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The effect of practical blood flow restriction on the relationship between systolic blood pressure and raising the training intensity for performing skill lifting exercises for power lifting players in Baghdad Governorate

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Abstract

The research aimed to use rubber bands to achieve practical blood flow restriction (PBFR) and measure its effect on the anterior and posterior quadriceps muscles on the increasing in systolic blood pressure associated with high training intensity during the performance of the squat lift skill by nine strength athletes in some clubs within Baghdad city, whose ages were (19.25±0.89) years. The researcher used an experimental method of experimental and control groups design. The experimental group performed squat skill exercises with (PBFR), while the control group performed the same exercises without blood flow restriction. The SIG value for the Wilcoxon statistical coefficient for the experimental group before performing the exercises ($0.043 \leq 0,05$) and after performing the exercises ($0.042 \leq 0,05$) showed a statistically significant difference due to the blood restriction by rubber bands, favoring the post-test results for measuring systolic blood pressure. While the SIG value for the control group before performing the exercises ($0.59 \geq 0,05$) and after performing the exercises ($0.66 \geq 0,05$) didn't show any statistically significant difference due to unrestricted blood flow by the rubber bands in the selected muscle during the practical performance of the squat lift skill exercises. The researcher recommended using the rubber bands for (PBFR) for the arm muscles during the bench press skill and using other exercises performed by the legs for the deadlift skill.

Keywords: Blood flow restriction, Systolic blood pressure, Power lifting; Exercises; Baghdad.

Introduction

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1. Introduction

Blood flow restriction (BFR), is one of the innovative training methods discovered in 1994 According to one of the scientific studies, "The Japanese scientist (Yoshiaki Sato) invented the training method and obtained a patent for this auxiliary method in many countries, including Japan, the United States of America, Germany, the United Kingdom, Italy, and France" [1]. The functional basis of this method is to obstruct the venous blood flow out of the restricted muscle, as Al-Rubaie defined in one of his scientific studies that investigated the effects of the aforementioned method, as "one of the auxiliary training tools made of cotton or rubber materials that partially restricts the venous blood flow out of the muscle when placed on the muscle origin of the working limb while performing low-intensity exercises, which leads to accumulate the cellular metabolic products within the muscle fiber, accompanied by adaptations in the biochemical variables, which works to develop the muscular strength of the restricted muscle" [2]. One of the changes that occur within the muscle as a result of the process of blood flow restriction is a volume increasing in venous blood within the muscle due to the decrease in flow outside the muscle during physical exercise. After the muscle is released from the restriction, large quantities of this venous blood are released towards the heart, which later pushes it towards the functional excretion organs to get rid of the products of the cellular metabolism process. **(Dawson, et al)** explained the effect of increasing training intensity during exercise on heart function: "When practicing high-intensity, intense physical activity, there was a significant increase in the concentration of troponin protein within the heart muscle, which helps in achieving the cardiac muscle fibers contraction , which works to increase the pumping of arterial blood towards the muscles, and the strength of the left ventricular muscle contraction leads to collecting a greater venous blood return. It was noted that there was an increase in the level of systolic arterial blood pressure after the aforementioned performance" [3].The researcher believes that the importance of the current study lies in reducing the high systolic blood pressure associated with the heart rate and the amount of venous return when performing physical effort by restricting the blood flow accompanying the performance of physical effort for squat exercises.

1-2 Research Problem:

The research problem is the increasing in systolic blood pressure which related to high heart rate due to increasing the training intensity during the performance of squat exercises by power lifting players.

1-3 Research Objectives:

1. using rubber bands to achieve (PBFR) process for the selected muscles of the research sample under study.

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2. measure the effect of using rubber bands for (PBFR) on systolic blood pressure after the restriction process.

2. Materials and Methods:

The researcher used the experimental research method with an experimental and control group design. The researcher chose 9 power lifting players from some youth clubs in Baghdad Governorate as a research sample, 5 players for the experimental group and 4 for the control group. The researcher measured the anthropometric variables age **(19.25±0.89)**, body mass **(84.69±1.25),** length **(171.17±1.75)**, and their homogeneity by means of the statistical variation coefficient that showed the homogeneity of the sample since all its statistical values age **(4.61)**, body mass **(1.02)**, length **(1.48)** ≥ 50%.

The researcher used the one repetition max test to identify the highest training intensity that the player can do it once for determining the exercises intensity performed by the research sample members with or without the restriction process. The researcher used the rubber bands for (PBFR) process to restrict the anterior and posterior quadriceps muscles at the (Squat) (1RM) lift exercises.

The researcher used the Perceived Pressure Standard (PPS) to determine the appropriate pressure in the muscle restriction process. the scientific studies have proven that the best pressure is the pressure of the area (10-7) degrees in this standard. The researcher used rubber bands dedicated to restricting blood flow, an electronic weight and height measuring device, blood pressure measuring device, and the Perceived Pressure Standard (PPS) [4] [5] [6].

The study protocol was applicating the pre-test on 6/3/2024 by measuring the blood pressure of the experimental and control research sample members using the, blood pressure measuring device while sitting on a chair and remaining calm for 5 minutes before the measurement.

The research sample members started the main experiment on 6/4/2024 to 10/4/2024. The experimental group members performed a set of resistance exercises to develop the squat skill at a rate of 3 exercises in each training unit with a training intensity of (50-70)% of (1RM) accompanied by the process of restricting the anterior and posterior thigh muscles by the rubber bands.

The experimental group members applied a set of resistance exercises to develop the squat skill at a rate of 3 exercises in each training unit with a training intensity of (90-95)% of (1RM) without using rubber bands.

The researcher reapplied the post-test on 10/5/2024, adhering to the same conditions and requirements of the pre-test.

The researcher used the Statistical Package for the Social Sciences (SPSS) software to process the results of the pre- and post-tests for both experimental and control research groups. The researcher used the Wilcoxon statistical coefficient to identify the significance of the statistical difference between the results of the pre- and post-tests of the experimental and control research sample groups. The researcher used the arithmetic mean and standard deviation of the variables in the research under study to identify the direction of the significance of the statistical difference.

2. Results:

Table 1 the Wilcoxon values for the variables of the experimental and control research groups.

Variables / Value	N.Ranks	P.ranks	Z	Sig.
Pre-Posttest of SBP Exp.g. Before Performance with PBFR	3.0	0.0	2.032	0.043
Pre-Posttest of SBP Exp.g. After Performance with PBFR	3.0	0.0	2.032	0.042
Pre-Posttest of SBP Ctrl.g. Before Performance without PBFR	2.5	0.0	1.890	0.59
Pre-Posttest of SBP Ctrl.g. After Performance without PBFR	2.5	0.0	1.841	0.66

Unit Measurement (mmhg), Sig ≤ (0,05)

Table 2 the arithmetic means and standard deviation of the variables of the experimental and control research groups.

Variables / Value	N	Mean	Std. Deviation
Pre-test Exp.G. SBP. Before erformance with PBFR	5	14.64	0.49

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Pre-test Exp.G. SBP. After Performance with PBFR	5	13.82	0.66
Pre-test Ctrl. SBP. Before Performance Without BPFR	4	14.8000	0.39
Pre-test Ctrl. SBP. After Performance Without BPFR	4	16.43	.31
Post-test Exp.G. SBP. Before Performance with PBFR	5	12.68	0.28
Post-test Exp.G. SBP. After Performance with PBFR	5	12.64	0.40
Post-test Ctrl. SBP. Before Performance Without BPFR	4	14.68	0.36
Post-test Ctrl. SBP. After Performance Without BPFR	4	16.18	0.22

3. Discussion:

Table 1 shows the SIG () value for the pre-post test measuring systolic blood pressure of the experimental research sample before performing squat lift skill exercises accompanied by the restriction process. This indicates a statistically significant difference due to the use of rubber bands to restrict blood flow in favor of the mean of the post-test, as shown in Table 2.

The researcher believes that the significance of the statistical difference indicates a permanent adaptation occurring in the blood vessel lining, which expands due to the restriction of blood flow, allowing the largest amount of blood to reach the muscles, resulting in a decrease in systolic blood pressure after the muscle is released from the restriction. Restricting blood flow during resistance exercises improves the endothelium of blood vessels, making it easier for them to dilate and allow a greater volume of blood to pass to the muscles. The dilation of blood vessels after releasing the muscle from blood flow restriction leads to a decrease in systolic blood pressure [7] [8].

Table 1 shows the **SIG (0.043), (0.042)** value for the pre-test and post-test to measure systolic blood pressure for the experimental research sample before and after performing squat lift skill exercises accompanied by the restriction process. This indicates a statistically significant difference due to the use of rubber bands to restrict blood flow in favor of the post-test mean, as shown in Table 2 .

The researcher believes that the significance of the statistical difference indicates the temporary adaptation occurring in the peripheral circulation due to the dilation of blood vessels, which leads to a reduction in the systolic pressure on the walls of the blood vessels after a large volume of venous blood flows through the selected constricted muscle. The process of restricting blood flow in the muscle

increases the production of nitric oxide, which dilates blood vessels and allows a large amount of blood to flow after the muscle is released, leading to a decrease in the blood pressure exerted on the walls of the blood vessels [9].

Table 1 shows the **SIG (0.59), (0.66)** value for the pre-posttest measuring systolic blood pressure for the control group research sample before and after performing the squat lift skill exercises, indicating no statistically significant difference. This confirms that there was no effect on systolic blood pressure due to the absence of rubber bands used by the control group members when performing the squat lift skill exercises.

4. Conclusion:

1. Using rubber bands to restrict blood flow in the arm muscles during the bench press skill .
2. Performing other exercises accompanying the blood flow restriction process done by the legs for the deadlift skill.
3. Measuring other variables when performing blood flow restriction during squat skill exercises, such as heart rate and Vascular Endothelial Growth Factor (VEGF).

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