EXERCISE AND SPORTS MEDICINE CLINIC

Blood Pressure After Supervised Physical Exercise Program in Elderly Women With Hypertension

ORIGINAL ARTICLE

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ABSTRACT

Introduction: The elderly population has increased the levels of chronic diseases such as hypertension (HBP) with prevalence in women. Non-pharmacological interventions, such as exercise, have been indicated by the effectiveness in lowering blood pressure (BP). Objective: To analyze the blood pressure response in elderly hypertensive women in the different moments of a supervised physical exercise program (SPEP). Methods: It consisted of a cross-sectional descriptive study carried out for 18 weeks. 41 elderly women with hypertension, under pharmacological treatment, distributed in the experimental group (EG) (n=26) which participated in the intervention, and control group (CG) (n=15) in two stages: before and after SPEP. BMI, systolic blood pressure (SBP) and diastolic blood pressure (DBP) were evaluated at baseline and after 18 weeks of SPEP in the EG and CG. The intra and inter comparison was made with the paired t test and two-way ANOVA with Kruskal Wallis test, with a significance level of $p < 0.05$. Results: The EG (68.7 ± 8.4 years, BMI = 27.23 ± 4.73) and CG (67.3 ± 6.3 years, BMI = 26.13 ± 4.36), with a prevalence of overweight in all groups, without significant difference after SPEP. There was a correlation between BMI and SBP ($r = 0.456$, $p = 0.01$) and between SBP and DBP ($r = 0.380$, $p = 0.01$). The initial similarity between the groups was changed by SPEP in EG, remaining in the CG. Intergroup comparison showed differences in SBP ($p = 0.000$) and DBP ($p = 0.005$) before and after SPEP and intragroup, with reductions in SBP ($\Delta = 9.61$ mmHg, $p = 0.000$) and DBP ($\Delta = 1.54$ mmHg, $p = 0.043$) after SPEP, which did not occur in the CG. Conclusion: The supervised physical exercise program exerted an important model of non-drug treatment in the hypotensive response observed.

Keywords: elderly, blood pressure, physical conditioning, hypertension.

INTRODUCTION

The elderly population is the one which increases the most worldwide as well as in Brazil, considering the result of the National Research by Household Sampling (PNAD) carried out in 2005, which revealed that the number of individuals older than 60 years is higher than 18 million, corresponding to about 10% of the total population[1].

The aging process of the population increases the indices of some chronic diseases such as systemic arterial hypertension (HBP) and presents increasing demand for specialized health services whose response capacity is still extremely below the needs of this population[2].

Hypertension is the main risk of death factor among non-transmissible diseases[3] and consists in an important problem of public health[4], with about 70% of the elderly population being considered hypertensive[5] ,and higher prevalence in the female sex in the age group between 70 and 90 years[6-8].

The prevalence of HBP as an important cardiovascular risk factor (CVRF), its high global prevalence as well as the increase of probability of fatal ou not-fatal circulatory closings, when other risk factors are associated with it, make the understanding of its correlation with other possible factors potentially triggering of cardiocirculatory events very important.

Higher prevalence of HBP in women is also associated with other alterations typical of the aging process such as prevalence of hypercholesterolemia, more specifically, dyslipidemias and immobility characterized by sedentarism, responsible for modern diseases, such as chronic stress, obesity and increase of blood fat[9], which express important information on the health status of this population and decrease in quality of life[9,10].

Non-pharmacological interventions have been mentioned in the literature by their low cost, minimum risk and efficiency in decreasing blood pressure[11].

The aim of the present study was to assess the blood pressure response of hypertensive elderly women in the distinct moments of a supervised physical exercise program.

MATERIAL AND METHODS

Subjects selection

This descriptive study of transversal cohort started in August, 2008 with random selection of 41 sedentary hypertensive women, aged 60 years or older, originated from the social group of the Resident Association of the Piçarreira I Neighborhood, members of the Extension Program of the Diferential Full-time Project – FACID, "Surpassing Aging" and the Third Age inaction Program – PTIA of the Federal University of Piauí – UFPI, of Teresina, PI. All elderly women underwent a medical evaluation in the health unit of the neighborhood and were under medication treatment for hypertension, dissociated from other pathologies. Out of these subjects, 50% used the angiotensin converting

enzyme inhibitor – ECA (captopril), and the remaining ones made use of the thiazide diuretics hydrochlorothiazide[5].

There was no alteration in the medication of any elderly woman during the study nor the diet was individually controlled, only speeches on eating focusing on hypertensive subjects were performed.

The classification of the elderly women as hypertensive was done according to the V Guidelines of Arterial Hypertension[11], which consider as "optimum pressure" levels lower than 120mmHg x 80mmHg; as "normal pressure" levels lower than 130mmHg x 85mmHg and as "borderline pressure" 130mmHg to 139mmHg and 85mmHg to 89mmHg levels, for systolic (SBP) and diastolic (DBP), respectively.

Inclusion criteria were women older than 60 years with independence in performance of daily physical activities, good clinical conditions and who should not have been practicing regular physical activity for a minimum period of six months. The elderly women with any kind of musculoskeletal conditions or neurological problems which could compromise the study and which did not present frequency above 70% in the SPEPwere excluded from the sample.

Subsequently to the inclusion and exclusion criteria, a sample of 26 elderly women was composed for the experimental group (EG) who came from the Piçarreira I neighborhood and submitted to the pre-participation evaluation of physical exercise aptitude through the r-PAR-Q questionnaire – *Revised Physical Activity Readiness Questionnaire*[12] at the beginning of the research. The EG was classified in two distinct moments of the research: the group before the Supervised Physical Exercise Program (EG pre-SPEP) and the group after the intervention (EG post-SPEP).

The control group (CG), with origin in the PTIA, was composed of 15 sedentary elderly women presenting the same inclusion criteria of EG, and oriented to keep their daily routines and not to engage in any physical exercise program.

The present study fully met the guidelines for performance of research with humans, Resolution 196/96 of the National Health Board from 10/10/1996[13] and of the Declaration of Helsinki[14]. All participants signed the Free and Clarified Consent Form and the project was approved by the COMEP- Ethics Committee in Research Involving Humans of the Castelo Branco University, RJ, under number 0121/2008.

Anthropometrical parameters evaluation

In order to have the sample characterized and evaluated, body mass (kg) and stature (m) were measured with a mechanical scale (Filizola®, Brazil) and stadiometers (Personal Sanny® Caprice-Brazil) respectively, following the guidelines by the ISAK[15], and served as grounding for the calculation of the body mass index – BMI, classified according to the SBEM[16]. These measurements were taken at the beginning and after 18 weeks for the EG and for the CG.

Blood pressure evaluation

This measurement was after 10 minutes at sitting position, by the indirect method, through the auscultatory technique with calibrated aneroid sphygmomanometer (Premium, Glicomed-Brazil). In the EG and CG pre-SPEP and CG post, BP was measured only once at the beginning of the research, while in the EG post-SPEP, BP was checked at the beginning of the exercise sessions.

The hypertensive patients considered with BP controlled were those with SBP < 140mmHg and DBP< 90mmHg, according to the Brazilian and International Guidelines[11].

Intervention

The intervention was composed of a Supervised Physical Exercise Program – SPEP with duration of 18 weeks, applied to the EG and developed based on the *American College of Sports Medicine*[17] which adopted the following criteria: 10 minutes of stretching exercises; 35 minutes of aerobic endurance (gait) and muscular endurance (localized exercises); and 10 minutes of stretching with five minutes of relaxation, performed two times per week (Tuesdays and Thursdays) in a total of 35 sessions of 60 minutes in the morning shift[10].

The exercise choice varied daily, including exercises for the elbow, shoulder, knee and hip joints and spine, as shown in table 1.

Exercise intensity during the SPEP was monitored by the subjective perceived exertion through the Borg's scale and was kept in weak to moderate, corresponding hence to indices between 7 and 12[18].

Stretching exercises intensity was controlled with the perceived exertion in flexibility scale as base (PERFLEX)[19]. It was observed that the perceived exertion of the EG members indicated forcing between levels 31 and 60. The result of the final mean as well as the standard deviation of the perceived exertion of each of the members of the group was EG= 45.3 ± 4.2.

Statistics

Descriptive statistics with mean and standard deviation was used; sample normality was assessed by the Shapiro-Wilk's test. The analysis of the responses of the intragroup variables was performed by the paired t test, while the intergroup ones was through the *two-way* ANOVA with Kruskal-Wallis test. The $p < 0.05$ level was adopted for statistical significance and the Excel program and the SPSS 18.0 statistical package were usedfor evaluation of the results.

RESULTS

The elderly women of the experimental group (EG) presented age mean of 68.7 ± 8.4 years while the ones in the control group (CG) presented 67.3 ± 6.3 years.

Figure 1 presents the prevalence of classification overweight of BMI in the EG pre (46.4%) and post-SPEP (53.6%) and of normality in the CG (43.7%). This percentage increase of elderly women with overweight observed in the EG post-SPEP probably occurred due to alterations in the body mass with increase of elderly women with normal classification (+3.6%) and decrease of obese elderly women (-10.7%).

The BMI variable did not present significant alteration in the intergroup (EG and CG) and intragroup (EG and EG; CG and CG), and some possible causes for the alterations the lack of control of the daily food consumption as well as the insufficient intervention time (18 weeks).

The assessment of readiness to physical activity through the rPAR-Q questionnaire in the EG pre-SPEP presented 12.5% of the elderly women with negative results and 87.5% with positive results, characterizing hence the need for a previous medical

Table 1. Supervised Physical exercise Program – SPEP.

Variables	Stretching (static straining)*	Aerobic endurance	Muscular endurance**		Flexng (passive or static) ***
Time	5 to10 minutes	20 minutes	15 minutes		10 minutes
Number of moviments / session	7	-	10		7
Number of sets	1	1	2		3
Number of repetitions	1	-	10		1
Time of insistence	6 seconds	-	-		10 seconds
Exercises	23; 24; 25; 26; 28; 30; 31; 33; 34; 35; 37; 40; 41	Leg alternation with stationary elevation onária e caminhada	Tuesday 1; 5; 6; 7;10;11; 13; 15; 16; 18; 20; 22	Thursday 2; 3; 4; 8; 9; 12; 14; 17; 18; 19; 2	27;29;32; 34; 35; 36; 37; 38; 40; 41; 42; 43

* The insistence for each movement should reach the discomfort threshold to cause the physiological effects (ALTER, 1999).
** Alternated by segment kind in two sets of 10 repetitions each, with 40-sec intervals, with 1kg load.
*** The insistence should surpass the discomfort threshold with very slow performance velocity.

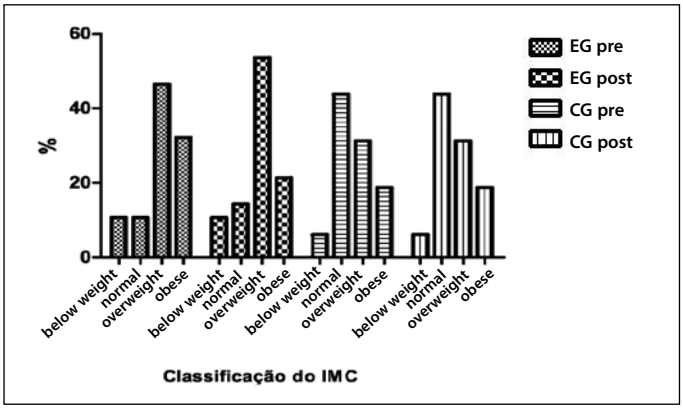

Figure 1. Classification prevalence of the BMI of the elderly women assessed in the EG and CG pre and post-SPEP.

evaluation for the practice of physical exercise, a pre-requisite which was fulfilled.

Concerning the classification of arterial hypertension in the study groups, the EG presented 55.17% of the elderly women with controlled blood pressure (normal) and 44.83% with increased blood pressure (borderline), differently from the CG which presented 81.20% of the elderly women with BP above the level considered normal (borderline) and only 18.8% with controlled blood pressure (normal).

Significant correlation was also observed between BMI and SBP($r = 0.456$; $p = 0.01$) and between SBP and DBP($r = 0.380$; $p = 0.01$), illustrating that high levels of SBP are directly correlated with the increased BMI and DBP indices.

Table 2 exposes the comparisons concerning the pre-SPEP period between the control and experimental groups. Similar initial characteristics were observed between groups, besides normal data distribution only of BMI. Differences of SBP and DBP have been found in the comparisons between groups in this period, except for the BMI; nevertheless, this relation was altered after the SPEP, making hence the groups different (table 3).

Table 3 presents the results of the descriptive and inferential analysis between groups in the post-intervention period. Systolic and diastolic blood pressure was significantly lower in the

Table 2. Descriptive and inferential analysis between groups in the pre-SPEP period.

Variables	Control group (n = 15)	Experimental group (n = 26)	P value
BMI (kg/m^2)	26.13 ± 4.36	27.23 ± 4.73	0.448†
SBP (mmHg)	138.8 ± 23.63	135.4 ± 17.02	0.000†*
DBP (mmHg)	77.50 ± 5.77	74.62 ± 9.05	0.005†*

BMI= Body Mass Index; SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure
*$p < 0.05$ between the control and experimental groups.
† ANOVA test (Kruskal-Wallis)
Every value in bold means that data did not present normal distribution.

Table 3. Descriptive and inferential analysis between groups in the post-SPEP period.

Variables	Control Group (n = 15)	Experimental Group (n = 26)	P value
BMI (Kg/m^2)	26.37 ± 4.45	27.17 ± 4.77	0.582†
SBP (mmHg)	137.5±20.17	125.8± 16.53	0.000†*
DBP (mmHg)	76.25 ± 5.00	73.08 ± 7.36	0.005†*

BMI = Body Mass Index; SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure
*$p < 0.05$ between the control and experimental groups.
† ANOVA test (Kruskal-Wallis).
Every value in bold means that the data did not present normal distribution.

experimental group ($p \leq 0.001$ and $p \leq 0.005$) after the SPEP period, indicating hence the positive effect of this program in the EG.

Figure 2 shows the intragroup comparisons with significant differences between pre and post-SPEP EG for SBP ($p = 0.001$) and DBP ($p = 0.0430$) and showing the positive effect of SPEP for this group of hypertensive elderly women, with mean decrease of SBP of 9.615mmHg and of DBP of 1.25mmHg. However, in the pre and post-SPEP control group, significant differences have not been observed, which implies that the absence of SPEP did not alter this relation.

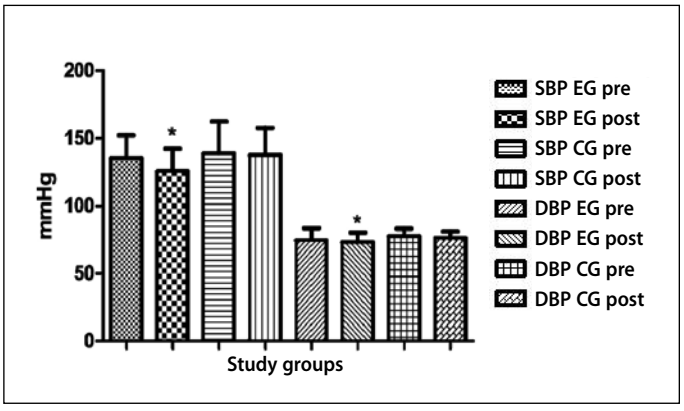

Figure 2. Intragroup differences of the SBP and DBP pre and post-SPEP.

DISCUSSION

Aging adds up to increasing health, functionality as well as social participation risks to women. These risks may partly occur due to biological factors, life style, disease history and social isolation. Factors such as blood pressure and BMI above normal parameters are predictors of cardiovascular diseases and modify quality of life.

Systemic arterial hypertension is considered a public health problem in Brazil, and such information may be considered alarming, since chronic increase of blood pressure is an important factor of cardiovascular risk. Therefore, there is a series of

interventions (pharmacological and non-pharmacological ones) in the treatment of HBP. The non-pharmacological ones are related to alterations in life style[11] such as inclusion of physical exercises, which according to the *American College of Sports Medicine*[17], constitute in the "cornerstone" in the primary prevention and control of high blood pressure already established.

Studies with normotensive individuals point that at 55 years old they will present 90% of risk to develop high blood pressure; thus, the pre-hypertensive subjects (SBP of 120-139mmHg or DBP of 80-89mmHg) will require alterations in life style, with practice of PA to avoid progressive increase of blood pressure and cardiovascular diseases[20].

Increase in BP represents an independent, linear and continuous risk factor for cardiovascular disease[21]. After 65 years old, the mortality rate by cardiac diseases in women surpasses the one in men, as well as the prevalence of HBP in 29.2% of men and in 40.8% of women[22].

The prevalence of high blood pressure in the group of elderly subjects, in a study by Victor *et al.*[1] on the sociodemographic and clinical profile of these individuals seen in a Family Basic Health Unit, was of 68.6%, similar to the results found in another study performed on the prevalence of high blood pressure in elderly subjects in the city of Bambuí, Minas Gerais (61.5%)[23]. However, these results expressively differ from what was observed in the Brazilian elderly population based on the PNAD (National Research by Household Sampling) (43.9%).

Considering the magnitude of the risk provided by the increase in BP, it is probable to conclude that its control would lead to an important impact over the mortality rates by cardiovascular diseases and improvement in quality of life. Thus, the fifth report of the *Joint National Committee*[24] proposes that obesity treatment, decrease in salt intake, increase of potassium intake, decrease in alcohol consumption and performance of dynamic physical exercises are efficient non-pharmacological measures to decrease BP and consequently, the risk to develop cardiovascular diseases.

The positive effect of the decrease of the BP levels may be observed in this study, in which the presence of a supervised physical exercise program – SPEP of 18 weeks – altered the characteristics, initially similar, of the groups of the hypertensive elderly women, presenting alterations in the levels of SBP and DBP with significant reductions. These results corroborate with epidemiological evidence which support the positive effect of an active life style and/or the engagement of individuals in physical activity programs (PA) or physical exercises in prevention and decreasing of the deleterious effects of sedentarism and aging[25-27].

Further research which corroborates the favorable effect of dynamic exercise, of light and moderate intensities in the reduction of blood pressure in hypertensive subjects, also indicates the need of a follow-up by specialists[28,29]. This recommendation was followed in this study, in which the SPEP applied to the elderly women was carried out by a skilled professional after a clinical evaluation in the community health center. Decrease in BP levels in the present study was also found in a review article which, after four to eight weeks of regular physical activity presented decrease of SBP of 10 to 15mmHg and diastolic BP of 5 to 10mmHg[30]. Another study also highlighted that physical activity mean reduction of 11 and 8mmHg in systolic and diastolic blood pressure respectively, besides reducing or even eliminating the need to use medication[31].

These chronic effects of physical exercise, also named adaptations, result in autonomic and hemodynamic alterations which will influence the cardiovascular system and guide the pressoric decrease [32,33].

According to the Brazilian Guideline of Arterial Hypertension[11], which considers "optimum pressure" levels lower than 120mmHg and 80mmHg; "normal pressure" levels lower than 130mmHg x 85mmHg; and "borderline pressure" 130mmHg to 139mmHg levels for systolic and 85mmHg to 89mmHg for diastolic pressure, reduction of the BP levels in the present study demonstrate improvement in the blood pressure control of the experimental group.

Although there is a wide therapeutic selection for the treatment of HBP, only one third of hypertensive patients under treatment have their levels controlled[34]. In Brazil, the prevalence studies which report patients with controlled BP under anti-hypertensive treatment present rates of 10.4% to 33%, a range which is below the result obtained in this research, which was of 55.2% for the EG[20].

The prevalence of elderly women with HBP with uncontrolled BP levels identified in the CG of this study, even when participating in drug treatment, may be explained by the deficient information about the disease and by the resistance to change life style.

Nevertheless, clinical essays on the effects of physical exercise in the prevention and treatment of HBP suggest that medication is more efficient than non-pharmacological interventions to prevent clinical manifestations, although they accept the idea that exercise is a benefit to health[35], contrary to the results found in this study.

Concerning the BMI, the results of this study do not demonstrate significant difference after the SPEP with mean BMI above the normality level and prevalence of overweight for the hypertensive group, reflecting hence the data observed in world studies in which the increase of HBP prevalence concomitantly occurs with the increase of overweight and obesity in the population[36,37].

The prevalence of overweight in the groups and the correlation between BMI and BP observed in the EG have confirmed the need of the individuals with BMI > 25kg/m^2 to be treated with non-pharmacological measurements for HBP the same way that individuals with higher BMI, according to the *World Hypertension League*[34].

Therefore, the prevention and treatment of hypertension through non-pharmacological interventions have gained many followers, doctors and patients who have used this the therapeutic strategy more frequently, enjoying their medium and long term benefits [32,33,37].

It is concluded that the proposal of a supervised physical exercise program, as the one presented in this study, is an important strategy of non-pharmacological treatment for HBP in elderly women and presents positive responses of SBP and DBP levels.

The association between BMI and BP identified in this study is another impact factor for the development of cardiovascular risk factors and should also be fought.

The lack of information on the disease (HBP) and the difficulty in controlling diet, seasonal factors and alteration of medication which

did not occur, did not affect the development of the groups in the present study, but it is a reality which should serve as a warning to the health planners in order to organize an awareness program on the HBP problem in the elderly population as well as promote interventions in this group so that a change in their life habits can be introduced.

The majority of the randomized studies shows that even slight reduction in weight, from 3% to 9%, is associated to significant reduction of SBP and DBP of approximately 3mmHg in individuals with overweight. A diet with decrease in sodium intake has been historically considered a critical alteration for decrease in blood pressure[38].

From the physiological point of view, seasonal (climatic) reasons, which cause increase of decrease in temperature, can generate a set of alterations which boost disease situations, especially in older populations, in patients of chronic disease or with fragile immune system. Fletcher *et al*.[39] identified a seasonal variation of the arterial pressure variation among hypertensive patients, in which the blood pressure increased during the winter months.

In the present study, the analysis of the blood pressure variability as well as atmospheric conditions was not carried out considering the behavior of the climatic parameter, since the region has only two seasons, that is to say, winter and summer, or drought and raining seasons, and did not present at the time of the study (August to December), significant temperature alteration.

Although studies with this characteristic can be generalized, its relevance is unarguable for professionals from the health field as well as local providers, since they enable the implementation of disease prevention measures and health promotion.

Finally, further investigation involving the health status of the hypertensive subjects should be carried out not only to focus on the causes which lead them to the increase of pressure levels, but also to research on the difficulties to access the health units and the physical exercise programs, as well as their satisfaction concerning the health promotion programs.

All authors have declared there is not any potential conflict of interests concerning this article.

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