

Received: December 2023 Accepted: January 2024

DOI: <https://doi.org/10.58262/ks.v12i2.092>

Special Strength Exercises and their Effect on Some Functional Indicators and Measurements of the Heart Muscle among Junior Handball Players

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Abstract

The research's objectives are to design specific strength-training workouts and to determine how these activities affect various heart muscle measures and functional indicators. In order to address the nature of the research challenge, the researchers for both research groups employed the experimental technique. Young athletes from the Dhi Qar Governorate who play for Al-Nasr Club represented the research community in the 2022–2023 season. There were twenty players total, split into two groups of ten players each—the experimental and control groups. The training units are applied by the team trainer for the control and experimental groups, and the two studies carried out homogeneity and equality in the study variables. The training program lasted for twelve weeks, starting on Monday, June 17, 2023, and ending on Sunday, September 17, 2023. The curriculum was part of it. 36 training units, or three sessions every week. The researchers came to the conclusion that the experimental group, which depended on the exercises they had planned, clearly outperformed the control group in the post-test of a few functional indicators and heart muscle measurements. Every field test and measurement method was completed. It allows us to get the required data then conduct appropriate statistics, classify them in the form of tables, analyze and discuss them, and draw appropriate conclusions and recommendations from the results achieved.

Keywords: *special strength exercises - functional indicators and measurements of the heart muscle.*

1. Introduction

Using the optimal scientific method to plan and direct the training process has led to tremendous development at the sports level. This method requires the coach to have objective indications about the abilities and capabilities of the players he works with, as well as the duties and characteristics of the sports activity being practiced. He engages in a wide range of movement and physical activities. The athlete continuously concentrates on one of the energy generation processes. In addition to changing biochemical variables, these exercises have an impact on the body and its functional systems. They also result in morphological and physiological changes, which together improve the body's ability to produce anaerobic energy more often and aerobic energy less frequently. As it is known, sports events and games contain varying proportions of energy production systems, noting

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that there are advantages to games in the type of system used, and that conducting functional tests of the heart muscle comes at the forefront of things that must be known regarding the extent of its response to efforts, as the results of sports physiology research in recent years have contributed to raising The level of sporting achievement has increased significantly, especially in digital events such as running, swimming, and organized games such as handball. The special concepts in how to use and develop physical abilities and special strength in the human body and the functional variables that accompany them have a major role in this development in order to achieve functional adaptation. The research deals with physiological and morphological tests and measurements and physical abilities to reflect the level of adaptation brought about by the training curricula that the players of the clubs under study underwent. This allows coaches to determine the extent to which the desired goals of the training curriculum have been achieved. This reflects the development in level, and physiological and morphological tests and measurements are the clear evidence to know the level of adaptation of vital devices through the devices' response to physical load. A handball player must improve both their anaerobic and lactational systems because to the game's numerous requirements. Since the development of the aerobic energy system is a good background for facilitating the production of anaerobic energy, on which the speed of playing in handball depends, and here the importance of research is highlighted by identifying the effect of special strength in developing performance and achievement through preparing special strength exercises according to high intensity, which is included in the special preparation in units. Organized training, as well as the extent of the importance of identifying the most important changes that occur as a result of these exercises on the functional and morphological variables of the heart muscle that cause a change in the performance and achievement of the players, and knowing the extent of the differences between them before and after they perform the physical load through measurements of the heart muscle via a device ((Echo)) Which gives many significant indicators about the impact that the training curricula have had on the players. The researchers discovered the need to understand the physiological variables of the heart muscle that correlate with the performance of the fundamental skills of handball players through their observation and follow-up with the coaches in the specialized handball clubs and centers. This is because there is a relationship and harmony between the strength of the functional variables and the morphology, and both have a significant and vital impact on the players' achievement of advanced positions and levels. The research hypotheses state that for tests and measurements in the two research groups, there are statistically significant differences between junior handball players at Al-Nasr Club with respect to some measures and functional indicators of the heart muscle.

1.2 Problem of the Study

Through the researchers' observation and follow-up with the coaches in the specialized handball clubs and centers, they noticed the necessity of knowing the physiological and functional variables of the heart muscle, which coincide with the performance of the basic skills of the handball players, as there is a connection and harmony between the strength of the functional and morphological variables because they have an important and vital impact in achieving advanced positions and levels in Players and the researcher's belief in the effectiveness of special strength exercises determines the research problem in studying the changes occurring in physical abilities, structural hormones, the heart muscle, and some physiological and morphological indicators due to regular practice of handball. The research will address the changes before and after performing an effort to

find out the effects on the above measurements, in addition to that Some coaches lack knowledge of the changes that occur in the body's systems while performing exercises, especially exercises with an intensity of 80-100%, in addition to verifying the effectiveness of the training curricula and physical loads on the heart muscle and the circulatory system by knowing the individual differences between players in the clubs of Dhi Qar Governorate.

1.3 Aims of the Study

The study intends to do the following:

- 1- To prepare junior handball players at Al-Nasr Club for specific strength exercises.
2. And to determine how specific strength training affects various cardiac muscle measurements and functional indicators for the two research groups as well as the junior handball players of Al-Nasr club.

1.4 Limits of the Study

1.4.1 Human Field: Al-Nasr club's junior handball players, aged (15-17) years.

1.4.2 Time Limits: for the period from 12/20/2022 to 10/1/2023.

1.4.3 Spatial Limits: Nasiriyah Heart Center - Bin Al-Bitar Medical Laboratory - and the sports hall of Al-Nasr Sports Club for Handball.

2- Research Methodology and Field Procedures

2-1 Research Methodology: The researchers used the experimental method with equal groups (control and experimental) to suit the nature of the research problem.

2-2 The Sample: The research sample included Al-Nasr Handball Club players in the junior category, represented by (25) players, who represent 33.3% of the original population. The research sample was tested, and they were (20) players, after excluding the goalkeepers, and after homogenizing the sample, it was distributed to Two groups were intentionally controlled and experimental, each with 10 players. Sample homogeneity was carried out as shown in Table 1.

Table (1): It Shows the Homogeneity of the Sample Members as a Whole.

Variables	Measuring Unit	Sample	Arithmetic Mean	Standard Deviation	Coefficient Of Variation	Statistical Significance
height	cm	20	172.4	7.634	4.428	homogeneous
Bloc	kg	20	65.142	5.813	8.923	homogeneous
Chronological age	Month	20	18.2	0.741	4.071	homogeneous
Training age	Month	20	4.6	0.924	20.086	homogeneous

As shown in Table (1), the values of the coefficient of variation fell below (30%), and this indicates the homogeneity of the sample in one group. "The closer the coefficient of variation is to (1%) is considered high homogeneity, and if it exceeds (30%), it means that the sample is not Homogeneous" (7: 161)

2-3 Methods, Tools and Devices Used in the Research

2-3-1 Methods of Data Collection: observation - Arab and foreign sources - questionnaire form and names of experts - personal interviews with experts and specialists - tests and measurements - information network -

2-3-2 Tools, Devices and Methods Used in the Research

A medical device to measure pulse, high blood pressure, and wattage, Swiss made (Rossmax).

- HP laptop. - Treadmill (trade mail). - Handball court (closed hall). - Medicine balls (different weights). - A Chinese-made dolphin whistle. - A medical scale to measure weight and height. - A stopwatch with an accuracy of 1/100 of a second. - Electronic calculator (Casio). - Legal handball (10). - Wooden box (4). - Swedish bench (4). - Form for recording the results of the tests used. - Cone chart (15). - Adhesive tape - Ultrasound device (Echo) (Echocardiography).

2-4 Tests Conducted During the Study

After examining a wide range of literature and research on the topic of handball strength and speaking with experts in both the sport and sports training, it was determined that explosive ability and strength characterized by speed are the two main components of special strength in handball because of their strong relevance to the study's focus. Because of their clarity and suitability for the research population, which consists of burgeoning handball players, the researchers selected a few physiological indicators related to the game of handball. as seen in table (2) below.

Table (2): Showing Physiological and Hormonal Variables.

Physiological and Hormonal Variables	No.
Left ventricular diameter at end systole (LVSD)	1
Left ventricular diameter at end diastole (LVDD)	2
Left ventricular wall thickness (LVWT)	3
Aortic trunk diameter (AOD)	4
Heart rate (H.R)	5
Systolic blood pressure (S.B.P)	6
Diastolic blood pressure (D.B.P)	7
Blood paid in one hit (SV)	8
Cardiac output volume (C.O)	9

After examining the relevant research sources, the researchers integrated a few physical tests that the experts had recommended in a questionnaire. The individuals who were in charge of them were experts in the handball game, sports training physiology, and sports training experience.

The tests that received the highest percentage were sorted by the researchers once they had gathered and opened the questionnaires, as shown in Table No. (3).

Table No. (3): It Shows the Opinions of Experts and Specialists Regarding the Nomination of Physical Tests and the Percentage of Approval and Rejection.

No.	Physical Abilities	Parts of Body	Tests	Fits	Percentage	Doesn't Fit	Percentage	Ca Value	Indication
1	Explosive capacity	for arms	Throwing a 3 kg medicine ball while standing	5	33.333	10	66.667	1.667	Unaccepted
			Throwing a 3 kg medicine ball from a seated position on a chair	12	80.000	3	20.000	5.400	Accepted
		for legs	Vertical jump up from a standstill	13	86.667	2	13.333	8.067	Accepted
			Horizontal jump forward	6	40.000	9	60.000	0.600	Unaccepted
		for arms	Pull up with the bar continuously for 10 seconds	7	46.667	8	53.333	0.067	Unaccepted
			Lie down, then bend and extend the arms for 10 seconds	14	93.333	1	6.667	11.267	Accepted
for legs	Partridge on one leg 30 m right and left	15	100.000	0	0.000	15.000	Accepted		
	Partridge maximum distance 10 seconds for each leg individually	5	33.333	10	66.667	1.667	Unaccepted		
2	Power distinguished by speed	for abdomen	From the position of leaning on the back with the hands clasped behind the head, raise and lower the torso with the help of a colleague while pressing the knees with the elbows for 10 seconds.	13	86.667	2	13.333	8.067	Accepted
			From the position of leaning on the back with the hands clasped behind the head and holding the feet steady with the help of a colleague, raise the torso while pressing the knees with the elbows for 10 seconds.	4	26.667	11	73.333	3.267	غير مقبول
		for back	From the prone position on the stomach, clasping the hands behind the head, while stabilizing the feet, with the help of a colleague, raising the torso up to a certain level for 10 seconds.	12	80.000	3	20.000	5.400	مقبول
			From the prone position on the stomach, clasping the hands behind the head and stabilizing the feet with the help of a colleague, raising and lowering the torso off the ground for 10 seconds.	10	66.667	5	33.333	1.667	Unaccepted

2-4-1 Tests Used in the Research

Testing the explosive ability of the arms. (4:289)

Explosive ability test for the legs: (6:285)

Arm speed strength test: (5:149)

Test of strength and speed of the legs: (4:248)

Raising the torso and pressing the knees (abdomen) in (10 seconds) (5:340)

Raising the torso back (back) in (10 seconds) (3:127)

2–5 Field Procedures

2-5-1 The Exploratory Experiment: It was carried out on a sample of four youth handball players from the Al-Nasr Sports Club by the researchers, with assistance from the assistant work team, after their explanation of the tests and registration procedures. The experiment was conducted on November 6–12, 2023. Physical examinations and Physiological measures took place at precisely four o'clock in the afternoon for two days. The exams were as follows:

Day one, June 11, 2023 physical examinations.

Day Two: June 12, 2023 Physiological Measurements and tests

2-5-2 Pretests

On June 14–15, 2023, the first day of the pre-tests was dedicated to physical examinations, while the second day was devoted to Physiological tests for the study. The tests were spread out over two days in order to prevent the athlete from being tired from taking so many tests and thus not receiving accurate results.

2-5-3 Principal Experiment

The exercises were carried out throughout the primary portion of the team coach's training unit. Body weight was used in the workouts, which were performed in a high-intensity, repeating interval training style with high intensities ranging from 80 to 100%.

The primary purpose of the interval training approach is to improve aerobic capacity because most workouts are completed rapidly, which causes lactic acid to build up. (1:218)

The exercises (volume, intensity, and interval comfort) were chosen based on the sources and preliminary tests carried out on the research sample and administered to the experimental group during the training process, overseen by the team's trainer.

2-5-4 Post-Tests

After implementing the exercises, the researchers re-administered the post-tests for the research sample (the experimental and control groups), where the researchers conducted the physical tests for the research sample on one day, and the Physiological tests were conducted by the researchers on another day, 9/18-19/2023, after the end of the exercise period, in the same manner as the pre-tests. The researchers were keen to Prepare the post-tests as similar in terms of spatial and temporal conditions to the pre-tests as much as possible.

2-5-5 Statistical Methods

The data was processed statistically using the Statistical Package for the Social Sciences (SPSS 26) program.

3. Results Presentation, Analysis, and Discussion

It involved studying and debating the data after they were displayed in informative tables.

3-1 Presenting the Results of Some Physiological Variables Before Exertion, Analyzing Them, and Discussing Them for the Control Group

Table (4): It Shows the Differences Between the Pre- and Post-tests in Some Physiological Variables Before the Effort for the Control Group.

No.	Variable	Pretest		Post-Test		Amd	Sd D	Calculated T Value	Significance Level
		Am	Sd	Am	Sd				
1	Diameter of the left ventricle at the end of systole	27.000	2.049	28.900	0.831	-1.900	2.283	2.632	0.027
2	Left ventricular diameter at end diastole	48.500	2.617	51.200	2.135	-2.700	3.335	2.560	0.031
3	Left ventricular wall thickness	7.700	0.781	8.912	0.703	-1.212	1.044	3.672	0.005
4	Diameter of the aortic trunk	27.100	1.758	31.300	1.792	-4.200	2.860	4.644	0.001
5	Heart rate	70.100	0.700	63.900	1.044	6.200	1.476	13.286	0.000
6	Systolic blood pressure	12.500	0.500	19.100	1.044	-6.600	0.966	21.604	0.000
7	Diastolic blood pressure	8.600	0.490	8.200	0.400	0.400	0.516	2.449	0.037
8	Blood paid in one hit	65.500	9.952	70.300	5.178	-4.800	6.179	2.457	0.036
9	Cardiac output volume	4.587	0.662	5.200	0.400	-0.613	0.696	2.786	0.021

From the presentation, it seems that the trainer's training program had an effect on the control group sample members. Additionally, the development of the control group members due to ongoing training, feedback, and daily dedication to the program helped to develop and execute the trainer's prepared program accurately and in line with his style. The human body adjusts to the physical activities it engages in, which results in modifications to skill and tactical performance in addition to physiological alterations. Development of broad physical and motor traits must result from practicing effectiveness and carrying out game-specific workouts.

"A set of exercises that mimic the speed and strength of a group of muscles' movement in the same direction as the muscles perform in the game or sporting event must be performed in order to achieve an effective training effect. These exercises must be derived from the game or sporting event in which the athlete specializes." (2:63)

3-2 Presenting, Analyzing and Discussing the Results of Some Physiological Variables Before the Exercise for the Experimental Group

Table (5): It Shows the Differences Between the Pre- and Post-tests in Some Physiological Variables Before the Effort for the Experimental Group.

No.	Variable	Pretest		Post-Test		Amd	Sd D	Calculated T Value	Significance Level
		Am	Sd	Am	Sd				
1	Diameter of the left ventricle at the end of systole	27.100	0.943	29.800	0.789	-2.700	1.337	6.384	0.000
2	Left ventricular diameter at end diastole	48.000	2.324	53.300	1.160	-5.300	3.199	5.239	0.001
3	Left ventricular wall thickness	7.300	0.640	9.700	0.483	-2.400	0.843	9.000	0.000
4	Diameter of the aortic trunk	27.000	1.732	34.900	1.101	-7.900	2.378	10.505	0.000
5	Heart rate	70.000	0.632	67.000	1.563	3.000	1.886	5.031	0.001
6	Systolic blood pressure	12.600	0.490	18.100	0.738	-5.500	0.850	20.466	0.000
7	Diastolic blood pressure	8.700	0.458	7.800	0.422	0.900	0.568	5.014	0.001
8	Blood paid in one hit	66.000	9.788	77.000	4.028	-11.000	7.944	4.379	0.002
9	Cardiac output volume	4.616	0.653	5.800	0.422	-1.184	0.808	4.633	0.001

Examining the pre- and post-test results for the experimental group prior to the effort, we find

that there are definite, noteworthy differences in favor of the post-test due to the use of unique exercises created by the researchers and implemented precisely scientifically in accordance with the schedule called for in the curriculum.

"At the same time as working on the player's skill mastery, the coach can develop physical attributes by selecting appropriate exercises." (2:46)

The statistical evidence indicates that the junior player was impacted by exercises at both maximum and below maximum intensity. This effect is observed on certain functional indicators, particularly structural hormones, where the effect became apparent post-training. This is evident when discussing the results of hormonal measurements prior to the effort. which, at this point, had lasted for three months, giving it a noticeable impact on the hormone variables and physical prowess, particularly for the developing athlete.

We notice the development of the characteristic of special strength before effort after applying the exercises, through which the functional equipment is developed for players who need such exercises to increase the functional efficiency of the respiratory and circulatory systems, in addition to the fact that the research sample is from the junior category, which these exercises clearly affect.

The researcher believes that the increased work of the heart due to the effect of continuous and organized training affects all morphological measurements and that the change that affects the heart muscle includes all its measurements.

"The heart is a single muscle bundle, and therefore the morphological change that affects one part of the heart muscle may affect other parts that participate positively in muscular work through the integrity of the functional work of the heart muscle" (5:82)

3-3 Presenting, Analyzing and Discussing the Results of Some Physiological Variables Before Exertion for the Control and Experimental Groups: -

Table (6): It Shows the Differences Between the Control and Experimental Groups in the Post-test in Some Physiological Variables Before Exertion.

No.	Variable	Main Control Group		Experimental Group		Calculated T Value	Significance Level
		Am	Sd	Am	Sd		
1	Diameter of the left ventricle at the end of systole	28.900	0.831	29.800	0.789	2.415	0.027
2	Left ventricular diameter at end diastole	51.200	2.135	53.300	1.160	2.623	0.017
3	Left ventricular wall thickness	8.912	0.703	9.700	0.483	2.818	0.011
4	Diameter of the aortic trunk	31.300	1.792	34.900	1.101	5.208	0.000
5	Heart rate	63.900	1.044	67.000	1.563	5.127	0.000
6	Systolic blood pressure	19.100	1.044	18.100	0.738	2.387	0.028
7	Diastolic blood pressure	8.200	0.400	7.800	0.422	2.121	0.048
8	Blood paid in one hit	70.300	5.178	77.000	4.028	3.124	0.006
9	Cardiac output volume	5.200	0.400	5.800	0.422	3.182	0.005

Table (6) makes it evident that there are significant differences, favoring the experimental group, between the two research groups—the control and the experimental—in the post-test of all physiological measurements of the heart muscle used in the study. The improvement in the respiratory and circulatory systems' functionality brought about by appropriate scientific application is credited by the researcher for this development among the experimental group's participants. The handball game and the suggested exercises are restricted to the anaerobic and aerobic systems. Through observation and follow-up, the researcher found that adaptation

brings about an improvement in the functions of the heart and blood circulation, as well as the efficiency of muscle work. However, some coaches begin their training late, and this does not allow them to achieve proper adaptation for the players. This is the result of haphazard planning, which produces unfavorable outcomes. One of the key factors used to determine and design activities is performance time. Given this, the load is dispersed and the energy system to be employed is decided upon. The key to boosting the body's resistance is to adopt high-intensity, repeating interval training techniques. He considered the relationship between load and rest in opposition to the factors that cause fatigue, i.e., reducing fatigue while executing the training and exercise program proposed by the researcher, since no coach can ignore this relationship and must take care of it if he wants to achieve adaptation among the players.

Interval and repetitive training is characterized by increasing the body's resistance to the factors that lead to fatigue to delay its manifestations by utilizing and maximizing energy sources during the exercises. This is because the exercises are designed with repetitions and rest periods in mind, which allows the athlete to rebuild energy and eliminate waste products to prevent acids from depositing in the muscles involved in the exercises. The interplay of strength and relaxation, tiredness and activity recovery, and the storage and depletion of high-energy sources is what allows athletes to function at their best. The core of the interval and repetition training approach is these occurrences.

4. Conclusions and Recommendations

4.1. Conclusions

The researchers reached a set of conclusions:

- 1- The special exercises prepared by the researcher have an effective role in developing some physiological indicators and physical abilities among the experimental group.
- 2- All the measurements that were carried out before performing the physical effort and that were covered in the research, including the physiological and morphological indicators of the heart muscle, indicated the physiological and normal level and an improvement in the functional systems, especially the heart muscle, with the superiority of the players of the experimental group, which indicates their high level of adaptation.
- 3- Physiological indicators after the effort showed the existence of adaptation among the players of the experimental group, with superiority in most indicators, the most prominent of which were the amount of blood expelled in one shot, cardiac output, and a decrease in pulse rate.

4.2 Recommendations

Among the conclusions reached, the researchers recommend the following:

1. A focus on using diversity in training unit exercises because it plays a useful function in improving some of the physiological indicators and physical skills in handball that are being studied.
2. Coaches of handball should focus on developing players' physical prowess and physiological markers by employing effective training techniques, particularly the high-intensity, repeating interval training method.
3. Extrapolating the training program activities that the researcher used and their direct and effective involvement in the development of some of the physiological markers, physical skills, and structural hormones that are being studied.

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Appendix (1) Questionnaire for Experts and Specialists

The honorable Mr

Kind regards

The researchers intend to conduct their research entitled (Special strength exercises and their effect on some functional indicators and measurements of the heart muscle among junior handball players) as part of obtaining a doctorate degree in physical education and sports sciences / University of Dhi Qar.

Name

Scientific title

University/college:

Specialization:

The researchers

Abbas Muhsin Eliwi

Ph. D. Sadiq Yousuf Mohammed

No.	Physical abilities	parts of body	Tests	fits	Doesn't fit
1	Explosive capacity	for arms	Throwing a 3 kg medicine ball while standing		
			Throwing a 3 kg medicine ball from a seated position on a chair		
		for legs	Vertical jump up from a standstill		
			Horizontal jump forward		
2	Power distinguished by speed	for arms	Pull up with the bar continuously for 10 seconds		
			Lie down, then bend and extend the arms for 10 seconds		
		for legs	Partridge on one leg, 30 meters, right and left		
			The maximum distance is 10 seconds for each leg separately		
3	Torso	For the abdomen	From lying on your back with your hands clasped behind your head and raising your torso while pressing your knees with your elbows for 10 seconds.		
			From the lying position on the back with the hands clasped behind the head and the feet fixed with the help of a colleague, raising the torso while pressing the knees with the elbows for 10 seconds.		
		for the back	From the prone position on the stomach, clasping the hands behind the head, while stabilizing the feet, with the help of a colleague, raise the torso up to a certain level for 10 seconds.		
			From the prone position on the stomach, clasping the hands behind the head and stabilizing the feet with the help of a colleague, lift the torso off the ground for 10 seconds.		

Appendix (2): Shows the Names of the Supporting Staff.

No.	Name	Specialization	Workplace
1	Dr. Mohammed Ali Hussein	Cardiac rehabilitation	Nasiriyah Heart Center
2	Dr. Sura Al-Talib	Eco check	Nasiriyah Heart Center
3	Ahmed Tawfiq Awad	Medical Technologist Pathological Analysis	Nasiriyah Heart Center
4	Muhannad Kareem Mohammed	PhD student	Dhi Qar Education Directorate