# EXERCISE CONTROLS BLOOD PRESSURE AND IMPROVES QUALITY OF LIFE

EXERCISE AND SPORTS MEDICINE CLINIC

ORIGINAL ARTICLE

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## ABSTRACT

Introduction: In order to correctly treat hypertension, it is plausible to hypothesize that in the face of regular exercise, these patients would not need anti-hypertensive drugs. Objective: To evaluate the effect of treatment exclusive with exercise on blood pressure (BP) and quality of life (QOL) of hypertensive subjects. Methods: Clinical trial of 32 sedentary hypertensive subjects, 55 ± 9 years, who were under pharmacological treatment (PT) randomly allocated to Exercise Group (EG) and Control Group (CG). At EG, 18 subjects (50% women) at least 10 days after the cessation of PT started the exercise program of 10 weeks, 3x/week, 30 minutes of aerobic exercise followed by resistance exercises, while 14 CG (57% women) remained under PT. Systolic (SBP) and diastolic blood pressure (DBP) was evaluated by auscultation at the beginning and end and QOL were evaluated using the MINICHAL questionnaire. Data were expressed as mean ± SD and statistical analysis was performed using t test, Mann Whitney U and Wilcoxon test. Results: At the beginning and end of the study, there were no significant differences in BP between the groups. Within groups, the BP in EG remained similar to the values before the drugs removal (SBP 132.2 ± 13.3 x 134.4 ± 10 mmHg, DBP 85.0 ± 9 x 85.3 ± 10 mmHg p = ns) and the CG (SBP 127.2 ± 19 x 130.2 ± 16 mmHg, DBP 82.1 ± 16 x 85.3 ± 12 mmHg p = ns). Regarding inter-groups QOL, there was no difference in scores at the beginning and end, with intra-group significant improvement in the emotional aspect of the EG (p = 0.02). Conclusion: The antihypertensive therapy only through exercise in comparison to conventional pharmacological treatment allowed the same BP control and better perception of QOL.

**Keywords:** life style, pharmacologic treatment, non-pharmacologic treatment.

## INTRODUCTION

The modern population has adopted a lifestyle basically characterized by poor eating habits, sedentarism and exacerbated stress. Physical inactivity is directly connected with the onset of a series of organic disorders, with special attention to Systemic Hypertension (SH). Having this lifestyle as scenario, the use of pharmacological aids becomes inevitable for the SH, a condition which affects the population of western countries[1]. Guidelines of Brazilian and international scientific societies[2,3] propose that the SH treatment starts by changes in lifestyle habits, and only when the non-pharmacological treatment strategy is not sufficient to control blood pressure (BP) is that the pharmacological treatment should be initiated. However, efforts to control the pressure levels have been generally exclusively focused on pharmacological therapy[4], which despite its proved efficiency in the BP control with consequent reduction of its comorbidities, does not exclude the need for other strategies, especially physical exercise, due to its cost-effectiveness meaning, applicability as well as influence on quality of life (QOL)[5-8]. Nevertheless, there is a considerable gap on non-pharmacological treatment with emphasis on physical exercise, in hypertensive patients medicated or not. Despite being highly recommended by the guidelines, non-pharmacological treatment is extremely neglected in the clinical practice[9]. Moreover, the plausible hypothesis that many patients, when adopt regular physical exercise practice, would not need anti-hypertensive medication. It should be also considered that the secondary effects of medication, many times interfering in QOL, are associated with less engagement to the treatment[2,10], the fact of taking medication many times means a greater problem than the disease itself[10] and that there are few reports on QOL of hypertensive patients inserted in a physical exercise program, this study proposes to analyze the effect of a treatment exclusively with physical exercise in BP and QOL of hypertensive patients.

## METHODS

### Subjects

44 hypertensive individuals, controlled by exclusively pharmacological treatment, with no regular physical exercise for more than six months, with no coronary cardiovascular episodes, cerebrovascular events, diabetes mellitus and without physical exercise practice restriction, took part in the study. The subjects were randomly placed in the Exercise Group (EG) and in the Control Group (CG). All of the participants signed the free and clarified consent form, and the researh was approved by the Ethics Research in Human Subjects Committee of the State University of Santa Catarina – UDESC, under the number 188/2007.

Out of the 44 volunteers, 32 completed the study. Out of the seven individuals from the EG who had been excluded, six did not participate in the exercise due to reasons not related to the study and one needed to return to the use of medication for having developed SH stage 3. Out of the five subjects excluded from the CG, four were due to reasons not related to the study and one stopped the medication at his own will. 18 subjects from the EG and 14 from the CG completed the research.

Initially, all of them were submitted to the medical evaluation to verify the BP control level and investigation of occasional comorbidities which would justify the exclusion. Subsequently, according to the group they were placed in, they received instructions to interrupt or continue with the pharmacological treatment. They were submitted to BP checking[2], application of the QOL questionnaire[5] and measurement of the abdominal circumference (AC)[2] and body mass and stature, which served for the calculation of the body mass index (BMI)[2]. Afterwards, the medication of the subjects from the EG were gradually removed and the individuals remained up to ten days without pharmacological treatment before they initiated the physical exercise program in a procedure similar to the one proposed for medication removal of the brief ergometry protocol[11]. The individuals who remained with pressure values until stage 2 of SH[2] without medication were included in the study. At the end of ten days, the cardiopulmonary ergometric test (CPET) was performed with a ramp protocol of the cardiorespiratory fitness an exercise prescription for the EG. At the end of the study all of them were submitted to the same initial evaluations, except for the CPET, which was performed only in the EG, considering that the subjects from the CG were not submitted to intervention which could cause alteration in their functional capacity in this period.

### Measurements

For the initial B and reavaluation BP, three measurements with one-minute interval between them were performed. The mean of the two last ones was considered the blood pressure of the individual. BP was checked with the subjects at sitting position, always on the left arm and performed by the same evaluator. A Sankey® mercury column sphygmomanometer and a Litmann® stethoscope were used. The BP of the group which performed physical exercise was checked once in each session with the same equipment.

Anthropometric measurements were evaluated with stadiometers with 1 cm of resolution and a Filizola® scale with resolution of 100 g for body mass determination and a Sanny® metal tape measure with precision of 0.1 cm for determination of the abdominal circumference. (HR) heart rate was controlled during the exercise with the use of a Polar® hand heart monitor.

The MINICHAL-Brazil[12] questionnaire was used for measurement of the subjective perceived of QOL related to health. This questionnaire was composed of 17 items which includes two domains: Mental Status with nine questions and Somatic Manifestations with seven questions. The answers are distributed on Likert frequency scale and has four options ranging from zero (no, absolutely) to three (yes, a lot), in which the closer the result is to zero, the better the QOL. The last seven days were considered for the answers. Question 17, which analyzes the general health perception of the patient, is not included in any domain, not being analyzed in this study for being considered of ambiguous character, with misinterpretation risk in the answer alternatives.

## STUDY PROTOCOL

### Exercise Group

The exercise program was performed in structured Cardiopulmonary and Metabolic Rehabilitation program, being composed of 30 sessions, with frequency of three times per week. In each session, five minutes of warm-up followed by aerobic exercise (walk and/or treadmill run for 30 minutes) at HR intensity reached in the CPET threshold one were performed. Subsequently, resistance exercises for upper and lower limbs with free weight, two sets of 12 repetitions with load corresponding to 50% of maximum resistance were performed. At the end, stretching was performed for five minutes. HR was verified during aerobic exercise and BP was checked before and immediately after each training session.

### Control Group

The CG subjects were told to keep their life habits. A meeting with the participants of this group was set in the beginning and at the end of tem weeks for evaluation and reevaluation of the variables previously mentioned. At the end of this period, they were invited to participate in the physical exercise program.

### Statistical analysis

Data were expressed in mean ± SD and assessed inter and intragroup. In the inter-group analysis, an independent Student's *t* test for parametric data and Mann-Whitney U test for non-parametric data were used. Concerning the intra-group analysis, a paired Student's test for parametric data and a Wilcoxon test for non-parametric data were used. Concerning the analysis of the category variables, a chi-square test was used, while for the BP variables and anthropometric measurements, the MANOVA for repeated measures with degree adjustment of the Bonferroni test for analysis of the main effects was used. The data were analyzed by the SPSS version 11® and the results were considered significant with $p < 0.05$ values.

## RESULTS

Baseline data of the 32 subjects who completed the study are in the following table 1:

Table 2 evidences the pre-study and after tem weeks of follow-up pressure values, comparing the group which substituted the pharmacological treatment for physical exercise with the group which continued with the medication. It also expresses exclusive data of the EG in the first and last exercise session without medication use.

It was possible to observe that there was no significant difference between groups. After ten weeks, the group which performed physical exercise maintained the pressure values similar to the initial values when it was still under pharmacological treatment, without significant difference in the comparison with the subjects who remained under medication. In the intra-group analyses, no difference was observed either comparing the beginning and end of the follow-up. Figure 1 presents the EG pressure behavior before each of the 30 exercise sessions without use of medication. Since the physical exercise was performed three times per week, the BP of this group was checked every 48 hours. BP presented light variability session by session, without significant difference between

**Table 1.** Baseline characteristics with comparison between groups of the 32 participants of the study.

| Variable | EG (N = 18) | CG (N = 14) | p value |
|---|---|---|---|
| Sex (F/M) | 9/9 | 8/6 | Ns |
| Age (years) | 54.6 ± 8.7 | 55.6 ± 9.7 | Ns |
| BMI (kg/m2) | 30.3 ± 4.8 | 32.2 ± 6.5 | Ns |
| AC (cm) | 101.1 ± 11.4 | 105.0 ± 14.2 | Ns |
| VO2peak (mL/(kg.min)) | 27.5 ± 5.4 | 25.1 ± 5.1 | Ns |
| Associated risk factors | | | |
| Dyslipidemia | 06 (33%) | 04 (28.6%) | Ns |
| Overweight | 11 (61.1%) | 08 (57.1%) | Ns |
| Obesity | 04 (22.2%) | 05 (35.7%) | Ns |
| Smoking | 01 (5.5%) | 01 (7.1%) | Ns |

EG: exercise group; CG: control group; F: female; M: male; BMI: body mass index; AC: abdominal circumference; $VO_2$peak: oxygen consumption peak in the cardiopulmonary ergometric test; Ns: not significant.

**Table 2.** Blood pressure of the two groups in the beginning, at the end of the study and in the first and last sessions of the exercise group.

| BP (mmHg) | Groups | Initial check – with medication | Final check | p value |
|---|---|---|---|---|
| SBP | EG | 132.2 ± 13 | 134.4 ± 10 | Ns |
| | CG | 127.2 ± 19 | 130.2 ± 16 | Ns |
| | (EG x CG) | Ns | Ns | - |
| DBP | EG | 85.0 ± 9.0 | 82.1 ± 16 | Ns |
| | CG | 85.3 ± 10 | 85.3 ± 12 | Ns |
| | (EG x CG) | Ns | Ns | - |
| | | 1st session | 30th session | |
| SBP | EG | 136.0 ± 16 | 136.4 ± 9.0 | Ns |
| DBP | EG | 84.7 ± 13 | 85.0 ± 12 | Ns |

EG: exercise group; CG: control group; SBP: systolic blood pressure; DBP: diastolic blood pressure. Data expressed in mean ± standard deviation. NS: not significant.

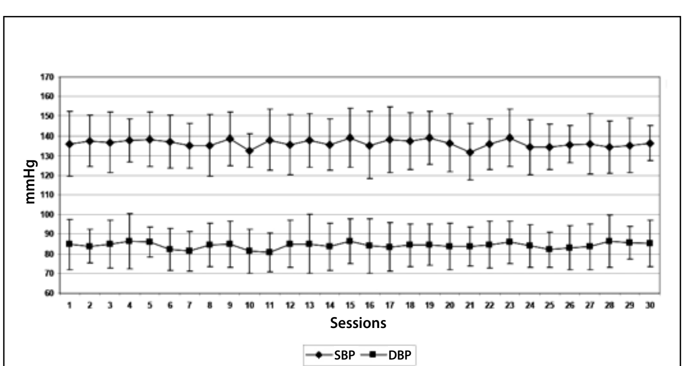


**Figure 1.** Behavior of the systolic and diastolic blood pressure mean before each of the 30 exercise sessions.

the means of each day. It was demonstrated that physical exercise kept the pressure levels of these individuals well-controlled.

Figure 2 demonstrates the SBP and DBP behavior with pre--exercise and immediately after values in each of the 30 sessions. As expected, considering the pre-exercise values, significant reduction of SBP was observed at the end of each session ($p < 0.05$). However, since it was not object of this study, we cannot state the time extension of the acute hypotensor effect of the exercise. Significant alterations of DBP have been observed during the physical exercise program.

Concerning Health-Related Quality of Life (HRQOL), from the data exposed in table 3, significant difference has not been observed between groups initially and after ten weeks. When intra-group analyzed, only in the subjects who performed physical exercises improvement in both domains was observed, with significance only in the mental status domain ($p = 0.02$).

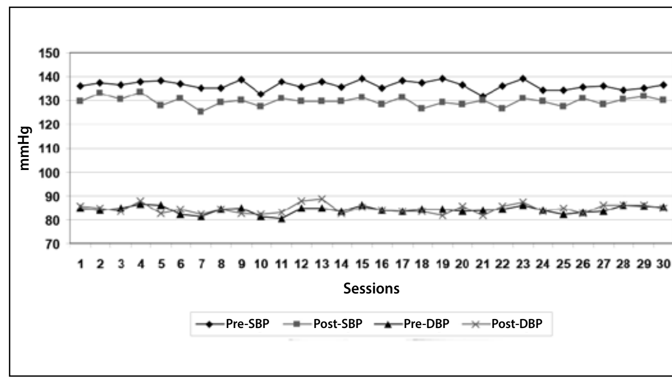


**Figure 2.** Behavior of the pre-exercise and post-exercise systolic and diastolic blood pressure mean during aerobic exercise in each of the 30 sessions.

**Table 3.** HRQOL scores in the mental status and somatic manifestations domains.

| Domains | Groups | Initial CI (95%) | Final CI (95%) | P value |
|---|---|---|---|---|
| MS | EG | 5.33 (3.24 – 7.43) | 3.67 † (2.08 – 5.26) | 0.02 |
| | CG | 4.64 (2.30 – 6.98) | 4.93 (2.16 – 7.70) | Ns |
| | EG x CG | Ns | Ns | - |
| MS | EG | 2.56 (1.53 – 3.50) | 1.83 (0.91 – 2.76) | Ns |
| | CG | 2.79 (0.89 – 4.68) | 2.57 (0.99 – 4.15) | Ns |
| | EG x CG | Ns | Ns | - |

EG: exercise group; CG: control group; MS: mental status; SM: somatic manifestations; (†) significant difference intragroup $p < 0.05$; NS: not significant.

## DISCUSSION

Our data demonstrated that physical exercise during the intervention period was sufficient to maintain the pressure levels, not being observed significant differences in the inter-group and intra-group evaluation after tem weeks of regular physical exercise, corroborating the results found by Marceau *et al.*[13] and Barroso *et al.*[14], in which medication was substituted for exercise. In the study by Marceau *et al.*[13] ten-week periods of exercise with intensities range from 50% and 70% of $VO_{2max}$ were used. In the casual measurement, BP alteration was not observed after training at any intensity, while Barroso *et al.*[14] found initial and final pressure values similar to the ones reported by us. Aerobic and resistance exercises were performed; in spite of the more prolonged duration, after six months of intervention significant pressure reduction was not demonstrated.

In the EG individuals the BP was measured every 48 hours, before and immediately after each one the 30 sessions. Acutely, significant SBP reduction occurred in the end of each day of training. Although it had not been na aim in this study, we found out that the BP behavior was not significantly different in each session, unlike what was demonstrated by Viecili *et al.*[15], who in their investigation carried out with hypertensive subjects under medication, found persistent pressure reduction during the exercise program. However, studies which investigate hypotension after an exercise program in a longitudinal manner in hypertensive subjecs not medicated are still limited[16], which requires further investigation.

Concerning the pressure values in the group submitted to physical exercise, the BP initially evaluated with medication was within the borderline classification. When the pharmacological treatment was removed, small and not significant alteration occurred, which can suggest that some of the patients could keep BP controlled without use of medication, or that they were still under the medication influence due to the medication pause considered for re-evaluation; however, this is a very improbable situation. It is worth mentioning that studies conducted without use of medication, such as the ones by Seals and Reiling[17], Takata *et al.*[7] and Simão *et al.*[1], presented subjects with initial BP higher than the values we presented. However, in those studies individuals without any previous treatment were evaluated. Therefore, it can be inferred as suggested by Arroll and Beaglehole[18], that more remarkable pressure reduction may have occurred due to the higher initial BP values.

Our results were different from the ones found in other studies with hypertensive subjects not medicated who presented significant pressure reduction after the intervention period with exercise[1,7,17,19,20]. However, it is worth mentioning that the models of these studies were different from ours concerning in the exercise protocol concerning type, duration, intensity and frequency. Furthermore, contrary to those studies in which the hypertensive subjects were initially without any kind of treatment for SH, in our research an alteration in the treatment was promoted in the EG with substitution of the pharmacological treatment for a treatment with exercise. Thus, the comparison in the beginning and end of our experiment was concerned about individuals who were already undergoing treatment, a fact which can explain the reason for the BP maintenance in the EG.

Concerning the behavior of the group which remained under pharmacological treatment, as in the present study, the individuals of the control group in the majority of the evaluated investigations in the meta-analysis by Whelton *et al.*[6] were told to keep the same lifestyle. As demonstrated by other authors, our results for the group which remained under pharmacological treatment, did not evidence alterations in the BP[13,19], something obvious, since they were already undergoing a treatment considered effective.

The evaluation of the quality of life demonstrated that only the EG subjects presented improvement, a fact which reflects an advantage of the alteration of the therapeutic modality; that is, the substitution of the pharmacological treatment for the physical exercise. Since this is a recently validated questionnaire in Brazil, we did not find articles published to compare with our results, which motivated us to develop a study[21] in which QOL was transversally evaluated through the MINICHAL-Brazil in hypertensive subjects participants of cardiopulmonary and metabolic rehabilitation programs compared with individuals who exclusively performed first-aid treatment. The group which performed regular physical exercise presented better HRQOL score both in the emotional and physical domains, as well as used less medication than the sedentary group. A possible explanation for these results may be in the kind of treatment, considering that in the treatment of the physically active group there was involvement of a multidisciplinary team, which made it possible that educational and information aspects contributed to better understanding of the hypertensive disease, besides the positive influence provided by the social interaction present in this kind of activity[10].

Our results, even considering the distinct methods and instruments, corroborated the epidemiological studies which demonstrated that individuals with chronic disease who are physically active present better physical and mental condition[22-24]. This fact has been confirmed in other articles which used physical exercise as intervention in patients with different examples of chronic diseases and who also demonstrated QOL improvement[25,26]. It must be highlighted that our study may be considered pioneering in the assessment of the QOL of hypertensive subjects exclusive treated with physical exercise, compared with the sedentary hypertensive subjects submitted to a pharmacological treatment.

In a study in which QOL was assessed through the SF-36 questionnaire, hypertensive patients helped at the first-aid office presented the perception of physical aspects with worse scores than the emotional ones[10]. Another investigation using the same generic instrument demonstrated that the QOL of 131 hypertensive subjects presented physical and emotional compromising[27]. Our results demonstrated that initially the worse scores were emotional, exactly the ones which presented the best significant improvement in the EG. Besides the BP control, we should consider other aspects besides QOL improvement, observed only in the group which practiced exercise, since the medication removal avoids adverse effects and also offers economic advantages due to lower costs with the treatment.

It must be highlighted that these data report about ten weeks of observation and that, according to what has been already reported in the literature, whenever there is exercise interruption, the hypotensive effects and the remaining benefic effects produced by it are also interrupted[28]. Thus, the result persists while the exercise program is going on, just like with the pharmacological treatment.

Finally, our data demonstrated that physical exercise is effective in controlling BP and reaching a better QOL and hence, it should be used as the first course of action in the treatment of SH, contributing to inform the health professional about the absolute need to systematically implement the non-pharmacological treatment due to the great benefits brought not only to patients but the health system as well, even including economic advantages.

## CONCLUSION

In conclusion, anti-hypertensive treatment exclusively through physical exercise, when compared with the conventional pharmacological treatment, enabled identical control of the systolic and diastolic blood pressure, besides better perception of quality of life.

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

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