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## The synchronous training effect of muscle mechanism on the CPK-LDH enzyme concentration and the particular power of Paralympic powerlifting

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### Abstract

The following study has tried to figure out the synchronous training effect of muscle mechanisms on the CPK-LDH enzyme concentration and the particular power of Paralympic powerlifting. The experimental method of the two equivalent groups has been chosen. The research community is composed of (10) athletes in the youth category of the Diwanayah Paralympic Powerlifting Sub-Committee for the year 2024. They were put in two groups (experimental & control groups) each of them consisting of (5) athletes. After that, pre-tests were conducted, through which the homogeneity and equivalence of the two groups were calculated. Having done that, the exercises have been conducted, which took (8) weeks during the special preparation course, of (3) sessions per week, (24) sessions as total.

The most important conclusion reached by the researcher is that the synchronized training of muscles involved in performance has a big effect on the CPK-LDH enzyme concentration and the particular power that directly contributed to the development of the achievement of the Paralympic Powerlifting compared to the ones of the control group.

**Keywords:** Synchronous training, muscle mechanism, CPK-LDH enzyme, strength, performance, Paralympic powerlifting

### Introduction

In recent years, many Paralympic sports have flourished because of the contributions of athletes of both genders with motion disabilities. Thus, it has transformed from a recreational sport that aims to integrate people with disabilities with the community and spend leisure time to a competitive pursuit that seeks achievement. This is because of the increasing numbers achieved in many international and Paralympic championships. As a result, these games have gained much more attention in many different countries. Those countries have taken it upon themselves to develop Paralympic games, such as powerlifting. In its turn, this has given an incentive to many athletes, and their goal has become the high achievement of qualifying for the Paralympics, which have taken place every four years for all games under the umbrella of the International Paralympic Committee. Therefore, many researchers have shifted their attention to investigating the problems and obstacles that Paralympic athletes are facing using a framework of scientific research. That is, powerlifting is one of the most important sports on the International Paralympic Committee. In addition, there are many tournaments throughout the year, whether continental or international, in which many athletes from different countries around the world participate. Therefore, many records are consistently broken in different weight categories. This is due to the maximum strength of the arm and shoulder muscles in lifting heavy weights from a lying position on the bench. Apart from that, "athletes are medically classified according to the type and severity of their disability. In addition, the athletes' body weights and muscle strength are taken into consideration. Each athlete participating in the tournament is allowed three attempts from the prone position on the seat, and the result of the best lift is counted" (4:68). To break records, it is necessary to choose the correct training methods and approaches to increase the athletes' physical, physiological, and performance capabilities. Synchronous training is "a combination of endurance training (aerobic and anaerobic) with muscle strength training in the same training unit or as isolated training within the training course" (8:34-37).

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This synchronous training works to develop and improve two qualities at the same time, which are the qualities of maximum strength and strength endurance within the training unit. The targeted muscles are the auxiliary, antagonist, and involving muscles, depending on the type of activity, which is powerlifting. The effectiveness of powerlifting in particular depends on maximum strength as well as strength endurance, as they are physical characteristics specific to the game. Synchronous training is suitable for combining these two characteristics mainly, which has a major role in activating anaerobic enzymes such as the CPK-LDH enzymes, which have a direct role, because "The demolition that occurs in some cells increases the productivity of these enzymes, as well as the increased permeability of the cell walls in releasing these enzymes into the blood. The percentage of this increase is directly proportional to the severity of the physical load" (3:101–102). In recent years, the qualitative leaps achieved in breaking records in Olympic powerlifting were not a coincidence but rather the result of work, studies, and research. Therefore, there must be work and research on the factors that help our athletes reach the best levels and compete with world champions in the game. Through the researcher's experience in this sport, he has noticed that it is better to give maximum strength training along with the strength and endurance of the working and opposing muscles according to the mechanics of the muscles and in the same unit within the framework of synchronous training and not each characteristic separately. The researcher believes that this will lead to good results in developing special muscle strength as well as activating the CPK-LDH enzymes. And, in turn, it will have the greatest impact on developing the performance of young athletes. Hence, the importance of research in establishing synchronous training

for muscle mechanics is to identify the extent of its influence on the concentration of the enzyme CPK-LDH as well as the strength and achievement in Paralympic powerlifting.

### The study Objective

1. To identify the effect of synchronous muscle mechanics training of the pre & post-test of the two research groups on the enzymes CPK-LDH, strength, and performance.
2. Identifying the best group in the two post-tests of the two research groups on the enzymes CPK-LDH, strength, and performance.

### Method and procedures

Because it fits the nature of the study, the researcher chose an experimental design with an equivalent group. Athletes of the Paralympic Powerlifting Sub-Committee in Diwanayah were chosen to be part of the research community. (10) opponents in the young category, those under the age of (20), made up the powerlifting team. The mean and standard deviation of their ages was ( $17.40 \pm 1.26$ ), while their training ages were ( $2.70 \pm 0.80$ ), and the mean and standard deviation of their weights was ( $73.60 \pm 12.10$ ). The study sample was divided into two groups: (5) athletes who followed the coach's training plan made up the control group. As for the experimental group, which also consists of (5) athletes, they follow the researcher's developed training program, namely, the synchronous training. Having conducted equivalence for the control and experimental research groups in the study variables as in Table (1), the value of (sig) showed that it was greater than (0.05), which indicates that the two groups are equivalent in the research variables.

**Table 1:** Shows the equivalence of the control and experimental groups in the study variables

Variables	Unit of measure	Control		Experimental		Calculated (T) value	Sig
		Mean	Deviation	Mean	Deviation		
CPK	U/L	135.80	5.02	130	4.12	1.94	0.08
LDH	U/L	147.20	6.30	143	6.08	1.06	0.31
Maximum strength	kg	25.80	2.28	25.50	4.69	0.83	0.42
Endurance	Frequency	18.20	1.79	17.20	1.92	1.00	0.34
Achievement	kg	92	10.37	90	7.91	0.34	0.74

### Enzyme measurement (CPK – LDH)

Enzymes (creatine phosphate dehydrogenase (CPK) and lactate dehydrogenase (LDH)) were extracted (5) minutes after the completion test. 5 ml of blood was drawn from the athletes by a specialized nurse at Al-Kindi Laboratory in Al-Qadisiyah Governorate.

### Maximum arm strength measurement

Pulling by bending the two arms over while seated on an incline bench (Larry's Curl Bench) with iron to overcome maximum resistance for one time (5:96).

### Arm strength endurance measurement

Pulling by bending the two arms over while seated on an incline bench (Larry's Curl Bench) with iron at 50% of maximum intensity, perform as many repetitions as possible until fatigue (5:96).

### Measuring achievement

An achievement test has been conducted for athletes of the

Paralympic Powerlifting Sub-Committee in Qadisiyah Governorate in the weightlifting hall at the Youth Aliskan Sports Forum. Each athlete is given three attempts as per international law, and the best weight lifted is recorded for the successful attempt.

### Main experience

The pre-test was conducted for the following variables (CPK-LDH enzyme, maximum arm strength, arm strength endurance, achievement) for athletes of the young Paralympic powerlifting on Friday, March 5, 2024, at 4:00 p.m. in the weightlifting hall at the Youth Aliskan Sports Forum in Qadisiyah Governorate on the research groups (control and experimental).

After that, the synchronous muscle mechanics training (working and opposing muscles) was conducted every Monday, Wednesday, and Friday, starting from May 6, 2024, until Friday, June 28, 2024. The number of training units was (24) units over the course of (8) weeks, at a rate of (3) training units per week for the experimental group

sample. As the control group continues to follow the coach’s program. To identify the effect of the training carried out by the researcher on the athletes, and after completing the training, a post-test was conducted on the same variables measured in the pre-test, taking into account the same test

conditions on Monday, 7/1/2024, at four o’clock in the afternoon, on the two research groups. This is a sample training unit for the research sample, the experimental group.

**Table 2:** This table presents exercise routines for Maximum Strength and Endurance, detailing intensity, frequency, performance time, breaks, and total training durations

Physical Attribute	Exercise	Intensity	Frequency	Performance Time/Sec	Groups	Break		Total Exercise Time	Total Training Time
						Groups	Exercises		
Maximum Strength	Bench press	80%	6	20	4	4 mins	5 mins	13.20 mins	48.40 mins
	Machine Low Row		6	20				13.20 mins	
Endurance	Dumbbell triceps Extension	50%	15	30	3	1.30 mins	3 mins	4.30 mins	
	Barbell Curl		15	30				4.30 mins	

**Results**

**Table 3:** Shows the differences in the study variables in the pre- and post-tests for the control group

Measurements	Unit of measure	pre-test		Post-test		Calculated (T) value	Sig
		Mean	Deviation	Mean	Deviation		
CPK	U/L	135.80	5.02	144.60	4.72	2.02	0.10
LDH	U/L	147.20	6.30	154.60	4.16	3.46	0.02
maximum strength	kg	25.80	2.28	31.20	2.17	3.24	0.02
Endurance	Frequency	18.20	1.79	22.60	2.88	3.10	0.03
Achievement	kg	92	10.37	98.60	6.35	1.77	0.14

**Table 4:** Shows the differences in the study variables in the pre- and post-tests of the experimental group

Measurements	Unit of measure	Pre-test		Post-test		Calculated (T) value	Sig
		Mean	Deviation	Mean	Deviation		
CPK	U/L	130	4.12	155	5	7.97	0.00
LDH	U/L	143	6.08	161	4.18	13.15	0.00
maximum strength	kg	25.50	4.69	33.80	0.84	3.79	0.01
Endurance	Frequency	17.20	1.92	26.20	1.30	5.85	0.00
Achievement	kg	90	7.91	107	4.69	2.85	0.04

**Table 5:** Shows the differences in the study variables in the post-test for the control and experimental groups

Measurements	Unit of measure	Control group		Experimental group		Calculated (T) value	Sig
		Mean	Deviation	Mean	Deviation		
CPK	U/L	144.60	4.72	155	5	3.19	0.01
LDH	U/L	154.60	4.16	161	4.18	2.34	0.04
maximum strength	kg	31.20	2.17	33.80	0.84	2.41	0.04
Endurance	Frequency	22.60	2.88	26.20	1.30	2.45	0.03
Achievement	kg	98.60	6.35	107	4.69	2.30	0.04

**Discussion**

Tables (2, 3) show the statistical differences between the pre- and post-tests of the control and experimental groups. The differences were significant between the two tests in favor of the post-test, with the exception of the variables (CPK, achievement). No significant differences appeared between the two tests in the control group. The significance value (sig) reached (0.10, 0.14) respectively, which are greater than the error rate (0.05), and this indicates the insignificance of the two measurements. However, the rest of the measurements achieved a noticeable development for both groups (control and experimental). This, according to the researcher, is a result of the study sample athletes' hard work, the execution of the trainings that were provided for them, and the training's consideration of their training loads and gradations throughout the course of the training period. That is “Changes in energy metabolism are evident after every training session; these changes are mostly related to movement, chemical reactions, or nerve cells that supply the

muscles. Furthermore, the intensity of a performance is correlated with the repetition of a certain motor ability, and this strongly influences the development or enhancement of performance level” (2:20). The nature of the action requires muscle strength training and concentration on the opposing and active muscles used in the performance, which boosts the growth of muscular strength and accomplishment. That is, “Better results in strength gain come from using exercises that are consistent in their nature of performance with the general form of performing specific skills” (1:98). Eight weeks is thought to be enough time for the sample of athletes in the study in the study to develop. This is especially true given that the sample is made up of young people, whose functional changes happen earlier than in the adult group, who are in a more stable physical and functional condition. That is, “Most of the changes resulting from training occur during the first part of the program within 6–8 weeks” (1:206).

Regarding Table 4, shows the statistical differences between the variables examined in the post-test of the control and experimental groups. The results showed the significance of the differences between the two post-tests, which favored the experimental group that concurrently trained the synchronous muscle mechanics (active and opposing muscles). Maximum strength and endurance training should be the main focus of a training unit in order to induce physiological changes in the athletes' functional systems, which will improve their performance. "A successful approach to developing strength, endurance, and maximum strength is training that contains a sufficient level of intensity and quantity, as well as a variety between them in stimulating the nervous system" (6:322). The use of synchronous training, which included maximum strength training and endurance for the active and opposing muscles in the same training unit in accordance with scientific foundations, with standardized loads and sufficient rest periods, taking into account the level of the research sample individuals, is credited by the researcher as the reason why the experimental group outperformed the control group. This was confirmed by (Murlasits Z. *et al*, 2017) <sup>[9]</sup>, "In light of the demands of professional sports, it is imperative to employ contemporary training techniques that enhance certain physical attributes and skill performance. Synchronous training is regarded as one of the contemporary training techniques that has produced benefits for athletes in the past by combining strength and endurance training" (9:1-8). The increase in the concentration of the enzyme (CPK - LDH) as a result of maximum strength and endurance training using the synchronous training method, That is "Sports training leads to an increase in the enzymes (CPK - LDH) with sports exercise, and these enzymes increase as a result of the demolition that occurs in some cells and through the increased permeability of the cell walls in releasing these enzymes into the blood, and the percentage of this increase is directly proportional to the intensity of the physical load" (3:181). The development of the Paralympic powerlifting achievement that everyone seeks to was positively reflected in the development of the study variables (CPK - LDH, maximum strength, endurance) as a result of the synchronous training of the active and opposing muscle mechanics. That is, "Given that the goal of the training process is to improve the player's achievement, the objective is to identify the most effective techniques for achieving this goal" (7:114).

### Conclusions

1. As a result of maximal strength training and strength endurance training for the active and opposing muscles during the same training session, synchronous training enhanced the concentration of the enzymes (CPK - LDH).
2. Paralympic powerlifters' specific strength increased as a result of synchronous training that focused on both maximum strength and endurance.
3. The powerlifting achievement variable strongly correlated with the substantial increases in the research variables (CPK - LDH, maximum strength, endurance).

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