COMPARISON OF BLOOD PRESSURE RESPONSE AFTER ARM AND LEG STRENGTH EXERCISES IN NORMOTENSIVE YOUNG ADULTS

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ABSTRACT

Strength training is still understudied when compared to aerobic exercise and its relationship with blood pressure. Therefore, further research on this subject is necessary. This study aimed to evaluate blood pressure response after strength training for upper and lower limbs in normotensive young adults. This is a controlled experimental study that evaluated 80 individuals. They performed one exercise session for upper limbs (UL), one for lower limbs (LL), and one control session (CS). Blood pressure was measured between exercise sets and up to 20 minutes after completion. In the control session, there were no exercises, but blood pressure was measured. Descriptive statistics were performed using the nonparametric Wilcoxon test. Significance was set at $p \leq 0.05$, and the program used was SPSS 10. Pre-exercise blood pressure results were not significant, but post-exercise there were significant changes in SBP and DBP levels. There was a greater increase in leg exercises than in arm exercises. Thus, it was concluded that there was a greater increase in BP in the leg protocols than in the arm protocols.

Keywords: blood pressure; strength exercises; young normotensive individuals.

INTRODUCTION

Blood pressure is understood as the force exerted by blood flow in the arteries (SILVA, 2009), which varies during exercise, with the difference in systolic blood pressure response to upper and lower limb exercises having significant effects on the heart (COSTILL; WILMORE, 2001).

Several studies have found that physical exercise can be used to reduce blood pressure in hypertensive individuals; however, contradictory data are found when associated with strength training. According to Mediano et al. (2005), the response to BP behavior after a strength training session is poor. Thus, it is necessary to investigate the pressor effect after strength exercise in both normotensive and hypertensive individuals and in different age groups.

This study aims to verify the effect of blood pressure response after strength training for the upper and lower limbs in young normotensive individuals.

METHODOLOGY

This is a controlled experimental study conducted at a gym in the city. The study protocol was submitted to the Institutional Ethics Committee and involved 80 individuals of both genders, with a random sample of 40 female and 40 male participants. The inclusion criteria for volunteers for the study were: signing the Free and Informed Consent Form (FICF), being between 18 and 25 years of age, having systolic blood pressure below 140 mmHg and diastolic blood pressure below 90 mmHg, and not practicing any type of physical exercise. Exclusion criteria were: obesity; hypertension; any physical or mental limitation that would prevent the study procedures from being performed.

After signing the FICF, in accordance with Resolution 196/96 of the National Health Council, and inclusion in the study, the individuals underwent anamnesis and then physical evaluations. After these procedures, the individuals performed 10 maximum repetition tests (10 RM), which were alternated between the upper and lower limbs on the following weight training equipment: bench press, biceps curl, flexor table, and extension chair.

The volunteers attended once before performing the experimental part of the research. This visit took place in the Physical Assessment Room of the Espaço Fitness 43 Henrique Pessoa Gym, to sign the FICF, respond to the medical history, and then undergo physical assessments. The second pre-study visit consisted of a 10 RM test, which took place in the weight training room at Academia Espaço Fitness Henrique Pessoa, in order to define the load to be used in the arm and leg exercise protocols. The 10 RM test was performed according to the Baechle & Earle (2000) protocol.

The individuals were taken to the weight training room, where they remained seated for 10 minutes to have their BP measured. They were warmed up for 5 minutes by stretching the areas that would be subjected to training. There were two machines for the upper limbs, bench press and biceps curl, consisting in three sets of 10 repetitions were performed. At the end of each set of exercises, blood pressure was measured. After the session, the subjects remained seated for 20 minutes for BP measurement.

The participants were taken to the weight training room, where they remained seated for 10 minutes for BP measurement. They were warmed up for 5 minutes with stretching of the areas to be trained. There were two devices for the lower limbs, a

flexion table and an extension chair. For each of these, three sets of 10 repetitions were performed, and blood pressure was measured at the end of each exercise series. After the session, the individuals remained seated for 20 minutes for BP measurement.

The individuals were taken to the weight training room, where they remained seated for 10 minutes for BP measurement. They did not exercise, but remained for an average of 30 seconds and had their BP measured as in the other protocols, i.e., the experimental protocol. This 30-second time is equivalent to the average simulated time for performing one set of exercises. The same number of BP measurements performed in the experimental protocols were performed in the control protocol. After the control session, the individuals remained seated for 20 minutes for BP measurement.

The measurement was taken before the start of each protocol; between each series of exercises; after the end of the protocol and for 20 minutes afterwards, with 10-minute intervals. The measurements were repeated at 2-minute intervals, and the average of the two measurements will be used for analysis. Descriptive statistics were used to process the data, and the *Student's t-test* for paired samples was used to compare them. A $p<0.05$ was considered significant.

RESULTS

Eighty-four (84) individuals participated in the study, four (4) of whom were excluded because they did not complete the entire study protocol. There was no significant difference between genders. The characteristics of the sample can be seen in Table 1 below.

Table 1 – Characteristics of the study population, values presented as mean and standard deviation

Sample characteristic	**MINIMUM**	**MAXIMUM**	**AVERAGE**	**STANDARD DEVIATION**
AGE (years)	18	25	20.8	2.35
WEIGHT (kg)	42.10	87.00	62.01	9.84
HEIGHT (m)	1.49	1.87	1.70	0.08
BMI (kg/m2)	16.71	26.12	21.37	2.36
%G (%)	2.89	98.51	14.38	11.61
PRE PAS (mmHg)	89.00	140.00	114.71	12.98
PRE PAD (mmHg)	51	94.00	69.27	8.78

- Sample characteristics (n= 80)

The behavior of SBP and DBP at different times during the study in the flexion table exercise showed that SBP increased significantly in the male EG at times after the

execution of series 1, series 2, series 3, and 10 minutes after performing the flexion table exercise. In the female EG, SBP increased significantly only after series 3. There were no changes in SBP in both control groups. DBP increased significantly only in the female EG after series 3. There were no significant changes at any other time in the EG and CG.

The behavior of SBP and DBP during the chair extension exercise showed significant values in the male EG in series 2 and series 3. In the female EG, there was an increase in series 1, series 2, and series 3. There were no changes in SBP in both control groups. Regarding PAD, significant results occurred in series 2 in the female EG, in series 3 in both the male and female EGs, and at 10 minutes in the male CG, there was a considerable increase that continued until 20 minutes of rest.

During the bench press exercise, SBP was significant in series 1, series 2, and series 3 of the male EG. There was an increase in SBP in the male CG at 20 minutes of rest. It was observed that PAD was significant only in series 3 of the male CG and in the male EG, followed by another increase in the male EG at 10 minutes, which continued until 20 minutes of rest. At other times, there was no significant increase in PAD.

The behavior of SBP and DBP during the biceps curl exercise can be analyzed as follows: SBP obtained two moments that were relevant for the male EG in series 2 and 3, while the others did not obtain significant values. During the exercise, DBP increased significantly at the moment of series 2, and this did not occur at other moments.

CONCLUSION

As presented in the results, the blood pressure values between the male and female EG and male and female CG were statistically different ($p>0.05$). In the arm and leg protocols at different moments from the beginning, i.e., pre-exercise until the end of the protocol after 20 minutes of rest, the male and female CG did not achieve significant results ($p<0.05$) in blood pressure values regarding SBP and DBP. while male and female GEs showed the opposite, with significant increases in blood pressure ($p>0.05$), demonstrating that strength training for the lower limbs requires greater physiological demand, consequently raising blood pressure levels.

Thus, it can be concluded that the most relevant finding of this study was the increase in blood pressure levels during the leg protocol compared to the arm protocol, where there was a greater increase in SBP and DBP during the execution of the lower limbs than the upper limbs, which is probably related to the amount of muscle mass involved.

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