Fitness for elders: A comparison between practioners and non-practioners of exercise

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Abstract The aim of this study was to investigate the level of fitness of older people with more than sixty (60) years of age, practicing physical exercise over non-practitioners. The elderly from Santa Fe High (Alta Santa Fe), located in Nova Santa Rosa–Paraná, with 60 individuals, practitioners and non-practitioners of physical activity have participated in the evaluation of physical fitness including tests such as balance, flexibility, and muscle strength. We were unable to detect significant differences between groups of practitioners and non-practitioners of exercise for this study. The physical activity program conducted with this population may still be beneficial for various social and emotional needs but falls short in maintaining physical fitness in these individuals.

Keywords Seniors · Physical fitness · Sedentary · Exercise

Introduction

Over the years, the human body goes through a natural aging process that causes functional and structural changes, reducing vitality and enhancing the appearance of diseases, being common alteration of the physical abilities (Ruwer et al. 2005).

In this context, it is noticed the importance of a workout on physical fitness in aging. Therefore, the themes were fitness, balance, flexibility, and strength in the elders over sixty (60) years of age, practicing physical exercise in relation to non-practitioners.

The aging process is accompanied by successive changes in organs and physiological systems, like changes in muscle composition, bone mass, and cardio-respiratory capacity, which may cause impairment in the performance of various tasks, including the simplest day to day (Zaitune et al. 2010).

As people get older, they become less active, and therefore, there is a loss in functional capacity and a decrease in the physical activity, resulting in the emergence of diseases that helps deteriorate the aging process (Matsudo et al. 2000). The most important benefit of exercise is the increase from 6 to 10 years in life expectancy adjusted for the quality of life (Shephard 2003).

For Gonçalves et al. (2010), physical fitness and its components are directly related to health, reducing the risk of diseases and functional disabilities. Aging can cause the decline of physical fitness and functional capacity, getting worse with a sedentary lifestyle.

According to Kopiler (1997), as people get older, the chances of some reduction in the functional capacity increases. However, this adverse development is not even since there are interventions that can potentially promote successful aging, such as physical activity.

In Rebelatto's study (2006), pointing to regular physical exercise as a strategy, it is attractive and effective to maintain and improve the physical and mental health at any age, having direct and indirect beneficial effects to

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prevent and slow the functional loss that occurs in aging, reducing the risk of diseases and disorder common in old age.

Performing physical activity provides numerous health benefits to the elders, however in necessary a special conduct and care when performing these exercises with this population, so that there will be no detrimental effects to physical skills, resulting from efforts beyond the capacity of each individual (Kopiler 1997). The practice of regular exercise in addition can avoid illnesses, depression and collaborates more significantly to the maintenance and upkeep of physical skills such as balance, flexibility, and strength.

It is known that with aging, fitness levels end up being reduced. However, little research has been undertaken in relation to the elderly population, which leads to the ignorance of some of the dimensions that surround and factors that contribute to the reduction of motor declines. Therefore, given the importance of this issue, the present study aimed to investigate the level of physical fitness of elderly people over 60 years of age, practicing physical exercise in relation to non-practitioners.

Development

Methods and materials

This is a descriptive applied research, with existing third age group in the association Country of Nova Santa Rosa–Paraná, realised in 2012. For the composition of the sample, it was considered 60 seniors, all volunteers, 46 women and 14 men over 60 years old, participants of the Club Seniors Good Shepherd from Alto Santa Fé, Nova Santa Rosa County–Paraná, and the sample was divided into two groups: First group consisting of 33 participants were physical exercise practitioners and 27 non-practitioners.

All ethical research procedures, followed appropriate techniques described in the literature, without implying any physical, psychological risk, or moral harm to the individuals involved. The study followed the “Guidelines and Regulatory Standards for Research Involving Humans” (196/96) issued by the National Commission of Health and approved by the ethics committee and research of the Assis Gurgacz College, accepted under No. 174/2012.

After the acceptance and the free and informed consent signed by the volunteers, the measurement data was initiated. The elders were evaluated individually, the measures were collected during their normal frequency on the activities, the days were combined with the direction of the establishment, not causing harm to the activities of the group.

To evaluate the measures of balance, static balance control with visual test standardized battery of Williams tests were conducted (Spirduso 2005; Matsudo 2004).

Flexibility was measured by the sit-and-reach test. The protocol of the sit-and-reach test, called Wells test (Wells and Dillon 1952 apud Queiroga 2005), is recognized as a classic in the category of range-seated model tests being recommended for the assessment of flexibility of the spine and hamstrings at all ages (ACSM 2000; Queiroga 2005).

The distance was recorded every 0.5 cm. For both, this is determined by the maximum position reached by the tips of the fingers, with the requirement to keep the distance reached by about 2 s. The evaluator supported one hand on the patellar region evaluated in an attempt to ensure that their legs remain fully extended during the test. Three attempts were allowed; however, for the final result record, computed distances were achieved by the greatest evaluated score. If there was a difference equal to or greater than 4 cm between measurements, three attempts were offered to the reviews.

To measure the muscle strength of the upper limbs, the elbow flexion test was adopted, which is an alternative test to indirectly measure the strength of the upper limbs when you do not have on the manual hand dynamometer (Rikli and Jones 1999 apud Matsudo 2004).

The subject was encouraged to run the widest possible range of flexion within 30 s. After a demonstration conducted by the examiner, an attempt by one or two repetitions to impart the proper way to accomplish was performed, followed by a second attempt to 30 s.

The result was obtained from the total number of push-ups done correctly within 30 s. If the arm was in over half of the movement to the end of time, it was counted as a full movement.

Two battery tests were performed to evaluate the muscle strength of the lower limbs: 1) vertical impulse test without assistance of the upper limbs, according to the standards mentioned by Matsudo (2004); and 2) the test of lifting chairs in 30 s, which has been recommended as a practical alternative to indirectly measure the strength of the lower limbs due to moderately high

correlated with the 1 RM test in “leg press” in men (0.78) and women (0.71) (Rikli and Jones 1999 apud Matsudo 2004).

To evaluate the nutritional status of the elders, body mass index (BMI), which is the indicator used to evaluate the ratio between weight and height of subjects, was used. Measurements of weight and height of the individual were recorded and evaluated according to recommended methods. BMI was calculated using the formula: $BMI = \text{weight (kg)} / \text{height (m)}^2$.

This way, the measurement unit for this indicator is kg/m^2 . The classification of nutritional status was performed from the gross value of BMI, which allows a classification, regardless of the gender, according to the World Health Organization (1997).

According to Matsudo (2004), the rating would be: below normal ≤ 18.5 , 18.5–24.9 for normal weight, overweight ≥ 25 , pre-overweight 25–29.9, 30–34.9 obese class 1, 35–39.9 obese class 2, and obese class 3 ≥ 40 .

Statistical analysis of the data was taken from descriptive statistics using SPSS version 15.0 to perform the calculation of minimum, average, maximum, and standard deviation for all variables. The student *t* test to compare means at the 5 % significance level in particular with the two tests was used to evaluate the strength of the lower limbs and between balance and lower limb strength, and a comparison between all tests was also performed. Pearson linear correlation was used to correlate the strength of the upper limbs, lower limbs, and flexibility. Chi square test at the 5 % significance level for superior strength, flexibility, and lower and logistic regression to classify members of the independent variable was the balance.

Results

The sample included 60 elderly people aged 60 to 82, constituting the group at an average of 67 years of age. Of these, 14 were male and 46 were female. In weight, the average was 74.5 kg, with a minimum weight of 52.2 kg and a maximum of 120 kg. Now, the stature presented was with a minimum of 152 cm, average of 166.9 cm, and maximum of 186 cm. The IMC has achieved the following results: a minimum value of 19.2, an average of 26.6, and a maximum of 36.6. The values are shown in Table 1.

Table 1 Descriptive statistics of the variables of age, weight, height, and BMI

Variables	Minimum	Average	Maximum	Standard deviation
Age	60	67	82	6.2
Weight	52.2	74.5	120.0	12.8
Stature	152.0	166.9	186.0	7.7
BMI	19.2	26.6	36.6	3.8

Data taken from own research

According to Table 2, the highest percentage of elderly people (50 %) are overweight, followed by 31.7 % normal weight, 13.3 % overweight type I, and the remaining 5 % obese type II.

Regarding the static balance test with visual control, we obtained a minimum of 2 s in a time of 30 s, average of 15.8 s, and a maximum of 30 s. In the sit-and-reach test, the minimum was 3 cm, with an average of 22.8 and maximum value of 43 cm. The elbow flexion test showed the minimum value of 4 replicates, with an average of 13.6 repetitions and the maximum value of 22 repetitions. The vertical jump test without the upper limbs showed less than 3 cm, an average of 12.6 cm, and maximum of 28 cm. For lifting the chair in 30 s, test showed a minimum value of 6 replicates for the average value of 11.1 repetitions and maximum of 16 repetitions. The values are shown in Table 3.

Comparing the average of vertical jump without the upper limbs (12.6) with the average of the chair lift test in 30 s (11.1), statistically significant at the 5 % level was found (*p* value=0.03), with the vertical jump test without assistance of the upper limbs having the highest average. In other words, individuals evaluated

Table 2 Nutritional status of the sample

Nutritional status	Number	Percentage
Normal weight	19	31.7 %
Pre-obese	30	50.0 %
Obese I	8	13.3 %
Obese II	3	5.0 %
Total	60	100.0 %

Data taken from own research

Table 3 Descriptive statistics of the variables of physical fitness

Variables	Minimum	Average	Maximum	Standard deviation
Static balance with visual control (balance)	2.0	15.8	30.0	8.5
Sit-and-reach test (flexibility)	3.0	22.8	43.0	8.8
Elbow flexion test (FMS)	4.0	13.6	22.0	4.0
Vertical jump test (IMF)	3.0	12.6	28.0	5.7
Lifting chair test (IMF)	6.0	11.1	16.0	2.3

Data taken from own research

performed better in the vertical jump without upper limb test.

It was found (Table 4) that there is a significant linear correlation between the strength of the upper limbs and lower limbs (p value=0.02); however, no significant correlation between upper limb strength and flexibility (p value=0.16). That is, the strength of the upper and lower members depends on the other; since the strength of the upper limbs are independent of flexibility.

Comparing the average of the static balance with visual control and vertical jump test, it was found that there are statistically significant at the 5 % level (p value=0.02) showing that the static balance with visual control had the highest average. In other words, the fitness group presented the best average of balance (15.8) than in the strength of the lower limbs (12.6).

Table 5 presents the results of tests comparing values among all tests.

As the data presented in Table 5, we see that the static equilibrium with visual control showed a significant difference compared to sit-and-reach test (0.00), vertical jump test (0.02), and chair lifting test (0.00).

Already, the sit-and-reach test showed a significant difference in relation to the elbow flexion

test (0.00), vertical jump test (0.00), and chair lifting test (0.00).

The elbow flexion test was significant with the chair lifting test (0.00).

There was no statistically significant difference between the vertical jump test and chair lifting test (0.06).

When performed logistic regression testing in relation to the dependent variable equilibrium, it was found that 12 individuals, corresponding to 20 % of the sample, are presented below the cut-off point (below -2) and 48 individuals, i.e., 80 %, had seen their balance within the established or above cut-off point (greater than -2).

Among the independent variables: flexibility (sit-and-reach test), strength of the upper limbs (elbow flexion test), and strength of the lower limbs (vertical jump without the upper limbs test and chair lift test in 30 s), only the strength of the lower limbs with the vertical jump without the upper limbs test was significant in the logistic model (X1). In other words, only the vertical jump without the upper limbs test is a risk factor for balance.

The coefficient for the test vertical impulsion without upper limb is -0.1125. The odd ratio for each increase in vertical impulse without assistance of the upper limbs is 0.8936, i.e., in every increase in the vertical jump without the upper limbs, there is a reduction of 11.25 % in the risk of not having balance.

Among the 60 patients evaluated, 33 (55 %) are practicing physical exercise and 27 (45 %) are not exercisers. Comparing the results of all tests in these individuals (Table 6), it appears that none of them showed a significant difference between practicing and non-practicing physical exercises.

Table 4 Correlation between strength of the upper limbs, lower limbs, and flexibility

	Lower limbs	Upper limbs
Flexibility	$r=0.30$	p value=0.02*
	$r=0.18$	p value=0.16 ns

Data taken from own research

ns not significant

*Significant at 5 %

Table 5 Comparison between all tests

Average	Static balance, with visual control	Sit-and-reach test	Elbow flexion test	Vertical jump test	Lifting chair test
SD	15.83	22.87	13.68	12.60	11.07
<i>p</i> value	8.54	8.76	4.08	5.68	2.31
		0.00*	0.08 ns	0.02*	0.00*
Average	Sit-and-reach test	Elbow flexion test	Vertical jump test	Lifting chair test	
SD	22.87	13.68	12.60	11.07	
<i>p</i> value	8.76	4.08	5.68	2.31	
		0.00*	0.00*	0.00*	
Average	Elbow flexion test	Vertical jump test	Lifting chair test		
SD	13.68	12.60	11.07		
<i>p</i> value	4.08	5.68	2.31		
		0.23 ns	0.00*		
Average	Vertical jump test	Lifting chair test			
SD	12.60	11.07			
<i>p</i> value	5.68	2.31			
		0.06 ns			

Data taken from own research

ns not significant

*Significant values $p < 0.02$

Discussion

According to the objective of this study which was to investigate the level of physical fitness of elderly people over 60, practicing physical exercise in relation to non-practitioners, it is observed that there were no significant values-related skills among these groups.

Unlike the results of this research, the study carried out by Etchepare et al. (2012) which aimed to verify the effect of the practice of gymnastics on variables of physical fitness (static balance, agility, and flexibility) in the elderly women, after 20 exercise sessions in a sample of 15 women, it was concluded that there was improvement in all tested physical qualities, i.e., we obtained an improvement in the index of overall physical fitness of elderly women engaged in regular exercise.

The restriction of this study is due to the fact that the evaluated sample was subjected to a physical exercise program with a pre-determined amount of sessions, i.e., a longitudinal monitoring not happening and could therefore be the factor that there were different statistics for the variables evaluated when compared with other studies where they had control of training sessions for the sample assessed.

However, when analyzing the statistics of the nutritional status of the target group of this research, it was observed that 50 % of seniors are overweight, 13.3 % obese type I, and 5 % obese type II, with 68.3 % at risk or already at risk for obesity, which brings various health ailments like heart disease, diabetes, and osteoporosis in adulthood. We conclude that performing regular exercise brings health benefits and promotes decreased risk of developing these disorders (ACSM 2000). The results show that the statements made by the physical activity program were not sufficient to modify the BMI of the elders.

The literature shows that the increased fat in the first decades of aging and fat loss in the later decades of life seem to be the most likely behaviors of adiposity in aging (Going and Lohman 1995) standard.

According to a survey of Santos and Sichieri (2005), with the objective of assessing the nutritional status of 699 elders aged 60 and over and comparing the body mass index ($BMI = kg/m^2$) with measures of adiposity and fat distribution in the elderly and middle-aged adults, it was found that 50.6 % of individuals aged between 60 and 69 years are at the level of pre-obesity, similar to the results shown in

Table 6 Comparison between physical fitness variables of practitioners and non-practitioners of physical exercise

	Exercise	Number	Average	Standard deviation	<i>p</i> value
Static balance with visual control	Practitioners	33	14.8	9.1	0.31
	Non-practitioners	27	17.0	7.7	
Sit-and-reach test	Practitioners	33	22.8	9.9	0.94
	Non-practitioners	27	22.9	7.2	
Elbow flexion test	Practitioners	33	14.5	4.3	0.07
	Non-practitioners	27	12, 7	3.6	
Vertical jump test	Practitioners	33	13, 5	6.5	0.20
	Non-practitioners	27	11.5	4.3	
Lifting chair test	Practitioners	33	11.4	2.4	0.27
	Non-practitioners	27	10.7	2.2	

Data taken from own research

the present study. Therefore, studies show that at this age there is a trend to a higher rate of fat mass relative to lean body mass, a factor that must be controlled by exercise programs.

For the variable balance, the average time of 15.8 s in 30 s is compared to the reference value of 16.9 s. For ages between 60 and 69 years old, it is observed that, in absolute values, the group is below the value quoted by Matsudo (2004). However, it is noteworthy that the group has reported a mean age of 67 years old, almost to the end of the reference range, which shows that the group is not bad at all, or that can be found in reference to the average of age.

Regarding the analysis of the balance variable between groups practicing and non-practicing physical exercise, a difference of 2.2 s was found, and the first group (practitioners of exercise). A low average of 14.8 s was found, and the second group (not practitioners) averaged 17 s, being above average. Considering the reference value, opposite values expected between the groups, because the practice of physical exercise seeks to improve physical fitness, which did not occur.

For the variable flexibility, an average of 22.8 cm was obtained, a result that is above the average for men (20–27 cm) and about average for women (22–26 cm) aged 60 to 69 years old, considering the normative values of flexibility for the sit-and-reach test suggested by Ribeiro et al. (2010). Previous studies aimed to identify the level of flexibility of men and women of different ages through the sit-and-reach test following the Canadian standardized test of fitness (CSTF) protocol and classify

them according to the table suggested by same and from the results obtained to prepare a new table that reflects the normative population studied.

Comparing the averages of practitioners and non-practitioners physical exercises, it was found that the value is 22.8 to 22.9 cm for practitioners and non-practitioners. These results, compared to the study by Ribeiro et al. (2010), are above average for men (20–27 cm) and about an average for women (22–26 cm) aged between 60 and 69 years old. However, do not expect the average of the group not practicing physical exercise could reach a value higher than the group of practitioners of physical exercise.

The data obtained are quite distinct from the values of other studies for elderly practitioners of regular exercise, showing that the exercise program conducted by these seniors does not have adequate intensity so that you can bring improvements to their quality of life.

The exercise contributes significantly to the flexibility, resistance exercises that improve the tensile strength of tendons and ligaments, and flexibility exercises maintaining the elasticity of tendons, ligaments, and muscles, therefore allowing full range of motion of the joint (Spirduso 2005). Study by Brown and Holloszy (1991) apud Spirduso (2005) found improvements in joint range of motion in people who participated in a program of stretching exercises with five times per week for 3 months, finding 35 % improvement in the hip flexion.

In a study performed with a sample of 51 elderly water aerobics Study Group of the Third Age program (GETI) of the State University of Santa Catarina

(UDESC), it was also found a positive result for improvement of levels of flexibility after a program physical activity for 6 months (Silveira 2006).

Simons (2012) found that flexibility has improved significantly in the groups of seniors who participated in strength training (10 %) and cardiovascular training (11 %) compared to the control group (2 %). Therefore, it is observed that the practice of regular exercise has benefits in terms of improved flexibility in the elders.

As for the strength of upper limb variable for this study, the average score (13.6) was found below the recommended by Matsudo (2004) (17.1), and when individuals are divided into practitioners and non-practitioners, average physical exercise shown is even smaller for the non-practitioners (12.7) than for practitioners (14.5).

During this study, for the variable lower limb strength, two tests for evaluation (vertical jump test without the upper limbs with an average of 12.6 and rising from a chair test in 30 s with an average of 11.1) were performed. In these tests, the practitioners of physical exercise, with an average of 13.5 for the vertical jump without the upper limbs and 11.4 for the lifting of the chair in 30 s, therefore are doing slightly better than non-exercisers with averages of 11.5 and 10.7, respectively. These values are even lower than the benchmarks cited by Matsudo (2004), showing the average of 16.5 for the test drive vertically without help of the upper limbs and 14.9 for the lifting of the chair test in 30 s.

The work of muscular strength through the gym with very light loads seems not to lead to significant gains in strength, reduction of sarcopenia, and mobility of elderly individuals (Matsudo et al. 2000). Moreover, Trancoso and Farinatti (2002), through a survey of studies on strength in older adults, show that there is some consensus that training programs can increase strength in individuals at all ages, but in spite of this agreement, other studies have doubts about the evolution of strength gain in the elders in response to strength training, especially when it comes to individuals with high levels of functional independence and/or programs conducted for long periods.

The authors point out that most studies reporting high earnings strengthen elders due to training focused on populations with impaired functional independence, whose strength levels at baseline tend to be reduced, which may influence the magnitude of reported earnings.

As individuals age, the physical skills such as strength and endurance become more important. Proper leg strength may prevent the individual from falling as it allows correct momentary loss of balance in time to avoid a fall, and the strength of the muscles of the upper body can reduce the amount of injuries caused from a fall interrupting the acceleration fall or stabilizing joints (Spiriduso 2005).

By using the test of balance as the dependent variable for performing the logistic regression analysis, the result obtained was that 20 % of the sample are with inadequate balance or below the cut-off point, and the other 80 % of the sample achieved results in the established or above the cut-off point. The values were obtained for the test of static balance with visual control to demonstrate that the practitioner group exercise (14.8 s) has the lowest balance compared to non-practicing group (17 s). This fact alone leads us to discuss that the program of physical activity may be beneficial for several deficiencies with the elders who have between the social, emotional, and even day-to-day tasks balls, but it left to be desired in maintaining the physical skills that it is of great importance in the health of this population.

For that, it is necessary to conduct further studies on this age group not only performed by physical education professionals and those facing the physical skills, but also by nutrition professionals and those related to the nutritional status of this population, as this is one of the limiting factors for the improvement and maintenance of physical fitness of elderly people, since obesity is a characteristic of the aging process, bringing much mass indexes of fat in the body.

Conclusion

It is concluded that there was no significant difference between groups, at the 5 % level of practitioners and non-practitioners of physical exercise; however, the importance of exercise was evident to improve or maintain all the components of physical fitness, even if taken into account the reduction and loss of physical conditioning that occurs during the aging process.

Therefore, the values obtained in this study shows very different results that literature presents to seniors who engage in regular exercise, therefore indicating that the time of the exercise program created by this sample may have interfered, so that it provides some change in

the quality of life of these people, promoting best rates or at least near recommended reference.

With the comparison of the results of all tests (balance, flexibility, and muscle strength), it was found no significant difference between practitioners and non-practitioners of physical exercise. These figures show that the group of seniors who were evaluated at regular physical exercise did not affect the results of the variables studied.

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