

---

**MULTICOMPONENT PHYSICAL ACTIVITY PROGRAM: STUDY WITH FALLER AND NON-FALLER OLDER ADULTS****PROGRAMA DE ATIVIDADE FÍSICA MULTICOMPONENTE: ESTUDO COM IDOSOS CAIDORES E NÃO CAIDORES****Andréa Kruger Gonçalves<sup>1</sup>, Adriane Ribeiro Teixeira<sup>1</sup>, Nádia Cristina Valentini<sup>1</sup>, Amanda Suely Rodriguez de Vargas<sup>1</sup>, Vanessa Dias Possamai<sup>1</sup> and Valéria Feijó Martins<sup>1</sup>**<sup>1</sup>Universidade Federal do Rio Grande do Sul, Porto Alegre-RS, Brazil.**RESUMO**

As quedas são consideradas um problema de saúde pública e a atividade física é uma estratégia eficaz para preveni-la. O objetivo foi avaliar o efeito de um programa de atividade física na aptidão física, medo de cair e qualidade de vida em grupos de idosos com e sem quedas. Estudo realizado com participantes de um programa multicomponente de atividade física em uma universidade do Brasil, divididos em: caidores (n = 25) e não caidores (n = 133). Foram avaliados através do Senior Fitness Test, Falls Efficacy Scale-International Brasil e do The Medical Outcomes Study 36. A média, o desvio padrão, o teste t de Student e o tamanho do efeito foram realizados. Houve diferença entre os indivíduos caidores e não caidores na FLEXMI (p=0,05), FMS (p=0,04), RA (p=0,03), FES (p=0,00), SF36 (p=0,00). O grupo não caidor melhorou a aptidão física. O pré teste do grupo caidor mostrou aumento do medo de cair em comparação com o grupo não caidor. O programa de atividade física não influenciou o medo de cair em nenhum dos grupos. A qualidade de vida apresentou melhores resultados no grupo não caidor, com variação em alguns aspectos entre os grupos e ao longo do tempo. Idosos com história prévia de quedas necessitam de um programa físico diferenciado.

**Palavras-chave:** Envelhecimento. Quedas. Aptidão física.**ABSTRACT**

Falls are considered a public health problem and physical activity is an effective strategy to prevent fall. The goal of this study was to assess the effect of a physical activity program on physical fitness, fear of falling and quality of life in groups of faller and non-faller older adults. Study was conducted with participants of a multicomponent program of physical activity at a university in Brazil. The participants were assigned to: faller (n=25) and non-faller (n=133) groups. Participants were assessed using the Senior Fitness Test, Falls Efficacy Scale-International Brasil and The Medical Outcomes Study 36. Mean, standard deviation, Student "t" test and effect size were conducted. There was a difference between faller and non-faller individuals at LLFLEX (p=0,05), LLS (p=0,04), BA (p=0,03), FES (p=0,00), SF36 (p=0,00). The group of non-faller elderly people improved physical fitness. The pre test of the faller group showed increased fear of falling in comparison to the non-faller group. The physical activity program did not influence fear of falling in any of the groups. The quality of life showed better results in the non-faller group, with variation in some aspects between groups and over time. Elderly people with a previous history of falls need a differentiated physical program.

**Keywords:** Aging. Falls. Physical fitness.**Introduction**

The prevalence and incidence of falls in elderly people are high across different cultures<sup>1</sup>. In Brazil, 30% of older person fall at least once a year<sup>2</sup>; this prevalence reduced to 21% in US, 16% in Sweden and 15% in Hong Kong<sup>3</sup>. One possible explanation is the lack of adequate condition for elderly' mobility in Brazil; the majority of the Brazilian cities have unsuitable outdoor environment and are unprepared for avoiding falls, it has unsafe and poorly lit environment, poorly planned and poorly constructed and with architectural barriers<sup>1</sup>. On the other hand, Brazilian health's policies, to the older population have improved in the last decades and includes primary medical care, health promotion and humanization of services within the public health system<sup>4</sup>.

Prevention of falls has also been, since 2006, the target of aging educational programs. Just like the rest of the world, falls have become a public health problem in Brazil, since it has

been related to increases in morbimortality and hospitalization, about 2.5% require hospitalization and half will survive after one year, and the reduction of functional capacity<sup>1,4</sup>.

The National Health Policy for the Elderly<sup>4</sup> in Brazil indicates that actions are necessary to prevent accidents at home and on public roads, such as falls and run over. The documents 'Elderly Health Care' and 'Aging and Elderly Health' (published in 2006 and 2007) are part of the policy of the Pact for the Life and Health of the Elderly. The theoretical basis and specific technical subsidies are indicated for health actions and in the context of the Unified Health System.

Fear of falling is related to increasing age and has been associated with muscle weakness, balance and gait disorders, functional and cognitive impairment, postural hypotension, the use of medication targeting the central nervous system and visual impairment<sup>5</sup>. Some studies have shown that 45% of elderly people older than 75 years (with a fall resulting in an injury) developed fear of falling, 26% ended up limiting activities that demanded higher balance abilities and displayed low self-confidence to perform daily living activities<sup>3,5,6</sup>. Falls and fear of falling are also related to a reduction in the level of physical activity<sup>7,8</sup>. Fear of falling may persist regardless of having or not a history of falls, which demonstrates the importance of its assessment and prevention<sup>9</sup>.

Physical activity is strongly recommended to prevent falls in older people, although its efficacy can be a matter of debate<sup>5</sup>. Early studies failed to provide find an association between the type and frequency of physical activity with history of falling, even though the increased physical limitations were observed in the fallers groups<sup>10</sup>. More recently, studies suggested that the leisure physical activity and domestic activities have positive prevention effects on the frequency of falls in older men and women<sup>1,6,11</sup>. However, real-life based studies with older people under different conditions and in different places of society<sup>6</sup>.

Furthermore, the increase in fear of falling may be influenced by the kind of physical activity and outdoor environment, and its intensity<sup>5</sup>. Consequently, physical activity programs that implemented strategies to reduce fear of falling and to improve gait and balance in the physically frail elderly have improved in at least one of these four parameters: fall incidence, walking speed, balance and muscular strength<sup>12</sup>. Moreover, it is of note that the most studied physical fitness variables associated to prevention of falls are dynamic balance, muscular strength and flexibility<sup>13</sup>. It is also known, that the physically active elderly demonstrate better perception of their quality of life than those who are inactive<sup>14,15</sup>.

In this regard, previous falls do not necessarily mean fear of falling. Elderly who fall become more cautious for their mobility, thus preventing future falls. There is a reciprocal relation among functional incapacity, fear of falling, falls and quality of life. Fear of falling, muscular strength, balance and functional skills are risk factors for falls, which can be positively influenced by regular physical activities interventions<sup>16</sup>. The need for a study based on a more innovative multicomponent physical program for elderly residents of the community is justified, and may help in understanding the relationship between falling concern and the occurrence of falls in the elderly. Considering this probable relation, the aim of this study was to identify the history of falls in a group of elderly people in the community, after evaluating the effect of a multicomponent physical activity program intervention in physical fitness, fear of falling and the quality of life.

## Methods

### *Participants and design*

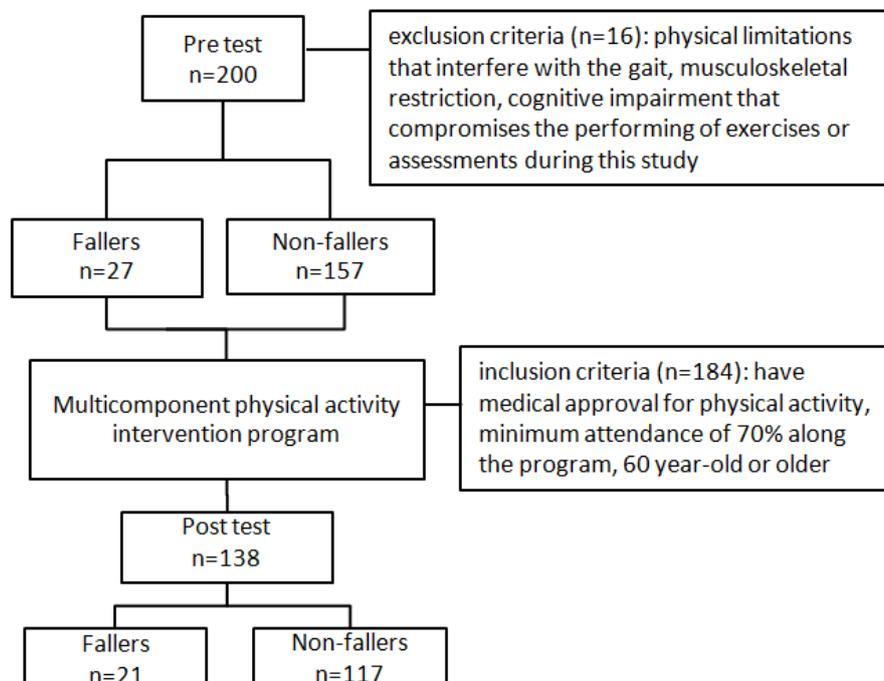
In this quasi-experimental study the sample was composed of males and females attending to multicomponent physical activity program at the Leisure Study Center and Physical Activity of the Elderly (CELARI) at a federal university in south of Brazil. Studies

performed in real world conditions, in addition to controlled and randomized studies, are necessary to identify the effects of these interventions<sup>17</sup>.

At the beginning of march, CELARI participants were invited to participate in the study. Of those people who accepted, the evaluation of the history of falls was accomplished a assessment (through a question: there was some drop in the last six months), to identify the number of fallers and to organize the division of the groups of the sample. The intervention program was started after the pre post, the two groups participated in the same activities without differentiating the group. This study was approved by the university of origin (n.870.096) and was conducted according to the Declaration of Helsinki. All participants signed informed consent form, in addition to respecting the guidelines of National Health Council's Resolution 466/2012.

Sample size was estimated based in previous studies with similar population and instruments. For this calculation was used the G\*Power Software: significance level of 5%, power of test of 80%, effect size of 0.70. The accepted effect sizes in similar studies ranged from 0.37 to 0.70, and level of significance of 5% to assure a treatment difference for potential 20% dropout rate and additional variations<sup>18,19</sup>. Participants (n=184) were organized according to the occurrence of falls (in the last six months): a faller group (n=27), non-faller group (n=157) only for the statistical procedures (Figure 1). The unbalanced sample size, although unwanted, illustrated the study ecological validity.

The following inclusion criteria were adopted: have medical approval for physical activity, minimum attendance of 70%, 60 year-old or older. The exclusion criteria were: physical limitations that interfere with the gait, musculoskeletal restriction, cognitive impairment that compromises the performing of exercises or assessments during this study (Figure 1).



**Figure 1.** Study design and participants flow

Source: Authors

### Instruments

A sociodemographic questionnaire was applied to describe participants as to the following variables: sex, marital status, education, housing, occupation and income.

The physical fitness assessment was conducted using the Senior Fitness Test<sup>20</sup> which comprises six physical subtests: 1) lower limbs flexibility (LLFLEX): chair sit-and-reach, 2) upper limbs flexibility (UPFLEX): back scratch; 3) lower limbs strength (LLS): 30-second chair stand” in repetitions, d) upper limbs strength (ULS) “arm curl”, e) aerobic resistance (AR): “2-minute step test”, f) balance and agility (BA): “8-foot up-and-go”<sup>20</sup>. The flexibility subtests were measured in centimeters, the strength subtests in number of repetitions. The test is easy to conduct and has low cost<sup>21</sup>.

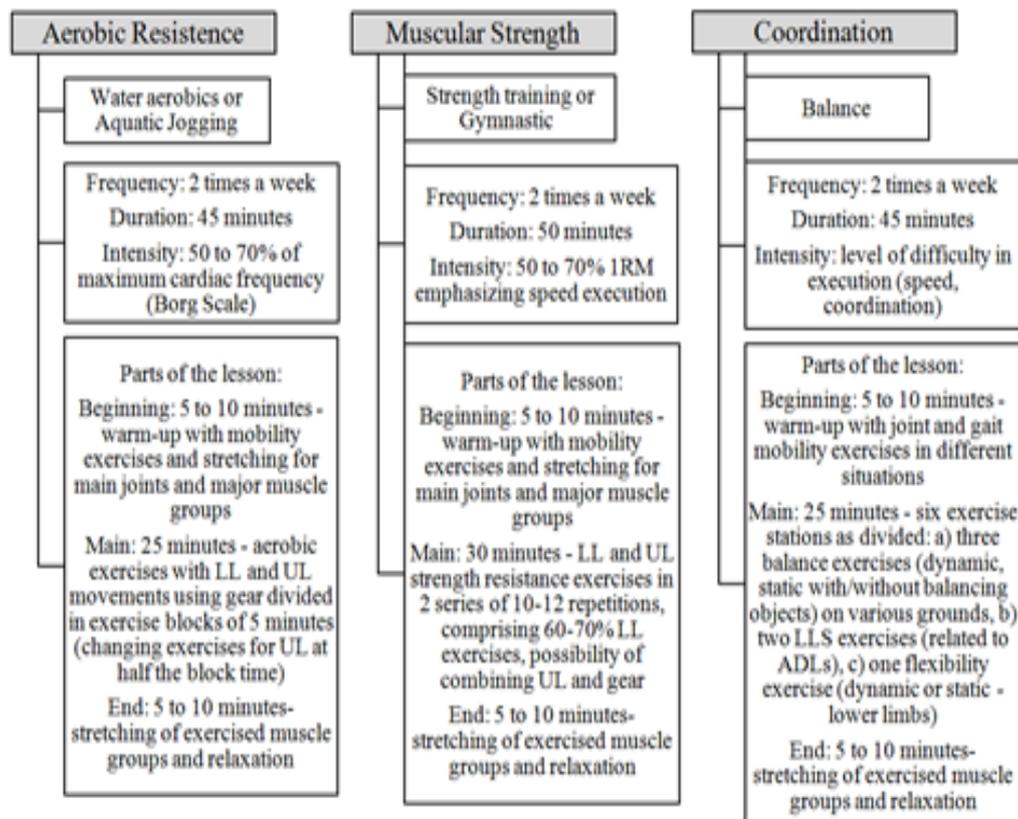
The Falls Efficacy Scale-International Brasil” (FES) adapted for Brazilian population<sup>22</sup> was used to assess fear of falling. The score varies from 16 to 64 points representing individuals who do not have any concern about falling (lower scores) and individuals with extreme concern about falling (higher scores)<sup>23</sup>.

The Medical Outcomes Study Questionnaire Short Form 36 Health Survey (SF-36)<sup>24</sup>, translated and validated in Brazil<sup>25</sup>, was used to assess quality of life regarding to health. The SF-36 is composed of 36 items organized in eight dimensions: Physical Functioning (PF), Role-Physical (RP), Role-Emotional (RE), Bodily Pain (BP), Vitality (VT), Social Functioning (SF), Mental Health (MH), General Health (GH). A maximum score of 150 could be obtained by the sum of subtotals. The test is widely used in studies that involve the elderly and physical activity.

A questionnaire containing socio-demographic information regarding age, sex, marital status, level of education, number of falls within the last six months was also used.

#### *The multicomponent physical activity intervention program*

The research was implemented in a community service program for elderly public, open annually, since 1999, in university in the south of Brazil. The CELARI is an university extension program with the goal to provide physical and socio-educational activities for people over 60 year-old to promote autonomy and functional independence. The elderly (approximately 250 every year) participate in different modalities of regular physical activity four days per week. The program comprised 144 lessons during 9 months (36 weeks/ 50 minutes each section). The program combined aerobic resistance and muscular strength, aerobic resistance and coordination, muscular strength and coordination along the sections (Figure 2). Flexibility was practice along all intervention sections. The volumes and intensities of the program are described in more detail in Figure 2. The intensity is periodized from the specificity of the purpose of the modality.



**Figure 2.** Description of modalities from the multicomponent physical activity program

Source: Authors

Prior to the intervention the research team, Physical Education graduate students and an university professor, were trained in the use of the assessments and regarding to the intervention protocol. The same team of examiners implemented the intervention and conducted the pre-test (march) and post-test (november). Participants were assessed before the start of the physical program. The assessment was individually scheduled. At the indicated date and time, the participants answered the questionnaires and performed the physical tests. The tests were applied in a laboratory following the order: 1) LLS, 2) ULS, 3) LLFLEX, 4) ULFLEX, 5) BA, 6) AR. Each evaluation was performed by two (previously trained) evaluators. In the post-test, the same procedure was followed.

### Analysis

Descriptive data, mean and standard deviation were provided. Since groups were non-similar in size, due to ecological characteristics of the program. Chi-squared test for categorical variables was used. Wilcoxon paired test-t was conducted to compare pre-test and post-test results. The Man Whitney test was used to compare groups, faller and non-faller, at the pre-test and post-test. For the estimation of effect size *d* Cohen's test was used. A significance alpha level of 0.05 was adopted. The SPSS 20.0 software was used.

## Result

### Groups Socio-Demographic Characteristics

The statistical analysis show that the groups were similar in every variable at the pre-test. Regarding to sex, the majority of the sample were females. Furthermore, the majority of the participants were married, and widowers were the second most common reported marital

status. Most participants lived alone (52%), and were retired with income varies from 2 to 4 Brazilian' minimum wages. Table 1 presents socio-demographic data for the total sample, and fallers and non-fallers groups.

**Table 1.** Participants socio-demographic characteristics and comparison between faller and non-faller groups

Variable		Faller %	Non-faller %	Total %	<i>p</i>
Sex	Female	84.0	88.6	89.5	0.49
	Male	16.0	11.4	10.5	
Marital status	Single	8.0	8.9	9.0	0.64
	Married	36.0	38.0	38.3	
	Divorced	20.0	22.2	22.6	
	Widower	36.0	31.0	30.1	
Education (in years)	01 - 04	16.0	15.8	-	0.32
	05 - 08	20.0	16.4	-	
	09 - 11	28.0	21.5	20.3	
	12 or +	36.0	46.2	48.1	
Housing	Spouse	32.0	36.7	37.6	0.21
	Children	16.0	20.9	21.8	
	Other relatives	-	8.2	9.8	
	Alone	52.0	34.2	30.8	
Occupation	Never worked	16.0	7.6	6.0	0.15
	Retired	72.0	74.7	75.2	
	Still works	12.0	17.7	18.8	
Income	No personal income	-	6.3	7.5	0.80
	Up to 1 MW	16.0	13.3	12.8	
	02 - 04 MW	52.0	40.5	38.3	
	05 - 07 MW	20.0	21.5	21.8	
	08 or + MW	12.0	18.4	19.5	

**Note:** *p*: level of significance; %: percentage; MW: minimum wag

**Source:** Authors

#### *Between Groups Comparisons*

*Physical fitness.* The between groups results of LLFLEX, LLS and BA subtest reveal significant differences between the groups at the pre-test, with smaller effect size for LLS, and large effect size for BA. With regard to the post-test, the differences were maintained (LLS and BA), with a moderate effect size.

*Fear of falling.* The non-faller group showed better results at pre- and post-test. The between groups results of the analysis revealed significant difference between groups for fear of falling at pre-test, with a moderate effect size, with non-faller group showing less fear of falling. However at the post-test differences were not observed.

*Quality of life.* The between groups results showed that for the quality of life subtests (PF, RP, VT, SA, GH) and the total scores significant differences between groups at the pre-test were observed with moderate to large (SA) effect size. At the post-test some variables remained identical to the pre-test (PF, VT, SA, GH, SF), and for other subtests statistic difference between groups (BP, MH) were also found, with PF and SF showing larger effect size. Concerning to RP subtest, significant differences between groups were observed only at the pre-test. Table 2 presents results of the comparison between groups at pre- and post-test.

**Table 2.** Comparison between faller and non-faller groups at the pre-test and post-test: Physical fitness, fear of falling and quality of life

Variable	Between Groups Comparisons							
	Pre-test				Post-test			
	Faller M±SD	Non-faller M±SD	<i>p</i>	<i>d</i>	Faller M±SD	Non-faller M±SD	<i>p</i>	<i>d</i>
Senior Fitness Test								
LLFLEX	-7.7±15.2	-1.7±10.5	0.05*	0.47	-3.6±14.0	1.9±11.3	0.10	0.31
ULFLEX	-7.0±8.5	-6.2±9.6	0.67	0.11	-7.9±12.3	-5.6±9.8	0.43	0.18
LLS	15.2±4.7	17.2±5.1	0.04*	0.44	15.1±5.6	19.4±6.9	0.00*	0.72
ULS	18.7±6.5	20.9±5.6	0.10	0.36	20.1±6.4	22.9±5.4	0.08	0.36
AR	76.6±24.8	81.7±23.7	0.32	0.21	80.4±30.6	88.0±26.1	0.29	0.28
BA	6.3±1.8	5.5±1.5	0.03*	1	5.8±2.2	4.8±1.9	0.03*	0.63
Falls Efficacy Scale								
FES	29.9±10.1	23.8±6.8	0.00*	0.72	28.4±9.0	23.8±6.6	0.06	0.65
Medical Outcomes Study Questionnaire Short Form								
PF	57.2±28.1	70.7±23.2	0.01*	0.50	55.0±24.6	74.3±21.3	0.00*	0.84
RP	52.0±44.4	75.6±36.5	0.01*	0.57	52.7±41.9	69.5±39.6	0.12	0.42
RE	89.4±22.3	81.2±31.7	0.16	0.29	62.7±38.8	77.7±34.5	0.14	0.41
BP	58.4±27.3	66.6±22.8	0.16	0.32	52.4±17.0	65.8±23.7	0.00*	0.64
VT	58.6±13.5	66.6±19.7	0.01*	0.49	60.0±20.5	71.5±19.3	0.03*	0.56
MH	71.2±17.5	78.1±17.3	0.07	0.41	69.3±22.4	81.6±15.5	0.03*	0.63
SA	67.0±22.7	85.0±20.6	0.00*	0.85	66.6±26.4	83.9±21.0	0.01*	0.71
GH	55.6±18.6	65.0±14.8	0.02*	0.62	54.0±18.3	65.0±15.2	0.02*	0.66
SF36	101.6±15.7	113.6±17.0	0.00*	0.74	108.0±19.4	123.8±16.4	0.00*	0.85

**Note:** LLFLEX: lower limbs flexibility, ULFLEX: upper limbs flexibility, LLS: lower limbs strength, ULS: upper limbs strength, AR: aerobic resistance, BA: balance and agility, FES: Falls Efficacy Scale-International Brazil, PF: functional capacity, RP: physical aspects, RE: emotional aspects, BP: bodily pain, VT: vitality, MH: mental health, SA: social aspects, GH: general state of health, SF36: total scores SF-36, M±SD: mean and standard deviation, *p*: level of significance, \*: *p* < 0.05, *d*: size of effect

**Source:** Authors

### Within-Groups Comparisons

**Physical fitness.** The within-groups results showed significant improvements in both groups. The faller group presented significant improvement from pre- to post-test in the BA subtest, with a moderate effect size. The non-faller group showed significant improvements from pre-to post-test for LLFLEX, LLS, ULS, AR and BA with small effect size.

**Fear of falling.** The within-group results showed that the fear of falling did not significant change over time for both groups.

**Quality of life.** Both groups showed significant changes from pre-test to post-test in SF-36 total scores, with small effect size. There was no significant changes for the faller group from pre-test to post-test regarding the subtests. However the non-faller group showed significant improvements vitality and mental health subtests also. Table 3 displays the results related to the within-groups comparisons from pre- to post-test.

**Table 3.** Effect of a multicomponent physical activity program on physical fitness, fear of falling and quality of life in of faller and non-faller older adults

Variable	Within Groups Comparisons							
	Faller				Non-faller			
	Pre-test M±SD	Post-test M±SD	<i>p</i>	<i>d</i>	Pre-test M±SD	Post-test M±SD	<i>p</i>	<i>d</i>
Senior Fitness Test								
LLFLEX	-7.3±14.2	-3.6±14.0	0.07	0.28	-0.9±10.4	1.9±11.3	0.00*	0.26
ULFLEX	-7.2±9.0	-6.6±11.1	0.58	0.09	-6.0±9.6	-5.6±9.8	0.42	0.04
LLS	15.2±4.6	15.1±5.6	0.92	0	17.3±5.2	19.4±6.9	0.00*	0.35
ULS	19.2±6.6	20.1±6.4	0.34	0.16	21.1±5.4	23.0±5.4	0.00*	0.35
AR	76.4±27.4	81.4±31.1	0.52	0.17	82.6±23.7	88.0±26.1	0.00*	0.24
BA	6.3±2.0	5.8±2.2	0.05*	0.5	5.4±1.4	4.8±1.9	0.00*	0.31
Falls Efficacy Scale								
FES	31.4±12.0	29.4±9.2	0.27	0.18	23.4±5.9	23.4±6.1	0.92	-
Medical Outcomes Study Questionnaire Short Form								
PF	54.6±27.7	52.5±25.0	0.44	0.07	71.3±23.3	74.1±20.9	0.09	0.13
RP	51.5±44.2	46.8±40.7	0.54	0.11	74.4±38.4	69.6±39.5	0.22	0.12
RE	84.8±27.3	78.7±26.9	0.55	0.22	79.9±31.1	82.4±30.5	0.39	0.09
BP	58.2±29.8	52.5±17.7	0.33	0.25	69.1±23.5	65.7±23.6	0.12	0.17
VT	57.8±14.4	60.0±21.6	0.52	0.1	67.9±18.8	72.7±16.7	0.00*	0.29
MH	70.0±17.2	71.0±22.1	0.80	0.05	78.0±18.0	81.8±15.3	0.01*	0.18
SA	64.8±22.4	67.1±27.7	0.59	0.12	85.0±20.5	83.9±21.6	0.62	0.09
GH	52.1±20.6	54.4±17.9	0.42	0.10	65.4±14.6	65.4±15.7	0.99	-
SF36	99.9±17.8	107.6±19.9	0.00*	0.44	114.4±17.3	124.2±16.1	0.00*	0.60

Note: LLFLEX: lower limbs flexibility, ULFLEX: upper limbs flexibility, LLS: lower limbs strength, ULS: upper limbs strength, AR: aerobic resistance, BA: balance and agility, FES: Falls Efficacy Scale-International Brazil, PF: functional capacity, RP: physical aspects, RE: emotional aspects, BP: bodily pain, VIT: vitality, MH: mental health, SA: social aspects, GH: general state of health, SF36: total scores SF-36, M±SD: mean and standard deviation, *p*: level of significance, \*: *p* <0.05, *d*: size of effect.

Source: Authors

## Discussion

This study showed that a intervention program has a different effect for elderly public who fall and those who don't. The non-faller group showed improvements in physical fitness in a more effective way, as well as in quality of life variables along the program. The results of this study support previous assumptions<sup>6,12,16</sup> about the effectiveness of a multicomponent programs in elderly public. Furthermore, the results emphasized that the notion that elderly people with history of falls, although more tenuous, also benefit from an multicomponent intervention program. Physical activity improves physical mobility and posture stability, which are directly connected to reducing the occurrence of falls.

Regarding groups differences, it was expected that non-fallers groups showed better results at the beginning of the intervention. Previous study indicate that elderly people having a history of falls before training had less mobility than those who did not have the same history<sup>26</sup>. Similar results were found in a study that involved 157 elderly people, men and women, having no history of falls. After a training period, the results showed significant improvement in mobility with regards to the faller group, although there were no differences in the analysis of faller and non-faller groups<sup>27</sup>. In the present study the results were more stronger for the non-faller group, and is aligned with previous studies that showed that

interventions incorporating postural balance and lower limbs muscle strengthening training promotes improvement in coordination and balance, resistance to muscular fatigue and hypertrophy, and therefore enhancing strength, mobility, quality of life and confidence in performing activities of daily living<sup>28</sup>.

Exercise prescription (frequency and type of activity) for maximum physical activity results is not yet well established for the elderly. Studies indicate that physical activity prevents falls by means of performing balance and strength exercises<sup>6,12</sup>. As example, the association of the level of physical activity, physical fitness and fear of falling was investigated in a longitudinal study regarding the elderly<sup>29</sup>. The results suggest an increased risk for falls in participants with a high level of physical activity and reduced physical fitness. As for the group with a low level of physical activity and superior physical fitness there was a higher increase in fear of falling over time. The results of this previous study indicate that the maintenance of elevated levels of physical activity do not diminish fear of falling over time<sup>29</sup>, and in some extension similar to our results, since although groups improved fitness, the fear of falling scores did not really change over time. Activities incorporating muscle strength and balance are those with stronger correlation to physical fitness and providing fall reduction<sup>29</sup>, and were provided in the present study but the fear of falling in fact did not change.

Nonetheless, concerning to the fear of falling, it is important to notice, that it is not present in the non-faller group, according to a normative FES table<sup>22</sup>. The occurrence of falls in the faller group becomes a trigger for fear. On the other hand, this variable did not show a difference between groups after the program, despite having a score reduction for the faller group with a tendency to be significant. Some studies that have related the history of research with fear through FES are in agreement with our results. The efficacy of a physical activity program was checked for improving balance and reducing fear of falling among the non-faller group, which proved to be an effective strategy for enhancing these variables<sup>18</sup>. Elderly public with a history of falls were classified according to their fear of falling level (FES), indicating that the fact of dreading falls worsen balance, lower limbs strength and gait results. Physical incapacity and problems in mobility seem to interfere with this association, but these aspects can be modified by physical activity<sup>16</sup>.

Researchers suggested that physical activity reduces the incidence of falls after a period of physical training (which varies from 22% to 58%) in elderly public<sup>12</sup>, however some studies did not support this relation. Intervention programs incorporating physical activity reduce strength and muscle mass loss, in addition to concentrating in the reduction of the number of falls, as well as balance and gait improvement. For the physically fragile, physical programs must combine intensity, volume and a weekly training schedule in their prescription in order to promote neuromuscular and cardiovascular changes which improve functional capacity<sup>12</sup>, and it seems to play a role in the present results. Although benefits were observed for both groups the more fragile group (fallers) benefit less, indicate the need to reinforce the intensity and frequency of the intervention for this group, if possible. Furthermore, regarding to physical activity for prevention and reduction of falls, multicomponent programs are indicated: strength, cardiopulmonary resistance and balance<sup>12</sup> and were implemented in the present study.

Quality of life in the non-faller group presented a better score than in the faller group, with some variation found among studied parameters. With regard to groups comparisons, the non-faller group showed more affected variables than the faller group. Quality of life and health are part of current promotion of health public policies, especially for elderly population. Physical activity reduces health-related impairments and functional capacity<sup>30</sup>. Nonetheless, there are only a few studies that provide results from elderly physical activity programs correlating quality of life, physical fitness and community falls beyond clinical trials<sup>31</sup>, a contribution of the present study.

Previously, physical activity program investigating balance, fear of falling and quality of life in elderly public suggested improvement in all of these variables. The SF-36 variables (functional capacity, vitality and general state of health), balance and fear of falling showed positive results after the program<sup>32</sup>. As for another intervention study comparing both types of exercise for improvement of balance in elderly also suggested improvements for balance and quality of life, showing a tendency for enhancement in the intervention groups, which was possibly related to greater confidence in executing activities of daily living<sup>33</sup>. Our study, extended these previous research by looking closely to the intervention effects in faller and non-faller groups, showing that although non-fallers had stronger benefits, the more fragile group also improve or did not showed decreases in performance over time, also a positive result. The clinical complaint of pain, the presence of depressive symptoms and reduced balance were the main factors that contributed to quality of life decline, although they are generally modifiable and can be considered a priority in fall prevention programs<sup>34</sup>, and were observed in the present study. Our results provided evidences that elderly people with history of recurrent fallers do not necessary have to presenting worse results for quality of life and physical fitness<sup>35</sup>, and that the approach to improve their health was at some extension attained.

As for prevention of falls, the literature<sup>12,16,27,29</sup> has suggested that the main variables to be improve in fitness would be lower limbs strength and balance, which supports our results for the non-faller group, but only partially for the faller group. The non-faller group has a protective effect in the combination of strength and balance for preventing falls. Concerning the faller group, a more directed intervention to improve strength seems necessary.

Although groups showed differences in the fear of falling in the initial assessment, a small decreases in the final assessment in the faller group reduce the differences between groups. That is, the fact of having a positive history for falls in the faller group reveals the differences between these two groups in the pre-test and that along the intervention the effects may become relevant and help fallers to became more confident. As for quality of life variables, the aspects that showed some difference between groups were those directly related to the necessary requirements for performing daily activities and social participation, faller groups may are more aware of their limitations and therefore change this parameters would require more time or even are less susceptible to change.

## Conclusion

In analyzing the physical fitness variables for the non-faller group, the efficacy of the physical activity program is evident in almost every investigated parameter (only the ULFLEX variable did not present significant improvements). Regarding the faller group, balance, agility and overall quality of live regarding health (SF36) showed enhancements. Based on the results of this study, it is possible to claim that elderly people with a history of falls need a task-specific intervention program with emphasis on muscular strength and aerobic resistance variables.

Among the limitations of this study, medication was not controlled, as well as hearing problems or impaired visual acuity assessments were not conducted. Another limiting aspect would be the existence of memory bias, given that the description of falls was based on a self-reporting approach. Our recommendation for further researches is the longitudinal design, this approach will allows to better understand the interactions of these parameters throughout the aging process.

## References

1. Cunha AA, Lourenço RA. Quedas em idosos: prevalência e fatores associados. *Rev Hupe* 2014;13(2):21-29. Doi: 10.12957/rhupe.2014.10128
2. Gonçalves AK, Hauser E, Martins VF, Possamai VD, Griebler EM, Blessmann EJ, et al. Postural balance program: variables related to falls in elderly. *J Phys Educ* 2017; 28(1):2798-2808. Doi: 10.4025/jphyseduc.v28i1.2808
3. Rosengren B, Ribom EL, Nilsson JA, Ljunggren O, Ohlsson C, Mellström D, et al. There is in elderly men a group difference between fallers and non-fallers in physical performance tests. *Age ageing* 2011;40(6):744-749. Doi: 10.1093/ageing/afr108
4. Biblioteca Virtual em Saúde. [internet]. Envelhecimento e saúde da pessoa idosa. [acesso em 02 dez 2018]. Disponível em: [http://bvsms.saude.gov.br/bvs/publicacoes/envelhecimento\\_saude\\_pessoa\\_idosa.pdf](http://bvsms.saude.gov.br/bvs/publicacoes/envelhecimento_saude_pessoa_idosa.pdf)
5. Kim, JC, Chon J, Kim HS, Lee JH, Yoo SD, Kim DH, et al. The association between fall history and physical performance tests in the community-dwelling elderly: a cross-sectional analysis. *Ann Rehabil Med* 2017;41(2):239-247. Doi: 10.5535/arm.2017.41.2.239
6. García-Molina R, Ruiz-Grao MC, Noguerón-García A, Martínez-Reig M, Esbrí-Víctor M, Izquierdo M, et al. Benefits of a multicomponent falls unit-based exercise program in older adults with falls in real life. *Exp Gerontol* 2018;110:79-85. Doi: 10.1016/j.exger.2018.05.013
7. Rogers NT, Marshall A, Roberts CH, Demakakos P, Steptoe A, Scholes S. Physical activity and trajectories of frailty among older adults: Evidence from the English Longitudinal Study of Ageing. *PLoS One* 2017;12(2):e0170878. Doi: 10.1371/journal.pone.0170878
8. Sipilä S, Tirkkonen A, Hänninen T, Laukkanen P, Alen M, Fielding RA, et al. Promoting safe walking among older people: the effects of a physical and cognitive training intervention vs. physical training alone on mobility and falls among older community-dwelling men and women (the PASSWORD study): design and methods of a randomized controlled trial. *BMC geriatr* 2018;18(1):215. Doi: 10.1186/s12877-018-0906-0
9. Malini FM, Lopes CS, Lourenço RA. Medo de quedas em idosos: uma revisão da literatura. *Rev Hupe* 2014;13(2):38-44. Doi: 10.12957/rhupe.2014.10127
10. Washburn RA, McAuley E, Katula J, Mihalko SL, Boileau RA. The physical activity scale for the elderly (PASE): evidence for validity. *J Clin Epidemiol* 1999; 52(7):643-651. Doi: 10.1016/S0895-4356(99)00049-9
11. Stahl ST, Albert SM. Gender differences in physical activity patterns among older adults who fall. *Prev Med* 2015;71(8):94-100. Doi: 10.1016/j.ypmed.2014.12.016
12. Cadore EL, Rodriguez-Mañas L, Sinclair A, Izquierdo M. Effects of Different Exercise Interventions on Risk of Falls, Gait Ability, and Balance in Physically Frail Older Adults: A Systematic Review. *Rejuvenation Res* 2013;16(2):105-115. Doi: 10.1089/rej.2012.1397
13. Tiedemann A, Sherrington C, Lord SR. The role of exercise for fall prevention in older age. *Motriz*, 2013;19(1):541-547. Doi: 10.1590/S1980-65742013000300002
14. Herens M, Bakker EJ, Van Ophem J, Wagemakers A, Koelen M. Health-related quality of life, self-efficacy and enjoyment keep the socially vulnerable physically active in community-based physical activity programs: A sequential cohort study. *PLoS One* 2016;11(2):e0150025. Doi: 10.1371/journal.pone.0150025
15. Svantesson U, Jones J, Wolbert K, Alricsson M. Impact of physical activity on the self-perceived quality of life in non-frail older adults. *J Clin Med Res*, 2015;7(8):585-593. Doi: 10.14740/jocmr2021w
16. Patil R, Uusi-Rasi K, Kannus P, Karinkanta S, Sievänen H. Concern about falling in older women with a history of falls: associations with health, functional ability, physical activity and quality of life. *Gerontology* 2014;60(1):22-30. Doi: 10.1159/000354335
17. Robitaille Y, Fournier M, Laforest S, Gauvin L, Filiatrault J, Corriveau H. Effect of a Fall Prevention Program on Balance Maintenance Using a Quasi-experimental Design in Real-World Settings. *J Aging Health* 2012;24(5):827-845. Doi: 10.1177/0898264312436713
18. Zhao Y, Chung PK, Tong TK. Effectiveness of a Community-Based Exercise Program on Balance Performance and Fear of Falling in Older Nonfallers at Risk for Falling: A Randomized, Controlled Study. *J Aging Phys Act* 2016;24(4):516-524. Doi: 10.1123/japa.2015-0224
19. Hauser E, Sandreschi PF, Parizzotto D, Araújo CCR, Mazo GZ. Medo de cair e desempenho físico em idosos praticantes de atividade física. *Rev Educ Fis/UEM* 2015;26(4):593-600. Doi: 10.4025/reveducfis.v26i4.28442
20. Rikli RE, Jones CJ. Development and validation of a functional fitness test for community-residing older adults. *J Aging Phys Act* 1999; 7:129-161. Doi: 10.1123/japa.7.2.129
21. Rikli RE, Jones CJ. Senior fitness test manual. 2.ed. Canada: Human Kinetics; 2013.

22. Camargos FF, Dias RC, Dias J, Freire MT. Cross-cultural adaptation and evaluation of the psychometric properties of the Falls Efficacy Scale-International Among Elderly Brazilians (FES-I-BRAZIL). *Rev Bras Fisioter* 2010;14(3):237-243. Doi: 10.1590/S1413-35552010000300010
23. Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. *J Gerontol* 1990;45(6):239-243. Doi: 10.1093/geronj/45.6.P239
24. Ware JEJR, Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF-36): I. Conceptual Framework and Item Selection. *Medical Care* 1992;30(6):473-483
25. Ciconelli RM, Ferraz MB, Santos WS, Meinão IM, Quaresma MR. Tradução para a língua portuguesa e validação do questionário genérico de avaliação de qualidade de vida SF-36 (Brasil SF-36). *Rev Bras Reumatol* 1999;39:143-150
26. Prata MG, Scheicher ME. Effects of strength and balance training on the mobility, fear of falling and grip strength of elderly female fallers. *J Bodyw Mov Ther* 2015;19(4):646-650. Doi: 10.1016/j.jbmt.2014.11.013
27. Gunter KB, White KN, Hayes WC, Snow CM. Functional Mobility Discriminates Nonfallers from One-Time Fallers and Frequent Fallers. *J Gerontol A Biol Sci Med Sci* 2000;55(11):672-676. Doi: 10.1093/gerona/55.11.M672
28. Karinkanta S, Nupponen R, Heinonen A, Pasanen, M, Sievanen H, UusiRasi K, et al. Effects of Exercise on Health Related Quality of Life and Fear of Falling in Home-Dwelling Older Women. *J Aging Phys Act* 2012;20(2):198-214. Doi: 10.1123/japa.20.2.198
29. Lewis ZH, Markides KS, Ottenbacher KJ, Al Snih S. The Role of Physical Activity and Physical Function on the Risk of Falls in Older Mexican Americans. *J Aging Phys Act* 2016;24(3):342-349. Doi: 10.1123/japa.2015-0150
30. Paterson DH, Warburton DE. Physical activity and functional limitations in older adults: a systematic review related to Canada's Physical Activity Guidelines. *Int J Behav Nutr Phys Act* 2010;7:27-38
31. Ramalho F, Carnide F, Santos-Rocha R, André HI, Moniz-Pereira V, Machado ML, et al. Community-Based Exercise Intervention for Gait and Functional Fitness Improvement in an Older Population: Study Protocol. *J Aging Phys Act* 2017;25(1):84-93. Doi: 10.1123/japa.2015-0290
32. Kovács E, Prókai L, Mészáros L, Gondos T. Adapted physical activity is beneficial on balance, functional mobility, quality of life and fall risk in community-dwelling older women: a randomized single-blinded controlled trial. *Eur J Phys Rehabil Med* 2013;49(3):301-10. PMID:23486300
33. Dunsky A, Yahalom T, Arnon M, Lido R. The use of step aerobics and the stability ball to improve balance and quality of life in community-dwelling older adults – a randomized exploratory study. *Arch Gerontol Geriatr* 2017;71:66-74. Doi: 10.1016/j.archger.2017.03.003
34. Lin SI, Chang KC, Lee HC, Yang YC, Tsauo JY. Problems and fall risk determinants of quality of life in older adults with increased risk of falling. *Geriatr Gerontol Int* 2015;15(5):579-587. Doi: 10.1111/ggi.12320
35. Boyé NDA, Mattace-Raso F, Van Lieshout EMM, Hartholt KA, Van Beeck, EF, Van der Cammen TJM. Physical performance and quality of life in single and recurrent fallers: Data from the Improving Medication Prescribing to Reduce Risk of Falls study. *Geriatr Gerontol Int* 2015;15(3):350-355. Doi: 10.1111/ggi.12287

**Author's ORCID:**

Andréa Kruger Gonçalves: 0000-0003-2772-3260  
Adriane Ribeiro Teixeira: 0000-0003-4242-1666  
Nádia Cristina Valentini: 0000-0001-6412-5206  
Amanda Suely Rodriguez de Vargas: 0000-0002-3606-0422  
Vanessa Dias Possamai: 0000-0001-8701-4963  
Valéria Feijó Martins: 0000-0001-5079-947X

Received on Sep, 12, 2018.

Reviewed on Nov, 25, 2018.

Accepted on Feb, 16, 2019.

---

**Author address:** Andréa Kruger Gonçalves. Escola de Educação Física, Fisioterapia e Dança/UFRGS. Rua Felizardo, 750, Jardim Botânico, Porto Alegre/RS. Brasil, CEP: 90690-200. E-mail: andreakg@ufrgs.br.