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Program of Combined Physical Exercises (Aerobic-Anaerobic), Aimed at Hypertensive Subjects of the Commune of Arica

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ABSTRACT Many authors emphasize the importance of physical exercise to treat arterial hypertension. However, there are contradictions related to the orientation of combined exercises (aerobic-anaerobic). This motivated the researchers to carry out a study that aimed to: Evaluate the effect of a combined physical exercise program aimed at hypertensive people in the Arica commune; Carry out a non-experimental, longitudinal, quantitative investigation, with a sample of 250 hypertensive subjects Grades I and II, to which a combined physical exercise program was applied during 12 weeks; Evaluate body composition and blood pressure, before, during and after of the implementation of the program. The primary results were the decrease in blood pressure and fat mass, as well as the increase in muscle mass, leading to the conclusion that aerobic-anaerobic combined exercises can be recommended as part of the non-medicated treatment of arterial hypertension.

INTRODUCTION

Hypertension is a chronic disease characterized by a continuous increase in blood pressure in the arteries and is associated with high morbidity. Hypertension (HT) is highly prevalent; it is estimated that more than fifty-five percent of adults over 60 years suffer from hypertension (Herrera et al. 2017). In Chile, as in many developed and underdeveloped countries, there is a high prevalence of this disease.

The Region of Arica and Parinacota has a population of 157,568 inhabitants, of which, according to the Basic Health Indicators Chile (2015), 14,317 have been diagnosed as hypertensive.

There are many predisposing elements that in one way or another can raise blood pressure, generated by the product of the interaction of genetic factors and environmental influences. Different strategies have been drawn up to fight against the increase in the prevalence of hypertension, among which the following stand out: acting on the modifiable risk factors, without taking into account that many hypertensive subjects also require treatment with drugs antihypertensive (Berenstein 2017).

Among the recommendations that are aimed at modifying risk factors in hypertensive patients, physical exercise is accentuated, which seems to be an optimal way to improve the physical condition related to hypertension. However, in some cases, physical exercise programs carried out by hypertensive patients are far from having the required structure or are not based on clear and specific scientific elements for this disease. Therefore, it is necessary to encourage, from the field of Physical Culture, the development of physical exercise programs that promote the improvement of the physical condition related to health (Durán et al. 2014).

Garrido et al. (2017) carried out an analysis of the literature, highlighting the influence of physical exercise in the treatment of hypertension. To do this analysis, they conducted a virtual survey in databases such as PubMed, Scielo, and Lilacs, with which they could need a positive relationship between the practice of physical activity and the reduction of the arterial pressure. Also, they emphasize the recommendation of aerobic exercises of low and moderate intensity to achieve to reduce the arterial tension.

In recent years there have been controversies regarding the incorporation of physical or

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anaerobic exercises to the treatment of hypertensive subjects, arguing that these exercises favor the increase in blood pressure figures.

Currently, there are physical exercise methodologies with high intensity and short duration characteristics, which have shown improvements regarding blood pressure figures (Olea et al. 2017).

Unfortunately, this variability of scientific criteria has influenced the recommendations that are offered today to hypertensive subjects. Similarly, studies that highlight the effect of the application of programs that combine aerobic and anaerobic work (combined) on subjects with high blood pressure are not required in the literature, which has motivated researchers to carry carried out the present study, for which the following objectives have been elaborated.

General Objective

- To evaluate the effect of a program of combined physical exercises (aerobic/anaerobic) aimed at hypertensive people of the Africa commune.

Specifics Objectives

- Identify changes in body composition: weight, body mass index, the percentage of fat mass and percentage of muscle mass of hypertensive people, before, during and after the application of a program of combined physical exercises.
- To identify the behavior of systolic and diastolic blood pressure of hypertensive subjects participating in a combined physical exercise program.

METHODOLOGY

A non-experimental, quantitative, longitudinal and prospective study was carried out, with a universe of 500 hypertensive individuals of both sexes from the Remigio Sapunar Marín Family Health Center in the city of Arica, Chile. The study sample consisted of 250 hypertensive people from the Family Health Center (CESFAM) Remigio Sapunar Marín, with systolic and diastolic blood pressure figures of 120-129, and <80 to 140-159, or 90-99 according to the classification given by The American College of Cardiology and the American Heart Association (ACC/AHA) (Jeffrey 2017) (Table 1).

Table 1: Classification according to guides of hypertension of ACC/AHA

Blood pressure systolic y diastolic (mm Hg)	*ACC/AHA 2017*
<120 y <80	Normal Blood Pressure
120-129, y <80	Blood Pressure Elevation
130-139, u 80-89	Hypertension Stage1
140-159, o 90-99	Hypertension Stage 2
>160 o >100	Hypertension Stage 2

The sample was distributed to 150 women and 100 men. For the selection of the same, the following inclusion criteria were taken into account: that the selected patients were from the Remigio Sapunar Marin Health Center, that they had blood pressure figures in the range indicated above and that they were in an age group between 35-60 years old. Another criterion taken into account for the selection of the sample was the willingness to participate in the research. For this, the verbal and written consent of the participants and the approval of the Bioethics Committee of the institution were obtained.

The exclusion criterion was taken into account: anyone presenting hypertension secondary to the underlying disease that they did not show diseases of the complication of arterial hypertension and that were not pregnant.

Procedure

Measurement of Body Composition

Basic anthropometric measurements (weight, height, body mass index, the percentage of fat, percentage of muscle, visceral fat) were evaluated. The corporal evaluation was carried out with bioelectrical impedance equipment "Omron HBF 514C", with bare feet, using clothes as light as possible (sportswear), standing on the digital scale, standing with a horizontal view to the front. To control the size, a portable Seca 217 was used, the subject was evaluated in a standing position, without shoes.

Heart Rate and Blood Pressure Measurement

This evaluation was carried out using a digital equipment of the Omron Hem-7120 brand. The technique was based on the standardized

guidelines for measuring blood pressure of the Ministry of Health (MINSAL). It was taken into account to make the measurement that the subject was in a sitting position: that the upper extremity rested on a table, at the height of the heart.

The hand-held portable manometer was placed on a smooth and hard surface; the brachial (or humeral) artery was located by palpation on the inner side of the arm and the fold of the elbow (antecubital fossa). The tight and firm cuff was placed according to the circumference of the examinee's arm. It was taken into account that the inflatable rubber chamber inside the sleeve will surround eighty percent of the arm and its lower edge, being 2.5 cm (two fingers) in the fold of the elbow, with the connecting tube parallel to the course of the humeral artery, once these aspects were taken into account, the measurement was carried out.

Program Description

The combined program of physical exercises was elaborated based on several criteria of the scientific literature related to the guidelines of prescription of exercise for hypertensive patients. Among them: The rehabilitation program established for hypertensive people, elaborated by the Department of Physical Education of the Institute National Sports, Physical Education and Recreation (INDER), Sánchez (2005), the program suggested by Buchheit and Laursen (2013), and the proposal given by Abellán et al. (2014).

The program was structured in two stages (familiarization and adaptation stage and maintenance or stabilization stage), which include introduction, objectives, content, control and evaluation system, criteria to be taken into account.

In the first month, the familiarization and adaptation stage was completed, at this stage, the development of aerobic resistance was emphasized. It was started by walking gradually increasing the time and the intensity in an individualized way. Each class session had a duration of 60 minutes, once the objectives of this stage were met, the maintenance or stabilization stage was passed, incorporating the combination of the different aerobic and anaerobic exercises of moderate intensity.

1. Adaptation Stage

With a duration of four weeks, the main objective was to develop the subject's aerobic capacity to adapt to the load they would receive in the next stage and provide them with the necessary knowledge of the exercises to be performed. In this stage, activities were oriented with heart rate ranges between 50 and 60 of their maximum heart rate (low intensity) (Table 2).

Table 2: General data: Adaptation stage

Duration	4 weeks
Frequency	3 times per week
Intensity	50-60% Heart rate 5-6 Scale Borg
Physical ability to work	Aerobic resistance
Training method	Method for aerobic resistance; Continuous career (continuous walk actively and passively)
Objective	Adaptation to aerobic capacity

2. Maintenance Stage

It lasted eight weeks, the objective was to get the subject to reduce his body weight, the percentage of fat mass, develop muscular strength and acquire greater functional capacity, with the consequent impact on the figures of tension arterial. This stage is suggested to be maintained for life. In this stage, a combination of aerobic-anaerobic work was oriented, which included activities with heart rate ranges between 60 and 80 of their maximum heart rate (moderate intensity) (Table 3).

Table 3: General data: Maintenance stage

Duration	8 weeks
Frequency	3 times per week
Intensity	60-80% heart rate 6-8 Scale borg
Physical ability to work	General resistance (aerobic, anaerobic)Localized muscular resistance
Training method	General resistance method; "Moderate intensity exercises or Farklet"; applied to "actively walk" and "trot or race" alternately-Localized muscular resistance method; "30 + - 15" in the first 4 weeks. And method "1x2x3" in the next 4 weeks
Objective	Neuromuscular adaptations complementary to cardiovascular workStabilize blood pressure levels, decrease % fat, weight and increase muscle mass

Statistical Analysis

The evaluations made during the development of the research were collected in SPSS 21

statistical package and subjected to analyses that included: descriptive statistics and standard derivation in a validation data index. The resulting information was summarized in tables.

RESULTS

After the application of a combined exercise program, the body weight variable did not show statistically significant changes (Table 4). In the first evaluation, it was possible to check an average weight of 75.2 kg, in its second evaluation the body weight was 75.3 kg and at the end the application of the physical exercise program, the weight reached an average value of 75.9 kg. This non-significant increase could be related to the increase in muscle mass experienced by practitioners.

Table 4: Evaluation of body weight in three stages of application of the program of combined physical exercises destined to hypertension subjects

Stages of the test	*Evaluation of body weight (kg)*	*Deviation tip*	*Typical mean error*
Pre test	75.2	9.0	1.7
During the test	75.3	8.9	1.6
Posttest	75.9	8.9	1.6

The Body Mass Index (BMI) evaluations are shown in Table 5, in the first evaluation performed an average of 27.8 is observed, while the second measurement, after 6 weeks of application of the program, its values were 27.9 and the at the end of the program application the value increased to 28.2. It was possible to see a discrete increase in BMI, which may also be triggered by weight gain at the expense of muscle mass.

Table 5: Evaluation of Body Mass Index (BMI) in three stages of application of the program of combined physical exercises destined to hypertension subjects

Stages of the test	*Evaluation of body weight (kg)*	*Deviation tip*	*Typical mean error*
Pre test	27.8	9.3	2.4
During the test	27.9	8.2	2.3
Post test	28.2	8.3	2.4

It was observed in the first evaluation, average values of percentage of the fat mass of 40.8 percent, in the second evaluation 39.8 and 36.9 percent in the third evaluation, after the implementation of the program (Table 6).

Table 6: Evaluation of the percent of fat mass in three stages of application of the program of combined physical exercises destined to hypertension subjects

Stages of the test	*Evaluation of body weight (kg)*	*Deviation tip*	*Typical mean error*
Pre test	40.8	9.1	3.6
During the test	39.8	9.3	3.8
Post test	36.9	9.2	3.5

It was verified through the results that after 6 weeks of applying for the exercise program there was a reduction in the percentage of fat mass with a tendency to decrease one percent. However, between the second and third evaluation, there was a reduction of 2.9 percent, with an average total decrease of 3.8 percent of the fat mass at the end of the program's application.

In its first evaluation, the percentage of muscular mass was found in an average of 25.4 percent, while in the remaining assessments it behaved in 25.6 and 26.7 percent respectively. You can check the existence of an increase in muscle mass from the beginning of the program until the end of it was by 1.3 percent. This tendency could be observed mainly when the work of moderate intensity was applied and the muscular program "1x2x3" (1 minute of exercise, 2 minutes of rest and 3 series of each exercise performed).

The results of resting heart rate are shown in Table 7. It was verified that during the first evaluation average values of 75.8 beats per minute (FC) were achieved. After 6 weeks of applying for the program, the second evaluation was performed, where a heart rate of 66.0 beats per minute was observed, decreasing this value in the third measurement, after 12 weeks of the application of the combined program of physical exercise, heart rate was observed at 61.0 beats per minute. This decrease may be related to the adaptive changes that occur in the cardiovascular system as a result of physical activity (Hayley and MacDonald 2016).

The behavior of the systolic and diastolic blood pressure in its three evaluative stages is shown in Table 8. A decrease in the values during the progression of the program was ob-

Table 7: Evaluation of the heart rate in three stages of application of the program of combined physical exercises intended for hypertension subjects

Stages of the test	*Evaluation of body weight (kg)*	*Deviation tip*	*Typical mean error*
Pre test	75.8	8.1	4.8
During the test	66.0	7.3	3.3
Post test	61.0	8.4	5.1

served. At the beginning of the application, blood pressure values were shown in 135.4 millimeters (mm) of mercury (Hg), while in the second evaluation, the systolic blood pressure values were 127.0 mmHg and finally in the third evaluation an average of 120.8 mmHg. On the other hand, the behavior in the diastolic blood pressure behaved at an average value of 86.5 mmHg in the first measurement, in the second evaluation its average was 84.0 mmHg and at the end of the physical exercise program, an average of 80.3 mmHg.

Table 8: Evaluation of the arterial tension in three stages of application of the program of combined physical exercises destined to hypertension subjects

Stages of the test	*Blood pressure sistolica (millimeters (mm) of mercury (Hg))*	*Blood pressure diastolica millimeters (mm) of mercury (Hg)*
Pre test	135.4	86.5
During the test	127.0	84.0
Post test	120.8	80.3

DISCUSSION

According to the results presented, it can be stated that in the study conducted in hypertensive people of the Family Health Center (CESFAM) Iris Veliz, the combined program of physical exercise had a favorable impact, which resulted in a decrease in blood pressure, heart rate, values of the percentage of fat mass and increase in the percentage of muscle mass of the subjects analyzed.

Recent research has shown that aerobic exercise is associated with a reduction of 4.9 to 3.7 mmHg in hypertensive patients (González and Llapur 2017). This decline, according to Whelton et al. (2002), does not vary in relation to the frequency or intensity of exercise; this author suggests that both moderate intensity and work volume can have a beneficial effect in hypertensive patients. On the other hand, Garrido et al. (2017) estimate that with physical exercise the decrease in blood pressure is 6 to 5 mmHg in hypertensive people. Sari et al. (2015) argue that the combination of continuous and interválico training improves the risk factors of the metabolic syndrome and acts in turn on the risk factors for hypertension.

In the present study, it was possible to verify the effect of the application of a program of combined physical exercises aimed at hypertensive people living in the commune of Arica. Among the variables to be highlighted is body weight and body mass index, which did not show significant changes in the researchers' research, they believe that this could be caused because in parallel there was an increase in muscle mass. González and Llapur (2017) point out that a ten percent reduction in the body mass index (BMI) in a short time produces a decrease in blood pressure of 8 to 12 mmHg, also acting on other cardiovascular risk factors such as dyslipidemia and insulin resistance. This data coincides with the researchers of the present investigation.

The program of combined physical exercises showed a marked decrease in the percentage of fat mass; this result coincides with the results obtained by Olea et al. (2017), who highlighted the effect of training at high-intensity intervals in hypertensive subjects. In their study, these researchers evaluated 11 men and 27 women who performed exercises three times a week, being able to verify a change in the percentage of fat mass from 41.7 to 38.4.

Olea et al. (2017) showed a significant reduction of systolic blood pressure values from 145.4 to 118.3 mm Hg; these results coincide with those shown in the present investigation. On the other hand, Boutcher and Boutcher (2017) emphasize that intermittent aerobic and anaerobic exercise, performed at an intensity>seventy percent of maximum oxygen absorption, significantly reduces blood pressure. These authors also consider that with these exercises there is an increase in aerobic fitness in less time and cause more significant changes in arterial stiffness, endothelial function, insulin resistance and mitochondrial biogenesis.

CONCLUSION

As a result, it was evidenced that after the application of a combined program of physical exercise for hypertensive subjects in the commune of Arica, it exerted a favorable effect, decreasing the blood pressure figures in the subjects studied. Significant values were observed in the systolic pressure of 135.4 at the beginning of the study and 120. 8 mmHg at the end and in the diastolic pressure were checked averages of 86.5 at the beginning and 80.3 mmHg at the end of the program. Likewise, the subjects presented changes in the variables of body composition, showing a decrease in the percentage of fat mass with initial values of 40.8 percent and final values in 36.9 percent, which favorably influences the evolution of the hypertensive subject. Therefore, the researchers consider that aerobic-anaerobic combined exercises can be recommended as part of non-medication treatment for hypertensive subjects.

RECOMMENDATIONS

The researchers recommend increasing the time of application of the program to evaluate the behavior of the variables in a long term.

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