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# Physiological Adaptation to Left Ventricular Enlargement

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**Abstract**. Background: Physiological adaptations, especially in sports exercise, usually occur through stress on the body. The changes that occur in the functions of the body's systems are what cause development in the responses of its organs and muscles, which leads to improved athletic performance. Adaptations in response to training include: decreased the heart rate, increased the stroke volume, increased the oxygen uptake, increased the blood hemoglobin levels, and the muscle hypertrophy. Objective of the study: To evaluate the rates of the left ventricular enlargement after years of aerobic training. The research sample: includes (24) athletes and all them practice aerobic activities at the present time, as follows:
Six they have (1-2) years of training.
Six they have (2-4) years of training.
Six they have (4-6) years of training.
Six they have (6-8) years of training.
The left ventricular mass was examined and diagnosed using the Echocardiogram.
Data analyses: The data was analyzed using the SPSS program V. 26. Conclusions: 1-Left ventricular hypertrophy increases with the increase in the years of the aerobic training. 2-During the four years of training, left ventricular enlargement remains within the normal range. 3-after four years, Left ventricular hypertrophy begins to rise above the normal range. 3- The left ventricular hypertrophy in an aerobic athlete is not considered a pathological condition.

**Highlights**:

1. Adaptation: Aerobic training increases left ventricular hypertrophy over time.
2. Timeline: Enlargement stays normal for 4 years, increases beyond normal after.
3. Conclusion: Hypertrophy in athletes is non-pathological and a physiological adaptation.

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**Keywords**: Physiological Adaptation; Ventricular Enlargement, Athletic Heart Syndrome.

# Introduction

is a structured physical activity to promote or maintain physical fitness and general health.

Sports exercises are practiced for specific reasons, such as losing excess weight, improving growth, improving strength, improving muscular endurance and the circulatory system, improving physical and mental health, or for the sake of communication and fun among members of society. 21

2.5 hours of moderate-intensity exercise per week is often advised for health advantages in order to lower the risk of health issues. However, even brief exercise is better for your health and more advantageous than doing nothing. Eleven minutes of exercise every day can lower the chance of heart disease, stroke, and early mortality. 20

Although a continuous drop in heart rate may be an indication, an athlete's heart rarely exhibits any symptoms or indications of illness. Because the athletic heart is a natural physiological reaction to the pressures of physical fitness and exercise training, athletes with athletic heart syndrome (AHS) are unaware of their disease unless they undertake clinical testing. When diagnosed with athlete's heart, athletes usually exhibit two symptoms that are traditionally indicative of a heart problem in a healthy person: an enlarged heart (cardiomegaly) and a slowed heart rate (bradycardia). Bradycardia is characterised by a heartbeat that is 40–60 beats per minute slower than usual. The thickening of the heart's muscular wall, particularly in the left ventricle, which pumps blood enriched with oxygen into the aorta, is known as cardiomegaly. Highly skilled athletes' bodies require more blood and oxygen to reach the peripheral tissues of their arms and legs during exercise and periods of extreme physical stress. Since more blood is pumped with each beat, a bigger heart may be able to beat more slowly at rest due to its increased cardiac output.

The goal of the study

To evaluate the rates of the left ventricular enlargement after years of aerobic training, as follows:

- The first and second years

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- The third and fourth years
- The fifth and sixth years
- The seventh and eighth years

## Methods

To achieve the objectives of this study, a descriptive design was chosen, as examinations were conducted to measure the left ventricular mass in the period from June 6, 2021, to August 2, 2021

The research sample includes (24) aerobic athletes continuing exercise, as follows:

Six they have (1-2) years of exercise.

Six they have (2-4) years of exercise.

Six they have (4-6) years of exercise.

Six they have (6-8) years of exercise.

They were selected from a probability sample (purposive sample) of Iraqi clubs. Echocardiogram was used to measure left ventricular adaptations , and data were analysed using SPSS version 26. Descriptive data analysis includes mean and standard deviation (SD).

## Result and Discussion

Tale 1 : Left ventricular enlargement rate (Gm) according to years of Aerobic exercises

| LVM | N | Min | Max | Mean | |
|---|---|---|---|---|---|
| LVM 1 – 2 years | 6 | 131.70 | 157.70 | 141.78 Gm | |
| LVM 3 – 4 years | 6 | 163.50 | 202.60 | 180.78 Gm | 4 |
| LVM 5 – 6 years | 6 | 219.90 | 263.62 | 240.50 Gm | 8 |
| LVM 7 – 8 years | 6 | 263.80 | 334.00 | 305.91 Gm | 6 |

LVM = 0.8 [ 1.04 (IVS + LPW + LVDD)3 – (LVDD)3 ] + 0.6

Table 1 displays the arithmetic means and standard deviations of the left ventricular enlargement rate according to years of Aerobic exercises, where the lowest

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arithmetic mean was after two years (141.78 Gm) and standard deviation (8.93), while the highest rate of left ventricular enlargement was (305.91 Gm) and standard deviation (23.96).

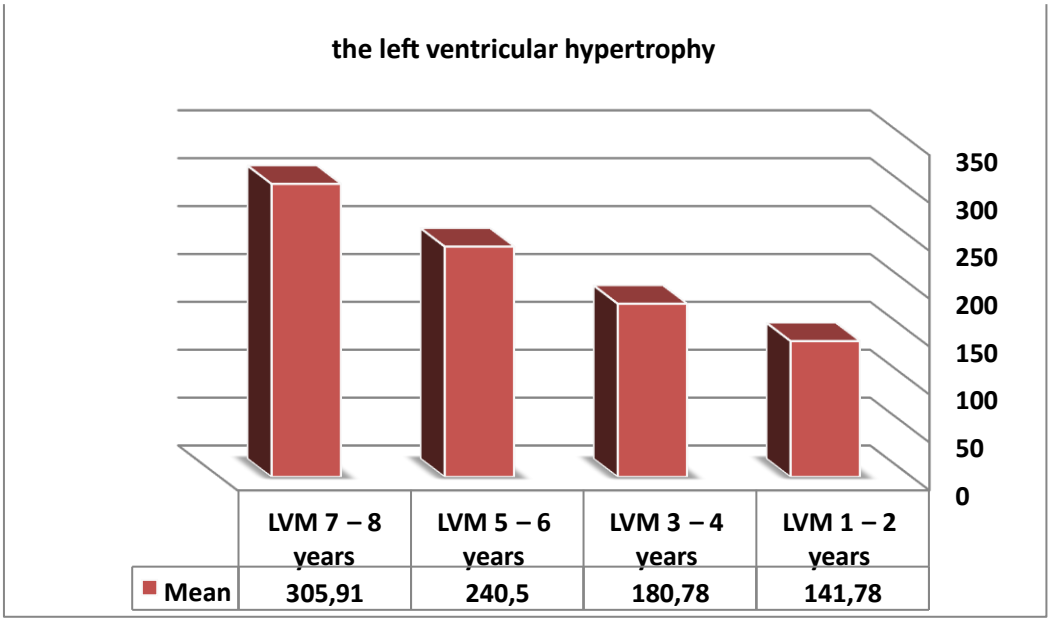


Figure 1 : Left ventricular enlargement rate according to years

e 2 : Evaluation of the left ventricular enlargement according to years of practicing aerob activities

| left ventricular mass (LVM) | Mean | Normal Range value[i] (88 – 224) Gm |
|---|---|---|
| LVM 1 – 2 years | 141.78 Gm | Normal |
| LVM 3 – 4 years | 180.78 Gm | Normal |
| LVM 5 – 6 years | 240.50 Gm | Hypertrophy |
| LVM 7 – 8 years | 305.91 Gm | Hypertrophy |

Table 2 displays the rates of left ventricular hypertrophy and their assessments according to years of practicing aerobic activities, where the hypertrophy evaluation after

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two and four years was within the normal range, while the left ventricle after five to eight years indicated hypertrophy and outside the normal range.

Discussion

Table 1 shows the arithmetic mean and standard deviations of the left ventricular hypertrophy rate according to the years of training, and Table 2 displays the rates of left ventricular hypertrophy and their ratings according to the years of training, as we notice an increase in the rates of left ventricular hypertrophy as the number of years of training increases, and this hypertrophy is considered a chronic physiological adaptation and an important sign of Signs of athlete's heart syndrome.

Cardiac enlargement can be seen through echocardiography, especially in the left ventricular cavity and conceder Physiological adaptation for an aerobic endurance athlete. 22

The functional reason for this hypertrophy is the increase in stroke volume in athletes during the rest period. The chronic adaptation of the left ventricle appeared very clearly after 4 years of training up to eight years, as left ventricular hypertrophy is one of the chronic adaptations that accompany long-term training in response to the physical effort exerted by athletes. It is worth noting that the hypertrophy of the left ventricle in athletes as a result of training is an unsatisfactory condition, and it confirms the safety of the heart and the health of the athlete.14 19 On the contrary, when hypertrophy occurs in normal people, this means that there is a real problem in the heart and a doctor must be consulted. Eccentric inflation is one of the most prominent characteristics of the heart of athletes practicing aerobic activities, as the heart chambers, especially the left ventricle, expand to accommodate the largest amount of returning blood and then pump it through the left ventricle to all parts of the body.18, 25

Eccentric cardiomegaly is commonly referred to as "athletics' heart" and is essentially seen as positive adoption or physiologic expansion. It is the typical response to athletic training, which increases the heart's pumping capacity and muscle mass. It is a reaction to "volume-overload," which can be brought on by an actual increase in absolute blood volume or by increased blood returning to the heart during exercise. 17 24 Sarcomeres are added in series, which increases the heart's ability to pump blood and allows the heart to contract harder. 16 23The Frank Starling mechanism, which explains how the sarcomere may contract more forcefully when more of its contractile unit parts

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engage, explains this. This reaction can be striking; the left ventricular mass of trained athletes' hearts can be up to 60% larger than that of untrained individuals. Eccentric hypertrophy is thought to result from volume overload, which causes the left ventricle to enlarge, whereas concentric hypertrophy is thought to result from pressure overload, which thickens the heart muscle's walls, including the left ventricle. 15.

## Conclusion

1. Left ventricular hypertrophy increases with the increase in the years of the aerobic training.
2. During the four years of training, left ventricular enlargement remains within the normal range.
3. after four years, Left ventricular hypertrophy begins to rise above the normal range.
4. The left ventricular hypertrophy in an aerobic athlete is not considered a pathological condition

## Recommendations

1- Adopting the results of the study in diagnosing left ventricular hypertrophy in aerobic athletes.

2- Conducting a study on anaerobic event athletes.

3- Accuracy and caution in diagnosing athletes' hearts

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