International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 09, 2020
ISSN: 1475-7192

A comparative study of the mechanical and electrical activities of the heart according to the energy systems of advanced players

Dr. Thaer Dawood Salman[1], Dr. Amjad Abdul Hamid Al Majed[2]

Abstract:

The study aims to identify the mechanical and electrical activities of the heart according to the energy systems of advanced players and to detect the differences between the energy systems in terms of the mechanical and electrical activities of the heart for advanced players. It was clear from the results of the significance of the differences between the three groups according to the energy systems of the advanced players in all research variables that (the non-oxygenic system "Lactic"), which represents the advanced players in the arches (800 m, 1500 m) was the first in most tests of mechanical and electrical activities of the heart, which is (Margaria-Kalamen, Wingate, systolic muscle strength of the heart FC, Stroke Volume SV, End Diastolic Volume EDV, Ejection Fraction Percentage EF, and Left Ventricular Diastolic Dimension(LVDD). The study recommended the need for trainers to use the indicators of the mechanical and electrical activities of the heart in knowing the functional susceptibility of players in each energy system in training players and conducting similar studies to measure mechanical and electrical indicators of the heart according to energy systems on sporting activities that were not addressed in the current study.

Keywords*: the heart mechanical and electrical activities, energy systems, advanced players.*

I. Introducing:

Introduction and importance of research:

Measurement and testing for high levels of sports is of great interest to trainers today. Its importance is clear in decision-making, building training curricula and developing plans alike. The measurement hand

[1] College of physical Education and Sports Sciences , University of Baghdad. profdrthaar@gmail.com .
[2] College of Basic Education/ Mustansiriya University , dr_amjadalmajd@yahoo.com

Received: 10 Jan 2020 | Revised: 09 Feb 2020 | Accepted: 27 Mar 2020

extends to all determinants of high achievement in terms of physical, psychological, skill, planning, and career.

As the practice of sports training leads to the occurrence of functional changes in all the body systems and as a result of the practice of training for long periods in a regular and codified manner functional adaptations occur in different body systems in general and the cardiac system in particular. These functional adaptations that occur and the result of organized training for many years are either peripheral adaptations including the passage of blood into the skeletal muscle and other changes that occur, or central adjustments that occur within the cardiovascular system that affect the susceptibility . The ability of the heart muscle to obtain and pump blood with the goal of providing blood with oxygen to the working muscles, and it appears that the physical and functional structure is the most affected requirement by the adaptation resulting from the training curricula and according to the type of physical activity practiced by the player.

These activities reflect the type of functional adaptation that occurs in its various organs as a response to the activity and its requirements, physiological and functional adaptations of the body systems in general. The cardiac system in particular occurs as the heart has a function that is appropriate to the requirements of the vital organs in the body from on the one hand and the extent of the cardiac work according to the energy system and the type of sports training on the other hand. As a result of the training For long periods, the body's systems adapt according to the type of energy system operating in it, as each energy system has functional requirements that differ from the other energy system. So, the body's ability to perform is a reflection of the ability of the body's vital systems on one side and the functional heart's capacity on the other.

The importance of the research lies through final results that clarify the difference between the mechanical and electrical activities of the heart, according to the energy systems of advanced players, which serve the coaches when planning training in various sports activities.

Research Problem:

The performance of a particular sporting activity affects the parts of the body that perform the performance and changes its shape resulting from continuous sports training and thus provides us with some indicators that the coach can use in the selection and evaluation of his players. This access to the higher levels requires high physical susceptibility and that requires the presence of vital devices. It works with high efficiency and ability to meet the body's needs of basic energy requirements such as oxygen and others due to the fact that a physical activity has its own energy system to cover the requirements of muscular work, and given that the type of activity exercised by the player is what determines what the heart needs from a functional ability commensurate with the work.

With the requirements Different body systems and the absence of a previous study that dealt with the comparison with the mechanical or electrical activity of the heart in addition to the absence of a previous study that dealt with research. The comparative study between activities according to energy systems, in

addition to the inability of players and their coaches to determine the functional capacity of each energy system, and that the difference and diversity in sports activities it is an indication of a difference in energy systems as well. So, we find when performing a variation in functional adaptation for the heart and cardiac muscle in a manner consistent with the effort that is performed for each energy system.

Therefore, the researchers decided to address an important topic as long as it raised its interest by conducting a study to compare the mechanical and electrical activities of the heart according to the energy systems of the advanced players.

Research Objectives:

1. Identify the mechanical and electrical activities of the heart according to the energy systems of the advanced players.

2. Detecting the differences between the energy systems in terms of the mechanical and electrical activities of the heart for advanced players.

Research Hypotheses:

1. There are statistically significant differences in the results of variables of cardiac mechanical activity for the three groups according to energy systems.

2. There are statistically significant differences in the results of the functional and physiological tests of the three groups according to energy systems.

Research Areas:

1 - 5 - 1 The Human Field: A sample of advanced players according to energy systems.

1 - 5 - 2 Time domain: 9/15/2019 until 2/12/2019.

1 - 5 - 3 Spatial domain: ICO Department, Cardiac Planning Department / Medical City Hospital, Physiology Laboratory, Closed Room, College of Physical Education and Sports Science / University of Baghdad.

II. Research methodology and field procedures

Research Methodology:

The descriptive approach was used in a way to compare the totals to suit the study objectives.

Research Sample:

The research sample consisted of (45) advanced players and those who represent the national teams in some sports activities and according to energy systems, (15) advanced players were selected in to run (100, 200, 400) meters that represent the non-oxygenic system "phosphogenic"), And (15) advanced players to

run (800, 1500) meters, which represents the "non-oxygen" system of "lactic").In addition to (15) players to run (5000 m, 10,000 m, marathon) who represent the "oxygen system" group.

Methods of Collecting Information:

The researchers used the following devices and tools:

1. Arab and foreign sources.

2. A questionnaire for experts to determine the most important physical tests for each energy system.

3. A questionnaire to record individual data.

4. Runner T220 Treadmill Catty - Conveyor Belt.

5. Electronic Pulse Oxymeters (Nonie Model 8600).

6. Echocardiography (Vousen530D).

7. Electrocardioghraphy.

8. Monarch Ergometer bike .

9. Casio manual calculator.

10. Electronic stopwatch, count .

11. Pentium Calculator (IIII).

Research Procedures:

First / cardiac functional and physiological tests:

1. Margaria-Kalamen-Test to measure the ability (non-oxygenic phosphogene) (6: 132).

2. Wingate -Test (30) seconds to measure the (non-oxygenic) ability (12: 184-185).

3. Physical Working Capacity test (PWC170) to measure (oxygen capacity).

4. Maximum oxygen consumption test Vo2 max indicator (Oxygen susceptibility) (12: 78).

5. Measurement of the force of contraction of the myocardium: Force of Contraction (7: 144).

Second / Mechanical Parameters Activity of The Heart variables includes the following cardiac measurements:

1. Stroke Volume (SV).

2. End Diastolic Volume (EDV).

3. Ejection Fraction Percentage (EF) (2: 45).

4. Left Ventricular Diastolic Dimension. (LVDD).

Pilot study:

The researchers conducted the pilot study on 9/17/2019 on (4) players representing the Army Sports Club, and from outside the sample limits in order to conduct physiological medical tests. The tests were which are (ECO examination and electrocardiogram) at Medical City Hospital at (9:30) in the morning while Functional tests were conducted in the physiology laboratory of the College of Physical Education and Sports Science / University of Baghdad, to avoid errors that may accompany the work during the tests on the three groups and distributed according to energy systems, which represent the main work sample.

The main Experiment:

The main experiment was conducted on 20/9/2019 after the sample was divided into three groups according to the energy systems where first physiological tests (ECO and ECG) were conducted in Medical City Hospital (ECO Department and ECG Department) at rest time. Secondly Functional tests were conducted in the physiology lab of the College of Physical Education and Sports Science / University of Baghdad after it was divided into the non-oxygenated ability tests (Markaria test - as safe) on the first day. The non-oxygenic ability test "phosphogenic - lactique", and the Wankett test 30 seconds on the second day, Oxygen Power Test (PWC170 Functionality Test) on the third day.

Statistical means:

The Ready Program (IBM SPSS Statistics Vr24) was used to extract the following statistical treatments (mean, standard deviation, analysis of variance (ANOVA), value of the least significant difference L.S.D.

III. Presenting, analyzing and discussing the results:

3-1 Display the results of the variables of the mechanical and electrical activities of the heart in the three groups according to the energy systems:

The researchers extracted the values of the arithmetic mean and the standard deviations of all variables of the mechanical and electrical activities of the heart for the three groups (the "Non-oxygen" system "phosphogenic", the "non-oxygen" system of "lactic", and the oxygen system) for the advanced players as shown in tables (1).

Table (1)

Means and standard deviations for mechanical and electrical activity tests for the heart for the three groups according to energy systems

GROUP (3) (the oxygen (system		GROUP (2) the "non-oxygen" "system of "lactic		GROUP (1) THE "NON-OXYGEN" SYSTEM "PHOSPHOGENIC,"		UNIT	TESTS
±SD	MEAN-	±SD	MEAN-	±SD	MEAN-		
8.719	1264.80	22.426	1414.66	13.673	1283.66	KG. M /SEC 2	MARGARIA-KALAMEN
9.970	1979.86	20.184	2671.53	10.051	2260.80	KG. M.SE C	WINGATE (30 SECOND)
5.627	1587.66	5.890	894.46	4.945	788.80	KG/ M/MI N	FUNCTIONAL ABILITY PWC170
57.181	4553.66	7.367	2784	5.444	2677.93	ML /MI	MAXIMUM OXYGEN CONSUMPTION VO2MAX
0.031	1.504	0.041	1.756	0.044	1.614	ML.V	SYSTOLIC MUSCLE STRENGTH OF THE HEART (FC)
1.869	106.066	2.350	115.66	2.416	106.13	ML	STROKE VOLUME (SV)
1.956	145.60	1.579	157.96	1.473	141.80	ML	END DIASTOLIC VOLUME(EDV)

Received: 10 Jan 2020 | Revised: 09 Feb 2020 | Accepted: 27 Mar 2020

0.068	71.371	0.071	73.35	0.080	73.26	%	EJECTION FRACTION PERCENTAGE(EF)
0.516	51.533	1.334	53.066	0.079	52.093	MLM	LEFT VENTRICULAR DIASTOLIC DIMENSION (LVDD)

3-1-1 presenting the results of the ANOVA test for variance analysis for the mechanical and electrical activities of the heart and the three groups according to the energy systems:

In order to determine whether there are statistically significant differences between the three groups according to the energy systems of the players applying in the tests of mechanical and electrical activities of the heart. To complete the statistical procedures for research, the researchers resorted to adopting the ANOVA law of variance analysis to identify the differences between the three groups as shown in the table (2).

The results showed that there were significant differences in all the tests because all the values of the Sig level were smaller than the value of the approved significance level (0.05) (3: 29). So, the researchers must use LSD to identify the value of the least significant difference between the three groups in all tests.

Table (2)

Variance analysis of mechanical and electrical activity tests of the heart and the three groups According to energy systems

result	Sig	F value	Estimated variance	DF	Sum of squares	Source of variation	Tests	ت
sig	**0.000**	**391.45**	**99942.422**	**2**	**199884.84**	Between groups	Margaria-Kalamen	**1**
			255.311	**42**	**10723.06**	In groups		
sig	**0.000**	**6484.539**	**1313870.46**	**2**	**2627740.93**	Between groups	Wingate	**2**
			202.616	**42**	**8509.86**	In groups		
sig	**0.000**	**93307.489**	**2824699.08**	**2**	**5649398.17**	Between groups	PWC170	**3**
			30.273	**42**	**1271.46**	In groups		
sig	**0.000**	**14897.494**	**16653364.4**	**2**	**33306728.9**	Between groups	VO2max	**4**
			1117.86	42	46950.26	In groups		
sig	0.000	152.973	0.241	2	0.481	Between groups	FC	5
			0.002	42	0.066	In groups		

معنوي	**0.000**	**92.404**	**457.62**	**2**	**915.244**	Between groups	SV	**6**
			4.952	**42**	**208**	In groups		
sig	**0.000**	**328.333**	**929.75**	**2**	**1859.51**	Between groups	EDV	**7**
			2.832	**42**	**118.93**	In groups		
sig	**0.000**	**3483.792**	**18.826**	**2**	**37.65**	Between groups	EF	**8**
			0.005	**42**	**0.227**	In groups		
sig	**0.000**	**13.189**	**9.030**	**2**	**18.060**	Between groups	LVDD	**9**
			0.685	42	28.756	In groups		

3-1-2 Presenting the results of the least significant difference (L.S.D) test results:

The researchers used the (L.S.D) test to find the value of the least significant difference between the three groups in the tests of mechanical and electrical activities of the heart, as shown in Table (3).

It is clear from Table (3) with respect to the variable of the electrical activity of the heart (Margaria-Kalamen). The results of the significant differences showed that the highest significant difference (149.866) is determined between the second and third groups and in favor of the second group (the non-oxygenic system "Lactic") with the high mean , followed by the first group (the non-oxygenic system “phosphogenic”) and finally the third group (the oxygen system).

Table (3)

Calculated L.S.D value and differences between the mean in mechanical and electrical activity tests of the heart

result	Sig	L.S.D	differences	differences between the mean	مجاميع المقارنة	Tests	No
sig	0.000	11.784	131 -	– 1283.66 1414.66	M1- M2	Margaria- Kalamen	1
sig	0.002		18.866	– 1283.66 1264.80	M1- M3		
sig	0.000		149.866	– 1414.66 1264.80	M2- M3		
sig	0.000	10.497	310.733 -	– 2260.80 2671.53	M1- M2	Wingate	2
sig	0.000		280.933	– 2260.80 1979.86	M1- M3		
sig	0.000		591.666	-2671.53 1979.86	M2- M3		
sig	0.000	4.058	105.666 -	– 788.80 894.46	M1- M2	PWC_{170}	3
sig	0.000		798.866 -	– 788.80 1587.66	M1- M3		
sig	0.000		93.2000 -	– 894.46 1587.66	M2- M3		

sig	0.000	24.660	106.066 -	– 2677.93 2784	M1- M2	VO_2max	4
sig	0.000		875.733 -	– 2677.93 4553.66	M1- M3		
sig	0.000		769.666 -	– 2784 4553.66	M2- M3		
sig	0.000	0.032	0.142 -	-1.614 1.756	M1- M2	FC	5
sig	0.000		0.110	-1.614 1.504	M1- M3		
sig	0.000		0.252	-1.756 1.504	M2- M3		
sig	0.000	1.640	9.533 -	-106.13 115.66	M1- M2	SV	6
Not sig	0.935		0.066	-106.13 106.066	M1- M3		
sig	0.000		9.600	-115.66 106.066	M2- M3		
sig	0.000	1.240	15.133 -	-141.80 157.96	M1- M2	EDV	7
sig	0.000		3.800 -	-141.80 145.60	M1- M3		
sig	0.000		11.333	-157.96 145.60	M2- M3		
sig	0.001	0.050	0.094 -	-73.26 73.35	M1- M2	EF	8
sig	0.000		1.891	-73.26 71.371	M1- M3		
sig	0.000		1.986	-73.35 71.371	M2- M3		
sig	0.002	0.610	0.973 -	- 52.093 53.066	M1- M2	LVDD	9
Not sig	0.71		0.560	- 52.093 51.533	M1- M3		
sig	0.000		1.533	- 53.066 51.533	M2- M3		

As for the variable of the electrical activity of the heart, it is a test (Wingate). The results of the significant differences showed that the highest significant difference (591.666) is determined between the second and third groups and in favor of the second group (the non-oxygenic system “Lactique”) with the highest mean, followed by the first group (the Non-oxyge system "phosphinic") and finally the third group (the oxygen system).

As for the test (functional ability) (PWC170), the results of the significant differences showed that the highest significant difference (798.866) is determined between the first and third groups and in favor of the third group (the oxygen system) with a higher arithmetic mean, followed by the second group (the non-oxygen system "Lactic") and finally the group The first (the non-oxygen system "phosphogenic").

As for the test (the maximum oxygen consumption VO2max)), the results of the significant differences showed that the highest significant difference (875.733) is determined between the first and third

groups and in favor of the third group (the oxygen system) with a higher mean. It followed by the second group (the non-oxygen system "Lactic"). finally the first group (the non-oxygen system "phosphogenic").

As for the test (systolic strength of cardiac muscle FC), the results of the significant differences showed that the highest significant difference (0.252) is determined between the second and third groups and in favor of the second group (the non-oxygen system "lactic ") with the higher arithmetic mean, followed by the first group (the non-oxygen system "phosphogenic" , and finally the third group (the oxygen system).

As for the mechanical activity variable of the heart test (strike size SV), the results of the significant differences showed that the highest significant difference (9.600) is determined between the second and third groups and in favor of the second group (the non-oxygen system "Lactic") with a higher arithmetic mean, followed by the first group (the non-oxygen system) "Phosphogenic").

As for the variable of the mechanical activity of the other heart, it is a test (EDV end size). The results of the significant differences showed that the highest significant difference (15.133) is determined between the first and second groups and in favor of the second group (the non-oxygenic system "Lactic") with the higher arithmetic mean follows that of the third group (The oxygen system) and finally the first group (the non-oxygen system "phosphogenic" system).

As for the test (Ejection Fraction Percentage EF), the results of significant differences showed that the highest significant difference (1.986) is determined between the second and third groups and in favor of the second group (the non-oxygen system "Lactic") with a higher mean, followed by the first group (the non-oxygen system "phosphogenic" And finally the third group (the oxygen system).

As for the test (left ventricular volume during diastole LVDD), the results of the significant differences showed that the highest significant difference (1.533) is determined between the second and third groups and in favor of the second group (the non-oxygen system "Lactic") with a higher arithmetic mean, followed by the first group (the non-oxygen system “Phosphogenic ").

3-2 the results discussing:

It became clear through the results of the significance of the differences between the three groups according to the energy systems of the advanced players in all search variables that they (the non-oxygen system "Lactique"), which represents the advanced players in the arches (800 m, 1500 m) was the first in most tests of mechanical and electrical activities For the heart (Margaria-Kalamen, Wingate, systolic force FC, stroke SV, end size of EDV diastole, percentage of blood pumping EF, and volume of left ventricle during LVDD diastole), which is a logical result as these variables .The Starling - Frank Heart Act changed, which states that "the volume of blood pushed increases with the effect of the increase in the volume of blood that fills the ventricle during diastole .The increase in the volume of this blood that fills the ventricle leads to a compressive effect on the muscle fibers in the heart and is reflected in the strength of the systole Cardiac muscle .The heart is likely to drive large amounts of blood during a single stroke (9: 248).

As (Guyton & Hall 1996) (10: 131) indicated, “When the heart shrinks sharply, the end-systole volume may drop to a low level of (10-20) milliliters .Also, when large amounts of blood flow to the ventricles during the diastole, it can become the size of the end of the great extent to extroversion (150-180) ml in the heart, increasing the size of the end of the strike sometimes doubled when increasing the size of the end of diastole and reduce the size of the end of the contraction.

In addition, the result attained efficiently indicates the ability of the circulatory system, which is due to the efficacy of blood transfusion from tissues other than substances to tissues that provide the ability of these activities to consume oxygen, and she indicated (Abu Al-Ula Ahmed 1982) (1: 64-69). "There Some physiological functions that occur in the efficiency of the function of the heart, lungs and blood vessels in the delivery of oxygen inhaled air from the lungs to the blood and the efficiency of the processes of delivering oxygen to the tissues. This means functional heart efficiency in the use of oxygen for metabolism.

It is also noticed that there are common factors between the two groups, the first group (the "oxygenic" "phosphine system"), which represents the advanced players in ARKAD (100m, 200m, 400m) and the second group (the non-oxygen system " Lactic "), which represents the advanced players in running (800m, 1500m) It is logical because the two groups depend on the non-oxygenic system, although the phosphenic group depends only on the elements of phosphogenic energy, whereas the lactic group depends on the "phosphogenic - and lactic" elements.

It was also clear through the results of the significance of the differences between the three groups according to the energy systems of the advanced players in all research variables that (the oxygen system), which represents the advanced players in running (5000m, 10,000m, marathon) was first in some tests of the mechanical and electrical activities of the heart, which are my test (PWC170 functional ability. The maximum oxygen consumption VO2max), and the two researchers believe that these two variables depend on the heartbeat after a specific voltage (N1) and the heart rate after another more intense effort (N2) . The functional susceptibility of the heart was extracted based on the Carpman equation and then Extraction of the value of oxygenability (VO2max) indirectly.

That this result is consistent with what he mentioned (Karpman. 1989) (11: 78) "There is a linear relationship between the heart rate on the one hand and the physical effort accomplished on the other hand, because after the pulse (170) z / d the relationship takes a linear form. So this test is the best way to detect cardiac functional susceptibility and is measured by dependence on functional susceptibility (PWC 170) as well as measuring oxygen susceptibility (VO2max) by increasing the intensity of muscular work to the extent that the increase in effort does not lead to any increase in the amount of maximum oxygen used and this depends on Functionality of the cardiovascular system.

The cardiac muscle contractility test (FC) indicates that the maximum susceptibility to shrinking of the ventricular fibers can be achieved during the contractions of the heart muscle .This can be done through the ability of the heart to push the largest amount of blood through each contraction of the heart muscle, as the increase in the strength of the stroke is accompanied by a decrease in Heart rate, and this result is

consistent with what he mentioned (Guyton & Hall 1996) (10: 278) "The change in systolic is always the opposite of the change in heart rate."

The heart muscle contracts and relaxes rhythmically due to changes in electrical activity. When excess amounts of blood flow to the heart, it expands the walls of the heart's chambers and the heart muscle shrinks more strongly as a result of this expansion and its chamber empties its contents normally (10: 278).

The researchers believe that the size of the stroke is the result of the contracting of the ventricle to push an amount of blood from the left ventricle to the parts of the body in one stroke. (Bahaa Al-Din 2000) (3: 44-45) indicated that the test of the percentage of blood pumping (EF) indicates that there is a remaining part of the blood between each contraction and relaxation of the heart muscle by the value difference or the difference of the impulsive part of the ventricle. It shows the amount of blood entering the ventricle that was actually pumped during the contracting process and is expressed in a percentage ranging between (60-70%) at rest and increases when the ventricles contract in the event of physical exertion, and the higher the percentage of blood out of (60%), this indicates the strength of the contractions of the cardiac muscle.

(Kazem Jaber 1997) (7: 259) indicated, When the strength of the contraction of the cardiac muscle increases, the volume at the end of the contraction (ESV) increases, leading to an increase in blood volume in one heartbeat (SV) and then to the increase in the volume of the cardiac impulse that crosses .This strength is expressed as the percentage of blood being pushed from the ventricle during the contraction, and the higher the percentage of more than (80%), this means that the athlete enjoys high physical fitness.

Also, the test (Ejection Fraction Percentage EF) indicates that the variables of the electrical activity of the heart are the factors that constitute the determining factor in the functional capacity of the heart in the players. While the variables of the mechanical activity of the heart are the influencing factor that is important in determining the functional ability of the heart among players who practice non-oxygen sports (Phosphine - and Lactic).

The researchers also believe that the increase in the volume of the heart is accompanied by an increase in the size and diameter of the blood vessels and arteries with an increase in the diameter of the heart valve openings .In order to accommodate this resulting increase in the volume and amount of blood flow in them. This indicates that the increase in the volume of blood excreted from the heart needs an increase in the size cardiovascular system to meet the needs of muscles and other body tissues during exercise.

It was also clear from the results of the significance of the differences between the three groups according to the energy systems of the advanced players in all the research variables that (the oxygen system " phosphogenic"), which represents the advanced players in the arches (100m, 200m, 400m) was second in some tests of mechanical and electrical activities For heart tests (Margaria-Kalamen, Wingate, Cardiac systolic strength FC, Percentage of blood pumping EF, and Left ventricular volume during LVDD diastole). The researchers believe that these athletes who practice these sports may at the same time exercise An attempt which led to an adaptation and development in these cardiac variables of a mechanical nature, and this result

is consistent with what he referred to (Muhammad Hassan and Abu Al-Ula Ahmad 2000) (8: 262). The left side is the end of diastole, as well as the force of its contracting during contraction. This indicates that the size of the stroke is related to the size of the heart muscle cavity.

also (Muhammad Hassan and Abu Al-Ula Ahmad 2000) (8: 320-326) indicated that the heart adapts to the practice of sports training as a result of the increase in the volume of blood paid in each of the heartbeats during the physical pregnancy. When the muscular action increases blood pressure inside the heart cavity and this It leads to increased relaxation of the heart muscle and increases the volume of the ventricular cavity and increases the capacity of the ventricular ventricle in its size during muscle work more than during rest. The difference between them in this case is called (reserve additional volume), and sports training also leads to a decrease in the diastolic muscle tone associated with a change in balance The involuntary nervous system on the heart muscle during rest, and accordingly it is observed to increase the relaxation of the heart muscle and then increase the amplitude of the diastolic ventricle size by no more than (5-10%) and based on the training system the length of the muscle fibers of the heart increases as a result of anatomical changes related to protein building activity And thus the functional expansion of the heart.

IV. Conclusions and recommendations

Conclusions:

1. It became clear through the results of the significance of the differences between the three groups according to the energy systems of the advanced players in all research variables that (the non-oxygenic system "Lactic"), which represents the advanced players in the arches (800 m, 1500 m) was the first in most tests of mechanical and electrical activities of the heart These are (Maracaria - Karmen-Maram-Kalamen, Wingate Wing, systolic force FC, stroke SV, end size of EDV diastole, percentage of blood pumping EF, and volume of left ventricle during LVDD diastole).

2. It became clear through the results of the significance of the differences between the three groups according to the energy systems of the advanced players in all research variables that (the oxygen system), which represents the advanced players in the stakes (5000m, 10,000m, marathon) was first in some tests of the mechanical and electrical activities of the heart, which are Test (PWC170 functional capacity, maximum oxygen consumption VO2max).

3. It became clear through the results of the significance of the differences between the three groups according to the energy systems of the advanced players in all the search variables that (the "oxygenic" "phosphine system"), which represents the advanced players in the arches (100m, 200m, 400m) was second in some tests of the mechanical activities Electrocardiograms (MARKARIA - Kalmanen-safe, Wingate, FC-systolic force, EF pump percentage, and left ventricular volume during LVDD dilation).

Recommendations:

Received: 10 Jan 2020 | Revised: 09 Feb 2020 | Accepted: 27 Mar 2020

1. Coaches use the indicators of the mechanical and electrical activities of the heart in knowing the functional viability of players in each energy system in training players.

2. Conducting similar studies to measure the mechanical and electrical indicators of the heart according to energy systems on sporting activities not covered in the current study.

3. Conducting similar studies to measure the mechanical and electrical indicators of the heart according to energy systems on the same activities that were covered in the current study and on sports activities that were not covered and on the players.

4. The use of the functional ability variables of the heart in the classification of players and according to the correct physiological classification for each player and in proportion to his functional capabilities.

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Received: 10 Jan 2020 | Revised: 09 Feb 2020 | Accepted: 27 Mar 2020

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Received: 10 Jan 2020 | Revised: 09 Feb 2020 | Accepted: 27 Mar 2020