DOI: 10.4025/jphyseduc.v29i1.2956

Original Article

ASSOCIATION BETWEEN INSUFFICIENT PRACTICE OF PHYSICAL EXERCISE, WALKING, AND OTHER MODALITIES IN HEALTHY ELDERLY

ASSOCIAÇÃO ENTRE A PRÁTICA INSUFICIENTE DE EXERCÍCIO FÍSICO, CAMINHADA E OUTRAS MODALIDADES EM IDOSOS SAUDÁVEIS

Anderson Bernardino da Silva[1], Roberta Fernanda da Silva[2], André Mourão Jacomini[2], Henrique Luiz Monteiro[2]eAnderson Saranz Zago[2]

[1]Universidade de São Paulo, Ribeirão Preto-SP, Brasil.
[2]Universidade Estudual Paulista, Bauru-SP, Brasil.

ABSTRACT
The objective was to compare functional capacity and health parameters of older adults with insufficient practice of physical exercise (IPPE) and older practitioners of different modalities of physical exercise. A cross-sectional study with 113 older people divided into the following groups: G1 - IPPE; G2 - walking practitioners; G3 - walking practitioners associated with one or more modalities; G4 - practitioners of one modality; and G5 - practitioners of two or more modalities. The AAHPERD test battery was used to evaluate functional capacity and the body fat percentage and blood pressure health parameters were analyzed. Analysis of Variance and the Odds Ratio were used. The results show differences at the level of p <0.05 in coordination and strength (G3> G1 and G4), agility (G2, G3 and G5 <G1 and G4), aerobic endurance (G3 and G5 <G1 and G4), the General Functional Fitness Index (G2> G1 and G3, G5> G1 and G4), and diastolic blood pressure (G1> G4 and G5). The practice of walking and practice of two or more physical exercise modalities are associated with better functional capacity in older adults.
Key words: Aging, functional capacity, health parameters.

RESUMO
O principal objetivo foicomparar a capacidade funcional e parâmetros de saúde de idosos com prática insuficiente de exercício físico (IPPE) e idosos praticantes de diferentes modalidades de exercício físico. Trata-se de um estudo transversal, com 113 idosos, divididos nos seguintes grupos: G1 – IPPE; G2 –praticantes de caminhada; G3 – praticantes de caminhada associada a uma ou mais modalidades; G4 - praticantes de uma modalidade; G5 – praticantes de duas ou mais modalidades. A capacidade funcional foi avaliada pela bateria de testes da AAHPERD, e nos parâmetros de saúde foram analisados o percentual de gordura corporal e a pressão arterial. Para análise estatística utilizou-se Anova e OddsRatio. Os resultadosmostraramque diferenças ao nível de p<0,05 foram encontradas na coordenação e resistência de força, (G3 > G1 e G4) na agilidade (G2, G3 e G5 < G1 e G4) na resistência aeróbia (G3 e G5 < G1 e G4); no Índice de Aptidão Funcional Geral (G2 > G1 e G3; G5 > G1 e G4) e na pressão arterial diastólica (G1 > G4 e G5). A prática de caminhada e a prática de duas ou mais modalidades de exercícios físicos estão associadas a melhor aptidão funcional em idosos.
Palavras chaves: Envelhecimento; Capacidade funcional; Parâmetros de saúde.

Introduction

Aging can be characterized as a progressive accumulation of changes which occur with advancing age, causing increased susceptibility to acquiring various chronic diseases, especially cardiovascular diseases. It is also characterized as a universal process, susceptible to environmental influences, with variations between individuals[1].

Some studies have presented the regular practice of physical exercise as one of the factors that counteract the deleterious effects of aging[2], contributing significantly to physical abilities[3], body composition[4,5], and regulation of blood pressure[6,7], among other benefits.

Maintaining a high level of functional capacity could be an important factor for the elderly to maintain autonomy and independence. Several studies have sought better understanding of functional capacity declines, through analysis of physical abilities and the effect of physical exercise, verifying increased performance in tasks involving strength, flexibility, coordination, mobility, agility, and balance[3,8-11]. For example, regarding cardiorespiratory capacity, Murias et al.[12] verified that the elderly presented an increase in oxygen consumption (VO_2max) when submitted to 12-weeks cycle ergometer training. Vicent et al.[13], applying high (80% of 1- RM) and low resistance training (50% 1RM) intensities, for 24 weeks, found a significant increase in both strength and VO_2max in the elderly exposed to both intensities.

It is interesting to emphasize the effect of physical training on the prevention or treatment of various diseases, especially cardiovascular diseases, which stand out as one of the major causes of death in developed and developing countries, accounting for more than 17 million deaths in 2008, with the population over 60 years old being the most affected[14]. Hypertension accounts for about 45% of deaths caused by CVD and 51% of deaths caused by acute myocardial infarction, and is a direct cause of approximately 9.4 million deaths worldwide each year[14].

A low level of physical activity is considered an important risk factor for CVD, since physical training may facilitate a decrease in blood pressure values[6,7]. On the other hand, the practice of physical exercise is associated with the control of several non-transmissible chronic diseases, especially in the fight against risk factors for cardiovascular diseases, with improvement or maintenance in physical fitness and, consequently, functional capacity, factors that directly influence the quality of life during old age. Li et al.[15], in a meta-analysis of prospective studies with a length of at least five years, found an association between a higher level of occupational and free time physical activity with a lower risk of coronary heart disease and myocardial infarction. Furthermore, cardiorespiratory capacity has been related to other risk factors for cardiovascular diseases, such as: BMI, lipoprotein concentration, and blood pressure[16].

Despite the large number of studies showing the beneficial effects of regular physical activity, there is no consensus on the ideal model of physical exercise that optimizes these benefits. Thus, considering accessibility to the population, walking is a widely practiced activity as a way to promote health. Yazdanyar et al.[17] investigated the relationship between the 6-minute walk test and causes of mortality in individuals over 60 years of age, finding an association between a shorter distance walked with a higher risk of mortality and the incidence of CVD. However, does only this practice contain enough stimuli to promote health benefits for the practitioner? And what about a variety of physical exercise, how beneficial would it be? Is the habit of practicing varied physical exercises better than just walking? What is the association of these different habits with functional capacity, health parameters (body fat and blood pressure), and quality of life in the elderly?

Based on the foregoing and the abovementioned questions, the hypothesis of this study was that, elderly individuals who practice a greater variety of modalities of physical exercises, and not only walking, would present greater functional capacity, associated with a better profile of health parameters (lower BMI and waist-to-hip ratio, lower percentage of body fat, and lower blood pressure). It should be noted that due to the absence of studies that seek to analyze these relationships, it is necessary initially to study the "healthy" population so that subsequently, the diseases that affect this population can be incorporated into these studies. Thus, the objective of the present study was to compare the functional capacity and health parameters (anthropometric measures, percentage of body fat, blood pressure) of healthy elderly people, verifying the relationship between these variables among elderly people with insufficient exercise practice and elderly individuals who practice walking or other forms of physical exercise.

Methods

Participants

Elderly people aged 60 or over, living in the city of Bauru-SP, participated in this study. By means of a sample calculation, using the formula $N= (2(Z_{\alpha/2}+Z_{\beta})^2\sigma^2)/d^2$ of Luiz and Magnanini[18], considering the variable maximum oxygen consumption (VO_2max), in which µ1=28.3; µ2=32.8; σ=7.3; having as reference values the study of Murias et al.[12]; assuming an alpha value of 5% and a beta value of 10%, where $Z_{\alpha/2}$= 1.96; Zβ=1.28; we established a sample "N" of 17 individuals in each group. Furthermore, considering a design effect (*deff*) of 40%, a total of 23 participants in each group were established. The variable VO_2 maximum was chosen as it is one of the most commonly used variables in scientific studies to depict the state of functional capacity of the organism.

The selection of the participants was carried out through personal invitation to elderly people attending centers for the elderly in the city of Bauru. After the selection, the participants were divided according to their reported habitual practice of physical exercises. Participants who did not achieve the minimum physical exercise recommendations (150 minutes of physical exercise per week, performed at mild to moderate intensity), according to the American College of Sport Medicine (ACSM)[19] were allocated to the G1 group, while those who reported practicing over 150 minutes per week were allocated to the other groups. Thus, the elderly participants were distributed as follows: G1 – insufficient practice of physical exercise (IPPE); G2 – perform only unsupervised walking; G3 – practice walking and other forms of exercise; G4 – practice of only one type of physical exercise, except walking; G5 – practice two or more types of physical exercise, except walking.

All individuals were required to have been engaged in their physical activity habits for at least three months. A total of 113 healthy participants were recruited, mean age 67.12 (± 6.57) years, of whom 15 were male and 98 female. The G2 group only included 21 participants, due to the difficulty in recruiting elderly individuals with these characteristics. In the groups in which the sample N was higher than that proposed, all individuals were allocated with a number, the numbers were tabulated, and then random selection was performed automatically by the Excel program, to include 23 participants in each group. The method used to select and divide the groups is shown in Figure 1.

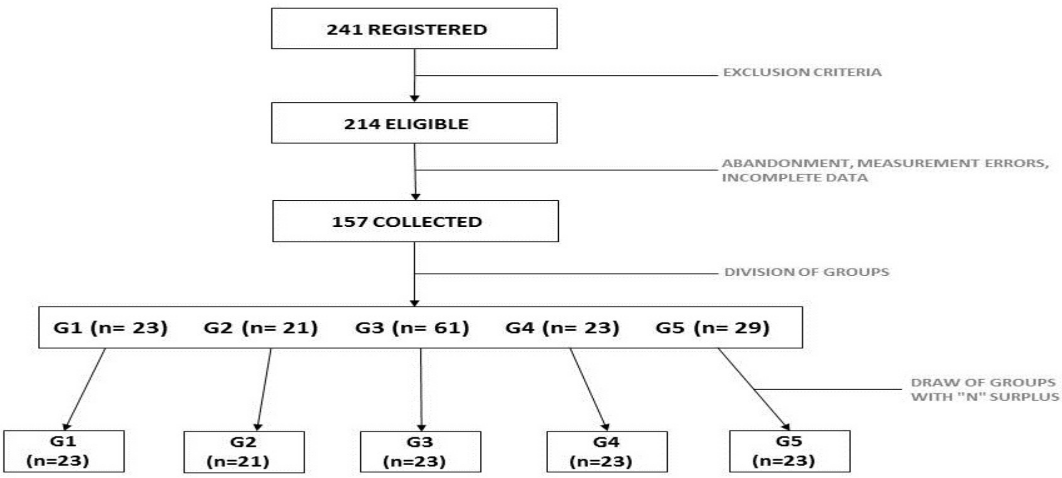

Figure 1. Sampling process

Note: G1 = insufficient practice of physical exercise; G2 = walking practice; G3 = walking associated with another modality; G4 = practitioners of a single modality; G5 = practitioners of two or more modalities
Source: The authors

The following inclusion criteria were adopted: not presenting cardiac problems (history of infarction, having a pacemaker), pulmonary disease, musculoskeletal and joint injuries, problems of balance control, or any other condition that impeded performance of the physical tests. Of the 241 elderly enrolled in the study, 214 were eligible to participate according to the inclusion criteria. However, ultimately, only 157 elderly people completed all the evaluations (sample loss of 57 elderly individuals). Prior to their participation, all the elderly people signed a free and informed consent form, approved by the ethics committee of the Faculty of Sciences of Unesp, Bauru (number 254.424).

Procedures

The data collection took place during three visits to the laboratory. On the first visit, the participants signed the informed consent form, answered an anamnesis, underwent blood pressure measurement and anthropometric measurements, and performed adaptation to the treadmill. On the second visit, blood pressure was measured again and, shortly after, physical ability tests were carried out using the Test Battery of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD). On the third visit, the blood pressure was measured, and soon after, the participants were submitted to the body composition test and the exercise test.

Anamnesis

The anamnesis was used to define the inclusion criteria and describe the sample evaluated. In addition to registration information, questions were elaborated on family history and personal diseases (characterization, time of onset, and medication for treatment). In particular, the current habitual practice of physical exercise was verified through previously formulated questions (including type of activity, activity engagement time, weekly frequency, and daily time).

Blood pressure

Blood pressure was measured by the same evaluator, previously trained and with extensive experience in this type of collection. The evaluation occurred after the participants had remained for five minutes in the sitting position at rest, on three separate days, according to the VII Brazilian Guidelines for Hypertension [20]. An aneroid sphygmomanometer, appropriate for the circumference of the participant's arm, was used, positioning the stethoscope on the brachial artery. The mean of the three measurements was retained for the analysis.

Functional capacity

Functional capacity was assessed using the test battery proposed by AAHPERD. All tests were performed in the morning, prior to any physical exercise sessions. Briefly, the AAHPERD test battery contains assessment of the following physical capabilities: Coordination - time to complete a task that requires precise manipulation of the positioning of cylindrical objects; Flexibility - sit and reach test; Muscle strength resistance - maximum amount of forearm flexions performed over a period of 30 seconds (holding a 2 kg halter for women and 4 kg for men); Agility and dynamic balance - time to complete a task of getting up from a chair, walking around cones, and returning to the chair; and Aerobic endurance - time to travel (walking) a course of 804.67 meters. The AAHPERD test battery is fully described in previous studies [21,22]. The general functional fitness index (GFFI) was calculated using normative data obtained from the sum of the percentiles, given by the score of each test, as described in previous studies [22,23]. All items included in the AAHPERD test battery have demonstrated good reliability and validity criteria for application in the elderly. The test re-test reliability coefficients for all items have been reported in the range of r = 0.80-0.99[22].

Ergometric test

For the indirect determination of maximal oxygen consumption (VO2max), the modified Balke protocol was used [24]. The participants performed an ergometric treadmill adaptation on the first day of evaluations to determine a speed at which the participant could walk comfortably during the test (which occurred on the third day of evaluations). The protocol consisted of maintenance of a speed between 1.6 and 7.2 km/h, previously determined, starting with a slope of 0% and increasing 2% every two minutes. At the beginning and end of each stage, blood pressure was measured and the subjective perception of effort was evaluated through the Borg Scale, positioned in front of the participant. The test was discontinued when submaximal heart rate reached 85% of maximal HR (as determined by Karvonen's equation[25]), or in the event of abrupt elevation of blood pressure, persistent heart rate reduction, severe physical exhaustion, pain or dyspnea. The participant underwent active recovery for at least 3 minutes followed by passive, with blood pressure and heart rate measured until they returned to their initial resting levels. The treadmill test protocol was chosen as it is considered safe for the elderly population, since it presents constant velocity and gradual load increment (slope) every minute. For the test to be considered valid, it was required to last between 10 and 15 minutes. In cases where this did not occur, a new day was scheduled for the test to be reperformed at a modified speed. The result enabled calculation of the maximum oxygen consumption, based on a linear regression analysis between HR and VO_2 for each stage and for each individual [24].

Body fat percentage

Body fat concentration analysis was performed using the dual energy X-ray absorptiometry (DXA) method with a Wi/HOLOGIC INC device, Bedford, USA. In this study, the total body fat concentration, expressed in percentage values, was used for analysis..

Statistical analysis

Participants were divided into the five groups, using information obtained in the anamnesis, and according to previously described criteria. The Shapiro Wilk test was used to verify the normality of the data distribution and the Levene’s test to verify the homogeneity of the variances. Data are presented as means and standard deviations. For the comparisons between groups, the analysis of variance of the walk was used and the components of functional capacity, weekly volume of physical exercise, and health parameters (anthropometric measurements, fat percentage, systolic and diastolic blood pressure) were considered as dependant variables.

Finally, the Odds Ratio calculation was used to verify the relationship between the elderly group with IPPE and each group of elderly people practicing different physical exercise modalities. In functional capacity, frequencies below or above the 50th percentile were used for analysis of each physical capacity test, and below or above the 25th percentile for GFFI. For the health parameters, the consumption of antihypertensive medication, cut-off values of BMI (below or greater than 25), waist-hip ratio (below or above 102 cm for men and 88 cm for women), systolic blood pressure (below or above 130 mmHg)[20], and diastolic blood pressure (below or above 85)[20] were used. A significance level of $p < 0.05$ was considered, and the SPSS statistical program was used for the analyses.

Results

Table 1 presents the characteristics of the participants, as well as comparisons between the groups for some health parameters. As can be observed, only the diastolic blood pressure presented a significant difference, with the elderly in the G4 and G5 groups presenting lower values compared to the G1 group (p = 0.02 and 0.001 respectively).

Table 1. Characteristics of the elderly studied and their respective risk factors, according to the distribution of the studied population by groups

	G1 (n = 23)	**G2 (n = 21)**	**G3 (n = 23)**	**G4 (n = 23)**	**G5 (n = 23)**
Age (years)	68.78 ± 8.29	65.67 ± 6.15	66.91 ± 6.96	67.35 ± 5.82	66.78 ± 5.62
Weight (kg)	73.73 ± 16.09	65.93 ± 9.38	70.49 ± 13.88	71.59 ± 14.86	68.34 ± 11.85
Height (m)	1.59 ± 0.07	1.56 ± 0.06	1.59 ± 0.08	1.57 ± 0.08	1.58 ± 0.07
BMI (kg/m^2)	29.14 ± 5.19	26.91 ± 3.35	27.77 ± 5.06	28.99 ± 5.45	27.51 ± 4.80
Waist (cm)	95.91 ± 17.31	91.16 ± 7.22	92.57 ± 8.94	98.09 ± 12.45	92.57 ± 13.80
Hip (cm)	106.87 ± 11.82	101.10 ± 5.89	104.35 ± 11.20	106.52 ± 12.79	104.48 ± 10.11
WHR	0.90 ± 0.14	0.90 ± 0.06	0.89 ± 0.05	0.92 ± 0.06	0.88 ± 0.09
% fat	36.93 ± 8.46	34.47 ± 6.24	38.20 ± 6.39	37.25 ± 7.81	37.81 ± 6.91
SBP (mmHg)	125.09 ± 10.34	120.57 ± 8.45	122.35 ± 8.43	121.74 ± 9.48	119.04 ± 11.16
DBP (mmHg)	79.52 ± 6.89	75.71 ± 7.88	74.87 ± 6.16	73.52 ± 5.73[a]	72.09 ± 6.62[a]
Individuals using antihypertensives	13 (56.52%)	8 (38.1%)	9 (39.13%)	12 (52.18%)	7 (30.44%)

Note: BMI = body mass index; WHR = waist-hip ratio (waist circumference divided by hip circumference); SBP = systolic blood pressure; DBP = diastolic blood pressure; G1 = insufficient practice of physical exercise; G2 = walking practice; G3 = walking associated with another modality; G4 = practitioners of a single modality; G5 = practitioners of two or more modalities.
Source: The authors

Table 2 presents the results of functional capacity and volume of weekly physical exercise. Differences were found in the coordination and strength test, where the G3 presented better performance than the G1 (p=0.03) and G4 (p = 0.03). For the agility test, the G2, G3, and G5 were better than the G1 (p=0.01, 0, and 0.001) and G4 (p=0.001, 0.001, and 0.001). In the aerobic resistance test, the G3 and G5 were superior to the G1 (p=0.001 and 0.03) and G4 (p=0.001 and 0.03). For GFFI, the G2 scored higher than the G1 (p=0.03), while the G3 and G5 presented higher scores than the G1 (p=0.001 and 0.001) and G4 (p=0.001 and 0.01).

Table 2. Functional capacity and volume of physical exercise of the elderly subdivided according to the practice of physical exercises

Physical Capacity	**G1** (n = 23)	**G2** (n = 21)	**G3**(n = 23)	**G4**(n = 23)	**G5**(n = 23)
Coordination (s)	15.63± 5.7	12.85 ± 2.3	12.10 ± 3.6[ad]	15.60 ± 3.4	13.48 ± 4.2
Flexibility (cm)	48.70 ± 8.3	57.86 ± 9.9	55.43 ± 13.6	54.63 ± 16.5	53.09 ± 11.7
Strength resistance (rep)	18.78 ± 4.5	22.52 ± 4.4	24.52 ± 4.8[ad]	19.70 ± 5.4	22.87 ± 5.7
Agility (s)	30.96 ± 6.1	25.90 ± 4.4[ad]	23.73 ± 4.2[ad]	31.43 ± 5.1	25.71 ± 5.2[ad]
Aerobic resistance (s)	574.22 ± 81.4	530.48 ± 35.6	496.09 ± 67.7[ad]	574.39 ± 74.6	515.57 ± 69.2[ad]
GFFI	145.01 ± 79.2	221.10 ± 76.2[a]	282.47 ± 81.3[ad]	155.43 ± 84.4	238.63 ± 97.3[ad]
VO_2max (ml/kg/min)	24.02 ± 8.3	30.06 ± 8.4	30.53 ± 8.0	25.70 ± 7.8	28.13 ± 7.7
Volume of P.E.	5.22 ± 18.3	234.0 ± 119.8[acd]	318.91 ± 115.9[ad]	149.87 ± 44.3[a]	303.26 ± 132.1[ad]

Note: GFFI = general functional fitness index; P.E.= Physical exercise; G1 = insufficient practice of physical exercise; G2 = walking practice; G3 = walking associated with another modality; G4 = practitioners of a single modality; G5 = practitioners of two or more modalities.
Source: The authors

Figure 2 presents the results of the risk calculation (oddsratio) according to criteria described previously. Significant results were found in the coordination test for the G2 (oddsratio = 5, CI 95%: 1.13 – 22.20) and G3 groups (oddsratio = 31, CI 95%: 6.25 – 160.54), in the strength test, for the G2 (oddsratio = 4.8, CI 95%: 1.29 – 17.87), G3 (oddsratio = 6.75, CI 95%: 1.82 – 25.03), and G5 groups (oddsratio = 4.78, CI 95%: 1.29 – 16.98), in the agility test, for the G3 group (oddsratio = 8.08, CI 95%: 1.52 – 42.93), in the aerobic resistance test, for the G3 (oddsratio = 20.16, CI 95%: 2.31 – 175.67) and G5 groups (oddsratio = 24, CI 95%: 2.75 – 209.06), and in the GFFI for the G3 group (oddsratio = 7.39, CI 95%: 1.89 – 28.94).

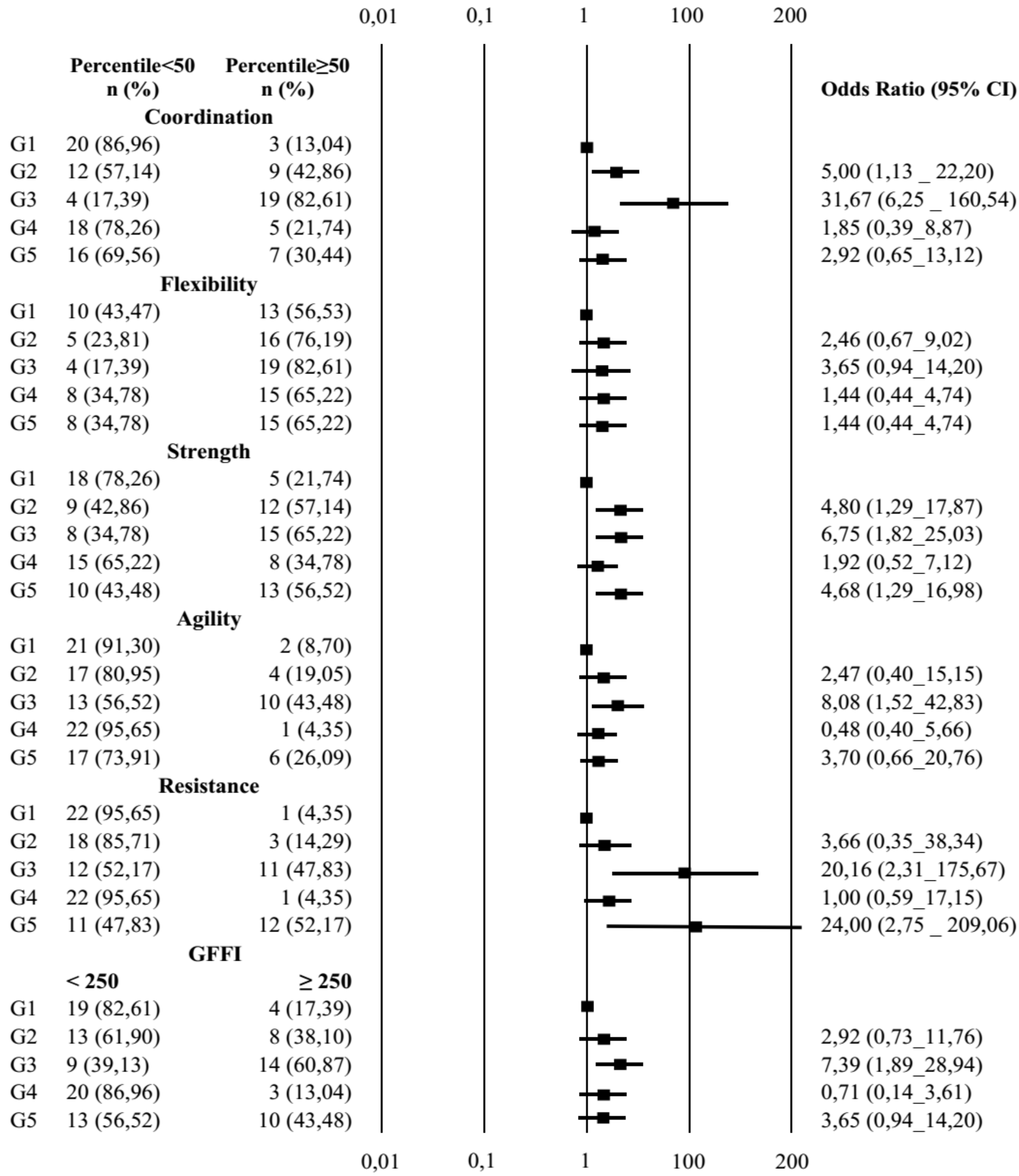

Figure 2. Calculation of risk (oddsratio) for functional capacity components
Source: The authors

Discussion

Considering the health parameters evaluated, significant differences were found only in diastolic blood pressure, in which the elderly in the group practicing one modality and the elderly in the group practicing two or more modalities (not including walking) presented the lowest values. Although there is no evidence that certain modalities of physical exercise are more efficient in reducing blood pressure, studies with different intervention methods (different modalities, volumes, and intensities) have shown a reduction in systolic and diastolic blood pressure during the day[7]. Studies indicate that physical training reduces 24-hour ambulatory blood pressure, with greater evidence for aerobic exercise[26]. In addition, increased cardiorespiratory capacity is associated with a lower increase in blood pressure throughout the aging process[27].

Although not analyzed in the present study, the potential physiological mechanisms involved in the responses from the regular practice of physical exercises are: (a) an increase in nitric oxide concentrations, a potent vasodilator responsible for the reduction in peripheral vascular resistance[28]; (b) lower activation of the renin-angiotensin system, responsible for the vasoconstrictor responses[29]; (c) an increase in the anti-oxidant capacity, which, in addition to reducing the damage from oxidation, increases the bioavailability of nitric oxide[28]; (d) adaptations favorable to the physical structures of blood vessels, reducing or preventing arterial stiffness[30]; (e) less activation of the sympathetic nervous system, generating lower cardiac work[31], and (f) greater baroreflex sensitivity and, consequently, greater stability in blood pressure values[31].

Although the present study also found no significant values for the other health parameters, such as BMI, WHR, and body fat percentage, some studies have verified that individuals who practice physical exercise, besides demonstrating better functioning of the cardiorespiratory system, also present lower values in risk factors for cardiovascular diseases[32]. As with the systolic blood pressure, the absence of differences in these variables may also have occurred due to the fact that the participants in this study were healthy, as established by the inclusion criteria.

Regarding the number of participants taking antihypertensive drugs, although the G5 group included a considerably lower number of individuals who used antihypertensive medication compared to the G1 group (the largest difference between groups) their DBP was lower, on the other hand, the G4 group presented a similar frequency to the G1 group (the smallest difference between the groups) and their DBP was also lower, indicating that the results did not follow any trend.

Regarding the results of the functional capacity variables, it is possible to perform two types of interpretations, since the analyzes were performed with continuous data (in which the groups were compared using gross values of the result of each motor test) and categorical data (where, from a reference population, the score of each test was used to verify the chance of each active elderly group having a higher level of capacity in relation to the elderly with IPPE).

As expected, in general, the results of the functional capacity tests indicated worse performance of the IPPE group compared to the others, especially when compared to the groups who practiced walking associated with other modalities. It is also interesting to note the differences found for the group of elderly people practicing only one modality, which were similar to those found for the elderly in the IPPE group. Through analysis of the motor performance tests, it can be verified that the group of practitioners of walking associated with other modalities were better in four of the five tests applied when compared to the elderly with IPPE and with the elderly that practiced one modality of physical exercise, contributing to the higher GFFI value in relation to these same groups. In a similar way, however, with lower differences, elderly people practicing two or more modalities demonstrated better performance in two motor tests and the GFFI compared to the elderly with IPPE and the elderly practicing one physical exercise modality.

The GFFI values of the elderly who practice walking suggest that there are benefits of this practice on functional capacity when compared to the elderly with IPPE. Roma et al.[8] in a one-year intervention study, investigated the effects of walking compared to anaerobic (practiced in a gym) exercises in untrained elderly. The authors verified an increase in the performance of lower limb strength, balance, and walking tests in the elderly who practiced walking, while anaerobic exercises improved speed, balance, and flexibility. In the case of the present study, both walking and the association with physical exercise modalities were efficient to increase some components of functional capacity.

Due to the ease of access to practice walking, this is an activity commonly practiced by the population. Merom et al.[33] conducted a longitudinal study with the Australian population and found that between 1989 and 2000 there was an increase in the proportion of people who walk, and those who practice walking associated with the another type of physical exercise, as well as a decrease in the proportion of those who practice other modalities not associated with walking. In the present study, the practitioners of walking associated with other modalities of physical exercise (G3) obtained the highest value of GFFI, in comparison with individuals with IPPE (G1) and those who practice a single modality (G4). This result reflects the better performance of these elderly participants in all motor tests (except the flexibility test) compared to the G1 and G4 groups. Gudlaugsson et al.[34], performed multimodality training (daily walking of 20-35 minutes, plus a circuit of resistance exercises performed in a gym, twice a week for 6 months) in the elderly over 70 years of age, finding an increase in agility, strength, and aerobic resistance, as well as better results in reported quality of life, physical activity level, and BMI compared to the control group. Several other studies have also found beneficial effects of physical training that encompass multiple physical abilities in the elderly, such as increased performance in strength and balance tests[35], walking speed, and a decreased risk of falls[36], as well as an increase in the performance of functional and cognitive tests[37].

Through interpretation of the results presented in Figure 2, it is possible to gain an even clearer view of the differences in functional capacity. We can consider that, given that the elderly walk (G2 group), they are 5 times more likely to perform well in coordination in relation to the elderly with IPPE, whereas when they practice walking associated with other modalities (G3 group) this chance rises to 31.67 times. In the strength test, the associations were similar for groups G2, G3, and G5. In the agility test, only the elderly of the G3 group presented a significant association, with an 8.08-fold chance of performing well. In the strength test, the associations were similar for groups G2, G3, and G5. In the aerobic resistance test, groups G3 and G5 presented similar associations, being 20, 16, and 24 times as likely to perform well. In the GFFI, only the G3 group demonstrated a significant association, with a probability of 7.39 times of having a high index in relation to the elderly with IPPE. The analyses performed with the health parameters did not find any significant associations.

These results show that when exposed to a greater variety of physical exercises the elderly can perform well in tests that simulate everyday tasks, especially when the practice of walking in association with other modalities is considered, which seems to provide a better stimulus for the maintenance of better levels of functional capacity in the elderly, whereas, the insufficient practice of physical exercise and the practice of only one modality of exercise other than walking, does not seem to bring these benefits. However, due to the cross-sectional bias of the present study, this claim needs to be further studied.

In general, these results also confirm the positive relationship between physical exercise practice and good performance in functional capacity tests, indicating the beneficial effects of exercise to maintain the ability to perform everyday tasks. Giné-Garriga et al.[38] in a meta-analysis study verified that several types of physical exercise increase performance in tests of functional capacity, in addition to which, a high level of physical activity practice has been associated with a low risk of dependence to perform activities of daily living in older adults [39]. Greater autonomy is related to better quality of life, and as shown by Vriendt et al.[40], a physical exercise program is efficient in increasing performance in tasks of daily living and in the improvement of the reported quality of life.

In summary, the practice of different modalities provides differences in functional capacity for the elderly, reflecting better GFFI values, especially for the G2, G3, and G5 groups, and differences in DBP, even though blood pressure values were very close. For all other parameters, no differences were noted. In this context, it is interesting to make some notes that contribute to the interpretation of the results presented herein. Initially it has to be taken into account that the elderly selected for this study were, according to the inclusion criteria, considered healthy and, therefore, did not present great differences, especially in the health parameters. Another aspect worth mentioning was the low GFFI obtained by the participants. Although older people practicing two or more modalities (associated or not with walking) obtained the highest values of GFFI, this remained in a regular category according to the normative tables previously described[21-24]. Thus, the absence of differences in SBP and body composition may have occurred due to the fact that this study did not involve elderly individuals with high GFFI values and unhealthy elderly individuals in relation to the parameters studied.

Due to the cross-sectional design, it is not possible to establish causal relationships between the variables presented in this study. Although it is clear from the results presented that there is a relationship between variables, there is no way to state that the best performance of a certain group of elderly people is a consequence of the type of physical exercise practiced, since there is a possibility of greater functional independence leading to the practice of certain physical exercise modalities. Other limiting characteristics were the lack of measurement of the intensity of the physical exercise practiced by the elderly and the non-use of a validated instrument to verify the habitual practice of physical exercise, however, it should be noted that obtaining the data via "open questions" was necessary due to the characteristics of information required for the division of groups.

Finally, this was a preliminary study on the relationship between different types of physical exercise and functional capacity and health parameters in the elderly, which provides support to the claim that two or more exercise modalities bring significant benefits to the functional capacity of the elderly, especially when these modalities include walking. Future work should be performed considering different levels of GFFI, percentage of fat, and blood pressure, among others.

Conclusions

The present study indicated that elderly people who practice multimodalities of physical exercise (associated or not with walking) present greater functional capacity than elderly people with insufficient practice of physical exercise (IPPE) and elderly individuals who practice a single modality. Consequently, elderly people who practice walking also have better functional capacity than elderly individuals with IPPE. Furthermore, elderly people who practice other modalities of physical exercise not associated with walking demonstrated lower values of diastolic blood pressure compared to the elderly with IPPE. Thus, it is concluded that in healthy elderly, different physical exercise practices are related to better functional capacity, without changes in health parameters.

These results contribute to the understanding of the consequences on the health status of the elderly when exposed to different modalities of physical exercise, and the importance of functional capacity and other health parameters for quality of life of the population over 60 years of age.

References

1. Harman D. The aging process. ProcNatlAcadSci 1981;78 (11):7124–8. DOI:10.1073/pnas.78.11.7124
2. Hamer M, Oliveira C, Demakakos P. Non-Exercise Physical Activity and Survival. English Longitudinal Study of Ageing. Am J Prev Med 2014;47 (4):452-460. DOI: 10.1016/j.amepre.2014.05.044.
3. Teixeira CV, Gobbi S, Pereira JR, Ueno DT, Shigematsu R, Gobbi LT. Effect of square-stepping exercise and basic exercises on functional fitness of older adults. GeriatrGerontolInt 2013;13(4):842-8.DOI: 10.1111/ggi.12011.
4. Beavers KM, Ambrosius WT, Nicklas BJ, Rejeski WJ. Independent and combined effects of physical activity and weight loss on inflammatory biomarkers in overweight and obese older adults. J Am GeriatrSoc 2013;61(7):1089-94.DOI: 10.1111/jgs.12321.
5. ChaléA,Cloutier GJ, Hau C, Phillips EM, Dallal GE, Fielding RA. Efficacy of whey protein supplementation on resistance exercise-induced changes in lean mass, muscle strength, and physical function in mobility-limited older adults. J Gerontol A BiolSci Med Sci 2013;68(6):682-90. DOI: 10.1093/gerona/gls221.
6. Whelton SP, Chin A, Xin X, He J.Effect of Aerobic Exercise on Blood Pressure: A Meta-Analysis of Randomized Controlled Trials.Ann Intern Med 2002;136(7):493-503. DOI: 10.7326/0003-4819-136-7-200204020.
7. CornelissenVA, Buys R, Smart NA. Endurance exercise beneficially affects ambulatory blood pressure: a systematic review and meta-analysis. J Hypertens 2013;31(4):639–48. DOI: 10.1097/HJH.0b013e32835ca964.
8. Roma, M.F, Busse A. L, Betoni R A, Melo AC, Kong J, Santarem JM, Jacob Filho W. Effects of resistance training and aerobic exercise in elderly people concerning physical fitness and ability: a prospective clinical trial. Einstein 2013;11(2):153-7. DOI: 10.1590/S1679-45082013000200003.
9. Yoshida D, Nakagaichi M, Saito K, Wakui S, Yoshitake Y. The relationship between physical fitness and ambulatory activity in very elderly women with normal functioning and functional limitations. J PhysiolAnthropol 2010;29(6):211-218. DOI: 10.2114/jpa2.29.211.
10. Shigematsu R, Okura T. A novel exercise for improving lower-extremity functional fitness in the elderly. Aging ClinExp Res 2006;18(3):242-248. DOI: 10.1007/BF03324655.
11. Hallage T, mkrause MP, Haile L, Miculis CP, Nagle EF, Reis RS, Da Silva SG. The effects of 12 weeks of step aerobics training on functional fitness of elderly women. J strengh Cond Res 2010;24(8):2261-2266. DOI: 10.1519/JSC.0b013e3181ddacc6.
12. Murias, J.M., Kowalchuk, J.M., Paterson, D.H. Time course and mechanisms of adaptations in cardiorespiratory fitness with endurance training in older and young men. J ApplPhysiol 2010;108(3):621-627. DOI: 10.1152/japplphysiol.01152.
13. Vincent KR, Braith RW, Feldman RA, Kallas HE, Lowenthal DT. Improved cardiorespiratory endurance following 6 months of resistance exercise in ederly men and women. Arch Intern Med 2002;162(6):673-678. DOI: 10.1001/archinte.162.6.673.
14. Mendis S, Puska P, Norrving B. World Health Organization. Global Atlas on Cardiovascular Disease Prevention and Control. Geneva; 2011.
15. Li J, Siegrist J. Physical Activity and Risk of Cardiovascular Disease - A Meta-Analysis of Prospective Cohort Studies. Int J EnviromentalResarch Public Health 2012;9(2):391-407. DOI: 10.3390/ijerph9020391.
16. Eaton Cb, Lapane Kl, Garber Ce, AssafAr, Lasater Tm, Carleton Rc. Physical activity, physical fitness, and coronary heart disease risk factors. J Am Coll Sport Med 1994;27(3):340-346. DOI: 10.1249/00005768-199503000-00009.
17. Yazdanyar A, Aziz MM, Enright PL, Edmundowicz D, Boudreau R, Sutton-Tyrell K, et al. Association Between 6-Minute Walk Test and All-Cause Mortality, Coronary Heart Disease-Specific Mortality, and Incident Coronary Heart Disease. J Aging Health 2014;26(4):583-599. DOI:10.1177/0898264314525665.
18. Luiz R, Magnanini M. The logic of sample size determination in epidemiological research. Cad Saude Colet 2000;8(2):9-28.

19. American College of Sports Medicine.American College of Sports Medicine position stand. Exercise and physical activity for older adults. Med Sci Sports Exerc 2009;41(7):1510-1530.DOI: 10.1249/MSS.0b013e3181a0c95c.
20. Sociedade Brasileira De Hipertensão. Diretrizes Brasileiras de Hipertensão VII. Rev Hipertensão 2016;13(1).
21. Zago AS, Gobbi S. Valores normativos da aptidão funcional de mulheres de 60 a 70 anos. Rev Bras de Ciênc e Mov 2003;11(2):77-86. DOI: 10.18511/0103-1716.
22. Osness WH. Functional fitness assessment for adults over 60 years. Reston: American Alliance for Health, Physical Education, Recreation and Dance; 1990.
23. Benedetti TRB, Mazo GZ, Gobbi S, Amorim M, Gobbi LT, Ferreira L, Hoefelmann CP. Valores normativos de aptidão funcional em mulheres de 70 a 79 anos. RevBras de Cineantrop&Desemp Hum 2007;9(1):28-36. DOI: 10.5007/%25x.
24. Farinatti PTV. Envelhecimento, promoção da saúde e exercício. Manole: Barueri; 2008.
25. Karvonen J, Vuorimaa T. "Heart rate and exercise intensity during sports activities. Practical application". Sport Med 1988;5(5):303-311. DOI: 10.2165/00007256-198805050-00002.
26. Gomes C, Jr C, Gomides IRS, Cristiane IA. Acute and chronic effects of aerobic and resistance exercise on ambulatory blood. Clinics 2010;65(3):317-326. DOI: 10.1590/S1807-59322010000300013.
27. Liu J, Sui X, Park YM, Cai B, Liu J, Blair SN. Effects of cardiorespiratory fitness on blood pressure trajectory with aging in a cohort of healthy men. J Am CollCardiol 2014;64(12):1245-1253. DOI: 10.1016/j.jacc.2014.06.1184
28. Feairheller, D. L., M. D. Brown, J. Y. Park, T. E. Brinkley, S. Basu, J. M. Hagberg, R. E. Ferrell and N. M. Fenty-Stewart. Exercise training, NADPH oxidase p22phox gene polymorphisms, and hypertension. Med Sci Sports Exerc 2009;41(7):1421-1428. DOI: 10.1249/MSS.0b013e318199cee8.
29. Najjar, S. S., A. Scuteri and E. G. Lakatta. Arterial aging: is it an immutable cardiovascular risk factor? Hypertension 2005;46(3):454-462. DOI: 10.1161/01.HYP.0000177474.06749.98.
30. Tordi, N., L. Mourot, E. Colin and J. Regnard. Intermittent versus constant aerobic exercise: effects on arterial stiffness. Eur J ApplPhysiol 2010;108(4):801-809. DOI: 10.1007/s00421-009-1285-1.
31. Droguett, V. S., C. Santos Ada, C. E. de Medeiros, D. P. Marques, L. S. do Nascimento and S. Brasileiro-Santos Mdo. Cardiac autonomic modulation in healthy elderly after different intensities of dynamic exercise. ClinInterv Aging 2015;10:203-208. DOI: 10.2147/CIA.S62346.
32. Vasconcelos APSL, Cardozo DC, Luchetti ALG, Luchetti G. Comparison of the effect of different modalities of physical exercise on functionality and anthropometric measurements in community-dwelling older women. J Body MovTher 2016;20(4):851-856. DOI: 10.1016/j.jbmt.2016.02.010.
33. Merom D, Phongsavan P, Chey T, Bauman A. Long-term changes in leisure time walking, moderate and vigorous exercise: Were they influenced by the national physical activity guidelines? J Sci Med Sport 2006;(9):199–208. DOI: 10.1016/j.jsams.2006.03.021.
34. Gudlaugsson J, Gudnason V, Aspelund T, Siggeirsdottir K, Olafsdottir AS, Jonsson P V, et al. Effects of a 6-month multimodal training intervention on retention of functional fitness in older adults: A randomized-controlled cross-over design. Int J BehavNutr Phys Act 2012;9(1):107. DOI: 10.1186/1479-5868-9-107.
35. 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. Rejuv Res 2013;16 (2):105-114. DOI: 10.1089/rej.2012.1397.
36. Abbema R V, Greef M D, Crajé C, Krijnen W, Hobbelen H. What type , or combination of exercise can improve preferred gait speed in older adults ? A meta-analysis. BMC Geriatr 2015;15(72):1-16. DOI: 10.1186/s12877-015-0061-9.
37. Vaughan S, Wallis M, Polit D, Steele M, Shum D, Morris N. The effects of multimodal exercise on cognitive and physical functioning and brain-derived neurotrophic factor in older women : a randomised controlled trial. Age Ageing 2014;43(5):623-629. DOI: 10.1093/ageing/afu010.
38. Giné-Garriga M, Roqué-Fíguls M, Coll-Planas L, Sitjà-Rabert M, Salvà A. Physical exercise interventions for improving performance-based measures of physical function in community-dwelling , frail older adults : a systematic review and meta-analysis. ArchphyscialMedRehabil 2014;95(4):753-769. 10.1016/j.apmr.2013.11.007.
39. Marques EA, Baptista F, Santos DA, Silva AM, Mota J, Sardinha LB. Risk for losing physical independence in older adults: The role of sedentary time, light , and moderate to vigorous physical activity. Maturitas 2014; 79(1):91-95. DOI: 10.1016/j.maturitas.2014.06.012.
40. Vriendt PDE, Peersman W, Florus A, Verbeke M, Velde D. Improving health related quality of life and independence in community dwelling frail older adults through a client-centred and activity-oriented program: a pragmatic randomized controlled trial. J NutrHealaging. 2016;20(1):35-40. DOI: 10.1007/s12603-015-0581-1.

Received on Jul, 20, 2017.
Reviewed on Sep, 19, 2017.
Accepted on Nov, 22, 2017.

Author address: Anderson Bernardino da Silva, Av. Luiz Edmundo Carrijo Coube, 14-01, Vargem Limpa, CEP: 17033-360, SP, CEP 17013-690. Email: silva.edfisica@usp.br.