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RESEARCH ARTICLE

The Effect of the Complementary Enzyme Q10 in Improving Some Functional Variables of Disabled Basketball Players

Sahar Hur Majeed[1], Hassanien Abdul-Wahid Abbas Shuaila[2], Hussein Manati Sajit[3]

1. *The Iraqi University/ College of Dentistry /IRAQ.*
2. *Al-Qasim Green University/ Department of Students Activities/IRAQ.*
3. *Kerbala University/ College of Physical Education and Sport Sciences/IRAQ.*

Abstract

Basketball for disabled players is regarded as a game that requires many functions, and this is attributed to the nature of the game itself that forces the disabled player to do moves recognized with high strength and special tempo in a short time. Therefore, the functional side is regarded as one of the fundamental demands for the occurrence of the necessary functional adaptations that might differ in degree from other sport games, and this is done through studying the biological variables because they are important and necessary since they have a great effect on the athletic performance and the physical capacities that are essential for the basketball game in general, and basketball for disabled players in particular because of its great importance in the basketball match especially they, functional variables, occur under the anaerobic lactic system where the player should have the ability to do his skills in a high speed and frequently in the match. The research aims at preparing anaerobic exercises through taking the Q10 enzyme to improve some of the functional variables of the disabled basketball players. The research also aims to identify the effects of the anaerobic exercises by taking Q10 enzyme, the experimental method was used by taking the Iraqi disabled basketball team as a specimen. 18 players were divided randomly into three groups (experimental 1, experimental 2, and control group) each group consisted of 6 players. The (experimental 1) group had to do the anaerobic exercises prepared by the researchers with doses of the coenzyme Q10; (experimental 2) group had to do anaerobic exercises prepared by the researchers, whereas the (control) group had to do special exercises. Based on the above plan, the coenzyme was used as capsules (100 mg.) taken daily before breakfast, the total enzyme dosage becomes (60 gm.) equivalent to (3gm.). The study concluded that exercises with the use of the complementary Q10 enzyme lead to improve heartbeat ratio before and after exertion, as well as improve the level of lactic acid before and after exertion. Furthermore, it improved the level of V2 Max of the research specimen.

Keywords: *Enzyme, Functional Variables and Basketball.*

Introduction

Basketball for disabled players is a game that requires many functions, and this is attributed to the nature of the game itself that forces the disabled player to do moves recognized with high strength and special tempo in a short time.

Therefore, the functional side is regarded as one of the fundamental demands for the occurrence of the necessary functional adaptations that might differ in degree from other sport games, and this is done through studying the biological variables because they are important and necessary since they have a great effect on the athletic performance and the physical capacities that are essential for the basketball game in general, and basketball for disabled players in particular because of its great importance in the basketball match especially they, functional variables, occur under the anaerobic lactic system where the player should have the ability to do his skills in a high speed and frequently in the match [1].

The coenzyme Q10 is regarded as a basic substance for every cell and it is similar to the vitamin. It enters the respiratory chain and it is an important factor in the oxidation and reduction of the lysosomes and the plasma membrane, in the Golgi apparatus, as well as it acts as an antioxidant in the

reduced formula. It also exists, in high rates, in the organs' tissue cells that consume more energy such as (heart, brain, and, with a less concentration, in the lung) [2]. The coenzyme Q10 plays a key role in this chain as it receives the electrons resulting from the metabolism of fatty acids and glucose, and transfers them to other transfer materials. At the same time, it transfers proton outside the cell membrane [3]. Hence, is the importance of the research in the preparation of anaerobic exercises with taking the enzyme Q10 in improving the important biochemical variables for the disabled basketball players.

Research Problem

The research problem centers on the nature of the exercises used with the disabled basketball players of the Iraqi national youth team. The problem was noticed when the researchers attended and watched the players' training units, and through the interview conducted by the researchers with most of the players which showed that they rely on specific trainings prepared by the trainers, in addition to taking some food supplements which caused functional disorders because they were used randomly, and this happened as the body does not need food merely for being fuel of energy, but also for the construction and recovery of the body because poor nutrition can lead to fatigue, stress, and food disorders.

The responses of the body's internal systems are considered important goals which sport training seeks to change or modify by changing or modifying the external influences (external load) or by trainings and exercises the athlete does constantly, which lead to make chemical and physiological changes in his body.

Likewise, the athlete's efficiency progress depends largely on the positivity of those chemical changes that enable the player to cope with the fatigue resulted from training or match as long as possible. After noticing this problem, the researchers determined to study it by taking regular doses of Q10 enzyme accompanied with anaerobic training in improving the functional variables of disabled basketball players.

Research Objectives

- Preparation of anaerobic exercises by taking the enzyme Q10 to improve some functional variables for disabled basketball players.
- Identifying the effect of anaerobic exercises with taking enzyme Q10 in improving some functional variables of disabled basketball players.

Research Hypotheses

- There are statistically significant differences between the pre-measurement and post-measurement of the research's target variables of the experimental group in favor of the post-measurement.
- There are statistically significant differences between the pre-measurement and post-measurement of the research's target variables of the control group in favor of the post-measurement.
- There are statistically significant differences between the post-measurement of the researches target variables of the experimental and control groups in favor of the experimental group.

Research Terminology

Enzyme Q10: is an important nutrient for the functions of each cell in the body and it contributes to many chemical interactions in all cells of the body such as the formation of ATP which is responsible for the composition of biological enzymes and body energy sources, including muscle cells [4].

Research Methodology

The researchers used the experimental method in the equal groups that have the pre and post measurement because it is suitable with the nature of the problem.

Research Specimen

The Iraqi national teams of basketball disabled players were taken as the research's specimen. 18 players were taken and randomly divided into three groups (experimental 1, experimental 2, and the control group). 6 players for each group. Experimental 1 group did the anaerobic exercises prepared by the researchers with taking doses of the coenzyme Q 10, experimental 2 group did the anaerobic exercises prepared by the researchers, whereas the control group did special exercises.

Specimen Homogeneity

Table 1: Shows the homogeneity of the specimen players

No.	Tests	Leven test value		Significance
		Calculated	Standard error	
1	Lactic acid	1.266	0.231	Homogeneous
2	Maximum of oxygen consumption	0.232	0.621	Homogeneous
3	Pulse rate before exertion	0.079	0.830	Homogeneous
4	Pulse rate after exertion	1.054	0.221	Homogeneous

Parity

In order to avoid the factors that may effect on the results of the main experiment, and for achieving parity between research groups, the researchers used variance analysis of the variables (lactic acid, oxygen maximum consumption, pulse rate before and after exertion) as Table (2) below shows:

Table 2: Shows the parity among the experimental groups

Tests	Variance Source	Total variations	Temperature	Average variations	(F) value		Significance
					calculated	Standard error	
Lactic acid	between groups	6.333	2	3.167	2.198	0.146	Equal
	Inside the groups	21.667	15	1.442			
	Error	28.000	17				
Maximum oxygen consumption	between groups	0.778	2	0.389	0.206	0.816	Equal
	Inside the groups	8.333	15	1.889			
	Error	29.111	17				
Pulse rate before exertion	between groups	0.333	2	0.167	0.084	0.940	Equal
	Inside the groups	29.666	15	0.978			
	Error	3.000	17				
Pulse rate after exertion	between groups	168.778	2	84.389	1.998	0.170	Equal
	Inside the groups	633.667	15	42.244			
	Error	802.444	17				

Research Apparatus

- Coenzyme Q10.
- Laptop (Dell).
- Camera (Sony) made in Japan.
- Cotton measure tape.
- Medical balance (buerer) made in China.
- Lactate (Pro2) made in Japan.
- Treadmill made in China.
- FITMAT (PRO) made in Italy.
- Plastic cones (6) in different heights.
- Standard basketballs (18).

Identification of the Functional Variables

Through exposure to many scientific references concerned with the physiology of sport training, basketball, the researchers arrived at identifying some of the functional variables which, they believe, are of great importance for the basketball players. These variables were presented to a group of experts in physiology of sport training and they, the variables, have been all accredited. The variables are: the ratio of accumulation of lactic acid in blood, heartbeat rate before and after exertion, maximum oxygen consumption (Vo2 Max).

Determining Coenzyme Q10 Dosage

The researchers conducted a reference survey of studies, researches, and scientific references, [5, 6] which dealt with the use of the coenzyme Q10 in order to identify the doses allowed and effective in the human body, and they came out with the followings:

- The effective doses for the adults (20-30 years old) must be between (6-8) gm. for (8-12) weeks as a maximum.
- The coenzyme Q10 must be taken as a one capsule 100 mg. once a day and it can be taken twice if the capsule is 50 mg. every 12 hours.

It is preferable to take the coenzyme Q10 before eating to increase the absorption speed and get more benefits. On this basis, doses of the coenzyme Q10 were used in the form of capsules (100) mg. daily before breakfast, so the total amount of the coenzyme Q10 in full is (60) gm. which is equivalent to (3 gm.), as Table (3) shows:

Table 3: Shows the doses of the coenzyme Q10 used in the research

Material	Capsule size	Dose per day	Total dosage for 8 weeks	Total dosage
Coenzyme Q10 (capsule)	100 mg.	100 mg. (1 capsule)	100×60 days =6000 mg.	6 gm.

Pilot Experiment

The researchers conducted the pilot experiment in March 23rd 2016 on (5) players within research community and outside the main research specimen, the purpose of which is to; first, identify the errors and obstacles and negatives that may accompany the experiment, second; identify the validity of tools and devices used, third; identify the exercises strength and their time for the research specimen, fourth, identify the test performance time.

Pre- Tests

The pre tests were conducted on the research specimen in March 3 rd, 2016 to identify the level of the functional variables, the tests and functional measures were done at 10 A.M.

Main Experiment

The researchers conducted the exercises prepared by them through the following procedures:

The exercises were in the special preparation phase of the training season. The researchers took into account the principle of diversity in the exercises used, see appendix (2). The exercises were conducted as (3) training units per week on Sunday, Tuesday and Thursday for (8) weeks. The training ranged from 85% to 95% of the maximum intensity of the player's ability as the maximum intensity of the exercises used was determined in the pilot experiment for each player. These exercises were applied at the beginning of the main section of the training unit.

Post Measurements and Tests

The researchers carried out post tests on the members of the research specimen in May 5th, 2016 under the same conditions and terms in which pre measures and tests were conducted as far as possible.

Presenting and Analyzing the Results of the Pre and Posttests of the Experimental Group

Table 4: Shows the median values and the quartile deviations and Wilcoxon value, and the statistical significance of the test of the variables studied in the experimental group

Variables	Measurement unit	Pre		Post		Wilcoxon Value	Significance
		medium	Deviation	medium	Deviation		
Heartbeat ratio before exertion	Beat/min.	70.51	3.76	66.76	2.87	3.98	significant
Heartbeat ratio after exertion	Beat/min.	185.76	5.87	179.76	5.32	Zero	significant
Lactic acid before exertion	mmol/L	1.750	0.105	1.383	0.117	1.09	significant
Lactic acid after exertion	mmol/L	11.79	1.25	9.76	2.87	5.76	significant
Vo2Max	ml/kg/min.	40.78	2.80	45.67	3.65	Zero	significant

Table (4) shows that the level of significance between the results of the pre-test and post-test of the experimental group in the variables examined (heartbeat rate before exertion, heartbeat rate after exertion, lactic acid before exertion, lactic acid after exertion, and the maximum consumption of oxygen (Vo2max) and the precision of jump shooting

reached (0.01) (0.02) (0.00) (0.04) (0.03) (0.00) respectively, and it is below the significance level (0.05) which means that the differences between the two, pre and posttests, were statistically significant in these variables.

Viewing and Analyzing the Results of the Pre and

Post Tests for the Control Group:

Table 5: Shows the median values, the spring deviations, Wilcoxon value, and the statistical significance of the test of the variables in the control group

Variables	Measurement unit	Pre		Post		Wilcoxon Value	Significance
		Median	Deviation	Median	deviation		
Heartbeat rate before exertion	Pulse/minute	71.46	3.37	70.98	2.99	3.871	significant
Heartbeat rate after exertion	Pulse/minute	182.23	4.99	180.43	3.88	4.434	significant
Lactic acid before exertion	mmol/L	1.741	0.342	1.831	0.24	20.982	Not significant
Lactic acid after exertion	mmol/L	11.54	1.98	11.86	2.01	19.887	Not significant
Vo2Max	ml/kg/minute	40.54	1.87	41.83	2.86	5.872	significant

It is clear from table (5) above that the level of morale between the results of the pre and posttests of the control group in the variables (heartbeat rate before exertion, heartbeat rate after exertion, and the maximum oxygen consumption) reached (0.04) (0.03) (0.00) respectively, which is below significance level (0.05), this means that the differences between the pre and post tests were statistically significant and in favor of the post tests in these variables. Whereas in the variables of lactic acid before exertion and lactic acid after exertion reached (0, 27) (0.09) respectively, which is higher than significance level (0.05) which means that it is not statistically significant and there are no differences between pre and post measurements in these variables.

Viewing and Analyzing the Results of the Post Tests for the Experimental and Control Groups

Table 6: Shows the medians' values in the control and experimental groups, and the statistical significance of the post tests of the variables

Variables	Measurement unit	Experimental		Control		Mann Whitney value	Significance
		Median	Deviation	Median	deviation		
Heartbeat rate before exertion	Pulse/minute	66.76	2.87	70.98	2.99	Zero	significant
Heartbeat rate after exertion	Pulse/minute	179.76	5.32	180.43	3.88	Zero	significant
Lactic acid before exertion	mmol/L	1.383	0.117	1.831	0.24	3.99	significant
Lactic acid after exertion	mmol/L	9.76	2.87	11.86	2.01	2.09	significant
Vo2Max	ml/kg/minute	45.67	3.65	41.83	2.86	2.98	significant

Table (6) shows that the level of morale between the posttests results of the experimental and control groups in the examined variables (heartbeat rate before exertion, heartbeat rate after exertion, lactic acid before exertion and lactic acid after exertion, and the oxygen maximum consumption (Vo2max) reached (0.00) (0.00) (0.02) (0.00), (0.04) respectively, and this is below the level of significance (0.05) which means that the differences between the post tests of the experimental and control groups were statistically significant in these variables and in favor of the experimental group .

Discussing the Results

The results in Table (4, 5, 6) of the research examined variables for the experimental and control groups showed that there were significant differences between the pre and posttests of the experimental group after carrying out the trainings prepared by the researchers. There were also significant

differences in the variables (heartbeat rate before exertion, heartbeat rate after exertion and the maximum oxygen consumption (Vo2max) of the control group. Table 4 shows that there are significant differences between the post tests of the control and experimental groups in favor of the experimental group as each training leaves an impact on the trainee's functional systems, especially the heart because it is the basis for pumping and distributing blood throughout the body.

And this impact increases in such a way that reflects the adaptations of the extent of development in the functional performance of the athlete and this is confirmed by the exercises prepared by the researchers of the experimental group as well as the functional improvement that occurred in the cardiovascular system, where the building of the athlete body quickly adapts with the training loads when the training is repeated.

The exercise carried out by the groups have led to increase the efficiency of heart function, as well as increase the economy of the work of the heart muscle and decrease the number of heart beats per minute during rest time due to the increased blood amount in each heartbeat. Fox has stated that "the slow heartbeat (low number of beats) at rest time is one of the accompanying phenomena of good training" [7]. Scientific studies showed that the coenzyme Q10 that relatively melts in fat in most body cells, mainly in the mitochondria, is a component of the electronic transport chain and is involved in the cellular aerobic respiration producing energy in a form of ATP. In this way, 95% of the human body's energy is generated. Therefore, organs with higher energy requirements such as heart, liver, and kidney have higher concentrations of this enzymatic companion, and it is regarded as a powerful antioxidant because it participates in the metabolism and energy production of the cell [8].

It also prevents cell damage useful for the treatment of cardiovascular diseases such as angina, irregular heartbeat and high blood pressure. It treats chronic stress and dysfunction of immune functions, and many people can benefit from these special supplements especially the elderly and athletes.

Conclusions

From what has been presented above, the researchers concluded the followings:

- The exercises which have been prepared by the researchers have led to improve heartbeat rate before and after exertion, as well as improve lactic acid level before and after exertion and the level of Vo2 Max for the research specimen.
- Taking coenzyme Q10 has a great importance in improving many functional indicators for the players.

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Appendix (1)

Exercises Prepared by the Researchers

- Standing under the basket, a quick start to the end line of the court, then return jogging backwards to the mid court line, and then turning, and running fast to the under of the basket.
- Standing under the basket, a quick start to the mid court line, dribbling and then return to the basket to do jump shot inside free zone.
- Under the basket, the player starts towards his teammate who is standing in the corner to make a quick turn and receive the ball from the other teammate who is standing under the basket to do jump shot.
- Under the basket, the player does half squats, then a quick start to the mid court line, returns back in a defense position and receives the ball in the centre (right-left) then doing jump shot.
- Jumping on the centre circle, then a quick start towards the basket, then return back faster to the other basket in the other side of the court to receive the ball from a teammate who is standing in the corner then doing jump shot (right-left).
- Under the basket, a quick start with the ball, when reaching the corner, the player does the jump shot from the right side, then receives the ball from a teammate who is standing under the basket, then starts towards the other basket when reaching the corner, the player does a left jump shot.
- From the sideline in the mid court line, the player runs towards the other sideline of the court and receives the ball from his teammate who is standing in the mid court, then runs fast towards the basket when he reaches the right field goal, the player does a jump shot then repeats the exercise in the other side with the other basket.

Appendix (2)

Sample of the training program applied on the research specimen

Weeks	Training unit	Exercises	Intensity	Volume	Rest time		Exercise Time	Total time
					Between repetitions	Between groups		
First Week	First	Exercise (1)	87%	3×5 set	120-130 beat/min	3 mins.	1.42 mins.	33.3 mins
		Exercise (2)		6 repeats	120-130 beat/min		2 mins.	.12 mins.
	Second	Exercise (1)	80%	3×3 set	120-130 beat/min	3 mins.	1.19 mins.	16.73 mins.
		Exercise (2)		6 repeats	120-130 beat/min		37.49 sec.	3.74 mins.
	Third	Exercise (1)	80%	6 repeats	120-130 beat/min		1.30 mins.	9 mins.
		Exercise (2)		3×4 set	-----	3 mins.	12.56 sec.	11.51 mins.

