Behavior of the blood pressure after a session of resistance exercise

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ABSTRACT: It has been suggested that resistance exercise (RE) can influence on post-exercise hypotensive effect, mainly on systolic blood pressure (SBP). However, there’s not consensus in the literature. The aim of this study was to verify post-exercise systolic and diastolic blood pressure (SBP and DBP) responses, after a weight training consisted of three 10 repetitions maximum (10RM) sets in four exercises. Nine subjects were studied, consisting of four women and five men. Each subject turned up 3 nonconsecutive days in the testing place. On the first day, it was realized tests to determine the load associated with 10RM for the following exercises: pulley pull down, seated leg press, biceps curl and leg curl. On the second day, a re-tests was done to verify the reliably of previous test. On the third day, subjects performed a specific warm-up and after an interval of two minutes, they began the session. Recovery interval between sets and exercises also was set in two minutes. Rest blood pressure (BP) was measured before the sequences on the third day, by auscultatory method. After the sequences of exercises, BP was measured at 5-minute intervals, being the subject at rest. Data were analyzed using Two-Way Repeated-Measure ANOVA followed by Tukey post-hoc test where appropriate (p<0.05), verifying post-exercise SBP and DBP. It was not observed significant differences between post-exercise SBP and DBP values, when compared to rest SBP and DBP. Nevertheless, a propensity to SBP hypotensive effect was observed when compared to rest measures. By the DBP, this propensity was not found Results suggest that low volume at RE does not reduce post-exercise BP.

Keywords: Hypotension, Systolic blood pressure, Diastolic blood pressure, Weight training.
INTRODUCTION

Epidemic and clinical studies have been demonstrating beneficial effects of the practice of physical activity on the blood pressure (BP) in individuals of all ages (SIMÃO et al., 2005). In Brazil, the cardiovascular conditions are the main death cause, and the arterial hypertension is one of the factors of primary risk for heart diseases (SIXT et al., 2004). In that way, to reduce the BP, it is important the reduction of the risk of heart diseases. The practice of exercises could aid in this reduction of the BP in rest, and with the continuous practice of physical activities, that reduction would become a chronic answer (FNS, 1998).

Those benefits of the physical activity on the BP do an important tool of he in the prevention and treatment of the hypertension. A metanalyses of 54 longitudinal studies randomized controlled, examining the effect of the aerobic physical exercise on the BP, it demonstrated that that exercise modality reduces, on mean 3,8mmHg and 2,6mmHg the systolic blood pressure (SBP) and the diastolic blood pressure (DBP), respectively (PARISI et al., 1992). Reductions of only 2mmHg in DBP can reduce the risk of diseases (POLITO et al., 2003; SIMÃO et al., 2005) evidence that RE has effect hipotensive, mainly in the SBP, and that the intensity of RE can influence the duration of the hipotensive effect after the resisted exercises (RE). During that activity type, the value of the BP tends to quickly elevate, could reach important values (POLITO et al., 2003). The magnitude of the mobilized loads, as well as the involved muscular masses, seem to be decisive of that gradient. However, only few studies (POLITO et al., 2003; SIMÃO et al., 2005) evidence that RE has effect hipotensive, mainly in the SBP, and that the intensity of RE can influence the duration of the hipotensive effect after the end of the activity, but not in its magnitude. However, the behavior of the BP just after RE stays little defined in the literature. Some studies demonstrate reductions (POLITO et al., 2003; SIMAO et al., 2005) of the BP after RE, but other data don’t report alterations (ROLTSCH et al., 2001) or show increase (O’CONNOR et al., 1993).

Like this, the objective of that study was to verify the behavior of the SBP and DBP in rest, after RE, in the accomplishment of a program composed of three series with loads for 10 maximum repetitions (10RM) in four exercises.
MATERIALS AND METHODS

The population was selected in an intentional systematic way, and formed by nine volunteers, with ages between 19 and 23 years, being four women (21 ± 0.8 years; 58.4 ± 4.4 kg; 165.5 ± 3 cm) and five men (20.6 ± 1.7 years; 76.5 ± 3.1 kg; 177.9 ± 3.4 cm). All were healthy individuals, normotensive and they would have to possess previous experience in RE for at least 12 months. We used as exclusion criterion, the use of any medicine that affected the BP in rest or during the exercise, anabolic or ergogenic substances, alcohol ingestion, besides problems in the muscle-skeletal and articular systems that can intervene in the perfect execution of the exercises. All the volunteers signed a consent term for the accomplishment of the tests and they answered to the EQUAL-Q questionnaire. That research assisted to the norms of the Resolution n° 196/96, of National Council of Health.

Each volunteer attended no three times consecutive in the place of the study. In the first visit, the anthropometrical measures and the 10RM tests (BAECHLE & EARLE, 2000) were accomplished for verification of the loads for the “Front Pull” in the pulley, horizontal leg press, thread biceps and flexor table. In the second visit, was accomplished a reverse-test for obtaining of the 10RM loads for verification of the fidelity of the previous test. In the third visit, the individuals accomplished a specific warming, of 15 repetitions with 30% of the 10RM load and, after the warming, were given two minutes of interval before the beginning of the training session. The above mentioned exercises were accomplished in three series of 10RM stipulated in two minutes, with recovery intervals between the series and the exercises.

In the third visit, the BP was checked before the work’s beginning, through the auscultatory method (Tycos. Adult Size CE 0050). The pattern of measure of the BP followed the recommendations of American Heart Association (PERLOFF et al., 1993). An experienced appraiser accomplished the rest measures, and the reliability of the measure was previously checked before the accomplishment of the study. For the rest measure, the subject positioned the left arm, relaxed, in a plane surface in the shoulder height. The fixation of the cuff in the arm happened with approximately 2.5 cm of distance between their inferior extremity and the antecubital pit. After the cuff inflated, the emptying process began in a reason of 2mmHg a second, until distinguishing the 10 and the 50 noise of Korotkoff, corresponding to the systolic and diastolic values, respectively. The individual stayed seating for five minutes before the gauging. After the end of the exercises sequence, the BP was checked in cycles of five minutes, with the individual in total rest, sat down comfortably for 60 minutes, making 12 measures. Besides, the subjects were well educated to not accomplish the Maneuver of Valsalva during the execution of RE.

RESULTS

The sample constituted for this study was characterized as homogeneous, presenting normal distribution in relation to the values of age, corporal mass, stature, fat percentile, thin mass and BMI variables, in women (21 ± 0.8 years; 58.4 ± 4.4 kg; 165.5 ± 3 cm; 19.2 ± 3.9%; 47.1 ± 3.7 kg; 22.2 ± 2 kg/m²), and in men (20.6 ± 1.7 years; 76.5 ± 3.1 kg; 177.9 ± 3.4 cm; 15.4 ± 2.4%; 60.1 ± 5.8 kg; 17.2 ± 2 kg/m²). The medium values for BP and DBP obtained in the rest and after the sequence of exercises are presented in the table 1. Significant differences were not verified between the values of the BP and DBP post-effort, when compared to the obtained in rest. However, a tendency was observed to the effect hipotensive of the BP, when compared to the rest measures. In relation to DBP, that tendency to the effect hipotensive was not observed.

DISCUSSION

The answers of the BP can be differentiated in normotensive and hypertensive individuals, once the post-exercise hypotensive effect can be associated to the individuals’ health condition (FLECK et al., 1987). Exist evidences that the aerobic exercises are effective in the reduction of the rest BP in hypertensive (TIPTON, 1991), and that the reductions of the BP after the exercise are larger in these individuals (MACDONALD, 2002). Besides, that BP reduction depends on the exercise duration, but it does not depend on its intensity. A study of FORJAZ et al. (1998a) in cicleergometer at 50% of VO2pick showed that the physical exercise accomplished for 45 minutes provokes a more accentuated decrease in the BP than the physical exercise accomplished for 20 minutes. In another study, FORJAZ et al. (1998b) verified that the physical exercise accomplished in 30, 50 and 70% of the maximum oxygen consumption provoke similar decrease in the BP in young normotensive subjects. Already BENNET et al. (1984) observed that a period of exercise of 10 minutes does not induce a reduction in the post-exercise BP, but that additional periods (four periods of 10 minutes) induce to a significant decrease in the BP.

It is possible that that relationship is maintained in RE. HARDY & TUCKER (1999) accomplished a study with sedentary and hypertensive, in which the ambulatorial mapping (MAP) of the blood pressure verified reduction in the BP and DBP, for 1 hour, after a RE session. However, some studies could not demonstrate any hypotensive effect after RE. HILL et al. (1989) observed a reduction of the BP in trained men, immediately after RE, however the

| Table 1 – Mean values of the BP and DBP, in each measure, after the end of the RE session |
|-----------------|-------|-------|
| MEDIDAS | SBP  | DBP  |
| Rest | 118.2 | 74.7 |
| 5 Min. | 125.8 | 77.1 |
| 10 Min. | 116.9 | 75.3 |
| 15 Min. | 116.7 | 77.8 |
| 20 Min. | 114.8 | 77.8 |
| 25 Min. | 113.2 | 77.6 |
| 30 Min. | 114.4 | 77.8 |
| 35 Min. | 114.6 | 77.8 |
| 40 Min. | 114.1 | 77.8 |
| 45 Min. | 113.9 | 77.6 |
| 50 Min. | 114.7 | 77.2 |
| 55 Min. | 113.6 | 77.6 |
| 60 Min. | 114.3 | 77.3 |
pressoric values reached the pre-exercise levels in few minutes and stayed during the sixty minutes of attendance. In a study of ROLTSCHE et al. (2001) important alterations were not verified in the BP after RE, in normotensive women and men. In that study, the BP was monitored for 24 hours by MAP; which leaves to have faith that is possible that RE do not provoke important reductions in the BP during a lingering period.

Other more recent studies (SIMÃO et al., 2005; POLITO et al., 2003) demonstrated an hypotensive in effect normotensive individuals, due to RE. POLITO et al. (2003) they verified that ER exercises an effect hypotensive, mainly on the SBP and that the magnitude of the loads revealed a tendency to maintain the period of SBP reduction. That study verified which effect of two sequences of exercises accomplished in different intensities, however with the same training volume, on the late acute answers of the SBP and DBP. Were analyzed six exercises: horizontal supine, leg press, deep in the pulley, flexor table, development and thread biceps.

After a test of 6RM for the determination of the maximum loads, in the second day three 6RM series were accomplished in each exercise, with interval of recovery of 2 minutes between series and exercises. In the last day, the same procedure was applied; however being used twelve repetitions with load corresponding to 50% of 6RM. The SBP and DBP were checked before each sequence and immediately after each sequence, in cycles of 10 minutes, in absolute rest during 1 h. For SBP, the sequence of twelve repetitions induced a significant reduction in a period not superior to 50 minutes, while the sequence of 6RM caused reduction in all the measures. The results of that study corroborate the results of FISHER (2001), in study with hypertensive and normotensive women, after the execution of 15 repetitions of five exercises accomplished in circuit of 50% of the load of 1RM, and it registered the post-effort BP for sixty minutes and it verified significant reduction only in the SBP.

The study proposed by SIMÃO et al. (2005) verified the late sharp answers of the SBP and DBP starting from the accomplishment of three sequences of RE. Two groups were randomly divided, in G1 and G2. Firstly, the load was tested for the accomplishment of 6RM in each exercise. The sequence of G1 was composed by the exercises: horizontal supine, sloping leg press, "front steep " in the high pulley, development for the front in foot and thread biceps. In the sequence of G2 consisted of all the exercises of G1, plus the flexor table exercise. In the second day, both groups accomplished three series of 6RM in each exercise, with an recovery interval of two minutes between the series and the exercises. In the last day, were accomplished twelve repetitions in each exercise, with load corresponding to 50% of 6RM, and G1 accomplished the exercises in circuit form, making a total of three passages, while G2 accomplished it in the same way that in the previous day. The BP was checked before beginning the data collection and immediately after the end of each sequence, for 60 minutes. The BP was checked in 10 minutes cycles through the MAP. In the first group, the training in circuit presented significant reductions up to 50 minutes and, for the training of 6RM, those reductions were of 50 minutes too. In the second group, the training of 6RM caused significant reductions in all measures, while the one of 12 repetitions caused reduction up to the 4th measure. It is important to stand out that was not identified significant reductions in DBP in any sequence of adopted training. Only to SBP suffered significant post-effort reduction.

In the present study, in spite of observing a tendency to the hypotensive effect of the SBP, when compared to the post-exercise measures amongst themselves, significant differences were not verified in relation to post-effort SBP and to DBP, comparing them with the rest measures. For a discussion concerning the non obtaining of an hypotensive effect, it is necessary that are considered some factors. The first factor concerns the possible mistakes in the measure. Measures obtained by the auscultatory method tend to underestimate the BP results in 30%, however, this is the viable and usual method for the verification of the values of the BP in RE. However, it is important that the responsible individual for the gauging have experience, because difficulties to distinguish the noises of Korokoff, could cause mistakes (FARINATTI, 2003).

The exercise volume is another factor to be considered. In this study, the accomplishment of three series of 10RM, in four exercises, it might not have been a session of RE with appropriate volume for the obtaining of an hypotensive effect. Should also be considered neither that not all of the individuals have to accomplish the 10RM in the certain exercises sequence. The effect of the fatigue provided a reduction in the number of repetitions to each new series. That might have influenced in the obtained results, corroborating the results evidenced in the literature on the fatigue effect in a sequence of exercises (SIMÃO et al., 2005).

In the study of Simão et al. (2005), besides the exercises accomplished in the present study, took place, also, the development in foot and the horizontal supine, in other words, there was a larger volume of exercises, what might have carted the verified hypotensive effect. Besides, the intensity of the load was larger, since the exercises were accomplished with load for 6RM and with load corresponding to 50% of 6RM, however with a larger number of repetitions (12 repetitions), while in the present study, the loads were of 10RM.

Seemingly, more intense sessions would promote a larger period of reduction of the SBP. That is corroborated in the study of Simão et al. (2005), in that the G2 group accomplished one exercise more than G1, in other words, six exercises, and it presented significant reductions in all the measures, while, in the first group, those reductions were only significant even to 5th measure. Those reductions, however, were not in the less intense form.

The mechanisms concerning to the post-exercise hypotensive effect are still not totally explained, however, SENETIKO et al. (2002) mentioned that the mechanisms of the sympathetic nervous system, the effect of the baroreceptors and the liberation of nitric oxide are aspects that can explain the reduction of the rest BP, although other ignored mechanisms are implicated also. The circulating hormones seem also to mediate the hypotensive effect. Hormones with potentials vasodilatators were moderated for the increase or to be maintained unaffected during the hypotensive effect. On the other hand, "vasoconstrictors agents were increased, decreased or unaffected after the effort." (MACDONALD, 2002). The possibility of none of those substances to be fundamental for the hypotensive effect is real.

Ending, our results suggest that a training of force with a small volume, did not promote significant reductions of the post-effort
BP. More intense sessions could promote an hypotensive effect and would influence in its duration after the end of the activity. Other studies should be accomplished to ratify these results and to extend them to other exercises, including the control of potentially intervening variables, as muscular mass, execution speed, order of the exercises and aerobic associated training.

BIBLIOGRAPHICAL REFERENCES


