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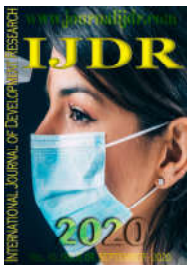


RESEARCH ARTICLE OPEN ACCESS

# ASSESSMENT OF REDUCED HEART RATE AND BLOOD PRESSURE WITH REGULAR PRACTICE OF RESISTED PHYSICAL EXERCISE

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**ABSTRACT**

**Introduction:** At rest, a person's normal heart rate (HR) varies between 60 and 100 heart beats per minute, above that it is considered tachycardia, and blood pressure (BP) must be within the recommended parameters. In this study we will discuss the effect of a resistance exercise intervention on HR and BP. **Objective:** To evaluate if there is a decrease in HR and BP parameters with the regular practice of resistance physical exercise for 8 weeks. **Methodology**: Cross-sectional, exploratory study with quantitative analysis of the results. Convenience sampling of 18 university students of both sexes. Normotensive and borderline students, over 18 years old, who had been attending a health course for at least 6 months at the Federal University of Fronteira Sul (UFFS) were included. **Results:** The age of the students varied between M = 20 years with SD = 2.32, with 83.3% of the sample being female and 16.6% male, only 5.5% smoker and 77.7% not practiced exercise. A significant reduction in BP ($p<0.001$) and HR with ($p<0.001$) was observed. **Conclusion:** The study showed that individuals who perform resistance physical exercises regularly can reduce their hemodynamic parameters of HR and BP and, consequently, reduce cardiovascular risk.



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## INTRODUCTION

Heart Rate (HR) consists of the number of beats that the heart performs per minute (BPM). It has been considered as a marker that may indicate greater longevity (Ehrenwald *et al*., 2019), as pointed out by Jensen (2019) in his review study. When at rest, individuals who have HR> 84 bpm are more likely to develop Cardiovascular Diseases (CVD), compared to individuals who have HR <74 bpm at rest (Gillum *et al*., 1991; Shi *et al*., 2018) . Studies indicate that high HR in individuals considered asymptomatic for other diseases, in most cases, trigger coronary artery disease or heart failure (Opdahl *et al*., 2014; Bohm *et al*., 2015; Fassbind *et al*., 2016).

It is known that the resting HR values are not considered a Cardiovascular Risk factor (CVR), however, it can be considered physiologically a warning sign (Christofaro *et al*., 2017). The main concern with high HR is due to the high rate of oxygen consumption by the myocardial muscle, leading to its early exhaustion (Hjalmarson *et al*., 1990). In this sense, studies affirm the correlation of CVD with elevated HR (Shi *et al*., 2018). A survey using data from the Framingham cohort study, between the years 1986 to 1991, concluded that "baseline heart rate predicts cardiovascular events", stating that, with the increase in HR by +/- 11 bpm, if the chances of CVD by 15% and the risk of having heart failure increases to

32% (Ho *et al*., 2014). Thus, the data show that high HR is a long-term threat to cardiovascular events (Opdahl *et al*., 2014). The increase in HR can be due to adrenergic stimulation, for example, in stressful situations, through the stimulation of the Autonomic Nervous System (ANS), which is physiological and expected. But it can also conjecture the onset of a disease, when its value remains high (Pereira, 2018). However, CF also tends to increase with aging. According to Michel Silva Reis *et al*. (2005), this is mainly due to "changes in the extracellular protein matrix, especially of collagen, responsible for the increase in pericardial, valve, myocardial and vascular wall stiffness". In addition, another parameter studied was blood pressure (BP), which is the pressure exerted by blood on the artery wall (Brazilian Society of Cardiology, 2017). Thus, the BP of an individual has interference from several factors, among them, unhealthy eating, overweight, excessive alcohol consumption, absence of physical activity, as well as persistent exposure to stress (WHO, 2013 ).

Such factors corroborate the increase in BP, causing the so-called Systemic Arterial Hypertension (SAH) (Brazilian Society of Cardiology, 2017). High blood pressure is one of the biggest public health problems today. In addition to being one of the main risk factors for CVD, which in the last decade represented the main cause of death in the world (Silva, Oliveira, Pierin, 2016). SAH is a multifactorial clinical condition, configured by the continuous elevation of blood pressure levels ≥ 140 and / or 90 mmHg (Malachias *et al*., 2016; Brazilian Society of Cardiology, 2017). Therefore, with the increase in blood pressure, the left ventricle tends to dilate as a physiological response, seeking to improve the contractile process through the Frank-Starling mechanism. This process generates an increase in ventricular wall stress, according to Laplace's Law. Thus, seeking to reduce the diameter of the cavity, hypertrophy of the ventricular wall occurs as a means of maintaining balance (Simões, Schmidt, 1996).

Such response causes several reactions, the increase in ventricular mass is one of them and causes a greater need for oxygen and nutrients for the cell, since the metabolism had to increase due to the greater number of contractile units. In order to seek a balance between oxygen supply and demand, the use of the coronary reserve is used, which, after exhaustion, triggers the occurrence of ischemia in the myocardium and, subsequently, cell necrosis (Simões, Schmidt, 1996). In view of the risks caused by changes in HR and BP, the stabilization of these parameters is analyzed in individuals who perform regular physical exercise. It is known that these markers tend to increase their baseline levels only with the age advancement factor, however, with greater subtlety when compared to individuals who exercise (Silva *et al*., 2005). This is because physical exercise intensifies blood flow, increasing friction in the vessel lumen and triggers increased nitric oxide production, which in turn has the effect of vascular relaxation and inhibits platelet aggregation, preventing atherosclerosis and hypertension and consequently the stiffening of the arteries and veins (Zago, Zanesco, 2006; Zanesco, Antunes, 2007; Silva, Zanesco, 2010; Brazilian Society of Cardiology, 2017).

In fact, the Brazilian Society of Cardiology (2017) states that dynamic resistance exercise can reduce approximately 3.8 mmHg in pre-hypertensive patients in both systole and diastole. Thus, the regular practice of physical exercise has been approached as a non-pharmacological treatment against cardiovascular diseases (Ghorbanzadeh *et al*., 2017; Brazilian Society of Cardiology, 2017) and seen as a promoter of health and well-being (Pagan *et al*., 2018). In this perspective, the importance of this study is due to the need to reduce hemodynamic parameters, in an attempt to minimize the high amount of cardiovascular risk factors, in search of greater longevity, through physical exercise in a short period of time. Thus, the objective was to assess whether there is a decrease in hemodynamic parameters with regular practice of resistance physical exercise for eight weeks.

## MATERIALS AND METHODS

Cross-sectional, exploratory, longitudinal study and quantitative analysis of the results. Convenience sampling of 18 students of both sexes, over 18 years old. Normotensive and borderline students were included, having attended a course in the health area at the Federal University of Fronteira Sul (UFFS) for at least six months. Students who dropped out of the research and those who had less than 75% attendance during the project were excluded from the sample. Participants were presented with the research objectives and methods, as well as the Free and Informed Consent Term (ICF) approved by CAAE 75549417.7.0000.5564. Data collection started with an individual socio-demographic questionnaire, to characterize the sample, and followed with the other data collected before and after the Physical Exercise Protocol, characterizing the pre and post hemodynamic parameters, including Blood Pressure (BP) ). To verify the Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP), a set of Stoter and Sphygmomanometer model C100 from Incoterm was used, using the measurement technique of Potter and Perry (2013). HR was measured with a Digital Oximeter Saturation and Heartbeat meter from the PlayShop Eletrônico brand. The protocol of muscular resistance physical exercises was developed twice a week, for eight consecutive weeks, with a total duration of 16 hours. The exercises were carried out in the auditorium of the administrative block at UFFS, from 5 pm to 6 pm.

The protocol consisted of 45 seconds of each exercise, with passive rest of 15 seconds between them. Initially, warm-up was performed with jumping rope and jumping jacks, followed by the abdominal exercise circuit (ventral board, abdominal on the ball, abdominal with the wheel, alternating oblique abdominal), upper limbs (triceps with dumbbell, lateral and frontal lift with dumbbell, hammer thread) and lower (lower squat with dumbbell, leg lift with shin, flexor standing with shin, gluteus four supports, abductor with shin) followed by stretching for the muscle groups worked. Shin guards, dumbbells, exercise mat, abdominal wheel, Swiss ball, elastic band and extensor, rope, speaker and stopwatch were used to perform the exercises. For the statistical data of this research an Excel spreadsheet was used, where the data were stored and afterwards, they were transported for analysis in the program SPSS version 29.0. For qualitative variables the results will be presented in frequency and the quantitative variables will be expressed as mean (M) and standard deviation (SD).

## RESULTS

The average age of the students was 20 years old, totaling 18 students, 83.3% of the sample being female and 16.6% male, only 5.5% smoking, and 77.7% sedentary (Table 1).

**Table 1. Clinical and Sociodemographic Data**

| Variables | % ou M | SD |
|---|---|---|
| Age | 20 | 2,32 |
| Sex: | | |
| Feminine | 15 (83,3 %) | |
| Male | 3 (16,6%) | |
| Smoker | 1 (5,5%) | |
| Sedentary | 14 (77,7%) | |

**Source:** Prepared by the author, 2020.

From the results of the hemodynamic parameters for BP, we obtained the SBP pre: 117.7 mmHg and the mean SBP post: 107.5 mmHg and the mean DBP pre: 71.3 mmHg and the mean DBP post: 66.3 mmHg . There is a significant reduction in hemodynamic parameters, in SBP: 10.2 mmHg and in DBP: 5 mmHg. A significant reduction in SBP was observed ($F(1.55) = 8.64$; $p<0.05$). In the HR measurement we obtained in the pre: HR = 85.1 bpm with SD = 13.1 and after HR = 66.8 bpm with SD = 7.7, with a reduction of 18.3 bpm and HR with ($F(1.55) = 19.06$; $p<0.001$) (Table 2).

**Table 2. Heart rate, systolic and diastolic blood pressure and measurements before and after intervention**

| Variables (M e SD) | Pre | Powder | P Value |
|---|---|---|---|
| HR | 85,17 ± 13,15 | 67,89 ± 7,73 | 0,0003** |
| SBP | 117.5 [110 – 120] | 110 [100 – 111.3] | 0,006* |
| DBP | 70 [60 – 80] | 65 [60 – 70] | 0,11 |

**Source:** Prepared by the author, 2020.
HR: Heart Rate; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure.
**P<=0,001
*P<=0,05

## DISCUSSION

As seen, HR was the hemodynamic parameter that most changed with eight weeks of resistance exercise, with a statistically significant reduction in mostly sedentary individuals. This result is in line with the study by Mahjoub *et al*. (2019), who carried out research with athletes and who presented in their results a reduction in hemodynamic parameters, in which HR reduced with greater statistical significance. Exercising in favor of reducing HR means decreasing the chances of coronary heart disease, heart failure, left ventricular dysfunction and myocardial tension (Opdahl *et al*., 2014). A greater reduction in SBP was noted when compared to DBP. An integrative review study by Carpio-Rivera *et al*. (2016), in order to analyze the acute effect of exercise on BP, compared sixty-five articles and found that the reduction of BP with physical exercise, occurs regardless of sex, level of physical activity, antihypertensive drugs, time of day on which BP was measured and technique used and physical training program ($p <0.05$ for all). In addition, it was found that in individuals who exercise as a prevention strategy, and in the case of not using medication for hypertension, the hypotensive effect is greater (Carpio-Rivera *et al*. 2016). The hemodynamic parameters of an individual say a lot about his health status in general, however in prophylactic situations, resisted physical exercise will provide a hypotensive response (Oliveira *et al*., 2019). The hypotensive response of physical exercise is one of the late effects that occur, mainly due to increased plasma volume and improved endothelial function (Silva, Zanesco, 2010; Brazilian Society of Cardiology, 2017). These effects, which in the long term will determine positive and permanent adaptations on the morphofunctional organism of the practicing individual, including the reduction of HR and BP at rest, keeping the normocardial and normotensive individuals, stabilizing their pressure and hemodynamic levels (Monteiro, Sobral Filho, 2004).

### Conclusion

Individuals who regularly perform resistance physical exercises have a high probability of decreasing their hemodynamic parameters, consequently decreasing and / or avoiding the chances of triggering CVR without the use of drugs. There is no doubt that resisted physical exercise, practiced on a regular basis, becomes an affordable and low-cost tool to avoid increasing HR and BP. In turn, the gains with this practice will result in the benefit through the morphophysiological changes of the individuals who exercise, and also, in decreasing the expenses that public health has due to the established diseases coming from the circulatory system.

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