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RBCM

Brazilian Journal of Science and Movement

Revista Brasileira de Ciência e Movimento

Open Access

VARIÁVEIS ASSOCIADAS A QUEDAS EM IDOSOS: EFEITOS DO EQUILÍBRIO E PROGRAMAS DE TREINAMENTO MULTICOMPONENTES

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Resumo: A queda em idosos tem sido apontada como um problema de saúde pública por causar danos à saúde e qualidade de vida desse grupo populacional. O objetivo deste estudo foi comparar os efeitos de um programa de treinamento de equilíbrio e multicomponente sobre as variáveis associadas à prevenção de quedas em idosos. Estudo realizado com participantes de um programa de extensão universitária de uma universidade do Brasil. Os participantes foram divididos em dois grupos: Grupo Equilíbrio (n = 14; 78,0 ± 4,7 anos); Grupo multicomponente (n = 14; 75,2 ± 8,7 anos). Os instrumentos utilizados foram Senior Fitness Test, teste de apoio unipodal, Time Up and Go, Falls Efficacy Scale-International e incidência de quedas. Dois programas diferentes de treinamento físico foram desenvolvidos ao longo de nove meses com duas sessões semanais. A análise foi realizada com Equações de Estimação Generalizadas, tamanho do efeito e Correlação de Spearman ($p \leq 0{,}05$). O Grupo Equilíbrio apresentou resultados positivos para: equilíbrio dinâmico ($p<0{,}001$, efeito grande), equilíbrio estático ($p=0{,}028$, efeito pequeno) e mobilidade funcional ($p<0{,}001$, efeito médio). O grupo que treinou equilíbrio melhorou as variáveis que se relacionavam particularmente com tais objetivos: equilíbrio dinâmico, equilíbrio estático e mobilidade funcional. Confirmando nossa hipótese do equilíbrio, estímulos específicos necessários para o seu desenvolvimento. A força muscular e a aptidão cardiorrespiratória estão associadas às variáveis de equilíbrio, embora não apresentem melhoras com o treinamento físico. O medo de cair foi associado à história prévia de quedas esporádicas no pré e pós-teste, em ambos os grupos. O Grupo Balance foi mais responsivo às variáveis.

Palavras-chave: idosos; queda; aptidão física; treinamento de equilíbrio; treinamento multicomponente

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VARIABLES ASSOCIATED WITH FALLS IN OLDER ADULTS: EFFECTS OF BALANCE AND MULTICOMPONENT TRAINING

Abstract: Falling in older adults has been identified as a public health problem because it causes damage to the health and quality of life of this population group. The goal of this study was to compare the effects of a balance and a multicomponent training program on variables associated with fall prevention in older adults. Study carried out with participants of a university extension program at a university in Brazil. The participants were divided into two groups: Balance Group (n=14; 78.0±4.7 years); Multicomponent Group (n=14; 75.2±8.7 years). The instruments were Senior Fitness Test, one-leg stance test, Time Up and Go, Falls Efficacy Scale-International and fall incidence. Two different physical training programs were developed over nine months with two weekly sessions. The analysis was realized with Generalized Estimation Equations, effect size and Spearman Correlation (p≤0.05). The Balance Group presented positive results for: dynamic balance (p<.001, large effect), static balance (p=.028, small effect) and functional mobility (p<.001, medium effect). The group that trained balance improved the variables that were particularly related to such objectives: dynamic balance, static balance and functional mobility. The balance of necessary specific stimuli for your development. Muscle strength and cardiorespiratory fitness are associated with balance variables, even though they do not show improvements with physical training. Fear of falling was associated with a previous history of sporadic falls in the pre- and post-test, in both groups. The Balance Group was more responsive to variables.

Key words: older adults; fall; physical fitness; balance training; multicomponent training

Introduction

Falling in older adults has been identified as a public health problem [1] because it causes damage to the health and quality of life of this population group. In addition, it affects approximately 30% of older adults and up to 50% of 80-year-olds or older [2, 3]. Physical exercise is indicated as a possibility of effective intervention with moderate evidence for fall prevention [4]. Fall incidence can be reduced by up to 40% with the practice of physical exercises [4, 5]. A systematic review reported that multicomponent exercises showed a statistically significant reduction in the incidence and risk of falls in the older adult [5.] A meta-analysis of clinical trials on prevention of falls in the older adult has shown that exercise reduces 61% of falls [6].

The aging process predisposes the highest occurrence of falls for different reasons, such as polypharmacy, cognitive dysfunctions, mobility problems, chronic-degenerative diseases, balance disorders and other problems associated with reduced level of physical activity, functional limitations and visual and hearing impairment [7]. Fear of falling has been studied because of its direct association with falls, since decreased confidence in one's own abilities limits the performance of routine activities and increases the likelihood of new events [8]. Older people who are afraid of falling are, precisely, those who have the highest risk of falling [1, 8]. Decreased levels of physical activity resulting from this fear cause a vicious cycle that leads to less energy expenditure and marked loss of physical fitness, which can cause further falls [9, 10]. Moreover, there is a reduction in motor capacity over time, e.g., muscle strength and coordination, plus insecurity when walking and less control of balance.

Reduced balance and agility capacity, as well as slower response to instability, seem to be due to the search for better body stability by increasing the double support phase, reducing the swing and impulse phase, widening the base of support, as well as decreasing step length and height [11]. In addition, the latter authors have reported that decreased cardiorespiratory endurance seems to be associated with more cautious movements, with slow and short steps, resulting in lower speed, predisposing to older adult fall. Strength is reduced with aging as a result of sarcopenia [5] it is even more evident in the lower limbs and is directly associated with mobility in the performance of daily activities [12].

The components of physical fitness most frequently associated with fall prevention are body balance and muscle strength. The strength of the lower limb extensors and flexors is related to balance because of its relationship with stability and dynamic postural control [2]. Reductions in muscle strength and decreased balance can lead to limitations in mobility in older adults [13], while greater joint amplitude may assist in correcting movement and enable regaining body stability. However, it does not yet have a consensus on flexibility as one of the contributing factors for falls [4]. Aging causes slower responses that increase the response time for corrective actions [12]. The older person needs to have physical conditions that allow their recovery, such as rising from the ground after a fall, despite the inherent changes over time.

The relationship between strength and fall incidence is not clear; it is known that fallers have a greater reduction in muscle strength and power, in addition to balance deficits. Thus, strength training alone is not enough to improve balance. Multifactorial programs are characterized by different stimuli and can be effective in preventing falls [14]. However, the combination of strength and balance has also been indicated in the guidelines for physical exercise to prevent falls and disability [4, 13]. Depending on risk of falling and level of physical conditioning, physical programs must be designed to increase muscular strength of the lower and upper limbs, cardiorespiratory endurance and, particularly, agility and dynamic balance performance [15]. This way, multicomponent training, lower limb strength and balance training, training with vibration platforms, Pilates, dance and Tai-Chi, led to improvements in balance, providing evidence that fall incidence can be reduced with physical activity [3, 10].

Physical exercise seems to indicate positive results for reduction of fall frequency in the older adult. However, it is still unclear which type of exercise is most effective. Our hypothesis is that balance, as a component of physical fitness, requires specific stimuli through exercises that directly stimulate this ability. Other components can influence, but are not decisive. In order to help fill the gap on the effectiveness of physical exercise for fall prevention, this study was carried out to compare the effects of a balance training program and a multicomponent training program on variables associated with fall prevention (physical fitness, fear of falling and fall incidence) in older adults.

Method

Study design

This study followed a quasi-experimental design with pre and post tests to compare between two groups with different interventions. The study was carried out based on a real-life setting with older people from an extension program university student from a university in Brazil [16, 17]. The study protocol complies with the Declaration of Helsinki and the Brazilian National Health Council Resolution 466/2012 and was approved by the research ethics committee of the local university (protocol n. 870.096). All participants signed an informed consent form before participating.

Sample

The sample consisted of attendees in a university extension program who were invited to participate in the study (figure 1). Those who agreed to participate were assessed for the study criteria. The inclusion criteria were from anamnesis: over 60 years of age, not having any type of musculoskeletal conditions or neurological problems that compromised the performance of the exercises or completion of the assessment instruments of the study, not having done physical exercises for at least three months. The exclusion criteria were: not participating in the two assessments of the physical programs, not attending at least 60% of the classes.

The sample size was calculated using the t-test with the difference between two independent means, with a priori power statistics from the Software G*Power, version 3.1.92 (Universität Kiel - Germany), indicating that an alpha level of 0.05, a power of 0.80 and an effect size of 0.98 18 would require a minimum sample of 28 participants. Considering possible sample losses, at least 28 people were recruited. Next, the sample was divided into two groups: Balance Group (n=14) with a mean age of 78.0±4.7 years and Multicomponent Group (n=14) with a mean age of 75.2±8.7 years.

Intervention

The intervention was based on two physical training programs, which originated the study groups, both of which were aimed at preventing and reducing falls. The Balance Group focused on the variables of body balance while the Multicomponent Group, on the variables of general physical fitness (muscle strength, cardiorespiratory fitness, balance/agility, flexibility). The groups participated in a nine-month training period that included two 45-minute sessions per week on non-consecutive days, in a total of 72 training sessions. The first month was used to enable the participants to adapt to the programs. After that, a gradual progression was implemented every two months from the specificity of each program. Prior to the intervention the research team, Physical Education graduate students and a university professor, were trained in the use of the assessments and regarding the intervention protocol. The same team of examiners implemented the intervention and conducted the pre test (march) and post test (november).

Participants were advised not to change their usual level of physical activity during the intervention period (uncontrolled data). Table 1 shows the structure of the training programs used in the study.

Table 1- shows the structure of the training programs used in the study.

Balance Training	Multicomponent Training
a) Warm-up (5–10 min): joint mobility, dynamic warm-up, and walking exercises b) Six-station circuit (25 min) aimed at improving: - Lower limb strength (2 exercises) - Static balance (1 exercise) - Dynamic balance (1 or 2 exercises, according to training microcycle) - Recovered balance (1 or 0 exercise, according to training microcycle) - Lower limb flexibility (1 exercise) c) Cooldown (5–10 min): stretching and relaxation exercises	a) Warm-up (5–10 min): joint mobility, stationary dynamic warm-up b) Eight-station circuit (25 min) aimed at improving: - Strength of lower and upper limbs with combined exercises (2 exercises) - Lower limb strength (1 exercise) - Upper limb strength (1 exercise) - Trunk or abdomen strength (1 exercise) - Balance-agility (1 or 2 exercises, according to training microcycle) - Cardiorespiratory fitness (1 or 2 exercises, according to training microcycle) c) Cooldown (5–10 min): stretching and relaxation exercises
Load: Each station lasted 90 s, followed by a resting time of 30 s. The circuit was completed twice at each session.	Load: Each station lasted 60 s, followed by a resting time of 30 s. The circuit was completed twice at each session.
Intensity: Progression was gradual (every 2 months). Exercise complexity and intensity were increased by reducing sensory stimuli, shifting the body's center of gravity, increasing execution speed, and requiring greater movement coordination. The interval between stations was used to increase the intensity, it became more active over time with the inclusion of walking.	Intensity: Exercise complexity and intensity were altered by increasing load and decreasing volume (muscle strength exercise), increasing complexity level (balance-agility exercise), increasing intensity (cardiorespiratory fitness exercise). The interval was used to increase the intensity of the training, becoming more active throughout the intervention through dynamic exercises with a focus on cardiorespiratory resistance.

Instruments

The study variables were assessed using the following instruments:

a) A questionnaire was used to collect sociodemographic data (age, sex, marital status, income, education level and living arrangements) in addition to questions related to health conditions and physical exercise.

b) physical fitness: muscle strength (MS) with the 'chair stand' test; flexibility (FLEX) with the 'chair sit-&-reach' test; cardiorespiratory fitness (CE) with '2-minute step' all included in the Senior Fitness Test [19]; balance was assessed through by tests: dynamic balance (DB) with '8-ft up-and-go test' (also the battery Senior Fitness), static balance (SB) with 'one-leg stance' [20], functional mobility (MF) with 'Time Up and Go' [21];

c) fear of falling: Falls Efficacy Scale-International (FES I-Brazil) questionnaire [22] was used to check fear of falling;

d) fall incidence: question about fall incidence in the three months prior to the intervention and in the last three months of intervention.

The evaluation of the results of the instruments was based on the number of repetitions, centimeters or time of each variable. The absolute value of each variable was used instead of normative result classification tables. The measured results in repetitions or centimeters are directly proportional to the best performance, in seconds they are inversely proportional.

Type of Analysis

The data were analyzed starting Generalized estimation equations (GEE) with intention to treat, to verify the effects of training in the older adults. The GEE analysis is based on the methodology of Generalized Linear Models and is characterized as a longitudinal regression that considers the subject variables to dependent variables over time. The time factor was adopted for pre test and post test. The group factor was organized as Balance Group and Multicomponent Group. The main effects of groups and time and the respective interactions were tested. The complementary test of multiple comparisons with Bonferroni's post-hoc was applied to indicate where this change occurred. The effect size was calculated using the difference between the average of the pre and post-test, considering the group. Cohen's d was interpreted as insignificant ≤0.19, small 0.20-0.49, medium 0.50-0.79 and large ≥0.8023. To relate the study variables, a Spearman correlation was assessed as: strong r>0.60, moderate r=0.30-0.60, weak r<0.30. The McNemar test was used to associate the incidence of falls paired by the study groups. For statistical data treatment, the software IBM SPSS® was used.

Results

Participants' pre-test sociodemographic characteristics by intervention groups are presented in Table 2.

Table 2- Distribution of the participants' sociodemographic characteristics in the Balance

Group and Multicomponent Group

Variable		Balance Group n (%)	Multicomponent Group n (%)
Sex	Woman	13 (93)	11 (79)
	Man	1 (7)	3 (21)
Ethnicity*	Black	1 (7)	-
	White	11 (79)	14 (100)
	Other	2 (14)	-
Dwelling*	Alone	5 (36)	6 (42)
	Spouse	3 (21)	4 (28)
	Children	3 (21)	1 (7)
	Other Family	2 (14)	3 (21)
Marital Status*	Single	1 (7)	3 (21)
	Married	2 (14)	4 (28)
	Divorced	2 (14)	3 (21)
	Widow	8 (57)	3 (21)
Income*	1-3 minimum wage	6 (43)	3 (21)
	4-6 minimum wage	1 (7)	2 (14)
	7-9 minimum wage	1 (7)	4 (28)
	+10 minimum wage	3 (21)	1 (7)
Occupation	Retired	13 (93)	12 (86)
	Worked not retired	-	1 (7)
	Never worked	1 (7)	1 (7)
Education*	Elementary	4 (28)	1 (7)
	High school or graduation	9 (64)	12 (86)

Note: *date with missing;

The characteristics of ethnicity, occupation, income and education are similar for both groups with the highest percentages for the categories: woman, white, dwelling alone, retired and high school or graduation. The Balance Group presented the highest percentage for widow and with income 1-3 minimum wages, but the Multicomponent Group was the highest percentage for married and income of the 7-9 minimum wages. Table 3 shows the results of the study variables, divided by group and by means and standard deviation of the pre and post test, followed by effect size and statistical analysis.

Table 3- Mean, standard deviation, test of main effects by GEE of the variables associated with falls (physical fitness, fear of falling) in the pre- and post-test for Balance Group and Multicomponent Group

Variables	Evaluation	Balance Group		Multicomponent Group		*p*-Value by GEE		
		Mean±SD	**Effect Size**	**Mean±SD**	**Effect Size**	***group***	***time***	***G*T***
Muscle strength	pre	15.23±6.07	-.23	14.75±4.59	.21	.702	.820	.062

(repetition)	post	13.85±5.59		15.83±5.35				
Flexibility (centimeters)	pre	-5.93±14.04‡	-.21	-7.29±11.38‡	-1.67	.709	<.001*	.793
	post	-8.76±12.09‡		-13.69±13.57‡				
Cardiorespiratory fitness (repetition)	pre	77.57±27.09	.33	81.54±20.31	.32	.626	.032*	.913
	post	85.15±17.44		88.38±21.16				
Dynamic balance (seconds)	pre	6.46+1.76‡	.83	6.11±1.68	.29	.953	<.001*	.086
	post	5.26±1.01‡		5.54±2.10				
Static balance (seconds)	pre	16.43±11.49‡	.31	24.86±10.17	.15	.125	.438	.034*
	post	19.92±11.01‡		23.23±10.56				
Functional mobility (seconds)	pre	6.89±1.63‡	.67	6.52±1.75	.86	.998	.010*	.080
	post	5.96±1.09‡		6.34±2.38				
Concern about falling (score)	pre	24.36±7.92	.01	24.14±7.62	.07	.967	.045*	.957
	post	24.25±4.45		23.58±7.06				

Note - Mean±SD: mean and standard deviation; *: *p* value <.050 main effect; ‡: p value <.050 post-hoc Bonferroni; Effect size: insignificant ≤0.19, small 0.20-0.49, medium 0.50-0.79 and large ≥0.80.

Participants' physical fitness results by intervention group are presented in Table 3. Results of participants' physical fitness by intervention group are presented in Table 3. No significant differences for group effects were found. Time effects showed significance statistically for flexibility (p<.001), cardiorespiratory fitness (p=.032), dynamic balance (p<.001), functional mobility (p=.010), concern about falling (p=.045). There was interaction for static balance (p=.034).

The adjusted analysis, Bonferroni's post-hoc, indicated differences when comparing pairs between times. The Balance Group showed significant differences for dynamic balance (p<.001, large effect), static balance (p=.028, small effect) and functional mobility (p<.001, medium effect) after the post test. It should be noted that the Balance Group was shown to be responsive to body balance, showing improvements in all related variables. The only variable with a significant difference was flexibility for Multicomponent Group (p=.001, large negative effect), however, this difference represented a deterioration in results, as in Balance Group (p=.003, small negative effect).

Fear of falling did not indicate a statistically significant difference in any of the groups, in the adjusted analysis with Bonferroni's post-hoc, although there was a decrease in the score and a significant difference. According to the instrument in use, the average score shows that fear is associated with occasional falls. Table 4 shows the analysis of the number of falls organized by group and by occurrence.

Table 4- Incidence in the pre- and post-test for the Balance and Multicomponent Group.

Group	Fall	Pre *n(%)*	Post *n(%)*	*p*-Value
Balance	Non-faller	11(79)	12(86)	1.000
	Fallers	3(21)	2(14)	
Multicomponent*	Non-faller	10(71)	9(91)	.250
	Fallers	4(28)	1(9)	

Note - *: missing in post test; n: individual; %: percentage.

However, there was no statistically significant difference between the pre- and post-tests regarding fall incidence. Table 5 indicates the analysis of correlation organized from the specific variables of balance with the variables of physical fitness in pre and post tests.

Table 5- Balance and physical fitness variables in the pre- and post-test.

Variable	Time	Balance Group			Multicomponent Group		
		Dynamic balance	Static balance	Functional mobility	Dynamic balance	Static balance	Functional mobility
		r	r	r	r	r	r
Muscle strength	Pre	-,569*	,496	-,493	-,647*	,742*	-,649*
	Post	-,595*	,557*	-,675*	-,743*	,640*	-,785*
Flexibility	Pre	-,291	-,209	-,221	-,508	,320	-,529
	Post	-,076	-,255	-,026	-,369	,601*	-,400
Cardiorespiratory fitness	Pre	-,825*	,526	-,784*	-,549	,032	-,420
	Post	-,576*	,300	-,496	-,621*	,622*	-,617*

Note - r: Spearman's correlation coefficient, *: p<.050, strong r>.60, moderate r=.30-.60, weak r<.30.

In the correlation analysis (table 5) the equilibrium variables of the Balance Group, in the pre-test, were inversely correlated in the three pairs: dynamic balance vs. muscle strength (p=0.43, moderate association) more vs. cardiorespiratory fitness (p<.001, strong association); functional mobility vs. cardiorespiratory fitness (p=.001, strong association). While in the post-test revealed correlation in the four pairs: dynamic balance vs. muscle strength (p=.032, inversely moderate association) more vs. cardiorespiratory fitness (p=.039, inversely moderate association); static balance vs. muscle strength (p=.042, directly moderate association); functional mobility vs. muscle strength (p=.011, inversely strong association).

For the Multicomponent Group in pre-test, there were three pairs of significant correlations with the variables of balance (dynamic balance, static balance and functional mobility) a vs. muscle strength (p=.023 inversely strong associations; p=.006 directly strong association; p=.023 inversely strong association respectively). These correlations were maintained in the post-test, plus four pairs of significant correlations: static balance vs. flexibility (p=.030, directly strong association) and the balance variables vs. cardiorespiratory fitness (p=.023 inversely strong associations; p=.023 directly strong association; p=.033 inversely strong association respectively).

There were more significant interactions in the post-test, especially in the Multicomponent Group. The three balance variables of the study were related to muscle strength in both groups. Cardiorespiratory fitness showed an association only with dynamic balance in the Balance Group, but in the Multicomponent Group this relationship also occurred for the three balance variables, as well as in strength.

Discussion

One of the strategies used to prevent falls in the older adult is physical exercise [5, 24, 16]. The aim of this study is to compare the effects of two physical programs (Balance x Multicomponent) on variables associated with fall prevention. The group that trained balance improved the variables that were particularly related to such objectives: dynamic balance, static balance and functional mobility. Confirming our hypothesis of the balance of necessary specific stimuli for your development. Muscle strength and cardiorespiratory fitness are associated with balance variables, even though they do not show improvements with physical training. Fear of falling was associated with a previous history of sporadic falls in the pre- and post-test, in both groups. For fall incidence, associated with the question ´have you fallen in the last 3 months`, the results showed that there was a decrease in the number of fallers between the pre- and post-test, but without statistical difference.

A systematic review [5] reported that there are multiple categories of balance training and muscle strengthening (in groups, individually or at home) that are effective in reducing the rate and risk of falling. For type of exercise, which is the focus of the present study, a review of fall prevention interventions analyzed frequency, intensity, time, type of exercise and the respective results [25]. The reviewed studies used comprehensive strength training, cardiorespiratory fitness and of the flexibility to reduce fall incidence. However, interventions with a higher percentage of balance exercises indicated better results. An exercise program that incorporates balance, gait and muscle strength should be offered, with flexibility and endurance training as adjuncts. A meta-analysis [26] on the effects of four types of balance-focused interventions (multidimensional, reaching, control center of mass, mobility and stepping), indicated small to moderate effects, indicating heterogeneity between studies.

Physical programs aimed at fall prevention, based on methodologies that involve balance or other components of physical fitness, have shown satisfactory results. To date, no studies were found using the methodology applied in the present research that have compared balance training and multicomponent training to prevent falls.

To determine the association between balance and risk of falling, a comparative study was carried out with a balance program group and control group with usual physical activities [27]. The results of the balance program were similar to those of the present study, i.e., significant improvement in dynamic balance, but there were positive results in flexibility and strength as well. There was a positive relationship between balance ability and lower risk of falling. It is noteworthy that the instruments were different from the ones used in the present study, but this is a challenge faced by intervention studies on fall prevention.

To check the effects of different modalities on balance, groups of older adults were evaluated (specific intervention for balance, Tai-Chi and control) using the Fall Risk Test and the Senior Fitness Test [24]. The results showed substantial improvements in functional fitness in the balance group compared to the other groups. There was a 15% increase in balance in the groups in which intervention took place (balance and Tai-Chi). Another study 9 sought to examine muscle strength and power, balance and functional performance through a balance circuit with older women. There were improvements in all the studied capacities in relation to the control group (without physical activity). The circuit intervention has proven to be an effective alternative in reducing the risk of falling. In a randomized study aiming at balance training, risk of falling and quality of life, the results indicated that balance assessment results in the intervention group were significantly better than those in the control group [28]. In these studies, it is clear that balance responded positively to specific balance interventions, as in the present study. The effect size was large for dynamic balance, medium for functional mobility and small for static balance, in our results, for the Balance Group, corroborating with the other studies. However, in a recent meta-analysis, the results for most balance exercise interventions indicate small or moderate effects on balance performance in the older adult [26].

Our study indicated that the older adults in the Balance Group improved in balance variables, while those in the Multicomponent Group did not achieve similar results. Conversely, research of the long-term effects of three exercise programs on physical performance and variables associated with falling, indicated that the multicomponent group and the multifaceted group (strength, balance and education for falling) showed significant results for mobility, balance and speed walking. The first group performed better after a 16-week intervention and a 24-month follow-up [29]. Another study [15] developed a multicomponent program combined with visual feedback for older women and their results indicated that the improved strength, flexibility and balance. The authors reported that balance was benefited by multicomponent exercise programs.

The effectiveness of a combined exercise program of balance, muscle strength, flexibility and Tai-Chi-Chuan for 12 weeks was evaluated [2]. The results indicated that physical performance (balance and strength) and gait parameters were better after the physical program. This modality, characterized by multiple objectives, has been increasingly developed with the older adults, as they have heterogeneous behavior owing to experience gained throughout many years of life. However, further studies are needed to prove its effects on the older adults.

Issues relative to risk of falling in the older adults have an important role in discussions about physical fitness in this population. In the present study, this variable was not significantly affected by the physical programs. However, a multifactorial program focused on preventing falls and improving physical fitness for 12 weeks, achieved a reduction in the risk of falling [30]. The intervention group significantly improved physical and functional performance, in addition to decreasing the propensity for falls. Another study, with similar objectives, also achieved a reduction in falls in the intervention groups, but with the inclusion of different types of training in older adults over aged 80 [31].

As for fall incidence, after intervention programs with physical exercise, a meta-analysis [32] indicated a 23% reduction in falls in the older adults who lived in the community and practiced exercise. The percentage of fallers was reduced in both groups of the present study, but it was higher in the multicomponent group. Physical programs that reduce falls primarily involve functional and balance exercises. Although, exercises with multicomponent objectives (strength, cardiorespiratory endurance, flexibility, balance) are also likely to have the same effect [27, 10].

Fear of falling, associated with occasional falls, remained stable in the results. Previous studies have reported similar results [29, 33] for non-modification of fear of falling in the older adults who participate in physical programs. Also, there is evidence of increased fear of falling with the occurrence of falls [16], while another study has reported a reduction in this fear 34. Exercises for the older adults are likely to have an acute effect in reducing their fear of falling. However, a systematic review pointed out that there is insufficient evidence to determine the chronic effect on this variable [35]. In the present study, it was found that fall incidence remained stable throughout the intervention. This relationship has not been confirmed in the literature, and requires further investigation [11].

The limitations of this study are the heterogeneous sample, as well as the interference of individual practices performed by the older adults, in addition to those of the study's exercise program. Most of the sample participants were females, but because it is a study conducted in a real-life setting, it reflects the greater number of women in this type of activity. The fact that it was a 9-month study did not allow for a larger sample and a control of the sample losses, but the time for carrying out the intervention was a priority.

Conclusion

When comparing the effects in the two physical training programs on variables associated with fall prevention, it was concluded that the Balance Group showed positive results in specific balance variables. Strength, cardiorespiratory fitness, fear of falling and fall incidence were maintained stable in both groups, but flexibility worsened. There is an association between balance variables and muscle strength and cardiorespiratory fitness in the Balance Group and Multicomponent Group. Further studies should be developed to confirm the degree of evidence of interventions with physical exercise to prevent falls, whether something specific (such as balance training) or more general (such as multicomponent training). Our study, when comparing these two modalities, is one of the first and indicates that specific training would be the more responsive. Scientific evidence is still needed.

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