

CHANGE IN BLOOD PRESSURE LEVELS AND ASSOCIATED FACTORS IN EXERCISE PRACTITIONERS IN SÃO LUÍS-MAVictor Nogueira da Cruz Silveira¹, Wilson Serrão Araújo Filho¹, Ahirlan Silva de Castro¹
Helma Jane Ferreira Veloso¹**ABSTRACT**

Introduction: Hypertension is a clinical situation characterized by elevation in systolic and/or diastolic blood pressure levels. Usually is associated with metabolic disorders, functional and/or structural changes in target organs, aggravated by the presence of other risk factors such as dyslipidemia, abdominal obesity, glucose intolerance and diabetes. **Objective:** To estimate the prevalence of altered blood pressure levels and their associated factors in exercise practitioners in São Luís. **Materials and Methods:** The instruments used for data collection were socioeconomic, demographic, and behavioral forms and dietary records. Anthropometric evaluation was performed as well as the bioelectrical impedance test for the evaluation of body composition. Statistical analysis included Pearson's Chi-square test to verify associated factors with blood pressure levels. Significance was assumed as $p < 0.05$. **Results:** The mean systolic pressure values were 114.3 mmHg \pm 18.4 and diastolic pressure 68.45 mmHg \pm 9.9. The prevalence of altered blood pressure levels was 35.3%. The variables male gender, high sodium intake and overweight by body mass index were associated. **Conclusions:** The high prevalence of deviations in blood pressure is worrying even for physically active individuals. The factors associated with these deviations reinforce the multifactorial character of this disease and the need to maintain surveillance programs and combat this silent problem.

Key words: Arterial Pressure. Hypertension. Motor Activity.

1 - Universidade Federal do Maranhão, Centro de Ciências Biológicas e da Saúde, Departamento de Ciências Fisiológicas, São Luís, Maranhão, Brasil.

E-mail dos autores:

victornsilveira@gmail.com

wilsonserrao77@gmail.com

ahirlancastro@yahoo.com.br

helmanut@gmail.com

RESUMO

Alteração dos níveis de pressão arterial e fatores associados em praticantes de exercício físico em São Luís-MA

Introdução: A hipertensão é uma situação clínica caracterizada pela elevação dos níveis da pressão arterial sistólica e/ou diastólica. Geralmente está associada a distúrbios metabólicos, alterações funcionais e/ou estruturais em órgãos-alvo, agravados pela presença de outros fatores de risco como dislipidemia, obesidade abdominal, intolerância à glicose e diabetes. **Objetivo:** Estimar a prevalência de alterações nos níveis pressóricos e seus fatores associados em praticantes de exercícios físicos na cidade de São Luís. **Materiais e Métodos:** Os instrumentos utilizados para coleta de dados foram os questionários socioeconômicos, demográficos, comportamentais e o registro alimentar. Foi realizada avaliação antropométrica e teste de bioimpedância elétrica para avaliação da composição corporal. A análise estatística inclui o teste Qui-quadrado de Pearson para verificar os fatores associados aos níveis pressóricos. A significância foi assumida como $p < 0,05$. **Resultados:** Os valores médios da pressão sistólica foram 114,3 mmHg \pm 18,4 e da pressão diastólica 68,45 mmHg \pm 9,9. A prevalência de níveis alterados de pressão arterial foi de 35,3%. As variáveis que apresentaram associação com a alteração dos níveis pressóricos foram sexo masculino, ingestão elevada de sódio e excesso de peso avaliado pelo índice de massa corporal. **Conclusão:** A alta prevalência de desvios da pressão arterial é preocupante visto que trata-se de uma população de praticantes de exercício físico. Os fatores associados reforçam o caráter multifatorial e a necessidade de manter programas de vigilância em saúde para combater este mal silencioso.

Palavras-chave: Pressão arterial. Hipertensão. Atividade motora.

INTRODUCTION

Hypertension (HTN) is a condition characterized by elevated blood pressure (≥ 140 mmHg systolic and/or ≥ 90 mmHg diastolic).

It is commonly associated with metabolic disorders, functional and/or structural alterations of target organs, aggravated by the presence of other risk factors, such as dyslipidemia, abdominal obesity, glucose intolerance and diabetes mellitus (SBC, 2016).

The HTN is considered one of the principal causes of death in the world nowadays (Coelho et al., 2019).

In Brazil, hypertension affects about 24.7% of the population and the lowest prevalence of self-reported hypertension among adults ranged from 15.9% in São Luís (location of this study) to 31.2% in Rio de Janeiro (Brasil, 2018).

Individuals with elevations in blood pressure levels that remain below the hypertension parameter may be classified as prehypertensive, a condition that may be linked to a higher risk of developing hypertension or other comorbidities, and that may be contained by changes in lifestyle (Gusmão et al., 2009).

In this sense, physical exercise is considered a great ally in the treatment or prevention of hypertension, as it has an efficient hypotensive effect (Boutcher, Boutcher, 2017).

Thus, it is expected that within a population that exercises regularly, the pressure values of these individuals are lower than in a sedentary population. However, factors such genetic predisposition, diet or overweight can be connected to pressure deviations even in these individuals (Caselli et al., 2017).

Another relevant factor is the socioeconomic condition experienced by the population. It is evidenced in the literature an increase in the prevalence of hypertension by people of lower socioeconomic class compared to those of higher class and may also vary by educational level and gender (Leng et al., 2015).

Due to the relevance of the hypertension and its multifactorial etiology, the objective of this study is to identify altered blood pressure levels of exercise practitioners in São Luís and its associated factors.

MATERIALS AND METHODS

This is a cross-sectional study with data from research entitled Evaluation of protein intake and kidney damage in physical exercise practitioners in São Luís.

Sample was by spontaneous demand, following the eligibility criteria, considering the number of active clubs in São Luís according to the Regional Council of Physical Education of Maranhão State.

Eligible gyms should have more than 300 students of both sexes with active enrollment, as well as offer sports modalities and the offer of resistance exercise was mandatory.

Were collected data from 92 subjects aged between 16 and 59 years who practiced exercises two or more times a week. All respondents agreed to participate in the study by signing the Informed Consent Form.

The instruments used for data collection were socioeconomic, demographic, and behavioral forms containing information about the time of physical exercise, duration and objective of bodybuilding related to the individual's lifestyle and a frequency questionnaire of dietary supplement consumption.

For the assessment of food consumption were used three 24h food records (24hFR), being held at the time of the interview and two delivered to the interviewee to be performed on a day of the week and another for the weekend. Each volunteer was instructed to fill in the time, place, preparation, and portioning data recorded.

To identify the anthropometric profile, body weight was measured on a digital scale (Omron Healthcare®, Brazil), with a capacity of up to 150 kg and an accuracy of 100g.

The volunteers were weighed standing in the center of the scale without shoes and light clothing; Height was measured using a wall stadiometer (Welmy®, Brazil) with a scale from 0 to 200 cm and 5 mm intervals. The subjects were placed in an upright position, barefoot, with upper limbs dangling along the body, the heels, the back, and the head touching the aluminum column (Brasil, 2011).

Waist circumference measurement was performed with individuals standing with relaxed abdomen, arms extended parallel to the body and weight distributed equally between the legs, with the region undressed and after an

exhalation, being careful not to compress the skin (Brasil, 2011).

The body composition evaluation included the bioelectrical impedance test using a tetrapolar device (Biodynamics 450®, USA), with the individual lying on a non-conductive surface, with legs apart and arms parallel to the trunk.

The electrodes were placed at specific locations of the hand and foot on the dominant side. After entering the data on the device (gender, age, weight, height, and hours of activity per week), the test was performed, and the body composition values were immediately printed. The percentage of body fat (% BF) obtained was classified according to the values proposed by Lohman (Lohman, 1992).

Food intake data obtained through 24hFR, considering the three-day averages, were calculated in the NutriPlan® spreadsheet (version 2.7).

The variables of food consumption, except sodium, were classified according to FAO/WHO method (FAO/WHO, 2001). Sodium intake was assessed from the calculated average of the 3 dietary records and was considered adequate to intake less than 2,000mg (SBC, 2016).

The variables analyzed were:

-Sociodemographic: age (< 20 years, 20 - 30 and ≥30), skin color (white and non-white), education level (up to high school and complete higher education).

-Lifestyle: smoking (yes and no), alcohol consumption (yes and no).

-Training characteristics: motivation to exercise (lose weight, gain lean or other); time practicing physical exercise (≤6 months, 6 - 12 months, ≥12); self-perceived training (mild, moderate, intense).

-Anthropometry: BMI (low weight, eutrophy and overweight), waist-circumference (no

cardiovascular risk and with risk), fat percentage (normal: and above).

-Food intake: consumption of protein (<10%, 10% to 35%.> 35%), carbohydrate (<45%, 45% to 65%,> 65%) lipid (<20%, 20% to 35%, > 35%), calories adequacy (<1500, 1500 to 2499, ≥2500), triglyceride (normal and dyslipidemia), total cholesterol (normal and hypercholesterolemia).

The dependent variable of the study was blood pressure, measured by an automatic Omron Healthcare® device. The measurements were taken three times, alternating between the right and left arms, with a mean spacing of two minutes between measurements and respected the recommended by the SBC (SBC, 2016).

Data obtained were stored and tabulated in the Microsoft Office Excel version 2007 program and analyzed from the Stata version 14 software. Simple frequencies and means were expressed as absolute numbers and percentages. The association of the response variables with the outcome of this study was obtained through Pearson chi-square and significance was established as $p < 0.05$.

Ethical approval for the study was obtained from the Research Ethics Committee of the Federal University of Maranhão (CEP-UFMA) under Opinion Number: 1,378,129.

RESULTS

For this study, seven people who did not agree to have their blood pressure measured were excluded, making a final sample of 85 individuals practicing physical activity.

The respondents had a mean age of 32.24 ± 9.96 years and mostly female (56.8%). Table 1 shows a brief description of the interviewees sociodemographic and training conditions. The detailed anthropometric status of the interviewees and the food consumption variables can be observed in tables 2 and 3, respectively.

Table 1 - Sociodemographic and behavioral data of resistance exercise practitioners in gyms of São Luís-MA, 2017.

Variables	n	%
Sex		
Male	38	44.7
Female	47	55.3
Age		
< 30 years	41	48.2
30 to 35 years	39	45.9
≥50 years	5	5.9
Skin color		
White	41	48.2
Non-white	44	51.8
Marital status		
Single	52	61.2
Married	20	24.7
Stable union	4	10.6
Separated	5	3.5
Alcohol consumption		
No	30	35.3
Yes	55	64.7
Smoking		
Yes	3	3.5
No	78	91.8
Former smoker	4	4.7
Schooling		
Complete high school	25	29.4
Incomplete higher education	25	29.4
Higher Education	35	41.2
Weekly training frequency		
> 3	70	82.4
≤ 3	15	17.6

Table 2 - Analysis of anthropometric variables stratified by gender of exercise practitioners, São Luís-MA, 2017.

Indicator	Category	Male		Female		p
		n	%	n	%	
BMI *	Eutrophy	23	60.5	35	74.5	0.261
	Overweight	13	34.2	10	21.3	
	Obesity	2	5.2	2	4.2	
Waist	No risk	35	92.1	35	74.5	0.068
	With cardiovascular risk	3	7.9	12	25.5	
% Fat†	Normal	20	52.6	10	21.3	0.021
	High	18	47.4	37	78.7	

Legenda: * BMI: body mass index; † % Fat: Percentage of Body Fat.

The prevalence of deviations in blood pressure of physical activity practitioners was 35.3% (95% CI = 24.9 - 45.6%) and higher in men 63.2% (95% CI = 47.1 - 79.2 %) than in women 12.8% (95% CI = 2.9 - 22.7%) (Table 4).

Systolic and diastolic pressures showed a mean of 114.3 ± 18.4 mmHg and 68.5 ± 9.9 mmHg respectively (data not shown in table).

Table 3 - Description of food intake of exercise practitioners, São Luís-MA, 2017.

Variable	n	%
Energy		
Up to 1499 kcal	22	25.8
1500 - 1999 kcal	23	27.1
2000 - 2499 kcal	26	30.6
≥ 2500 kcal	14	16.5
Carbohydrate (%)		
< 45%	33	38.8
45 - 65%	51	60.0
> 65%	1	1.2
Protein%		
< 10%	22	25.9
10 - 35%	60	70.6
> 35%	3	3.5
g protein/kg weight/day		
< 0.8 g/kg/day	2	2.4
0.8 -1.2 g/kg/day	19	22.3
1.21 - 2 g/kg/day	40	47.1
> 2 g/kg/day	24	28.2
Lipids (%)		
< 20%	7	8.2
20 - 35%	61	71.8
> 35%	17	20.0
TEE suitability*		
Below ideal	22	25.9

Suitable	49	57.6
Above ideal	14	16.5
Sodium		
≤2000mg	65	76.5
> 2000mg	20	23.5

Legenda: * TEE: total energy expenditure.

Statistically associated with deviations in blood pressure were the sex of respondents,

body mass index, body fat percentage and sodium intake ($p < 0.05$) (Tables 4 and 5).

Table 4 - Association of risk factors with blood pressure levels of resistance exercise practitioners in gyms in São Luís-MA, 2017.

Variables	Categories	Normotensive	Blood pressure deviation	p
Sex	Male	37.5%	62.5%	<0.001
	Female	85.7%	14.3%	
Ethnicity	White	64.9%	35.1%	0.568
	Non-white	54.5%	45.5%	
Smoking	Yes	0.0%	100%	0.344
	No	66.2%	33.8%	
Age	Former smoker	75%	25%	0.919
	< 30 Years	61.8%	38.2%	
	30-45	69.6%	35.4%	
% Fat	> 45 Years	77.8%	22.2%	0.223
	Normal	54.5%	45.5%	
Diabetes	Above	69.2%	30.8%	0.118
	Not	66.7%	33.3%	
BMI	Yes	0.0%	100%	0.032
	Eutrophy	72.3%	27.7%	
	Overweight	43.4%	56.6%	
Waist circumference	Obesity	100%	0.0%	0.429
	Normal	63.3%	36.7%	
Frequency of training	Cardiovascular risk	100%	0.0%	0.334
	> 4	67.5%	32.5%	
	≤4	61.3%	38.7%	

Legenda: BMI: body mass index; %fat: Body Fat Percentage Fat.

Table 5 - Food intake association with blood pressure levels of exercise practitioners in gyms of São Luís-MA.

Variables	Categories	Normotensive	Blood pressure deviation	p
Sodium	Suitable	74.4%	25.6%	0.022
	Inappropriate	33.3%	66.7%	
Protein	<10%	82.4%	17.6%	0.064
	10-35%	63.0%	37.0%	
	> 35%	0.0%	100%	
Carbohydrate	<45%	71.4%	28.6%	0.659
	45-65%	60.0%	40.0%	
	> 65%	100%	0.0%	
Lipid	<20%	85.7%	14.3%	0.697
	20-35%	61.1%	38.9%	
	> 35%	69.2%	30.8%	
TEE suitability*	Below	66.6%	33.4%	0.837
	Suitable	77.8%	22.2%	
	Above	93.8%	6.2%	
Calories	until 1499	85.0%	15.0%	0.224
	1500 to 1999	65.0%	35.0%	
	2000 to 2499	58.3%	41.7%	
	≥2500	40.0%	60.0%	

Legenda: * TEE: total energy expenditure.

DISCUSSION

The prevalence of deviations in blood pressure measured in individuals practicing physical activity was higher than that found in studies conducted with the general population in worldwide (Mills et al., 2016; Noubiap et al., 2017; NCD Risk Factor et al., 2017).

When compared to the practicing physical activity sample, the results presented here are also superior (Mazzocante et al., 2016; Martinelli, Paixão, 2019).

One of the findings of this study is the higher prevalence of deviations in blood pressure in males, which was statistically significant. This may be due to the lower demand for health care by this gender (Cruz, 2016; Gomes, Nascimento, Araújo, 2007).

Usually, men tend to be less careful with aesthetics, which may incur greater consumption of alcoholic beverages and high sodium food products (Gomes, Nascimento, Araújo, 2007).

In the long run, this carelessness with health can result in the emergence of heart disease and other NCD. It is noteworthy that,

even in the case of a physically active population, the results found in this study are worrying and raise the question about performing physical exercise without adequate nutrition.

The other sociodemographic factors were not statistically associated with blood pressure indices, even some classically associated with age and education (Ferrazzo, Meinke, Antoniazzi, 2014).

This is probably due to the homogeneity of the sample in both variables, being mostly composed of young people under 30 years old and people attending higher education or already completed.

Schooling was not associated with blood pressure levels as the results highlights a high percentage of participants with higher education. The increased knowledge provides greater interest and care with health conditions for disease prevention through practice exercises and proper nutrition under professional guidance (Firmo et al., 2018).

Another factor that was associated with blood pressure levels was BMI, which is recognized in the scientific literature as a risk

factor (Christofaro et al., 2017; Silva, Oliveira, Pierin, 2016). In this work, the highest prevalence of blood pressure levels was associated with overweight which is compatible with the scientific literature.

About the respondent's food intake, only sodium intake presented association. The inadequate intake of micronutrients had higher prevalence of abnormal blood pressure, which is already consolidated in the bibliography (Silva, Oliveira, Pierin, 2016).

National and international entities evaluate the potential impact of the reduction in sodium consumption in the medium and long term and found that the goals of reduction of this micronutrient have little impact on the average consumption of the population (SBC, 2016; WHO, 2013).

The literature highlights as a potential risk factor for the emergence of hypertension in physically active individuals the use of anabolic steroids and/or dietary supplements (Tuma et al., 2015). In this study, this result was not observed, since most did not use any supplement and those who did not discriminate which type were in use.

It is noteworthy that the results of this study are in line with what is addressed in the scientific literature, given the multifactorial character of the change in blood pressure levels.

The high prevalence of individuals with high blood pressure is worrying and reinforces the need for constant vigilance and self-care with health.

It is emphasized that pressure control programs and policies are fundamental to the progressive fight against this silent disease and the partnership of public and private entities is welcome for the greater access to information of all factors capable of causing this disease.

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CONFLICTS OF INTERESTS

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTION

We declare that all authors participated substantially in the process of preparation of the manuscript and assume full responsibility for its content.

All authors made substantial contributions in the design and design of the work; AHS and HJFV actively participated in data collection; All authors participated in the analysis and interpretation of the data; VNCS, WSAF and HJFV actively participated in the writing and critical review of the manuscript; all authors approved the final version to be published.

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Autor correspondente:

Helma Jane Ferreira Veloso

helmanut@gmail.com

Departamento de Ciências Fisiológicas.

Centro de Ciências Biológicas e da Saúde.

Universidade Federal do Maranhão.

Avenida dos Portugueses, 1966.

Vila Bacanga, São Luís, Maranhão, Brasil.

CEP: 65080-805.

Telefone: (98) 3272-8530.

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