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Analyze the Effects of Resistance Training with Active Muscle Action on Selected Physiological Variables of Adigrat Town Males

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Abstract: ***This study aims to analysis the effects of resistance training with active muscle action on selected physiological variables in the case of Adigrat town males. Twenty athletes were randomly distributed in to two groups, namely active muscle action group (AMAG) (n = 10), and control group (CG) (n = 10). Purposive sampling technique was used to select 20 interested male participants from the total population of 100, aged between 19 to 25 years from Adigart university sport science students. The experimentation was given three times in a week, 60 minutes per session for eight consecutive weeks to meet the selected physiological variables of (blood pressure and heart rate). The results indicated that there were significant improvements (P < 0.001/ p< 0.003) and in systolic and diastolic blood pressure and a significant increment (P < 0.001) in heart rate. In conclusion, this study indicates that, resistance training with active muscle action mainly provides aerobic benefits to the bodies' physiological function.***

Keywords: Active Muscle action, Blood Pressure, Heart rate, Physiological, Resistance training

1. Introduction

Resistance training is a modality of exercise that has grown in popularity over the past two decades, particularly for its role in improving athletic performance [1]. Traditionally, resistance training was performed by few individuals (e.g., strength athletes and those who strived to gain muscle hypertrophy such as body builders). However, the latest trend have a better understanding of the health-related benefits of resistance training; resistance training is now a popular form of exercise that is recommended by National Health Organizations such as the American College of Sports Medicine and the American Heart Association [2, 3] for most populations including adolescents, healthy adults, the elderly, and clinical populations (e.g., those individuals with cardiovascular disease, neuromuscular disease).

Resistance training, which is a specialized method of conditioning designed to increase muscle strength and power. Both skeletal and cardiac muscles adapt themselves in response to this type of training. Resistance training results in hemodynamic alteration with marked elevation of blood pressure (BP), leading to pressure overload in the heart, resulting in the parallel addition of sarcomeres or increase in cardiomyocyte cell width and consequently to an increase in left ventricular wall thickness without reducing the size of the internal cavity in diastole, with the development of concentric left ventricular hypertrophy [4, 5, 6]. The increase in wall thickness induced by pressure overload is mainly due to an increase in cardiomyocyte cross-sectional area [7].

The term "athlete's heart" has been widely used to characterize the changes that occur in the heart due to long-term physical exercise in athletes. Physical exercise can be classified as static or dynamic and leads to two different kinds of intermittent chronic cardiac workload, which induces morphological changes in the heart, such as concentric and eccentric physiological cardiac hypertrophy, characterized by a uniform profile of ventricular wall and septum growth [4, 5, 8].

High blood pressure (BP) is one of the nine leading risk factors influencing the global burden of cardiovascular disease [9] and is estimated to lead to _7 million deaths each year, that is, about 13% of the total deaths worldwide. Lowering of BP and prevention of hypertension is in first instance preferable by lifestyle changes. With regard to the physical exercise predominantly recommended aerobic exercises such as walking, jogging, and cycling for lowering BP [10, 11].

Thus, the aim of this study was to analyze the effects of resistance training with active muscle action on selected physiological variables of systolic and diastolic blood pressure and heart rate of adigrat town males.

2. Materials and Methods

Experimental design

Twenty male athletes aged between 19 - 25 years randomly selected from the interested Adigrat university sport science students were used for this study. The participants were divided in to two groups of ten numbers each i.e. resistance training with active muscle action group (AMAG) (n = 10) and control group athletes (CG) (n = 10). All players were familiar with the test procedures and the testing surroundings. Written informed consent was obtained before participation.

A purposive group design was used. For this study, pre- and post-tests was conducted on the selected physiological variables for both active muscle action group and control group athletes. The resistance training was delivered with three times per week for 40 minutes duration per session. The active muscle action group was undergone resistance training programs with active muscle action, but there was no treatment for the control group (CG).

Data Collection method
All measurements and data were collected by quantitative method through appropriate selected test and measurements. In this study the data from the experimental variables such as systolic and diastolic blood pressure and heart rate were taken by standardized test measurements. The baseline measurements served as the pre-test while the measurements taken at the end of the training served as the post test.

Procedures of Data Collection
The data for the above selected physiological variables of systolic and diastolic blood pressure and heart rate were collected through the following procedures of data collection methods. The investigator selected the following test items, which are standardized ideal for the chosen subjects.

Table 1: Experimental Variables and Their Test

No.	Criterion Variables	Test Items	Unit of Measurement
1	Blood pressure	Sphygmomanometer	MmHg
2	Heart rate	Counting the pulse rate	Numbers

Blood Pressure

Procedure
Attach the Blood Pressure Sensor to the blood pressure cuff if it is not already attached. There are two rubber tubes connected to the cuff. One tube has a black Luer-lock connector at the end and the other tube has a bulb pump attached. Connect the Luer-lock connector to the stem on the Blood pressure Sensor with a gentle half turn. Attach the Blood Pressure cuff to the upper arm, approximately 2 cm above the elbow. The two rubber hoses from the cuff should be positioned over the biceps muscle (brachial artery) and not under the arm. The subject should sit quietly in a chair and avoid moving his or her arm or hand during blood pressure measurements.

Heart rate (Measure Radial Pulse)
Pulse, or the tangible beating of the heart, is used by medical professionals to determine a patient's heart rate. It is measured in beats per minute (bpm) and can indicate the general health or fitness level of a patient. Resting heart rate is taken when a calm individual is sitting or lying down. A normal resting heart rate for an adult is between sixty and one hundred bpm. High resting heart rate may be caused by exercise, illness, certain medications, heart disease, and stress. On the other hand, various medicines and a high level of fitness can cause low resting heart rate. In order to measure radial pulse, the heart rate must be counted for at least fifteen seconds. However, it can also be measured for twenty, thirty, or sixty seconds. If you are measuring a pulse for fifteen, twenty, or thirty seconds, you must multiply the number you count by four, three, or two, respectively, to calculate the heart rate in bpm.

Statistical analysis
All data presented in this study were expressed as mean ± standard deviation and interpreted by descriptive statistical analysis of computerized statistical package for social studies software (SPSS). The paired t-test will be used to compare the pre- and post test data by calculating the t-value to compare the level of significance between control and experimental groups. A value of $p<0.05$ was considered significant.

3. Results

The data was analyzed through paired t-test. Therefore, the results for each variable are discussed as follow:

Table 2: The pre and post resistance training test results for the variables of systolic and diastolic blood pressure and heart rate of these control group and active muscle action group (AMAG) (Mean ± SD).

Blood pressure	**Control group (CG)**	**116.80 ± 7.39** **79.20 ± 2.62**	**112.0 ± 7.89** **77.40 ± 6.31**	**0.134** **0.451**
	Experimental group I (AMAG)	117.40 ± 6.89 79.20 ± 2.74	100.00 ± 7.07 69.00 ± 7.38	0.001 0.003
Heart rate	Control group (CG)	71.20 ± 6.34	68.00 ± 4.03	0.022
	Experimental group I (AMAG)	67.40 ± 7.73	62.00 ± 5.66	0.000

PT = Pre-training Test; PoT = Post training Test, $p < .05$ * = Significant and the data in the form of Mean ± SD (standard deviation).

Results of the above table 2 showed that the pre and post training test mean ± *SD (standard* deviation) values for systolic and diastolic blood pressure and heart rate of the control and experimental group (AMAG). While the systolic and diastolic blood pressure level significantly ($P < 0.001$/ $p< 0.003$) decreased and the heart rate also significantly ($P < 0.001$) decreased.

In terms of the control group athletes insignificantly ($P < 0.134$/ $p < 0.451$) decreases their systolic and diastolic blood pressure. This group also insignificantly ($P < 0.022$) decreased in heart rate.

The results obtained showed that a significant ($P < 0.05$) decrease in systolic and diastolic blood pressure and heart rate among adigrat town males. But, did not show any significant difference in control group.

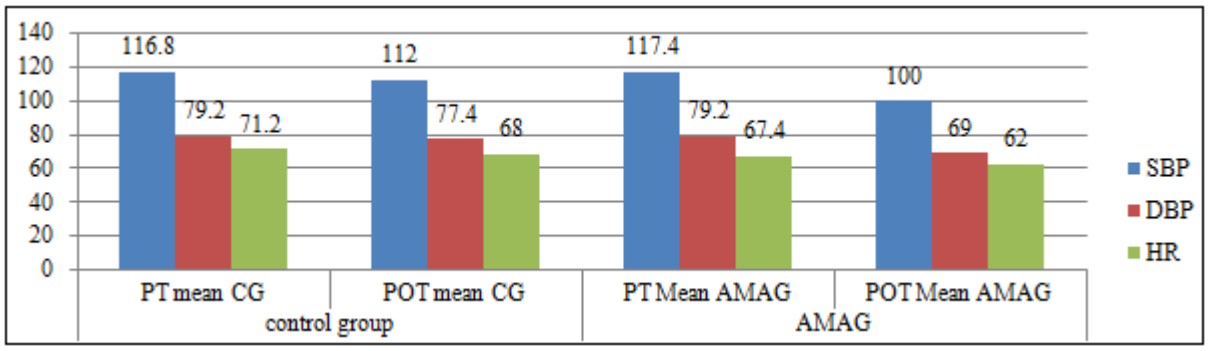

Figure 1: pre and post test means of controlled and experimental groups

The above figure 1 indicates that the pre post test mean systolic blood pressure of the controlled group were (116.8 and 112.00 mmHg), also the pre and post test mean diastolic blood pressure were (79.20 and 77.40 mmHg) and the pre and post test mean heart rate were (71.2 and 68 bpm). Whereas in the experimental groups (AMAG athletes) the result shows that the pre and post test mean systolic blood pressure were (117.40 and 100.00 mmHg), the pre and post test mean values of diastolic blood pressure were (79.20 and 69 mmHg) and finally, the pre and post test mean value of heart rate were (69.40 and 62.00 bpm).

4. Discussion

Table 3: Pre and post test mean differences among control group and experimental group (AMAG).

No.	Variables	Groups		Differences
		Control group (PT and POT mean difference values)	Experimental group (PT and POT mean difference values)	
1	Blood pressure	-4.80/1.80 mmHg **Sig. = 0.134/0.451**	-17.40/10.20 mmHg **Sig. = 0.001/0.003**	
2	Heart rate	-3.20 bpm **Sig. = 0.022**	-5.40 bpm **Sig. = 0.000**	

The above table 3, showed that pre and post test mean difference values of each variables between the two groups such as the control group athletes who were controlled and experimental group (AMAG). The control group showed reduction in blood pressure and heart rate with the value of; (4.8 ± 9.21/1.8 ± 7.22 mmHg, P = 0.134/0.451 and 3.2 ± 3.65 bpm; P = 0.022) respectively. The resistance training with active muscle action group also showed reduction in blood pressure and heart rate (17.4 ± 10.95/10.2 ± 7.98 mmHg; P = 0.001/0.003 and 5.4 ± 2.63 bpm; P = 0.000) respectively. Therefore, this verifies that the experimental group athletes (AMAG) benefits from the aerobic effects of the resistance training with active muscle action but the control group athletes did not show a significant change in both variables.

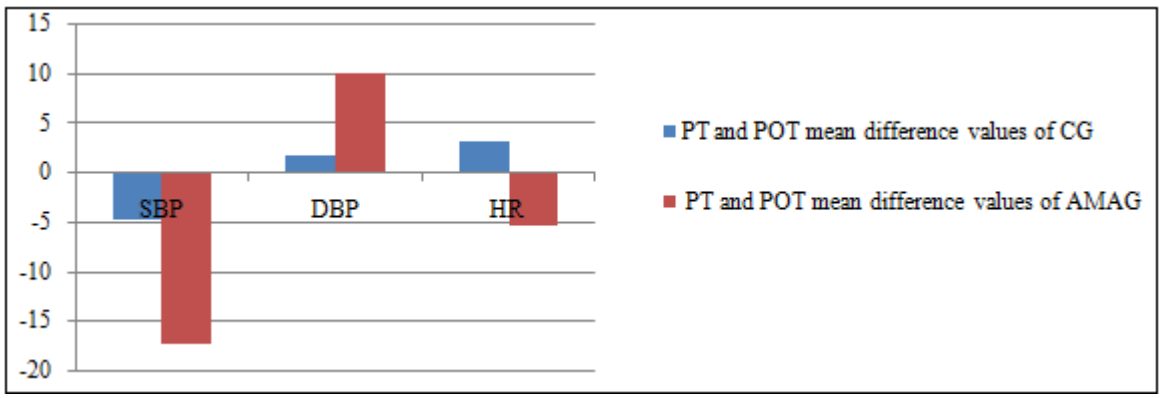

Figure 2: pre and post test mean difference of CG and AMAG

The term "athlete's heart" has been widely used to characterize the changes that occur in the heart due to long-term physical exercise in athletes. Physical exercise can be classified as static or dynamic and leads to two different kinds of intermittent chronic cardiac workload, which induces morphological changes in the heart, such as concentric and eccentric physiological cardiac hypertrophy, characterized by a uniform profile of ventricular wall and septum growth [4, 5, 8]

From the study, we noted a significant reduction in systolic and diastolic blood pressure level (Fig.2) and an appreciable decrease in heart rate (Table3), resistance training with active muscle action often occurring as a result of reducing

the amount of high blood pressure and the unnecessary elevation of a heart rate.

High blood pressure (BP) is one of the nine leading risk factors influencing the global burden of cardiovascular disease [9]. Lowering of BP and prevention of hypertension is in first instance preferable by lifestyle changes. With regard to the physical exercise predominantly recommended aerobic exercises such as walking, jogging, and cycling for lowering BP [10, 11].

The suggested that specifically the resistance training with active muscle action i.e. during lifting the weights or resistances there should be a complete contraction (concentrically) and relaxation (eccentrically) of the muscles to get the aerobic benefits or effects of the work out. As it mentioned in the above table 3; the experimental group athletes shows a significant improvement in lowering the blood pressure and heart rate additionally this helps for a proper functioning of the cardio vascular system.

5. Conclusions

This study clearly indicates that resistance training with active muscle action has having an effect on the physiological variables of systolic and diastolic blood pressure as well as the level of heart beat. This muscle action gives not to the morphological changes of the organs but the physiological change that was directly affects the normal functioning of the body.

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7. Conflict of Interest

The authors declare that there is no conflict of interest concerning the publication of this paper.

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