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Effectiveness of lactate threshold exercises in the concentration of lactic acid in blood and in the endurance performing layups in under 18-years of age basketball players

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ABSTRACT

The aim of the present study was to identify the effectiveness of lactate threshold exercises in the concentration of lactic acid in blood and in the endurance performing layups in under 18-years of age basketball players. The present study was conducted with basketball players of Al-Shorta Sports Club for the youth category aged 16-18 years, in the 2021 sports season, in the basketball court of Al-Shorta Sports Club, within the time frame of December 2021 to February 2021. The present study had an experimental design. Participants were allocated into two groups (experimental group and control group) by simple random allocation method (raffle). A total of 14 basketball players were selected as participants for the study. Participants were randomly allocated in each group with n=7 in each group. Lactate threshold exercises were applied in 24 training units, three training units per week for a total of 8 weeks. During weeks 1 and 2 the exercises were performed without a competitor, during weeks 3 and 4 with a negative competitor, and during weeks 5-8 with a positive competitor. In conclusion, the lactate threshold exercises used in this study improved the concentration of lactic acid in blood and the endurance performing layups in under 18-years of age basketball players.

KEYWORDS

Lactic acid; Layups; Basketball.

1. INTRODUCTION

The strength and speed are the key characteristics of basketball game. It depends upon the speed of the player while playing defense and offensive skills in the game. High physical effort is

needed to monitor the movements of the opponent players and high speed of the transition from defense to attack and vice versa (Abood et al, 2022; Munadi et al, 2022; Wahed Chalob, 2022). Lay-up shot skill is one of the basic skills in the basketball game. Lay-up shot skill forms the basic foundation. The accuracy in the playing technique of the player depends upon many variables related to his movements, such as his proximity or distance from the basket, the ball or the opponent. These factors help the players in raising their level of performance in offensive action (Hashem et al, 2022; Mashkoor & Hameed, 2022).

It is well known that the anaerobic system for energy production is the dominant system in the game of basketball because of the high speed and strength in physical performance of the players. Hence, there is strong need to for the training coaches to focus on the endurance of the players in order to help them to perform better under such anaerobic conditions (Sakhil et al., 2020). One of the important exercises for improving endurance of the players is the lactic acid threshold exercises (Abdullh et al, 2022). These exercises have a positive rest and lead to the development of endurance for performance in the game of basketball. Hence, the aim of the present study was to formulate a set of exercises based on lactic acid threshold in the concentration of lactic acid in the blood to resist fatigue and thus maintain the speed of performance for the longest possible period during the training competition and to develop the lay-up shot skill of basketball for young players.

Based on the researchers' experience and their follow-up to the training units of many basketball clubs, a conviction was obtained that some coaches pay enough attention to the exercises related to the physiological aspects, which is reflected in the level of performance of the players. It often decreases, especially in the third and fourth periods due to lack of effectiveness of the participation of the players in the competition for both defense and attack. In addition to this, a clear decrease in the level of implementation of basketball skills, including the lay-up shot skill also occurs. This negatively affects the team's performance and results, and the reasons could be an increase in the concentration of lactic acid in the blood, which causes fatigue. Therefore, the researcher aimed to conduct an academic field study to find out the effectiveness of the lactic threshold exercises in the concentration of lactic acid in the blood and the performance of lay-up shot skill in basketball for players under 18 years.

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2. METHODS

2.1. Participants

The present study had an experimental design. The present study was conducted on the basketball players of Al-Shorta Sports Club for the youth category aged 16-18 years, in the 2021 sports season, in the basketball court of Al-Shorta Sports Club, within the time frame of December 2021 to February 2021. Participants were allocated into two groups (experimental group and control group) by simple random allocation method (raffle). A total of 14 basketball players were selected as participants for the study. Participants were randomly allocated in each group with n=7 in each group.

2.2. Homogeneity and equivalence of the sample

The researchers found homogeneity and parity between the two research groups using the appropriate statistical treatments, as shown in Tables 1 and 2.

Table 1. The homogeneity of the sample

N	Variables	Unit of measurement	Value test (Leven)		Sig type
			Calculated	Standard Error	
1	Age	year	1.111	0.421	Non sig
2	Training age	year	0.432	0.342	Non sig
3	Weight	Kg	0.072	0.776	Non sig
4	Height	Cm	1.324	0.451	Non sig

Table 2. The arithmetic means, standard deviations, the calculated *t* value, and the significance of the differences in the investigated tests between the control and experimental groups in the pre-test.

Variables	Unit of measurement	Control group		Experimental group		T value	Error	Sig type*
		Mean	SD	Mean	SD			
Concentration of lactic acid in blood	m.mol/liter	12.448	0.373	12.406	0.500	0.150	0.884	Non sig
Endurance of the performance of layups	Degree	6.400	1.140	6.200	1.095	0.283	0.784	Non sig

** Significant at the significance level 0.05 if the error level is less than 0.05*

2.3. Tools and devices used in the research

In the present study, many tools and devices were used for the purpose of data collection with the aim to achieve the objectives of the research. Various tools used in the present study included a device for measuring height and weight, 10 basketballs, leather measuring tape of 15 meters, and a Casio electronic stopwatch.

2.4. Tests used in the research

2.4.1. Measuring the concentration of lactic acid in the blood

In the present study, Lactat pro2 device was used to measure the concentration of lactic acid in the blood, followed by a speed endurance test (25 x 8m) after a rest period of (5) minutes.

2.4.2. Performance Endurance Test (Lay-up shot skill)

The Lay-up shot skill test was intended to measure the endurance of the lay-up shot skill. The participant was asked to stand on the free-throw line, holding the ball in both the hands. After getting the start signal, the participant was directed to perform the lay-up shot skill in any direction he/she desired, return to take a second ball on the chair and on the free-throw line to complete another layup until a total of 30. For each successful hit, one point was awarded (Ahmed, 1997).

2.5. Exploratory experience

The researchers conducted a preliminary experiment. The preliminary experiment was conducted with the aim to verify the validity of the tools used in terms of positive assistance, to verify the fitness of the tests for the tester members and the ease of their application, to know the time required to conduct the tests, to verify the understanding and efficiency of the assistant work team in conducting measurements and tests and recording the results, to know the difficulties that the researcher may encounter during the course of the study and providing appropriate solutions to them. The researchers conducted the exploratory experiment on a sample of 3 players in the month of December 2020.

2.6. Pre-test

The researchers conducted the pre-tests in the month of December 2020. The concentration of lactic acid in the blood was measured, and the performance of lay-up shot skill with basketball was carried out on the participants of the experimental group and control group.

2.7. Suggested special exercises

The exercises were performed at the beginning in the first two weeks without a competitor, followed by which, a negative competitor enters in the third and fourth week, and in the last four weeks, a positive competitor for few exercises. A total of 24 training units were performed with three training units per week for a total of 8 weeks. The intensity of the exercises was determined by measuring the pulse during the effort so that the pulse rate was 185 / min and above. These exercises were applied at the beginning of the main section of the training unit. High-intensity interval training method was used, with the intensity ranging from 80-90% of the maximum effort.

2.8. Post-test

The final tests were accomplished by the researcher and his fellow teammates in the month of February 2021 in the Al-Shorta Sports Club Stadium. The post-tests were conducted for the control and experimental groups under the same conditions in which the pre-tests were conducted in terms of the sequence of the tests.

2.9. Statistical analyses

The statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 23, by computing arithmetic means, standard deviations and t tests.

3. RESULTS AND DISCUSSION

The results of this study are presented in tables 3, 4 and 5. Table 3 shows the differences between the results of the pre and post-tests of the experimental group. Table 4 presents the differences between the results of the pre- and post-tests of the control group. Table 5 describes the differences between the results of the post-test for the experimental and control groups.

Table 3. Differences between the results of the pre and post-tests of the experimental group

Variables	Unit of measurement	Control group		Experimental group		T value	Error level	Sig type*
		Mean	SD	Mean	SD			
Concentration of lactic acid in blood	m.mol/liter	12.448	0.373	13.504	0.510	9.000	0.001	Sig
endurance of the performance of Lay-up shot skill	Degree	6.400	1.140	11.200	1.303	24.00	0.000	Sig

** Significant at the significance level 0.05 if the error level is less than 0.05*

Table 4. Differences between the results of the pre- and post-tests of the control group

Variables	Unit of measurement	Control group		Experimental group		T value	Error level	Sig type*
		Mean	SD	Mean	SD			
Concentration of lactic acid in blood	m.mol/liter	12.406	0.500	12.466	0.498	-5.262	0.006	Sig
endurance of the performance of Lay-up shot skill	Degree	6.200	1.095	7.800	0.836	-6.532	0.003	Sig

** Significant at the significance level 0.05 if the error level is lower than 0.05*

Table 5. Differences between the results of the post-test for the experimental and control groups

Variables	Unit of measurement	Control group		Experimental group		T value	Error level	Sig type*
		Mean	SD	Mean	SD			
Concentration of lactic acid in blood	m.mol/liter	13.504	0.510	12.466	0.498	3.255	0.012	Sig
endurance of the performance of Lay-up shot skill	Degree	11.200	1.303	7.800	0.836	4.907	0.001	Sig

** Significant at the significance level 0.05 if the error level is less than 0.05*

In the present study, findings of the study revealed a significant difference between the pre and post-tests of the experimental research sample to test the complex offensive skills and the tactical endurance test in favor of the post test. Thus the lactic threshold exercises were found to be beneficial in the participants of the experimental group. These exercises were formulated on an organized scientific basis through the use of appropriate and gradual stresses and taking into account individual differences. Similar development in the concentration of lactic acid and the endurance of the performance of lay-up shot skill, this was confirmed by Abdel (1999). Authors in this study stated that "the performance of the skill is related to the individual's physical and motor capabilities, so special physical preparation must be taken care of in order to master the skills of the practiced activity".

The researchers of the present study believed that the development of lactic endurance has great impact on the skill performance, in raising and maintaining the level of performance of the players. The development of the endurance test of the performance of lay-up shot skill requires neuromuscular compatibility when the player performs repeated attempts as per the kinetic rhythms

in a motor path. The beneficial effects of these exercises were stated in many studies conducted by the various researchers. Mahmoud (2002) demonstrated that "there is a significant correlation between the skill level of shooting in basketball and the ability of arms and legs".

The positive results were also attributed to the keen interest of the players and their active participation in the training program. The training units helped the player in making important judgements regarding their movements in the field, appropriate utilization of the field space, the method to get rid of the defender to receive the ball in a good position that allows him to record an injury through lay-up shot skill. Thus the wide interests in the skill lead to the remarkable development of the endurance in the participants of the experimental group. These exercises helped in raising the physical ability of the athlete using appropriate skills in the correct direction (Abdel, 1999).

The researchers believed that variety of factors contributed in development of the lactic acid endurance among the players. One of the key factor was the type of exercises, the players were exposed to in the training units. In these exercises, players worked at less than maximum intensity. It helped the players in developing the ability to resist fatigue resulting from the accumulation of lactic acid. The second important factor could be the appropriate rest intervals provided to the players in between the exercise sessions. The rest intervals were given to remove the accumulated acid. It means that the players repeat the work in the presence of quantities of lactic acid, as well as a decrease in the PH of the blood. Increase in the levels of acidity has a positive impact on the work of the internal organs of the body especially in the work of vital organs that work to delay the drop in blood PH quickly by reducing the acidity caused by lactic acid and converting it from a strong acid to a weak acid which contributed to delaying the drop in blood PH and then increasing the physical exertion. Al Kaabi (2007) confirmed in their study that the energy production capacity of the lactic acid system requires the training load to be directed in a way to make the rate of lactic acid accumulation in the muscles and blood greater than the rate of its disposal to ensure that the lactic acid threshold is exceeded. It helps in creating functional adaptations in the various body systems and makes them able to withstand the lack of oxygen and the high levels of lactic acid and changes in blood PH. This leads to significant improvement in the athlete's ability to withstand such physiological and chemical conditions during training, which makes the athlete compete with high efficiency because the training conditions have become more difficult than the competition conditions.

4. CONCLUSIONS

Based on the findings of the study, the researcher concluded that the lactic threshold exercises contributed to the improvement of the variables investigated (the concentration of lactic acid in the blood and the performance endurance of lay-up shot skill in basketball). The results showed a marked superiority between the pre and post-test in blood lactic acid concentration and performance endurance for lay-up shot skill for the players of the experimental group in favor of the post-test. The experimental group outperformed the control group in the post-test of the variables investigated and in favor of the experimental group.

According to the set of conclusions adopted and formulated by the researchers from the results obtained in this experiment, the authors recommend that the training coaches pay attention to adopt the lactic acid threshold exercises when training offensive skills in basketball, including the lay-up shot skill. The authors also recommend to conduct large sample trials to identify the effect of the lactic threshold exercises on some physiological variables and the level of skill performance in other sports activities. There is a strong need to focus on developing the offensive skills of young basketball players, as they are of great importance in basketball training.

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AUTHOR CONTRIBUTIONS

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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