A Comparative Study of the Performance Efficiency and Morphology of the Heart Among Long-Distance Runners

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ABSTRACT

The research aims to reveal the efficiency of the performance and morphology of the heart between long-distance 3000, 5000, and 10000 meters and comparison between the three events. The descriptive approach was used in a comparative speech style for its suitability for research, The research sample of (6) has been set up by (2) for each effectiveness representing Nineveh province of power games (Athletics) selected in the deliberately, The average lengths, weights, ages, and the training age were (172,368 - ± 2,871) cm and (64,894 - ± 3,094) kg and (21,052 - ± 1,025) year and (8,336 - 1,654) years, respectively, The measurements were taken for the efficient performance and heart morphology by using the echocardiography. The measurements were conducted under unified laboratory conditions for all sample members, the researcher used the measurements and information available as means and tools for data collection, and a group of medical and laboratory devices were used. The following variables were studied (EF, IVSd, LVIDd, LVIDs, LVM). According to the type of efficacy they had undertaken for each player it led to positive significance changes between an enemy (3000 m and 5000 m), resulting in positive significance changes in (IVSd, LVIDd, and LVM). While these programs did not lead to any significant change in the values of the rest of the variables. But between the two activities of the elements (3000 m and 10000 m) have resulted in positive significance changes in (IVSd, LVIDd, and LVIDs), while these programs have not made any significant change in the values of the rest of the variables. Among the effectiveness of an enemy (5000 m and 10000 m) variable (IVSd), these programs have no significant change in the remaining values of variables.

Keywords: Efficiency of heart performance, heart morphology, long-distance hostility, Echocardiography.

دراسة مقارنة لكفاءة أداء ومورفولوجيا القلب بين عدائي المسافات الطويلة

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الملخص

هدف البحث إلى الكشف عن كفاءة اداء ومورفولوجيا القلب بين عدائي المسافات الطويلة ٣٠٠٠ و٥٠٠٠ و١٠٠٠٠ متر والمقارنة بين الفعاليات الثلاثة. تم استخدام المنهج الوصفي بأسلوب السببي المقارن لملائمته لطبيعة البحث، وتكونت عينة البحث من (٦) عدائين بواقع (٢) لكل فعالية يمثلون منتخب محافظة نينوى بألعاب القوى تم اختيارهم بالطريقة العمدية، وكان متوسط أطوالهم وأوزانهم وأعمارهم والعمر التدريبي (١٧٢,٣٦٨ – ±٢,٨٧١) سم و(٦٤,٨٩٤ – ± ٣,٠٩٤) كغم و(٢١,٠٥٢

– ±١,٠٢٥ (سنة و(٧,٣٣٦ – ١,٦٥٤) سنة على التوالي، تم اخذ القياسات لكفاءة اداء ومورفولوجيا القلب باستخدام جهاز الايكو غراف (Echocardiography). وقد تم اجراء القياسات تحت ظروف مختبرية موحدة لجميع افراد العينة، واستخدم الباحثون القياسات والمعلومات المتوفرة جميعها بوصفها وسائل وأدوات لجمع البيانات، إذ استخدمت مجموعة من الأجهزة والأدوات الطبية والمختبرية. وقد تمت دراسة المتغيرات الاتية: (EF وIVSd وLVIDd وLVIDs وLVM)، وتمت معالجة البيانات إحصائيا باستخدام المتوسط الحسابي والانحراف المعياري واختبار (ت) للعينات المستقلة. وتوصل الباحثون الى ان البرامج التدريبية المختلفة حسب نوع الفعالية التي خضعوا لها طول فترة العمر التدريبي لكل لاعب أدى الى حدوث تغيرات معنوية ايجابية بين فعاليتي عدو (٣٠٠٠م و٥٠٠٠م) فقد احدثت النتائج تغيرات معنوية ايجابية بمتغيرات (IVSd وLVIDd وLVM)، في حين أنه لم تؤدي هذه البرامج إلى حدوث أي تغيير معنوي في قيم بقية المتغيرات. اما بين فعاليتي عدو (٣٠٠٠م و١٠٠٠٠م) فقد احدثت النتائج تغيرات معنوية ايجابية بمتغيرات (IVSd وLVIDd وLVIDs)، في حين أنه لم تؤدي هذه البرامج إلى حدوث أي تغيير معنوي في قيم بقية المتغيرات. واما بين فعاليتي عدو (٥٠٠٠م و١٠٠٠٠م) بمتغير (IVSd)، في حين أنه لم تؤدي هذه البرامج إلى حدوث أي تغيير معنوي في قيم بقية المتغيرات.

الكلمات المفتاحية: كفاءة أداء القلب، مورفولوجية القلب، عدائي مسافات طويلة، تخطيط صدى القلب

1- Introduction to research

1-1 Introduction:

The functional importance of the heart in public life and sports, in particular, prompted scientists and researchers in the field of sports training to pay attention to methods of evaluating the efficiency of the heart muscle performance in terms of constructive and physiological physiology. As the breadth (inflation) is one of the most important characteristics of the heart of the sport, this term means the breadth of the cavity of the heart, as it includes the atheists and ventricles, but the breadth is more in the ventricles in the atrium. It has dealt with many previous studies in this field. the study indicated (Arrese A.L, et.al 2005, 740) that the "Adaptation of left ventricular morphology to long-term training in the sprint - and endurance-trained elite runners", Where the study reached a positive change in the left biturology of both the runners and long-distance hostages for those who have high-intensity exercises for more than three (Arrese A.L, et.al 2005, 740-746). While, Atwan, 2020 indicated his studies about "Analysis and Compare of Cardiac Functional Efficiency Level and the Circulatory System for Short, Middle and Long-Distance Runners" " the study concluded that the level of functional efficiency of the heart muscle of moderate-distance runners is better than my short and long hostilities (Atwan L.Y, 2020, 4). George, et al., touched on their study "The Endurance Athletes' Heart: Acute Stress and Chronic Adaptation" " where the study concluded that the intensity of acute exercise will lead to physiological adaptations and heart health (George K, 2012, 29- 36). Calderon,

et al, touched on a study "Cardiac Dimensions Over 5 Years in Highly Trained Long-Distance Runners and Sprinters", Where the study concluded that (17%) of the long-distance runner's percentage and (9%) of the two short distances showed that the left ventricular internal dimension is greater than (60 mm) at the end of the diastole, and after five years the rest of the changes in the Echocardiography variables that have been done, Its study is different between long-distance hostility and short distances (Calderon F.J, et.al, 2010, 112-118). Al-Lami added in his studies "After an air training approach to the cumulative responses of some measurements of the heart muscle on the players of young football", The study found that the training curriculum used has a positive impact on the cumulative responses of some heart measures of young football players (Al -Lami, N.A, 2018, 100-111). (ElShabrawi, 2020, 1-14) also added "The effect of very short training by race speed on morphological Adaptation and some functional responses for the heart muscle of the swimmer 50 m butterfly", And the study found that there are statistically significant differences between the tribal and paramedical measurements in the morphological and functional measurements of the heart muscle in the swimming pool of 50 m butterfly sample of the research and for the sake of remote measurement, And that very short training rapidly race to the occurrence of morphological changes of the heart muscle such as increased thickness of the wall of the left ventricle and the widening of the left ventricle (ElShabrawy, 2020, 1-14). From the foregoing, it is clear that all previous studies and research did not address the comparison of the efficiency of the performance and morphology of the heart between the runner's hostility in the different long distances. Hence the importance of research in the possibility of comparison between two different long distances, which is the enemy (3000m, 5000m, and 10,000m) to show the adaptations that were made by training programs throughout their training life on the efficiency of the performance and morphology of their heart and the best.

1-2 The problem:

scientists and researchers have not yet inferred how the breadth and inflation occurred in the athletes, but it is currently known that the causes of this breadth are due to the system and intensity of sports training programs. From here, crystallizing the search problem about answering the following question.

Does the privacy of different long-distance exercises have varying effects on the efficiency of the performance and morphology of the heart of the elite hostilities for these distances?

1-3 Search objectives

The research aims are detecting the efficiency of the performance and morphology of the heart in long distances of 3000, 5000, and 10,000 m. Comparison in the efficiency of the performance and morphology of the heart between the two runners of the long distances 3000, 5000, and 10,000 m.

The study hypothesizes there is no statistically significant difference in the efficiency of the performance and morphology of the heart between the long-distance hostility (3000, 5000, and 10,000) meters.

2- Search procedures

2-1 Materials and Methods:

The researcher used the descriptive approach in the comparative causal style of its suitability and the nature of the research.

2-2 The research sample:

The research sample included (6) runners by (2) for each event representing the Nineveh Governorate team with athletics (3000, 5000 & 10000) that were chosen in an intentional way, which is a comprehensive inventory of the research community. Table (1) shows information about the research sample.

Table (1) shows the specifications of the research sample.

Variables / Statistical Parameters	Height (cm)	Weight (kg)	Chronological age (year)	Training life (year)
Arithmetic mean	172.368	64.894	21.052	7.336
Standard deviation	2.871	3.094	1.025	1.654

2-3 Data collection

The researcher used all available measurements and information as means and tools to collect data.

2-4 Techniques and tools used in research:

- Echocardiography (Digital Color Doppler Ultrasound System) is of Italian origin.
- Detect is measured for the nearest (0.2) American origin.
- Sterile materials.
- Gel.

2-5 Description of measurements:

2-5-1 Description of the measurements of the efficiency of the performance and morphology of the heart:

This analogy and the test lying on the left side were conducted over the examination bed, Where the specialist doctor measures variables (EF, IVSd, LVIDd, LVIDs, and LVM) under study by using the Echocardiography.

2-5-2 Measuring the length and weight of the body:

The lengths of the search sample were measured using a device (measuring length and weight), as the laboratory stood on the base of the device without shoes, and the person in charge of the measurement process was

removed by a small metal plate on the head of the laboratory from the metal post and the number with which the index stands is the length of the laboratory in centimeters. As for weight measuring, the laboratory stands on the base of the device without a shoe, wearing only athletic pants, and the reading is done after the electronic meter is fixed on a number that represents the weight of the laboratory in kilograms, and the device measures the nearest (200 grams).

2-6 Research procedure steps:

2-6-1 Main research experience:

The measurements of the research sample were conducted on (31/3/2022) from four and a half in the afternoon, and as follows:

- ❖ Weights and lengths of the research sample were taken.
- ❖ All variable measurements were taken under study by using the Echocardiography at rest time, the procedure was done after the sample was seized for (20) consecutive minutes without any physical effort.
- ❖ The laboratory temperature was (22) degrees and the relative humidity (was 33%).
- ❖ The search data during the experiment was recorded in a form designed for that.
- ❖ It took an hour and a half to implement the measurements for a quarter of an hour for each laboratory.

2-7 The researcher used the following statistical methods:

1. Arithmetic mean.
2. Standard deviation.
3. Test (T) for independent samples.

The statistical package (SPSS) was used statistically.

3- Presenting and discussing the results:

3-1 Results and Discussions:

Table (2): It shows the Arithmetic mean, standard deviations, and the value of the calculated (T) and the level of probability between the two runners (3000m & 5000m) for variables of the efficiency and morphology of the heart.

Statistical Parameters / Tests	measuring unit	Runners 3000 meters		Runners 5000 meters		value (t)	Sig
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
EF	%	56.395	0.035	56.625	0.176	1.804	0.213
IVSd	cm	0.745	0.091	1.125	0.021	5.696	0.029*
LVIDd	cm	5.210	0.014	4.905	0.021	16.918	0.003*
LVIDs	cm	3.630	0.042	3.465	0.049	3.579	0.070
LVM	g	135.885	1.364	179.740	6.858	8.868	0.012*

* Significant at an error ratio ≤ (0.05), at degree of freedom = 5

The researcher inferred from Table (2) the presence of significant differences in the variables of (IVSd, LVIDd, and LVM) between two -distances (3000m & 5000m), as the value (T) of the calculated (5,696, 16,918, and 8,868) reached a possibility (0.029 and 0, 003 and 0,012) respectively. While significance differences did not occur in the variables (EF and LVIDs) between two -distances (3000m & 5000m), as the calculated (T) values (1,804 and 3,579) reached the probability level (0,213 and 0,070), respectively.

Table (3): It shows the calculations, standard deviations, and the value of the calculated (T) and the level of probability between the two runners (3000m & 10,000m) for variables of the efficiency and morphology of the heart

Statistical Parameters / Tests	measuring unit	Runners 3000 meters		Runner 10000 meters		value (t)	Sig
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
EF	%	56.395	0.035	56.225	0.077	2.814	0.106
IVSd	cm	0.745	0.091	1.315	0.021	8.545	0.013*
LVIDd	cm	5.210	0.014	4.825	0.035	14.299	0.005*
LVIDs	cm	3.630	0.042	3.350	0.070	4.802	0.041*
LVM	g	135.885	1.364	145.040	10.309	1.245	0.339

* Significant at an error ratio ≤ (0.05), at degree of freedom = 5

The researcher inferred from Table (3) the presence of significant differences in the variables of (IVSd, LVIDd, and LVIDs) between two -distances (3000m & 10,000m), as the calculated (T) values (8,545, 14,299, and 4,802) reached a possibility (0.013 and 0, 005 and 0,041) respectively. While significance differences did not occur in the variables (EF and LVM) between two -distances (3000m & 10,000m), the calculated (2,814 and 1,245) values reached a probability level (0,106 and 0,339), respectively.

Table (4): It shows the calculations, standard deviations, and the value of the calculated (T) and the level of probability between the two runners (5000m & 10,000m) for variables of the efficiency and morphology of the heart

Statistical Parameters / Tests	measuring unit	Runners 5000 meters		Runner 10000 meters		value (t)	Sig
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
EF	%	56.625	0.176	56.225	0.077	2.929	0.099
IVSd	cm	1.125	0.021	1.315	0.021	8.957	0.012*
LVIDd	cm	4.905	0.021	4.825	0.035	2.744	0.111
LVIDs	cm	3.465	0.049	3.350	0.070	1.884	0.200

LVM	g	179.740	6.858	145.040	10.309	3.963	0.058

* Significant at an error ratio ≤ (0.05), at degree of freedom = 5

3-2 The researcher inferred from Table (4) the presence of significant differences in the IVSD variable between two -distances (5000m & 10,000m), as the value (T) of the calculated (8,957) reached a probability level (0,012). While no significant differences occurred in the variables (EF, LVIDd, LVIDs, and LVM) between two -distances (5000m & 10,000m), as the calculated (T) values (2,929, 2,744, 1,884, and 3,963) reached the probability level (0,099 and 0, 111, 0,200 and 0,058) respectively.

3-2-1 EF (Ejection Fraction): It is clear from Tables (2, 3, and 4) the absence of significant differences between the two long distances of the three different events. This indicates that the training programs that these enemies were subjected to throughout their training life had a close impact on the development and adaptation of a variable (EF), which did not show any significant disparity between members of the research sample.

3-2-2 IVSd (Interventricular Septal at end-diastole): It is clear from tables (2, 3, and 4) the presence of significant differences between the two runners for the long distances of the three different events in favor of the runners (10,000m) and their hostility (5000m). We note that the variable (IVSd) through the results that appeared, that the thickness of the left ventricle muscle in the diastole had, according to the arrangement from the name to the thinner, the runners (10,000m) followed by two hostility (5000m) and then the hostility (3000m). This indicates that the greater the race distance, the greater the impact of the training programs for these activities on the variable (IVSd), and therefore we will get a stronger and better ventricular contraction, this is consistent with (Al -Lami, 2018), quoting (Al -Kubaisi and Al -Ali) "The severity of the effect on the ventricle varies from one sport to another, and the effect on the size of the ventricle increases with organized training and for long periods". (Al -Lami, 2018, 108-109). He also stated that the changes that occur in the heart muscle as a result of organized training for a long time increase the size of the left ventricle and enlarge the heart muscle wall. The increase in the size of the heart (inflation) as a result of adaptations that occur through long-term training programs for endurance sports is linked to an increase in the thickness of the heart muscle wall. This is consistent with (Wilmore, J.H, et.al, 2008, 124). The enlargement of the heart muscle shows the increase in the size and thickness of the heart muscle as a natural physiological phenomenon in athletes, and that this inflation in the heart muscle is similar to the inflation in any other muscle in the body, and that this inflation provides an increase in the efficiency of the organ.

3-2-3 LVIDd (Left Ventricular Internal Diameter at end-diastole): It is clear from the two tables (2 and 3) the presence of significant differences

between the hostility (3000m & 5000m) and the benefit of two hostilities (3000m) and between the hostility (3000m & 10,000m) and in favor of my hostility (3000m). As for Table (4), there is no significant difference between the two hostilities (5000m & 10,000m). Through the results that have emerged, the adaptive effects of the reinforcement of (LVIDd) in the runners (3000m) compared to a dimension (5000m & 10,000m) through the training programs they underwent in their training career. Perhaps the reason is due to the wrong training programs that were subjected to hostility (3000m), which led to an expansion in the size of the left ventricle to the level of the pathological condition that negatively affects the heart of the athlete. This is confirmed (Abdel Fattah A. E, & Hasanin M.S, 1997,27)

"The excessive increase in the stretching of the heart, even among the tolerance athletes, may lead to the transformation of physiological expansion into a disease, as this excessive increase in cardiac expansion reflects satisfactory aspects of the heart muscle, which may be one of the causes of the wrong sports training". Or perhaps the cause is due to a genetic worker due to the lack of members of the research sample.

3-2-4 LVIDs (Left Ventricular Internal Diameter at end-systole): It is clear from the two tables (2 and 4) the absence of significant differences between the hostility (3000m & 5000m), and between the hostility (5,000 m & 10,000m). Table (3), shows a significant difference between the hostility (3000m & 10,000m) and the benefit of my hostility (10,000m). Table (3), shows a significant difference between the hostility (3000m & 10,000m) and the benefit of my hostility (10,000m). Through the results that appeared, it turns out that (the LVIDs) of two hostilities (10,000m) were less than my hostility (3000m & 5000m), which indicates the excessive contraction of the heart, which is a regular condition among the tolerance athletes, this is consistent with (Abdel Fattah A. E, & Hasanin M.S, 1997,42) "The state of excessive constriction of the heart muscle is one of the natural manifestations of the overwhelming majority of athletes". (Abdel Fattah A. E, & Hasanin M.S, 1997,42) (Wilmore, J.H, et al, 2008) added, "The increase in the thickness of the left ventricle wall leads to an increase in its contract". (Wilmore, J.H, et.al, 2008, 124)

. This conclusion is identical to the results that appeared in the (IVSd). Likewise, the results of (LVIDs) came in conformity with the interpretations that we have shown in the (LVIDd) variable about the excessive increase in the cardiac expansion of the two tolerances due to the wrong sports training for the two runners (3000m).

3-2-5 LVM (Left Ventricular Mass): It is clear from Table (2) the presence of a significant difference between the hostility (3000m & 5000m) and the benefit of two hostility (5000m). As for the two tables (3 and 4), it is evident that there are no significant differences between hostility (3000m & 10,000m) and between hostility (5000m & 10,000m). We note that the variable (LVM) through the results that appeared, that the mass of the left ventricle muscle had the two runners (5000m) greater than the (3000m) mass. The reason is due to

the practice of sports activities, and the type of sporting activities determines the difference in the left ventricle mass of the heart, (Zayed, Z.I, 2020) As mentioned in the tables The practitioners of the tolerance have a left heart lump mass of the heart than the practitioners of the rest of the sports, adding that scientific studies have shown that the majority of sports practitioners have an increase in the left ventricle mass, and studies have shown that the heart mass increases for athletes by a rate ranging between (45-50 %) from otherwise Athletes (Zayed, Z.I, 2020, 20-22). About the increase in the left ventricle mass in the two runners (5000m) at the expense of the two runners (10,000m), this may be due to a genetic factor or to the difference in the body mass between the two runners due to the small size of the sample.

4- Conclusions

1- The training programs that were subjected to the various long distances under study did not occur in the study, a change between them, which included an (EF).
2- The training programs that were subjected to runners, the different long distances under the study, have made a positive change in the variable (IVSd) and for the benefit of my hostility (10,000m) and their hostility (5000m).
3- The training programs that were subjected to the two different long distances under the study have made a positive change in the (LVIDd) variable and for the benefit of my hostility (3000m) at a runners account (5000m & 10,000m), while there was no positive change between the hostility (5000m & 10,000m).
4- The training programs that were subjected to two different long distances under study have made a positive change in the (LVIDs) variable and for the benefit of two hostilities (10,000m) at the account of hostility (3000m), while there was no positive change between the hostility (3000m & 5000m), and two (5000m) (10,000m).
5- The training programs that were subjected to the two different long distances under study, a positive change in the variable (LVM) and for the benefit of my hostility (5000m) at a runners account (3000m), while there was no positive change between the hostility (3000m & 10,000m), and two (5000m) (10,000m).

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