 0.2; ** Medium: 0.5; *** Large: 0.8. ^{A} $P \leq 0.001$ *vs*. Pre-. ^{B} $P \leq 0.05$ *vs*. SG.

4. Discussion

The results of the present study demonstrate that the applied multi-component training protocols were equally effective in consistently improving muscle dynamic and isometric strength and power (moderate to large effect size magnitudes). There were less consistent significant and near significant improvements in body composition, but the magnitude of change was consistently trivial. The strength and power improvements indicate that physiological stress was more important than the specific training method for functional performance in physically active older women (Bouaziz et al., 2016). These results help to confirm the hypothesis that multi-component programs are more effective for minimizing physical disability related to senescence.

In the present study, the FUNCT showed increases of 23.5% in upper limb strength and 36.2% in lower limb strength after the intervention. In turn, these increases were 28.1% and 43.5%, respectively, for TRAD in relation to the STRETCH. These adaptations in the levels of maximal dynamic strength can be justified by the evident neuromuscular changes (Kraemer, Fleck, & Evans, 1996) resulting from the specificity of the training when used as a tool to attenuate the muscle strength loss typical of senescence (Cadore et al., 2013; Borde et al., 2015). In line with this statement, Lohne-Seiler et al. (2013) compared functional and traditional training, in both high intensity and velocity, and did not find significant differences between groups, suggesting that intensity and speed of execution are more important than the type of strength training in the elderly. However, when it comes to strength performance in activities of daily living of the elderly, FUNCT would theoretically present an advantage over TRAD due to its multi-segment character and specificity (Liu et al., 2014). However, activities of daily living were not monitored in the present study.

Sarcopenia leads to slower and less effective responses to external stimuli, affecting gait, balance, and thus increasing the risk of falls in the elderly (Hunter et al., 2016). Muscle power is one of the best indicators of functional performance because of its sensitivity to changes due to aging (Byrne et al., 2016). Speculatively, common characteristics between the groups, such as multi-component work and maximal concentric velocity, may justify the positive adaptations in this variable, through the increase in the activation of type II fibers and the excitability of alpha motor neurons in the spinal cord, decreased co-activation of muscles and consequent improvement of neuromuscular coordination (Davies, Kuang, Orr, Halaki, & Hackett, 2017).

Ramírez-Campillo et al. (2014) compared the effects of a 12-week high and low speed resistance training, noting that high speed exercises induce more effective changes in muscle power and the ability to perform functional tasks in older women. Considering the results presented, we suggest the stimulation of muscular power in multi-articular and multi-planar exercises similar to the patterns of movements commonly performed in daily activities is an essential factor to minimize the deleterious effects of senescence.

With respect to isometric strength, both experimental conditions showed significant increases in hand and lumbar grip strength, variables that are inversely associated with functional deficits and mortality risk in different age groups (Rantanen et al., 2003; Taekema, Gussekloo, Maier, Westendorp, & de Craen, 2010). From a practical point of view, these positive adaptations can be justified by the high intensity, dynamic nature and instability of the applied multi-articular exercises that generate greater muscle activation (Behm & Colado, 2012) and require greater grip strength for proper execution. It is worth mentioning that such adaptations favor performance in everyday activities such as opening pots, firmly holding handrail braces and moving objects.

Despite the body of evidence demonstrating the significant effects of multi-component training on structural changes such as increased muscle mass and reduced adipose tissue (Cadore et al., 2014; Tomeleri et al., 2016), we speculate that the lack of consistent and trivial adaptations in the present study may have been limited by the absence of nutrition or diet control. It might also be attributed to a low sensitivity of the instrument and relatively short training period. While body mass did not significantly increase in the present study, Cress, Conley, Balding, Hansen-Smith, and Konczak (1996) demonstrated positive myofibrillar adaptations and increased muscle cross-sectional area from aerobic and resisted exercises, with systematic training programs similar to the methods in the present study. However, the significant increases in all strength components in the present study indicate positive changes in muscle performance and quality, as they are strongly associated (Casas-Herrero et al., 2013).

This research presents two safe, effective, easily reproducible and valuable practical training methods. Although important information on the benefits of FUNCT and TRAD in different manifestations of strength in physically active elderly women was provided, future studies should apply interventions with a longer wash-out period, assess muscle power at 40, 50 and 60% of maximal strength so as to more accurately identify changes in movement velocities and analyze the influence of habitual physical activity in adaptations.

5. Conclusion

The functional and traditional conditions were equally effective in improving strength components in physically active older women. These results suggest that both methods can be safely and effectively used in this population. It is worth mentioning that because FUNCT has a greater focus on the benefits related to the independence and autonomy of the elderly, it tends to be more easily transferred into activities of daily living and can be integrated with long-term traditional resistance training. A stretching program was not effective for alleviating certain age-induced physical decrements or even improving body composition, strength or power of older women.

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