

Athlete older women and sedentary controls: comparing the incidence of frailty, physical aspects and falls

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ABSTRACT

Introduction: The aging process results in falls, frailty, and functional dependence. However, the practice of physical exercises can prevent negative impacts on the older adult health. **Objective:** To compare the incidence of frailty, physical aspects, and number of falls among older adult women and sedentary controls. **Methods:** The study has a cross-sectional design and included 70 community-dwelling older adult women (73.96±7.52 years). The frailty phenotype (Fried Criteria) and the history of falls in the last 12 months were analyzed, followed by the evaluation of muscle power (Five times Sit-to-Stand Test), functional mobility (Time Up and Go), balance (Mini BESTest) and fear of falling (Falls Efficacy Scale). The Mann Whitney and Chi-Square tests were used for statistical analysis. **Results:** The frailty rate among sedentary women (Pre-frail: 42.9%; Frail: 57.1%) was different from athlete women (Non frail: 100%). The rate of falls was the same in both groups (25.7%), however, sedentary controls fell at home (100%), while older adult athlete women fell in sports activities (88.9%). The athletes showed better scores ($p<0.001$) in all physical aspects when compared to the sedentary controls in muscle power (11.25 vs 24.10 seconds), functional mobility (10.01 vs. 16.04 seconds), balance (27 vs 19 points) and fear of falling (16 vs 27 points). **Conclusion:** Athlete older women had lower frailty rates and fear of falling, as well as better physical aspects. The characteristics of falls were different, indicating the need and the importance of contemplating the lifestyle in prevention programs promoting healthy life for older adults.

Keywords: aging; health of the elderly; accidental falls.

INTRODUCTION

In recent years (2000-2019), the world population has shown a new demographic pattern, characterized by a reduction in the population growth rate and an increase in the number of old people. The forecast for the older adult population by 2050 is to double the current population, from 900 million to approximately 2 billion older adults¹.

Global aging will place a greater focus on the health system, impacting it socially and financially as, over the years, older adults become more susceptible to illnesses and/or dependence². This information is evidenced with the study of the aging process,

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which involves the gradual degeneration of the systems responsible for the musculoskeletal, somato-sensory and proprioceptive systems which, when associated contribute to the increased risk of falls and sarcopenia, lead to several changes, such as the reduction of muscle strength and power^{2,3}. Still in this process, physiological alteration and modification occurs, resulting in problems in gait and balance, alteration of vision and peripheral sensitivity, reduced strength of lower limbs, appearance of diseases, which, consequently, can result in a complex and origin multifactorial problem: falls⁴. Approximately 30% of the older adults suffer one fall a year and 25% die within a year, directly or indirectly. These factors contribute to the decrease in the functional capacity of the older adult woman and are directly related to the frailty syndrome^{2,3}.

The frailty syndrome can be defined as a decrease in energy reserves and reduced resistance to stressors, which results in the decline of physiological systems^{2,5}. Frailty can be detected using the five criteria, according to Fried et al.⁵, in which the older adult woman who have none of them is considered non-frail, between 1 or 2 criteria - pre-frail; and 3 or more - frail.

Literature reports that the practice of physical exercises is an important measure to prevent the frailty syndrome⁵. Physical exercise programs for health promotion are crucial to minimize the deleterious effects of aging. Despite the high number of sedentary older women, there is an increase of those who practice sports activities regularly, that is, the master athletes, being considered from the age of 35 or over⁶.

It is considered relevant to emphasize that master athletes recognize their own potential, being demanding with results in their sport and having responsibility for their health, this allows them to have lower levels of frailty, better physical and cognitive aspects than sedentary older women.

Therefore, this study aimed to compare the incidence of frailty, physical aspects and number of falls between athlete older women and sedentary controls aged 65 years and over.

METHODS

Study design and population

The study has a cross-sectional character and was carried out with older women recruited from the Uberaba neighborhood, in the city of Curitiba, Paraná, Brazil, and at the Centro Dia do Idoso and at the São Vicente Association, in Araucária, in the Metropolitan Region of Curitiba, after the signing of the consent form. The project was approved by the Research Ethics Committee of Faculdade Dom Bosco (CAAE: 48548715.5.0000.5223, Opinion Number: 1,203,602).

The following inclusion criteria were applied: (i) Women aged 65 years or over, (ii) insufficiently active (below 150 minutes of

weekly physical activity - Sedentary group) (iii) practitioners of sport activities weekly in the last two years - Athlete group. The exclusion criterion was: (i) women with neurological and/or cognitive changes that made it impossible to perform functional tests, complete questionnaires or understand the guidelines. These criteria were identified by means of the Mini-Mental State Examination (MMSE) classified according to the level of education. In addition, women who did not complete all assessment steps were excluded from the study. The selection of only female participants was due to low male adherence, so, in order to avoid interference or confounding factors in the data analysis, only women were selected for the present study.

All criteria were identified through the initial screening carried out by the research team. At the end of the study, 77 older women were evaluated, seven of whom were excluded because they did not complete all the evaluation steps or because they did not reach the minimum score in the MMSE. The older women were distributed in their respective groups (sedentary or athletes), according to their level of physical activity, and each group was composed of 35 individuals.

Research instruments

The evaluations were carried out in the following order: evaluation form and history of falls, identification of the frailty phenotype, cognitive status for screening decreased cognition, muscle power test (sit and stand 5 times), functional mobility test (TUG), balance test (Mini BESTest) and scale of falls effectiveness.

Evaluation form

This form was composed of open and closed questions, related to identification data, sociodemographic characteristics, clinical and health conditions of the older adults. To assess the history of falls, women were asked about the occurrence of falls in the last 12 months, including aspects related to the location, frequency, and the consequences of the fall.

Screening for frailty phenotype

To identify frailty, its phenotype was used, composed of five items: reduced handgrip strength, self-reported exhaustion, decreased level of physical activity, self-reported weight reduction and low gait speed^{5,7}. The older women who did not present any positive items were considered non-frail; scores on 1 or 2 items were considered pre-frail; and if she scored more than 3 items, she was considered frail⁵.

Cognitive status

Cognitive status was assessed using the Mini-Mental State Examination (MMSE). This test is composed of questions grouped into 7 categories: orientations of time, location, immediate memory, attention and calculation, evocation, language and

visual constructive capacity. The score ranges from zero (0) to thirty (30). This test was performed to identify individuals with cognitive loss, according to the inclusion criteria^{8,9}.

Muscle power

The function of sitting and standing is among the activities of daily living most executed and its performance shows a direct relationship with the risk of falls and with the difficulty of standing after a fall, as it assesses the muscle power of the lower limbs^{10,11}. In order to evaluate such activity, the sit and stand test was used five times, which consists of the time required for the participant to perform the movement of getting up and sitting in a chair five times^{10,11}.

Functional mobility

The Time Up and Go (TUG) test assesses functional mobility and the risk of falls in the older adults¹². The older women who performed the test in up to 10 seconds were classified as independent and without balance change, those who obtained values from 11 to 20 seconds - partially dependent and with a low level for falls and those who obtained a value greater than 20 seconds indicate disability mobility and balance, with a high risk of falls¹³.

Balance: Mini BESTest

Mini BESTest, short for Balance Evaluation Systems Test (BESTest), was designed to assess functional balance^{14,15}. This test has 14 items, scored from zero to two, and focuses on the assessment of the dynamic balance construct. The maximum score can reach 32 points, where the highest score shows greater balance¹⁴.

Fear of falling: Fall Effectiveness Scale

The Falls Effectiveness Scale is an instrument to assess the fear of falling during the performance of activities of daily living, external activities and social gatherings. The scale has 16 activities, with respective scores from one to four in each item. The total score can range from 16 (no concern about falling) to 64 (extreme concern about falling)¹⁶.

Data analysis

In the Kolmogorov-Smirnov test, the data have a non-normal distribution and, therefore, non-parametric tests were used. Descriptive statistical analysis (frequency, mean, standard deviation, median, 25th and 75th percentiles) was used to characterize the study. The comparison of the groups (athletes x sedentary controls) was performed using the Mann-Whitney and Chi-Square tests according to the analyzed variable. Data analysis was performed using SPSS software, version 22. The level of statistical significance adopted was $p < 0.05$.

RESULTS

The present study was composed of 70 women aged 73.96 ± 7.52 years. Most older women had between 1 and 4 years of schooling (41.4%), widows (52.9%), consuming between 1 and 2 medications (47.1%) and not falling (60%). However, it is worth mentioning that 40% of the evaluated older women suffered at least one fall in the last twelve months (Table 1).

When comparing the frailty and the incidence of falls, it was possible to observe that sedentary older women had a higher prevalence of frailty and pre-frailty when compared to athlete older women. Regarding falls, there was no significant difference, indicating an equal number between the two groups (Table 2).

In the comparison between the older women regarding physical aspects and falls, it was possible to observe a significant difference in the analyzed variables ($p < 0.05$). The athlete older women presented lower consumption of medication, higher level of weekly

Table 1: Characterization of the study sample (n=70).

Variables	n	%
Education		
Illiterate	18	25.7
1-4 years	29	41.4
5-8 years	8	11.5
>8 years	9	12.9
Higher education/Postgraduate	6	8.6
Stable relationship		
No	50	71.4
Yes	20	28.6
Number of medications		
Non	3	4.3
1-2	33	47.1
3-4	19	27.2
≥5	15	21.5
Falls		
Yes	18	40
No	42	60

Table 2: Comparison of the incidence of frailty and falls between sedentary and athlete groups (n=70).

Variables	Sedentary n (%)	Athlete n (%)	p
Frailty			
Not frail	0 (0.0)	35 (100)	<0.001
Pre-frail	15 (42.9)	0.0 (0.0)	<0.001
Frail	20 (57.1)	0.0 (0.0)	<0.001
Falls			
Yes	9 (25.7)	9 (25.7)	>0.999
No	26 (74.3)	26 (74.3)	>0.999
Fall location			
In home	9 (100)	1 (11.1)	0.034
Outdoor	0 (0.0)	8 (88.9)	
Reason for falls			
Slipped	4 (44.4)	4 (44.4)	0.678
Stumbled	5 (55.6)	3 (33.3)	
Dizziness or vision darkening	0 (0)	2 (22.3)	

physical activity, less fear of falling and better physical aspects (balance, handgrip strength, muscle power, functional mobility and gait speed) when compared to sedentary older women (Table 3).

DISCUSSION

This study was designed to compare the incidence of frailty, physical aspects and the number of falls between athlete older women and sedentary older women aged 65 and over. The main finding is that sedentary older women presented a higher frailty index when compared to athlete older women. In addition, the athlete older women had better scores in physical aspects. However, the number of falls in both groups was the same (25.7%), with a high rate of falls among the study participants.

Frailty is a syndrome characterized by decreased functional reserve and resistance to stressful conditions and is associated with decreased response of the neuromuscular system, muscle activity, gait speed, with low functional performance and physical inactivity. The risk factors are female gender, advanced age, smoking, low socioeconomic status and greater presence of comorbidities, in addition to interacting negatively with episodes of falls¹⁷⁻¹⁹. Fragile older adults are at greater risk of having functional losses, hospitalizations, hospital readmissions and mortality^{17,18}. In this context, the early identification of frailty is important to indicate preventive measures that delay the onset or progression of the syndrome¹⁷.

It is known that one third of the older adults who live in the community experience at least one episode of fall each year, which is close to the prevalence found in the present study for the general sample (40%)¹⁹⁻²¹. Falls may be responsible for the dependence and loss of autonomy of the older adults, as it usually compromises their functional capacity, which is directly related to changes resulting from aging, whether anatomophysiological or psychological²⁰.

The number of falls was the same among the groups, but the sedentary older women fell in a residential environment, while the athletes fell outside, when performing sport activities. During games or competitions, older athletes are exposed to risk

situations for falls, however, they have a good physical profile, recovering quickly from these episodes, without physical or emotional consequences²².

Regarding the falls of sedentary older women, in addition to the associated physical factors, the use of medications can be reported. It was possible to observe a difference in the number of drugs consumed between sedentary older women (3.46 ± 2.08) and athlete older women (1.63 ± 1.71). The continuous and excessive use of medications can increase the risk of falls in the older adult, due to side effects. Older women who perform physical exercises consume a smaller amount of medications, which is an important fact in preventing falls in this population²³. Thus, it is noted that regular physical exercise can help to reduce the number of medications used, as it can provide a more active social life, helping to prevent emotional and psychological diseases, as well as preventing chronic non-communicable diseases, that directly affect the physical aspects of the older adult²³.

The athlete older women showed significantly better behavioral and physical aspects, among which the higher level of physical activity is noted. This practice results in several physical and emotional benefits, as observed in the analysis of the data in this study, in which the athletes had less fear of falling, greater balance, muscle strength and power and better functional mobility. The regular practice of physical exercises and sports activities is able to improve the muscle strength and joint mobility of the older adults, reducing the risk of falls, favoring self-esteem and disposition²⁴.

Older adults have a high rate of fear of falling, especially women who have already suffered a fall with complications, corroborating the result that sedentary older women showed greater fear of falls. It is also noted that the older adults restrict their activities of daily living to prevent new episodes of falls^{24,25}. Fear of falling may be characterized by anxiety and/or concern with walking, which generates less confidence, depression, worsening health conditions, sedentary lifestyle, social isolation and is capable of affecting the behavior of the older adults. In addition, most active older women leave home more, have greater social involvement, and during the assessment it was possible to observe that they have a greater desire to live and are sometimes

Table 3: Comparison of physical aspects and falls between between sedentary and athlete groups (n=70).

Variables	Sedentary			Athlete			p
	Median	P25	P75	Median	P25	P75	
Number of medications	3.00	2.00	6.00	1.00	0.00	4.00	0.022
Number of falls	0.00	0.00	2.00	0.00	0.00	1.00	0.661
Physical activity level (min/week)	30.00	30.00	50.00	340.00	200.00	630.00	<0.001
Fear of falling (points)	27.00	22.00	32.00	16.00	16.00	20.00	<0.001
Balance (points)	19.00	15.00	27.00	27.00	24.00	28.00	0.002
Handgrip strength (kgf)	16.54	9.00	28.00	31.10	24.00	36.00	0.002
Muscle power (s)	24.10	15.27	37.00	11.25	9.09	13.79	<0.001
Functional mobility (s)	16.04	10.78	22.00	10.01	8.80	13.00	0.005
Gait speed (m/s)	0.27	0.20	0.49	0.46	0.35	0.44	0.031

Min/week: minutes per week; kgf: kilogram-force; s: seconds, m/s: meters per second; P25: percentile 25; P75: percentile 75.

more cheerful. These findings demonstrate that physical exercise may be able to reduce the fear of falls among older women, as they feel physically more prepared and this can break the vicious cycle of sedentary lifestyle^{24,25}.

During locomotion and performing activities of daily living, it is extremely important to have a good balance to promote the necessary postural adjustments^{26,27}. In the present study, athlete older women showed better balance than sedentary older women. Similar studies demonstrate that the practice of physical exercises can help the older adults in improving balance and postural control, by promoting the proper interaction of the musculoskeletal system and adequate sensory information^{26,27}.

In this study, it was observed that athlete older women reached higher levels of muscle strength and power when compared to sedentary ones. In the study by Martin et al.²⁸ it was revealed that individuals who maintain high levels of handgrip strength in middle age are less likely to have functional disability when they are elderly. Studies indicate that the practice of physical exercises is directly related to muscle strength, and it is possible to note that sedentary older people have low levels of muscle strength²⁸. The reduction of handgrip strength is capable of affecting basic daily life activities, as soon as people use our hands to perform most of these, such as carrying bags, personal hygiene, preparing meals, food, among others²⁸.

In relation to muscle power, which involves aspects related to the strength and speed of movement, studies confirm that the practice of physical exercises proved to be an excellent alternative for the maintenance or improvement of these aspects, because in addition to the global alteration of all systems during aging, there is a decrease especially in muscle strength and power, which negatively affects the individual's posture, balance and functional

performance, increasing the risk of falls, decreasing gait speed and reducing independence in activities of daily living^{28,29}. The regular practice of physical exercises shows a high potential to minimize the negative effects of aging or its associated factors, such as the cycle of immobility-falls, pain, fear-immobility, being an important control of the health of the older adult through strategies primary prevention^{30,31}.

Finally, the older athletes had better functional mobility and gait speed when compared to sedentary ones. Regular physical exercise contributes positively to maintaining physical fitness, especially muscle strength and power, which are directly linked to aspects related to gait and contribute to reducing functional limitations of the older adults^{30,31}.

In conclusion, it was possible to observe that the older athletes had lower rates of frailty and fear of falling, as well as better physical aspects, such as balance, muscle strength and power, functional mobility and gait speed, aspects that are fundamental for the performance on activities of daily living. However, despite the data analysis showing the same number of falls among the older women, the athletes presented the episodes of falls during sports practice, while the sedentary older women fell in their residential environment, reinforcing the difference between the profile of these older adults.

This observation highlights the need and importance of prevention programs that address not only physical exercise, but also provide information through educational programs on the importance of a healthy lifestyle and fall prevention mechanisms in different settings that involve specific activities and lifestyle habits of the older adults whether they are sports activities or their basic or instrumental daily activities, thus promoting an active and healthy lifestyle regardless of the profile of the older adults.

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