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Influence of domestic and community exercise programs on the physical fitness, arterial blood pressure, and biochemical variables in hypertensive patients

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ABSTRACT

Background and purposes: Physical activity is accepted as a complementary strategy in the hypertension treatment. However, few studies were concerned with the effects of exercise programs which encourage a less strict training control, especially non-supervised programs. Thus, this study aimed to investigate the effects of two non-formal exercise programs on the blood pressure (BP), physical fitness and biochemical blood profile in hypertensive adults. **Methods:** Two groups were observed during 18 months: a) 29 subjects engaged in a domestic program (CLINEX) (age: 53 ± 11 yr); b) 42 subjects practicing calisthenics in a community program (NPRC) (age: 62 ± 9 yr). The following variables were assessed: BP, body weight, body fat percent, body mass index, sum of skin folds, waist-hip ratio, cardiorespiratory capacity, and biochemical variables (total cholesterol, HDL, LDL, plasma triglycerides, and blood glucose). The domestic program consisted in home-based programmed activities (walking and stretching exercises), held three times/week. The subjects were specifically trained for controlling the intensity and duration of the exercise, and filled an individual chart which was periodically delivered to the research group. The community program proposed hospital-based calisthenics and aerobic activities ministered by exercise specialists, also three times a week. In both programs, the data were assessed every three months and treated by repeated measures ANOVA ($p < 0.05$). **Results and conclusion:** The results suggested the exercise programs elicited positive effects, mainly in body composition and fat regional distribution. The repercussions on blood pressure, despite the fact of being statistically identified, seemed to be less consistent. There were not meaningful effects over the blood biochemical profile. The authors concluded that non-formal exercise programs can be related to favorable changes in overall condition of hypertensive patients, but their potential to elicit more specific changes should be better studied in the future.

Key words: Health. Cardiovascular disease. Health promotion. Physical training. Hypertension.

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INTRODUCTION

Changes in lifestyle may be important for hypertensive patients, fostering reduction of blood pressure and risk factors, by tackling overweight, glucose tolerance and serum lipids[1-5]. In this scenario, regular physical activity is often mentioned. In effect, a number of studies have identified an inverse relationship between physical activity and blood pressure or risk of hypertension[6-9]. The literature shows that aerobic training for hypertensive subjects seems to decrease systolic and diastolic blood pressure[6-8]. Even hypertensive subjects, once they become physically active, seem to present lower mortality rates than sedentary ones[10]. Thus, it seems reasonable to recommend the practice of exercises as a public health strategy for prevention and treatment of high blood pressure.

Prescribing exercises for hypertensive subjects is generally similar to the recommendations for normotensive adults to develop and sustain cardiorespiratory fitness[11]. However, there are some indications that reduced-intensity activities may affect blood pressure of hypertensive subjects, regardless of the effects on their aerobic fitness: experimental studies, such as Moreira's *et al*.[12], and meta-analyses, such as Fagard's *et al*.[8] report positive results for intensity between 20 and 70% of the maximum functional capability. This allows for the implementation of exercise programs that do not require a strict control of exertion intensity – in other words, non-formal programs. In this sense, one can mention two types of program: a) group or community physical activity programs; b) domestic or home-based physical activity programs. There is a gap in the literature regarding comparative studies on the effects of these different types of program on the blood pressure of hypertensive subjects. However, the characteristics of group and non-formal programs make them suitable as exercise-related public health strategies: they involve significantly less human and material resources and foster the patients' autonomy. Their potential to reach major populational segments at low cost tends to be higher than the one of formal, strictly supervised programs.

Thus, the purpose of this study was to investigate the effects of 18 months of application of two non-formal exercise programs, one a community-based program, the other a home-based program, on blood pressure, biochemical variables and physical fitness in hypertensive adults of both genders.

MATERIAL AND METHODS

Sample

The following groups were compared: a) subjects engaged in a domestic program from the Hypertension Clinic of the Medical and Experimental Pathophysiology Lab (CLINEX), State University of Rio de Janeiro's (UERJ) Pedro Ernesto University Hospital; b) subjects engaged in a physical exercise community program of the Prevention and Cardiac Rehabilitation Service (NPRC), Ergometry Division, UERJ's Pedro Ernesto University Hospital.

All patients had stage I or II hypertension at baseline. To be included in the study, the subjects had to take part in the programs for at least nine months. This period of time was established as the least for exercise-induced chronic effects could be manifested, and ensured assessment of the progression of patients really engaged in the program. The following exclusion criteria were also observed: a) bone-muscle-joint or metabolic problems that limited or contraindicated the practice of the programmed exercises; b) heart attack in the previous two years, heart failure, ischemic heart disease, or unstable angina; c) participation in other regular exercise programs; d) renal failure (creatinine > 1.5); e) anemia (Hb < 10 g/dl); f) dose increase or change in the class of drugs used; g) absence of more than 25% of the number of scheduled sessions.

At CLINEX, 185 patients were enrolled in the program, 111 went for an evaluation, and 74 had bimonthly visits. From the later, a sample of 29 patients was selected, proportionally randomized for genders, including 7 men and 22 women, age 31 to 77 years (mean: 53, SD: 11). At NPRC, from a total of 250 patients, the same procedure as above was used to select a sample of 42 subjects, 12 men and 30 women, age 36 and 77 years (mean: 62, SD: 9).

For the control group, 14 patients were randomly selected. All of them were being treated with drugs and diet, but did not practice regular physical activity. By looking at their charts from 3-4 months prior to the beginning of the programs, blood pressure levels, weight, BMI and biochemical variables were recorded. Physical fitness variables were controlled in patients who, after undergoing the first evaluation, remained for at least four months without engaging in any physical activity, for whatever reason. This type of strategy, in which subjects submitted to exercise programs can serve as controls for themselves, is not uncommon in experimental outline studies[13]. All study participants signed an informed consent form, according to the recommendations of the Brazilian National Health Council resolution 196/96.

Intervention programs

Hypertension Clinic (CLINEX) – In CLINEX program, the patients took part in a domestic exercise program including a light- to moderate-intensity walking (60-85% da HR_{max} estimated for their age), three times a week at least and for 30 minutes per session. Also flexibility exercises were prescribed, to be performed three times a week. Once at the clinic, the patients would have all the tests and measurements done, except blood tests, in the following order: weight, height, blood pressure, anthropometry, flexibility, and cardiorespiratory fitness. Then, they were oriented on how to control the intensity of the walkings (checking HR by palpation of the radial artery), its duration and frequency. They also received instructions on how to properly perform stretching exercises. Reassessment of the patients was made at every two months, to follow their progression and to adjust the loads to their new training status.

Prevention and Cardiac Rehabilitation Service (NPRC) – At NPRC, patients underwent a community exercise program of aerobic nature, with intensity from light to moderate (75-85% of HR_{max} at a maximum stress test), for 60 minutes per session, at least three times a week, in addition to flexibility and strength exercises. The activities were performed three times a week at the Pedro Ernesto University Hospital (HUPE). The session included: a) a 10-minute warm-up; b) 20 minutes of chiefly aerobic exercises, alternating walking and/or running with exercises for major muscle groups; c) 20 minutes of exercises for muscular strength and flexibility; d) a 10-minute cool-off. Monitoring of exertion loads was done through HR, BP and subjective perception of the strain. Except for the blood test, the patients were submitted to all the tests and measurements at HUPE's Ergometry Division, in a single session, at the following order: medical history, weight, height, blood pressure, anthropometry, and cardiorespiratory fitness. They were then given guidance as to the results and how to control the intensity of exercises (HR check by palpation of the radial artery). Reassessments were made at every three months to follow patient progression and re-evaluate exercise loads.

Instruments

Blood pressure was measured at rest, through auscultatiuon with a *Tycos*® (USA) sphygmomanometer, with the patient in a sitting position for at least five minutes. Systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean blood pressure (MBP) were assessed. Body weigh was checked on a *Toledo*® (Brasil) digital scale, and height with a stadiometer graded in millimeters. From these values one calculated the patients' body mass index (BMI). Through the measurement of waist and hip, done with a metallic metric tape graded in millimeters the waist-hip ratio was determined. To estimate the percentage of fat (%F), the skinfold method was used, measuring chest, tricipital, subscapular, abdominal, supra-iliac, thigh, and leg skinfolds with a *Lange*® (EUA) caliper. In addition to the percentage of fat, one added all skinfolds (∑Db). The model used to calculate the percentage of fat was Jackson and Pollock's[14] for men, and Jackson's *et al*.[15] for women. Biochemical variables were assessed through periodic and stardardized blood tests done at UERJ's Pedro Ernesto University Hospital. Serum levels of triglycerides (TRI), total cholesterol (COL), HDL-cholesterol (HDL), LDL-cholesterol (LDL), and glucose (GLU) were evaluated.

Only the assessment of cardiorespiratory fitness was different. At CLINEX, it was used a three-stage submaximal test with a *Monark*® (Brasil) cycle-ergometer with mechanic breaking. The protocol consisted on applying three progressive loads, each one lasting three minutes. At the end of each stage, HR and BP were recorded through a *Polar*® (Finland) heart rate monitor, and auscultatory method, respectively. To estimate cardiorespiratory fitness, one calculated the regression model between HR and loads during the test. Progression of the results was assessed by comparing the inclination of the curves from different evaluations (coefficient alpha), setting the intercept in zero (HR/W). In the NPRC-HUPE program, the assessment was made through a maximum stress test on a *Quinton*® (USA) treadmill. Bruce's protocol[16] was used. During the test, HR and BP were observed, in addition to electrocardiography markings, to check for abnormalities that could prevent the safe practice of physical activities. The maximum test time, in minutes, was used as reference for the patient's cardiorespiratory capability (T-Bruce).

Treatment of results

For the evaluation of the control period, Student's *t* test for paired samples was applied. The results from 18 months of engagement in the program were treated, for each group, through a variance analysis for repeated measures, with Tukey's *post-hoc* verification. There was no statistic comparison between the groups. For all cases, a significance level of $p < 0.05$ was used.

RESULTS

Comparison of the results for control subjects are in table 1. There were no significant differences among the values found, except for weight, %F and ∑Db, which were lightly higher.

Mean values for the observed variables at the period of the experiment, the number of subjects observed at each evaluation, and results from inferential statistics for the variables, from groups CLINEX and NPRC are presented in tables 2 and 3, respectively. Mean values are according to the sequence of the available assessments. The superscript numbers relate to those assessments where significant differences ($p < 0.05$) were found.

TABLE 1
Descriptive and inferential statistics
(paired Student t-test) for the control group

Variable	n (sample)	Evaluation 1	Evaluation 2
Weight (kg)	14	76.2	79.8*
BMI (kg/m²)	14	30.4	30.7 ns
Waist-hip ratio	6	0.96	0.96 ns
%F	6	33.8	36.7*
∑Db (cm)	6	93.2	95.9*
HR/W	5	0.97	0.96 ns
T-Bruce (min)	14	8.0	8.2 ns
SBP (mm Hg)	14	142.5	141.2 ns
DBP (mm Hg)	14	86.7	85.9 ns
MBP (mm Hg)	14	103.4	102.9 ns
COL (mg/dl)	12	225.2	223.4 ns
HDL (mg/dl)	12	46.2	45.8 ns
TRI (mg/dl)	6	137.9	140.1 ns
GLU (mg/dl)	8	110.8	112.4 ns

* p < 0.05; ns – non-significant.

TABLE 2
Descriptive (mean values) and inferential (ANOVA) statistics for the CLINEX program

Variable	Evaluation						
	1	2	3	4	5	6	7
Weight (kg)	78.9 (29)	78.1 (29)[1]	77.3 (29)[1]	77.3 (29)[1]	75.5 (23)[1]	76.4 (19)[1,2]	77.2 (15)[1,2]
BMI (kg/m²)	30.5 (29)	30.5 (29)	29.9 (29)[1]	30.3 (29)	29.5 (23)[1,2]	29.7 (19)[1,2]	30.1 (15)[1,2]
Waist-hip ratio	0.95 (29)	0.94 (29)	0.93 (29)[1]	0.92 (29)[1]	0.93 (23)[1]	0.94 (19)	0.95 (15)
%F	33.5 (29)	32.3 (29)[1]	32.3 (29)[1]	31.6 (29)[1,2]	30.0 (23)[1,2]	29.5 (19)[1-3]	28.1 (12)[1-4]
∑Db (cm)	94.0 (29)	92.6 (29)	89.3 (29)[1,2]	85.7 (29)[1,2]	83.4 (23)[1-3]	76.9 (17)[1-4]	77.6 (10)[1-4]
HR/W	0.98 (26)	0.98 (24)	0.97 (19)[1,2]	0.96 (16)[1,2]	0.97 (9)	0.95 (8)[1-3]	0.97 (4)
SBP (mm Hg)	141.1 (29)	134.0 (29)[1]	135.0 (29)[1]	134.7 (29)[1]	143.0 (22)	137.9 (17)	138.3 (11)
DBP (mm Hg)	85.5 (29)	83.3 (29)	83.3 (29)	83.0 (29)	86.0 (22)	86.6 (17)	86.8 (11)
MBP (mm Hg)	104.0 (29)	100.2 (29)	100.5 (29)	98.9 (29)	105.0 (22)[1,2]	103.7 (17)[1,2]	104.0 (11)[1,2]
COL (mg/dl)	224.8 (26)	210.8 (18)[1]	223.7 (11)	237.6 (5)	260.0 (4)[1]	250.6 (4)[1]	
HDL (mg/dl)	47.6 (24)	47.5 (17)	55.4 (11)	46.4 (5)	50.7 (4)	47.0 (4)[1]	
TRI (mg/dl)	142.3 (25)	119.6 (17)	130.0 (9)	166.2 (5)	172.6 (4)	124.3 (4)[1]	
GLI (mg/dl)	106.4 (26)	116.4 (18)	103.3 (12)	110.7 (8)	106.5 (4)	116.6 (3)	114.0 (3)

Values in parenthesis relate to n (number of subjects in the sample). Superscript values indicate significant shifts in relation to the assessed values ($p < 0.05$).

TABLE 3
Descriptive (mean values) and inferential (ANOVA) statistics for the NPRC program

Variable	Evaluation						
	1	2	3	4	5	6	7
Weight (kg)	70.3 (42)	70.6 (42)	70.5 (42)	69.7 (41)	70.6 (27)	71.5 (22)[1-3]	76.6 (12)[1-5]
BMI (kg/m²)	27.5 (42)	27.8 (42)	28.1 (42)[1]	27.8 (41)[1]	27.8 (27)[1]	27.8 (22)	28.5 (12)
Waist-hip ratio	0.90 (42)	0.90 (37)	0.91 (19)[1]	0.92 (10)[1]			
%F	35.3 (42)	36.1 (36)	38.3 (17)[1]	39.8 (9)[1,2]			
∑Db (cm)	103.7 (41)	103.2 (36)	108.6 (17)	109.4 (7)			
T-Bruce (min)	8.5 (42)	9.4 (42)[1]	9.6 (38)[1]	9.7 (28)[1]	10.2 (20)[1]	10.5 (15)[1]	10.4 (13)[1]
SBP (mm Hg)	140.5 (42)	132.0 (42)[1]	133.1 (40)[1]	133.0 (38)[1]	131.2 (28)[1-3]	127.7 (20)[1-4]	131.6 (14)[1-3]
DBP (mm Hg)	88.2 (42)	83.4 (42)	83.5 (40)	83.5 (38)	81.7 (28)	81.0 (20)	82.9 (14)
MBP (mm Hg)	105.6 (42)	99.6 (42)[1]	101.1 (40)[1]	100.0 (38)[1-3]	94.8 (28)[1-3]	96.6 (20)[1-3]	99.1 (14)[1-3]
COL (mg/dl)	217.9 (37)	215.1 (36)	202.7 (32)	211.5 (26)	207.1 (22)	200.9 (17)	229.8 (13)
HDL (mg/dl)	46.7 (37)	48.1 (34)	47.2 (31)	46.7 (24)	44.8 (18)	46.9 (16)	45.5 (11)
LDL (mg/dl)	143.2 (29)	134.9 (23)	130.2 (20)	143.6 (17)	137.8 (11)	144.7 (10)	155.0 (6)
TRI (mg/dl)	132.9 (37)	123.5 (36)	133.0 (32)	147.9 (20)	127.3 (17)	140.9 (13)	136.1 (9)
GLI (mg/dl)	115.9 (36)	106.2 (36)	105.4 (31)	109.2 (24)	104.8 (20)	112.4 (16)	115.9 (11)

Values in parenthesis relate to n (number of subjects in the sample). Superscript values indicate significant shifts in relation to the assessed values ($p < 0.05$).

DISCUSSION

Before moving on to the discussion *per se*, it is important to mention some limitations of the study that explain the decision of not making statistic comparisons between groups. In the first place, the measurements were made in different moments (sometimes, months apart, due to the different intervals between evaluations). The programs did not start at the same time, thus it was not possible to have homogeneous groups at baseline, which really makes a quantitative comparison of the progression of data quite difficult – if there are differences since the very first evaluation, the value of an item-to-item comparison at each evaluation is quite limited. Even if there were significant differences between re-evaluations of some variables, with statistical equality on the first evaluation, it would be risky to state that one program was more effective than the other regarding those variables, as percentual differences were too small, most of the times. For cardiorespiratory fitness, there is also the fact that measurement was made under different techniques, which prevents this variable to be statistically tested for possible differences. And last, measurements were made by different groups, which increase the possibility of biases when comparing data from both programs.

On the other hand, presented as they are, it is possible to interpret the progression of variables in each program, under a more qualitative perspective. This is why it was decided the results of the different groups should be analyzed separately in relation to the observed variables, in an attempt to identify general trends, rather than looking into more specific differences between the programs, at each evaluation. It should also be mentioned the difficulties in controlling potentially interfering variables, such as dietary restrictions. Notwithstanding, the length of the study period – quite unusual in investigations of exercise programs for hypertensive patients, particularly non-formal programs – and the significant amount of variables assessed make the data found useful to assess the effectiveness of the programs.

Domestic (or home-based) programs are those in which individuals practice their exercises out of a controlled environment, such as hospitals, clubs, gyms, and the like. Thus, one renounces to most of the physiological control of the training, as the physical activity is not directly followed. This is done so that individuals can have some autonomy regarding the exercise, once they are trained to control and manage loads. Domestic programs allow more patients to be reached, with less resources, and the exercises can be performed in the place and time the patient wishes. Even though the effects of training may not be so accurately controlled as in formal programs, there is evidence that this type of program seems to favor the assimilation of physical activities as a long-term habit[17,18].

The idea is that if one has an efficient combination of appropriate guidance, exercise performance and control, compliance to the proposed activities is likely to be higher, making them more accessible and less costly for the patients. One should consider such possibility under the scope of public health strategies, by promoting the practice of physical activities among the general population. However, few studies analyzed the effectiveness of such a program in populations with special needs. Duncan *et al.*[19], for instance, developed a home-based, randomized, and controlled exercise program for stroke patients, to be carried out for 12 weeks, four of those on a totally independent manner. Results of balance tests and performance of daily activities were positive. No such studies were found for hypertensive patients.

Particularly in regard to a community program for hypertensive and/or heart-condition patients, the intensity of training should be based on the patient's medical condition, physical fitness (assessment of risk factors) and on the results of the stress test carried out upon admission. This is a problem often found in community and home-based programs – many a time, the practice of exercises under supervision is not feasible in many of the weekdays, due to a number of limitations (for instance, availability of time, work, financial conditions, the program's material and human resources). In this context, concurrent home-based programs could help the patients in keeping a weekly frequency of exercise practice that allowed them to reach higher training volumes.

The results suggest that both, home-based and community program activities, influenced most of the observed variables. Comparing the data with the control period, one could identify significant differences, particularly over the first months, which are listed below:

a) Body weight: a slight, but constant decrease became apparent from the evaluations carried out in the two programs. Krauss *et al.*[20] report that overweight is an important risk factor for the development and worsening of high blood pressure, for both, males and females. Ross and Janssen[21], reviewing the literature regarding dose-response to exercise, suggested there is a directly proportional relationship between level of daily physical activity and weight reduction, with possible repercussion on the distribution of body fat. One may think that non-formal exercise strategies, because they carry a higher potential of spontaneous engagement to an active life-style, should be fostered in this scenario;

b) BMI and waist-hip ratio: an unfavorable distribution of body fat, with excessive abdominal fat, would be related to the development of chronic cardiovascular and metabolic diseases (JNC, 1997)[4]. Ito *et al.*[22], for instance, suggested waist-hip ratio could complement BMI in assessing obesity and its metabolic changes, being correlated to adverse lipid profile in hypertensive subjects. Ledoux *et al.*[23] considered that abdominal distribution of fat could be used as an indicator of the likeliness of high blood pressure, which has recently been confirmed by Meléndez *et al.*[24] in women of the city of Belo Horizonte metropolitan area: central fat was a reliable predictor of obesity and high blood pressure in the population under study. In both, the CLINEX and the NPRC programs, a tendency to waist-hip ratio decrease was observed, even though it was not evidenced at all the evaluations. This seems to confirm what the literature proposes as to regional distribution of fat[25];

c) Percentage of fat and sum of skinfolds: the relationship between regular physical activity and favorable changes of the amount of body fat and lean mass is well accepted[26]. At the CLINEX program, there was a tendency for body fat and skinfold sum to decrease. At the NPRC program, the tendency was for increase of body fat, what challenges the used strategies. In a community-based program, one should be careful with the time engaged in the activities. After an initial period of motivation, related to the entry in the program, a process of accommodation may occur. There are shifts in the interests, and socialization may become more important than the physiological component of the training. Another aspect to be stressed is attendance. In our sample, we selected patients whose absences were 25% or less, but continuous absences may compromise months of previous work;

d) Cardiorespiratory fitness: there are studies showing improvement of cardiorespiratory fitness in hypertensive subjects engaged in physical exercise programs with intensity close to the applied in the programs observed[5,6,9,10]. Confirming these studies, at CLINEX improvements were observed up to six to nine months in the program. The fact of the stress test being performed on a cycle-ergometer with the assessment of HR/W decreases the possibility of the positive effects being due to weight reduction. In the NPRC program, improvements were seen only in relation to the first evaluation, with further results tending to be stable. It is important to realize that beneficial effects are evidenced, but not as frequently as one would expect, particularly in hypertensive subjects who have a higher cardiac overload due to high blood pressure. In addition to the problems presented in the previous item, which could add to the explanation of the reduced effect of training on this variable, one may add that the cardiorespiratory measuring technique itself, being different in both programs, may contaminate the results. The NPRC-HUPE program uses a maximum stress test on a treadmill, whereas CLINEX uses a submaximum test. In the first case, the results depend, up to a point, on the motivation of the patients, as only the time on treadmill is considered. Motivation for the test may decrease as the activity becomes repetitive. However, it is hard to mask HR behavior at submaximal loads: this fact may have favored CLINEX in the comparison;

e) Blood pressure: a number of studies have identified a significant inverse association between physical activity and blood pressure levels in hypertensive subjects[8,27,28]. The literature states it is not necessary the practice of high-intensity aerobic exercises to achieve benefits in the blood pressure. The benefic effects of the physical activity may be induced by low-intensity exercises, with similar efficiency to that of higher-intensity exercises[8,12]. In 39 studies analyzed by Petrella[29], it was demonstrated that moderate-intensity walking allow BP to decrease from 13 to 18 mmHg in systolic and diastolic blood pressure in hypertensive patients. In most cases, the effects of training become evident after 10 weeks. Similar progress was observed in the programs under study, particularly NPRC, in which significant differences became evident for SBP, DBP, MBP from the second evaluation on (corresponding to a three-month period). In CLINEX, there were significant differences for SBP and MBP. Notwithstanding, these changes did not follow a defined progression pattern, and there are changes in relation to the first as well as to the fifth evaluation. Thus, as for blood pressure, NPRC program seems to have been more effective for the observed group and period. However, as mentioned before, for more consistent inferences, a higher control of potentially influencing factors is necessary, as well as the accurate drug dosage and the randomic effect of patient evasion;

f) Biochemical variables: Leon and Sanchez[30] report that significant LDL, TG and COL reduction due to exercise tend to be less frequently observed than HDL increase. The practice of exercises with no concurrent intervention on diet would lead to TG, LDL and COL reduction of about 3.7%, 5.0% and 1.0%, respectively. Stein *et al*.[31], in a sample of 49 high-cholesterol males, assessed the effect of moderate-intensity (group 1: 65% of HR_{max}), intermediate intensity (group 2: 75% of HR_{max}), and high-intensity (group 3: 85% of HR_{max}) activities on serum lipids, over 12 weeks. There was an HDL increase for groups 2 and 3, and LDL decrease for group 2, only. For all groups, there was no significant changes in COL and TG. King *et al*.[32] proposed activities with walkings or runnings for a 24-month period, and no significant changes on the lipid profile was found. The NPRC program presented similar results, with no significant differences found for COL, HDL, TG. The CLINEX program presented some minor, not consistent changes, basically concentrated on the first two evaluations. It was interesting to see that, in our study, no program presented any significant changes in glucose. This may be due to the fact that no patient had established diabetes. Thus, exercise-induced glucose changes would not be significant. It would be interesting to follow a particular group of diabetic patients.

The described results allow the conclusion that CLINEX and NPRC programs have positive effects on the condition of hypertensive patients, particularly in body composition, in terms of amount and regional distribution. As for cardiorespiratory fitness and blood pressure, results were not too conclusive: in spite of significant differences being found towards improvement, there was no behavior pattern that clearly supported these effects. Finally, both programs seem to be little effective in modifying the serum biochemical profile.

The lack of a accurate assessment of potentially influencing variables, such as diet and evasion, should be considered in future studies. Notwithstanding, results suggest the programs should be perfected, in terms of the physiological effects sought and enhancement of patient compliance. One should think the working method over. For instance, one may suggest better patient education on controlling exercise intensity, frequency and duration. And a system to follow more closely the activities actually performed by the patients should be implemented, particularly for a home-based program. These initiatives may contribute to the assessment of non-formal exercise programs' potential, as strategies that add to the therapeutic process of hypertensive patients.

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