EQUIPMENT IN SENIOR GYMS: INFLUENCE ON THE BEHAVIOR OF BLOOD PRESSURE AND HEART RATE OF ELDERLIES

Equipamentos das academias da terceira idade: influência sobre o comportamento da pressão arterial e da frequência cardíaca de idosos

Sillas Oliveira Leonel Júnior[a], Mateus Dias Antunes[a], Ramon Gustavo de Moraes Ovando[a], Ana Paula Serra de Araújo[a], Flávio Bortolozzi[a], Marcelo Picinin Bernuci[a], Sônia Maria Marques Gomes Bertolini[a]

ABSTRACT

OBJECTIVE: To analyze the behavior of blood pressure and heart rate in elderly people practicing physical exercises in Maringá, Paraná, Brazil. **METHODS:** 70 elderly volunteers were evaluated, 41 women and 29 men, with a mean age of 67.2 ± 6.6 and 65.9 ± 12.3 years, respectively. They performed three minutes of exercise on the selected equipment, evaluated by means of a frequency meter and by the auscultatory method, with the aid of a sphygmomanometer. **RESULTS:** High heart rate values were recorded in the multi-exerciser. In both the heart rate and the blood pressure, there were significant differences in the means of the values found in the initial evaluation, compared to the means of the final evaluation ($p < 0.05$). **CONCLUSIONS:** Blood pressure rises within the physiological limits established for the elderly, and these activities may be considered safe for this population.
KEYWORDS: heart rate; motor activity; aging; health promotion.

RESUMO

OBJETIVO: Analisar o comportamento da pressão arterial e da frequência cardíaca de idosos praticantes de exercícios físicos em academias da terceira idade de Maringá, Paraná. **MÉTODO:** Foram avaliados 70 idosos voluntários, sendo 41 mulheres e 29 homens, com idade média de 67,2 ± 6,6 e 65,9 ± 12,3 anos, respectivamente. Realizaram três minutos de exercício nos equipamentos selecionados, avaliados por meio de um frequencímetro e pelo método auscultatório, com auxílio de um esfigmomanômetro. **RESULTADOS:** Os valores elevados de frequência cardíaca foram registrados no multiexercitador. Quer seja na frequência cardíaca, quer seja na pressão arterial, houve diferenças significantes nas médias dos valores encontrados na avaliação inicial, comparadas às médias da avaliação final ($p < 0,05$). **CONCLUSÕES:** A pressão arterial eleva-se dentro dos limites fisiológicos estabelecidos para os idosos, podendo tais atividades serem consideradas seguras para essa população.
PALAVRAS-CHAVE: frequência cardíaca; atividade motora; envelhecimento; promoção da saúde.

[a]Centro Universitário de Maringá – Maringá (PR), Brazil.

Correspondence data
Mateus Dias Antunes – Centro Universitário de Maringá – Avenida Guedner, 1610 – Jardim Aclimação – CEP: 87050-900 – Maringá (PR), Brasil – E-mail: mateus_antunes03@hotmail.com
Received on: 06/08/2017. Accepted on: 09/14/2017
DOI: 10.5327/Z2447-211520171700042

INTRODUCTION

With the increased the number of elderly people and country's life expectancy, the prevalence of chronic non-communicable diseases (NCDs) is also increasing, as well as the concern with the elaboration and implementation of health promotion strategies aimed at meeting the needs of this population. Currently, one of the most recommended health promotion strategies for the elderly population is the encouragement of physical practices and physical activities. Encouragement to practice regular physical activity and the elaboration and execution of activity programs for the elderly are seen as some of the main actions from the health sector to promote the prevention of NCDs (such as systemic arterial hypertension, diabetes, osteoporosis and obesity) among the elderly, and to provide them with a more active and independent life, with greater autonomy and a better quality of life.[1,2]

Among the existing strategies and programs encouraged by the Brazilian Ministry of Health to stimulate the practice of physical activities by the elderly population, there is the implementation of senior gyms (SG), also known as outdoor gyms (ODG) or health academies. These gyms are installed in urban public spaces, such as squares and woods, and equipped with exercise machines which do not use loads for the practice of physical exercise, only the body's own strength for weight training, joint mobility and stretching exercises.[3]

In general, SGs are a system for practicing physical activity that adapts to the user, their physical capacity and their rhythm, creating resistance and generating benefit for personalized body systems such as the cardiovascular and the musculoskeletal ones.[3] In addition, these gyms encourage the practice of regular physical activities by their easy access, stimulate social inclusion, improve self-esteem, quality of life and the health of those who use it.[4]

SGs are indicated to be used by individuals aged over 12 years, especially the elderly,[3] who are the population group to benefit the most from the practice of regular physical activities, due to the morphophysiological changes resulting from the aging of the human body, which can be minimized by the exercises.[4]

The knowledge and monitoring of the cardiovascular parameters of the elderly during the use of the equipment available in the SGs, especially those that generate physical resistance, are greatly relevant. They may contribute not only to the analysis of how the use of such equipment influences cardiovascular parameters, but also to safely prescribe the practice of physical exercises to the elderly in these gyms. Thus, this study aimed to analyze the behavior of cardiovascular variables, such as blood pressure (BP) and heart rate (HR), of elderly people practicing physical activity in SGs in the city of Maringá, northwestern Paraná.

METHODS

The present study, conducted after approval of the Research Ethics Committee of Centro Universitário de Maringá (UNICESUMAR), under protocol No. 408.476/2013, is a quantitative interventional research. It was carried out in 8 of the 57 SGs in Maringá, namely: Parigot de Souza, Quebec, *Parque do Ingá*, *Parque Alfredo Nyeffeller*, Mandacaru, *Vila Olímpica*, *Centro Esportivo do Jardim Alvorada* and *Praça das Américas*. The SGs were chosen due to being, when visited previously, the most used ones by the elderly population.

The population consisted of individuals aged 55 and over, of both genders, who practiced physical exercises at the Maringá SGs for at least 3 months, at least twice a week. In order to determine the exercise time performed in each machine, an *in loco* observation of the routine of the elderly in the SGs was carried out. Data collection was performed between October and November 2014, totaling 30 days, and was done by an interdisciplinary team composed of two physiotherapists, a biologist and a nutritionist. In order to meet the proposed objectives, each professional was responsible for collecting data in two SGs. The researchers carried out shifts from Monday to Sunday in the SGs in the morning (from 6:30 a.m. to 9:00 p.m.) and in the afternoon (from 3:00 p.m. to 6:00 p.m.). During the shifts, the professionals approached the incoming seniors individually and invited them to participate in the study, explaining the research objectives, their purpose and how it would happen. The elderly were also requested to sign an informed consent.

When they agreed to participate in the study, the elderly were initially submitted to a structured interview, consisting of questions about: age (in full years), gender, use of SG (in months) and frequency of use of the equipment in the SG (times per week). Subsequently, they were instructed to perform physical activities in six of the ten SG machines randomly, so as not to influence the results of the research, with the selected machines being those that generate musculoskeletal resistance, such as the walking simulator, the ski machine, the rowing machine, the surf machine, the horse riding machine and the multi-exercise machine. The volunteers were instructed to perform three uninterrupted minutes of activity on each of the six devices. The time between exercises in each machine depended on

the return of the HR to the initial values, which varied from three to four minutes of rest, after performing the activity in each machine. The elderly were also instructed to do it in their usual rhythm of execution of the activities in the equipment studied.

Before the start of the activity on each of the machines, the researchers assessed the BP and HR of each volunteer. After three minutes of exercise, the volunteers were instructed to interrupt the practice and had the parameters above measured again, and were then asked to initiate activity in the subsequent machine. The acute response to the exercises performed in each device was evaluated using a Polar® cardiofrequency meter and the systolic (SBP) and diastolic (DBP) values were obtained by the auscultatory method with the aid of a sphygmomanometer, following the parameters established by the V Brazilian Guidelines for Hypertension.[5]

To control the time, a digital timer was used. To determine the time of execution of the physical activity in each SG machine and rest time after execution, a pilot study was carried out, which included the voluntary participation of ten elderly individuals practicing physical activities in the Maringá SG.

For the better knowledge of the intensity of the exercises performed in the different machines, according to the equation by Tanaka et al.,[6] the theoretical heart rate [%HRmax. = 208 - 0.7 × age] and the respective percentage value for each of the evaluated subjects [%HRmax. = HRmean/HRmax.T] during the workout were estimated.

The classification criteria used in the present study was proposed by The American College of Sport Medicine (ACSM).[7,8] This classification is based on six categories, according to Table 1.

The collected data were inserted into spreadsheets and presented through descriptive statistics, such as tables, mean and standard deviation. Using the Kolmogorov-Smirnov test, the non-normality of the data was observed and the Wilcoxon test was applied to verify the differences between the variables. The level of significance was set at 5% ($p < 0.05$).

RESULTS

Of the 70 subjects evaluated, 58.6% (n = 41) were females and 41.4% (n = 29) were males. The mean age of the elderly was 67.5 ± 6.3 years, with the mean age of the men being 65.9 ± 12.3 years and, for the women, 67.2 ± 6.6 years (Table 1).

When evaluating the HR of the elderly of both genders in different SG machines, a significant difference between the initial and final moments of the evaluations in all machines was evidenced (Table 2).

Table 3 shows the distribution of the equipment according to the parameters of effort intensity, based on the percentage of maximum HR. It is noteworthy that the exercises performed in the majority of the machines, by both genders, were of moderate intensity.

When assessing SBP and DBP in the elderly, in both men and women, in different SG equipment, a significant difference between the evaluations in all machines was evidenced (Tables 4 and 5).

DISCUSSION

No national and international studies that verified cardiovascular parameters during physical activity in SGs were found. In the present study, in relation to the initial HR in each machine, there was a small variation between the machines in both genders, which may be justified by the lower capacity of adaptation and recovery to the exercise that is inherent in the aging process.[9] When considering gender, as can be seen in Table 2, the HR of women at the beginning of each exercise is higher, which is in accordance with the literature on cardiovascular physiology.[10] This is justified by typically higher levels of aerobic fitness in males than in females.

The changes in HR and BP that occur during exercise reflect the type and intensity of the exercise performed, its duration and the environmental conditions under which it was performed.[11] It was possible to observe that the highest values of HR were recorded in the multi-exerciser, the horse riding machine and in the surf machine (Table 2).

In Table 3, the results show that the intensity of the exercise, assessed by means of the hemodynamic variable CF in most SG machines (83% of cases) was physiologically safe and moderate enough to induce possible adaptations

Table 1 Classification of heart rate proposed by The American College of Sport Medicine.

Intensity	% of maximum heart rate
Very low	Below 35
Low	Between 35 and 54
Moderate	Between 55 and 69
High	Between 70 and 89
Very high	Equal or above 90
Maximum	100

in the cardiovascular system. Although the multi-exerciser promotes the highest HR elevations in both genders, the values are still considered a moderate intensity effort. In the literature, it is reported that moderate intensity exercises (40 to 60% of maximal oxygen consumption - VO2max) are as effective as vigorous intensity exercises (more than 60% of VO2max) in relation to the hypotensive effect at long term.[12]

Regarding the acute hemodynamic response of physical exercise, one of the factors that influence the increase

Table 2 Distribution of heart rate in the initial and final evaluations of the elderly practicing physical activities in senior gyms.

Equipment	Heart rate		
	IEV (n = 41) FEV (n = 41)		p-value
	Mean ± SD	Mean ± SD	
Females			
Walking simulator	72.1 ± 10.0	82.8 ± 10.9	< 0.001*
Ski machine	73.6 ± 10.0	88.9 ± 15.3	< 0.001*
Rowing machine	76.5 ±9.7	93.6 ± 16.9	< 0.001*
Surf machine	77.5 ± 10.4	95.2 ± 18.5	< 0.001*
Horse riding machine	77.9 ± 11.3	93.5 ± 16.0	< 0.001*
Multiexerciser	78.2 ± 11.8	99.0 ± 20.1	< 0.001*
Males			
Walking simulator	70.0 ± 9.0	80.6 ± 11.3	< 0.001*
Ski machine	71.5 ± 11.8	86.0 ± 17.1	< 0.001*
Rowing machine	72.1 ± 10.9	92.9 ± 18.1	< 0.001*
Surf machine	73.8 ± 10.3	92.0 ± 20.1	< 0.001*
Horse riding machine	73.3 ± 12.5	91.5 ± 13.3	< 0.001*
Multiexerciser	75.7 ± 12.7	94.5 ± 20.1	< 0.001*

IEV: initial evaluation; FEV: final evaluation; SD: standard deviation; *significant p-value according to the paired Wilcoxon test considering a 5% significance level.

Table 3 Intensity of effort by the elderly in relation to the heart rate in the equipment of senior gyms.

Equipment	Females		Males	
	% of maximum heart rate	Intensity of effort	% of maximum heart rate	Intensity of effort
Walking simulator	51.50	Low	50.13	Low
Ski machine	55.30	Moderate	55.10	Moderate
Horse riding machine	58.16	Moderate	56.60	Moderate
Rowing machine	58.22	Moderate	57.79	Moderate
Surf machine	59.22	Moderate	57.23	Moderate
Multiexerciser	61.58	Moderate	58.78	Moderate

Note: According to the criteria by The American College of Sport Medicine.

Table 4 Distribution of systolic blood pressure in the initial and final evaluations of the elderly practicing physical activities in senior gyms.

Equipment	Blood pressure		
	IEV (n = 41) FEV (n = 41)		p-value
	Mean ± SD	Mean ± SD	
Females			
Walking simulator	120.5 ± 11.6	128.3 ± 12.6	< 0.001*
Ski machine	122.0 ± 12.9	123.7 ± 20.8	< 0.001*
Rowing machine	119.0 ± 10.4	126.3 ± 11.6	< 0.001*
Surf machine	123.4 ± 10.2	127.6 ± 13.4	< 0.001*
Horse riding machine	123.4 ± 8.5	127.1 ± 10.5	< 0.001*
Multiexerciser	124.6 ± 10.5	129.5 ± 10.7	< 0.001*
Males			
Walking simulator	129.3 ± 20.0	134.8 ± 20.3	< 0.001*
Ski machine	130.3 ± 20.4	135.2 ± 18.6	< 0.001*
Horse riding machine	128.6 ± 20.0	134.1 ± 21.6	< 0.001*
Surf machine	129.7 ± 21.1	134.8 ± 19.0	< 0.001*
Horse riding machine	129.3 ± 18.3	136.1 ± 20.1	< 0.001*
Multiexerciser	131.7 ± 18.1	137.6 ± 19.6	< 0.001*

IEV: initial evaluation; FEV: final evaluation; SD: standard deviation; *significant p-value according to the paired Wilcoxon test considering a 5% significance level.

Table 5 Distribution of diastolic blood pressure in the initial and final evaluations of the elderly practicing physical activities in senior gyms.

Equipment	Blood pressure		
	IEV (n = 41) FEV (n = 41)		p-value
	Mean ± SD	Mean ± SD	
Females			
Walking simulator	74.9 ± 9.3	80.0 ± 10.7	0.003*
Ski machine	78.5 ± 7.6	82.7 ± 8.7	0.031*
Rowing machine	75.6 ± 9.2	80.0 ± 8.9	0.022*
Surf machine	76.0 ± 8.1	81.0 ± 8.6	0.037*
Horse riding machine	77.3 ± 9.5	82.2 ± 7.2	0.042*
Multiexerciser	76.8 ± 8.5	83.7 ± 8.0	0.000*
Males			
Walking simulator	79.7 ± 12.1	84.5 ± 13.3	0.015*
Ski machine	78.3 ± 11.7	82.8 ± 13.3	0.013*
Rowing machine	78.6 ± 11.3	83.1 ± 12.0	0.024*
Surf machine	79.8 ± 13.9	83.1 ± 11.7	0.044*
Horse riding machine	80.0 ± 12.9	85.5 ± 9.9	0.048*
Multiexerciser	81.4 ± 12.5	87.6 ± 11.2	0.002*

IEV: initial evaluation; FEV: final evaluation; SD: standard deviation; *significant p-value according to the paired Wilcoxon test considering a 5% significance level.

in BP is the increase in HR.[13] As can be seen in Table 3, SBP values increased relatively in all machines, for both genders, reaching their maximum value in the multiexerciser. It was also noted that, in both sexes and in all machines, there were statistically significant differences between the mean values of SBP in the initial evaluation and the SBP values in the final evaluation. The BP values were not considered as risky in any of the machines, with the maximum value found for SBP being 137.6 mmHg and, for DBP, 87.6 mmHg.

Regarding the behavior of the cardiovascular parameters of the elderly practicing physical activities in SGs, there is still little evidence. Esteves et al.,[4] after a systematized program of physical activities during six months in SGs, verified important reductions in pressure levels, which was reported even by the users themselves. The modalities of exercise performed in SGs at the moment of the research — considering the type of contractions performed (predominantly dynamic), the moderate external load (body weight and machine weight) and the reduced number of muscle groups requested at the same time[13] — may explain the lower physiological response to the effort.

The results of the maximum HR and, consequently, the percentage of the maximum HR, although estimated, allowed to observe that, in both genders, the walking simulator did not allow the subjects to reach the intensity required for the induction of significant physiological alterations;[14] that is, the elderly did not reach 55% of maximal HR. However, it is important to emphasize that these machines are not necessarily aimed at the development of aerobic capacity, but rather at better scores in motor variables, such as agility and balance.[14] The exercises performed in the multiexercise machine were those that induced higher HR and BP elevations, probably related to the greater active muscle mass. In this sense, it is worth mentioning that the quantity and quality of exercise required for elderly adults seem to be associated with a lower risk of chronic degenerative diseases and the improvement of metabolic fitness.

Although the time of exercise performed in each machine was established after on-site observation of the routine of the elderly in the SGs, this aspect is highlighted as a factor that may imply the generalization of the results, since, most of the time, there are no professionals in these places that can guide the performance of these exercises in systematic form, with control of the time, frequency and intensity. That is, there may be seniors performing exercises on a single machine for one or even ten minutes. Another point that should be emphasized is that the sample consisted of elderly people practicing physical activities in the SGs for at least three months. This fact can be pointed out as a limitation of the study, which did not count on the existence of a control group constituted by insufficiently active elderly individuals.

CONCLUSION

The HR behavior indicated that the exercise intensity during the exercises performed in the SG equipment is predominantly moderate. In addition, both SBP and DBP increase within the physiological limits established for the elderly, and such activities may be considered safe for this population.

The findings of the present study suggest that, although the exercises performed in the SGs do not necessarily aim at the development of aerobic capacity, it would be better to include equipment with similar characteristics to the multiexerciser, so that moderate intensity exercises are practiced by a greater number of elderly individuals that use the SGs. However, new controlled intervention studies should be performed to verify the chronic effects, in CF and BP, of the exercises performed in SGs by individuals aged over 60 years.

ACKNOWLEDGEMENTS

The authors would like to thank *Instituto Cesumar de Ciência, Tecnologia e Inovação* (ICETI) and the Coordination for the Improvement of Higher Education Personnel (CAPES) for the granting of research funding.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

REFERENCES

1. Salvador EP, Florindo AA, Reis RS, Costa EF. Percepção do ambiente e prática de atividade física no lazer entre idosos. Rev Saúde Pública. 2009;43(6):972-980.
2. Silva MC, Silva AB, Amorim TEC. Condições de espaços públicos destinados a prática de Atividade Físicas na cidade de Pelotas/RS/Brasil. Rev Bras Ativ Fis e Saúde. 2012;17(1):28-32.
3. Lima FLR. Percepção do esforço em idosos nas academias ao ar livre. Rev Bras Prescr Fisiol Exerc. 2013;7(37):55-64.
4. Esteves JVDC, Andreato LV, Pastório JJ, Versuti JKB, Almeida HC, Moraes SMF. O uso de academias da terceira idade por idosos modifica parâmetros morfofuncionais? Acta Sci Health Sci. 2012;34(1):31-8.
5. Sociedade Brasileira de Cardiologia. V Diretrizes Brasileiras de Hipertensão Arterial. Arq Bras Cardiol. 2007;89(3):1-55.

6. Tanaka H, Monahan KD, Seals DR. Age-predicted maximal heart rate revisited. J Am Coll Cardiol. 2001;37(1):153-6.
7. American College Sport Medicine. Position stand on the recommended cardiorespiratory and muscular fitness, and flexibility in healthy adults. Med Sci Sports Exerc. 1998;30(6):975-91.
8. American College Sports Medicine. ACSM's health-related physical fitness assessment manual. Philadelphia: Lippincott Williams & Wilkins; 2004.
9. Matsudo SM, Matsudo VKR. Prescrição de exercícios e benefícios da atividade física na terceira idade. Rev Bras Ciên Mov. 1992;6(4):19-30.
10. Powers SK, Howley ET. Fisiologia do Exercício. São Paulo: Manole; 2009.
11. Sydó N, Abdelmoneim SS, Mulvagh SL, Merkely B, Gulati M, Allison TG. Relationship between exercise heart rate and age in men vs women. Mayo Clinic Proceedings. 2014;89:1664-72.
12. Pescatello L. Exercise and Hypertension: Recent Advances in Exercise Prescription. Curr Hypertens. 2005;7(4):281-6.
13. Overend TJ, Versteegh TH, Thompson E, Birmingham TB, Vandervoort AA. Cardiovascular stress associated with concentric and eccentric isokinetic exercise in young and older adults. J Gerontol. 2000;55:B177-82.
14. Bertolini SMMG, Manueira P. Equilíbrio estático e dinâmico de idosos praticantes de atividades físicas em Academias da Terceira Idade. ConScientiae Saúde. 2013;12(3):432-8.