

The Effect of Ramadan Fasting on Maximum Aerobic Speed and Fat Mass in Football Players Under 19 Years Old

أثر صيام شهر رمضان على السرعة الهوائية القصوى والكتلة الدهنية لدى لاعبي كرة القدم أقل من 19 سنة

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Abstract:

The study aimed to determine the impact of fasting during the month of Ramadan on the maximum aerobic speed Regarding the amount of body fat among football players under the age of 19. The study used an experimental approach using a single-group design in order to accomplish this. A sample of twenty football players from the Taraji Guelma club participated in the study.

To assess this impact, the pre- and post-test stages of a series of field tests were employed by the researcher. There were two distinct tests utilized: one for maximum aerobic speed in football players, represented by the Yo-Yo Intermittent Recovery Test Level 1, and the other for body fat mass using the TANITA780 PRO device.

The general results of the study concluded that fasting during the month of Ramadan did not affect maximum aerobic speed, as indicated by comparing pre-test and post-test results. However, statistically significant differences were observed between the pre-test and post-test results in the body fat mass index, indicating that fasting affected the players' body fat percentage.

Keywords: Fasting; Ramadan; Maximum Aerobic Speed; Body Fat Mass; Football.

1. Introduction

Muslims are religiously obligated to observe Ramadan by fasting, requiring abstinence from eating and drinking from dawn until sunset for 29-30 days. Muslims observe this practice to enhance spirituality and piety and to remind themselves of the experiences of the poor and needy. Ramadan fasting differs from traditional fasting because it involves long hours each day and includes refraining from consuming liquids, making the physiological and psychological changes during the month more complex and impactful on the body. These changes include alterations in meal times, sleep patterns, and physical activity, which affect metabolism and the body's available energy. A study conducted by Maughan and colleagues (Maughan, Fallah, & Coyle, 2010, pp. 490-494) indicated that intermittent fasting, such as during Ramadan, can lead to changes in weight, metabolism, and the body's response to physical exertion.

Concerns rise every year with the arrival of Ramadan in the world of football regarding the health implications of practicing this sport while fasting. Different individuals hold varying beliefs, convictions, and investigations into the physiological impacts of fasting during Ramadan. Many coaches believe that fasting poses a risk to players who engage in strenuous physical activity (Ramadan, 2016, pp. 37-40). The effects of fasting on physical performance markers are yet uncertain, with several studies have documented a decrease in performance, whereas others have not observed any meaningful impact. These conflicting results can be partially explained by differences in experimental designs and participant characteristics, with limited evidence supporting the idea that endurance training and increased fat oxidation resulting from fasting are beneficial (Hassane Zouhal, 2020, pp. 01-28).

Fasting has multiple effects on athletic performance, such as maximal aerobic speed (MAS), which is the minimum speed at which a person can reach maximal oxygen consumption (VO₂ max). MAS is a critical metric for assessing aerobic endurance and is used to determine the effectiveness of athletic performance. A decrease in MAS may indicate a decline in athletic performance and endurance, which can result from dietary changes such as fasting. The study conducted by (Saltin & Astrand, 1967, pp. 353-358) illustrates that maximal oxygen consumption is a fundamental criterion for assessing cardiorespiratory fitness, which is influenced by the energy balance available from the diet. Additionally, changes in muscle mass and fat can result from modifications in food and drinking habits during Ramadan.

Some athletes may experience muscle mass loss due to reduced protein and energy intake, while others may experience an increase in fat mass due to consuming high-calorie meals during Iftar and Suhoor. A study by (Heymsfield & Wadden, 2017, pp. 254-266) how dietary changes affect body composition, emphasizing the importance of maintaining an appropriate balance between calorie intake and physical activities to preserve muscle mass and avoid fat gain.

Fasting leads to various physiological changes in the body. During fasting hours, the body relies on internal energy stores, such as glycogen and fat, to provide the necessary energy for vital functions. These changes affect blood sugar levels, metabolism, and hormone secretion. For example, reduced insulin levels and lipolysis may result from elevated glucagon levels during periods of fasting and the discharge of fatty acids as an energy source. A study by Trabelsi and colleagues (Trabelsi, 2013, pp. 38-46) demonstrated that fasting causes alterations in biochemical and anthropometric measurements among individuals who engage in regular physical activity, which may affect athletic performance in various ways.

The influence of the impact of Ramadan fasting on athletic performance has been the subject of numerous studies. This dietary change can influence athletic performance, especially in young athletes who require high energy levels and a balanced diet to maintain their physical performance.

The purpose of this investigation is to evaluate the influence of Ramadan fasting on maximal aerobic performance and fat mass among football players under the age of 19.

1.1 Study problem

The main question that formulates the problem of this study is as follows:

Does Ramadan fasting affect maximal aerobic speed and fat mass among football players under the age of 19?

The subsequent sub-questions are encompassed under this problem:

- Are there any statistically significant differences in the maximal aerobic speed (MAS) test findings between the outcomes of the previous and subsequent tests measurements among football players aged under 19?
- Is there a statistically significant difference in fat mass measurement between the outcomes of the previous and subsequent tests results of football players under the age of 19?

1.2 Study Hypothesis

This study is based on the following primary hypotheses:

- Ramadan fasting affects the maximal aerobic speed and fat mass among football players under 19 years old.

The primary hypothesis is supported by the following sub-hypotheses:

- In the maximal aerobic speed (MAS) test, The pre-test and post-test results exhibit statistically significant discrepancies of football participants under the age of 19.

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- There are statistically significant disparities in fat mass measurement between the outcomes of the previous and subsequent tests results among football players who are under 19 years old.

1.3 Study Objectives

- To assess the influence of Ramadan fasting on maximal aerobic performance and fat mass among football players under 19 years old.
- To measure and evaluate changes in maximal aerobic speed before and after Ramadan.
- To examine the effects of Ramadan fasting on fat mass among football players who are younger than 19 years old.
- To study changes in body fat percentage and distribution during the fasting period.
- To provide recommendations for improving the performance of football players during Ramadan.

1.4 Study Importance

- To provide scientific insights into the impact of Ramadan fasting on maximal aerobic speed and fat mass among football players under 19 years old.
- The results of this investigation will provide coaches with valuable information and those interested in the sports field on how to design appropriate training programs during Ramadan, which will help improve players' performance and reduce health risks.
- The study provides valuable data and information that could serve as a basis for future research on the effects of fasting on athletes in other sports or different age groups.

1.5 Literary Review

5.1.1 Study by Said Aissa Khelifa (2014):

Analysis and Evaluation of Anthropometric Parameters and Physical Performance in High-Level Athletes During Ramadan Fasting (2014)

- Study objective: The objective of the investigation was to evaluate the influence of Ramadan fasting on the physical aspect performance and anthropometric parameters of high-level athletes and analyze how their bodies adapt to the changes brought about by fasting.

- Methodology: A sample of 23 healthy individuals was subjected to the experimental approach, volunteer athletes (aged 20-28 years).
- Tests: The experiment was conducted in the laboratory under natural conditions over a period of 6 weeks, including 5 assessments of physical performance and 3 assessments of anthropometric parameters. The protocol involved using anthropometric tools and an electronic scale to measure the parameters one week before Ramadan, on the 18th day of Ramadan, and one week after Ramadan.
- Study Results: Fasting did not have a significant impact on the body during physical exertion.

5.1.2 Study by Lotfi S. et al. (2010):

Effects of Ramadan Fasting on Physical Performance and VO2 Max in Middle-Distance Runners and Football Players

- Objective of the Study: The goal is to assess the changes in physical performance and maximal oxygen consumption (VO2 max) during Ramadan fasting in professional athletes.
- Methodology: The experimental method was applied to a sample of 10 middle-distance runners aged 16 and 17 football players aged 15.
- Tests Conducted: The tests were conducted once before Ramadan, three times during, and twice after Ramadan:
- Hip and Back Flexibility Test: This measures the flexibility of the hip joint and the extensibility of the hamstrings and posterior ligaments. The test consists of bending the trunk over the legs while sitting with the legs extended. Two attempts are allowed, with the best result recorded in centimeters.
- 50-Meter Sprint Test: This is a sprint test with a half-bent starting position. Performance is recorded in seconds. The test assesses the maximum strength of the lower limbs.
- 20-Meter Zigzag Endurance Test with 1-Minute Stages: This test consists of running back and forth as many times as possible at progressively increasing speeds (1 km/h every minute) according to beeps from a magnetic tape, following the protocol designed by Leger, Cloutier, and Rowan (1985). The last stage completed by each participant is used to determine their maximal oxygen consumption (VO2 max).
- Results of the Study: The results showed a significant improvement in sprint performance during and after Ramadan for the runners, while the football players' performance remained consistent. In aerobic endurance activities, a significant

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decrease in VO₂ max was observed in the runners during Ramadan, while the football players demonstrated a gradual and noticeable increase in their performance.

- Trained athletes respond differently to the conditions of Ramadan fasting depending on the type of sport and the physical abilities required. Engaging in sports during Ramadan calls for exploring new training strategies to enhance performance.

5.1.3 Study by (Chiha, 2008):

The impact of fasting during Ramadan on the biochemical parameters and anthropometric measurements of football players aged 15-17.

- Objective of the study: The goal of the investigation was to assess the influence of Ramadan fasting, both independently and combined with physical exertion, on football players in terms of morphological parameters, maximal oxygen consumption (VO₂ max), and aerobic endurance (EA).
- Methodology: A sample of 30 football players, aged 15-16 years, underwent an experimental approach.
- Tests: The tests were applied in two phases: the initial stage occurs one week before to Ramadan, followed by the subsequent stage during the fourth week of the month. In each phase, two tests were conducted: The initial test conducted was the 20-meter shuttle run test (Leger, 1988), and the second was the Astrand test performed at 91% of maximal aerobic capacity, accompanied by morphological measurements and blood sampling.
- Study Results: The results showed that Ramadan fasting did not affect aerobic capacity, maximal oxygen consumption, or aerobic endurance.

2. Theoretical Framework of the Study

2.1 Ramadan Fasting

Observing Ramadan fasting is a fundamental tenet of the Islamic faith, during the period, healthy adult Muslims practice abstinence from consuming food, beverages, tobacco, and engaging in sexual activities (Wahba & Taha Hassan El-Nahas, 2019). It is also recognized as a means to restrict biological needs from sunrise to sunset, serving the Islamic religion and honoring its rituals (Zougai, 2022, p. 67).

2.2 Maximal Aerobic Speed (MAS)

MAS is the speed at which the body reaches its maximum aerobic capacity, serving as an indicator of maximal oxygen consumption. This speed is used as a criterion for determining and assessing the level of aerobic endurance (El-Jibaili, Azouni, & Qaroumi, 2024). It can also be defined as the speed attained by an athlete who has reached the maximum oxygen consumption level (Qaroumi & Wadhah, 2021).

2.3 Fat Mass

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Fat mass represents the body's energy storage, located in the adipose tissues of the body. It accumulates around vital organs such as the heart, liver, and pancreas, and is often concentrated in the lower abdomen (Achat & Gasmi, 2018, p. 451).

2.4 Football

Football is a sport that involves two teams competing against each other, each team is composed of 11 individuals that utilize a ball. At each end of the field is a goal, and each team attempts to score by getting the ball into the opponent's goal, defended by a goalkeeper. The ball is moved using the head and feet, with only the goalkeeper allowed to handle the ball with their hands within the penalty area (Qiya, 2022, pp. 137-119).

3. Field Study Procedures

3.1 Pilot Study

A preliminary investigation was carried out on a cohort of 20 athletes from the team "Taraji Guelma" under 19 years old. We considered several points necessary for initiating the fieldwork, which included:

- Understanding the various conditions surrounding the application process.
- Identifying the essential tools and equipment.
- Determining the most appropriate tests for measuring maximal aerobic speed and fat mass.
- Addressing organizational aspects and understanding the time required for each test.
- Assessing the validity and reliability of the tests.

3.2 Sample Characteristics

Table 01: Characteristics of the Sample

Count	Age	Weight	Maximal Aerobic Speed	Fat Mass
20	17.7	66.17	15.66	10.27

Source: The Author, 2024.

4. Methodology

In accordance with the nature and objectives of the research, we relied on the experimental method due to its alignment with the study's nature and its ability to control and manage the studied variables. This makes it the only method that allows for a precise elucidation of the cause-and-effect relationship (Zamali & Qalati, 2017, p. 75).

4.1 Population

The research population consists of all the teams in the first elite group under the Annaba Regional League, comprising 12 teams with a total of 300 players.

4.2 Sample

The sample was selected randomly and included 20 players from the under-19 football team of Taraji Guelma.

4.3 Research Fields

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- Human Field: The study included 20 players from the under-19 team of Taraji Guelma.
- Spatial Field:
 - The multi-sport complex Souidani Boujemaa in Guelma was used for the maximum aerobic speed test in the football unit.
 - The medical clinic of Dr. Taabek Khalida in Guelma province was used to measure body fat mass.
- Temporal Field
 - The pilot study was conducted from 01/02/2024 to 04/02/2024.
 - Pre-Ramadan tests were conducted on 02/03/2024.
 - Post-Ramadan tests were conducted on 25/04/2024.

4.4 Research Tools

- Theoretical Studies: Books, previous studies, and both Arabic and foreign references.

The tests relied upon:

4.4.1 Test for measuring maximum aerobic speed

Level 1 Yo-Yo Intermittent Recovery Test: This test evaluates a player's aerobic capacity and recovery after performing repeated intensive runs with active rest periods. The participant alternates between two markers that are situated 20 meters apart, following a series of beeps from an audio recording. After every 40 meters, they receive a 10-second rest period. The test begins at a gradually increasing speed with each level and concludes when the competitor is unable to sustain the necessary speed for two consecutive runs. The test commences with an initial velocity of 8 kilometers per hour.

A. The Tools Utilized

We used the following tools:

- Measuring tape.
- Cones.
- Whistle.
- An audio device.

4.4.2 Test for Measuring Body Fat Mass:

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We measured body fat mass using the TANITA 780 PRO device, which is used to measure and examine the composition of the body, including the amount of body fat and various other indicators. This device relies on bioelectrical impedance analysis (BIA) technology, where a low-intensity electric current is sent through the body to measure electrical resistance. The resistance varies based on the amount of water, fat, and muscle in the body.

A. The Tools Utilized:

We used the following tools:

- TANITA 780 PRO device.
- Height measuring tape.

4.4.3 Statistical Methods

- Arithmetic Mean.
- Standard Deviation.
- Student's T-Test.
- SPSS Program.

5. Analysis and Discussion of the Results

Table 02: This table shows the Shapiro-Wilk normality test for the maximum aerobic speed test.

	Shapiro-Wilk		
	Statistics	ddl	Sig.
Before Ramadan	0.911	20	0.067
After Ramadan	0.945	20	0.297

Source: Author, 2024.

5.1 Analysis

Based on the results obtained in Table 02, which illustrates the results of the normality test for the body fat mass data before and after Ramadan, we observe that the Sig. value reached 0.524 in the pre-test measurement of body fat mass, while in the post-test measurement, it reached 0.445. This implies that the data follows a normal distribution, as both values exceed the significance level (α) of 0.05.

5.2 Presentation and Discussion of the Maximum Aerobic Speed Test: Yo-Yo Intermittent Recovery Test Level

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Table 03: This table shows a comparison of the pre-test and post-test results for the study sample in the maximum aerobic speed test.

Decision-making	Degrees of Freedom	α	sig	t-Value	S.D	Mean	Test
Not statistically significant	19	0,05	0.847	0,195	1.13345	15.6625	Pre-test
					1.07115	15.65	Post-test

Source: Author, 2024.

5.2.1 Analysis

It is evident from Table 03 that the sample in the pre-test for the maximum aerobic speed test a standard deviation of 1.13345 and an average of 15.6625 were obtained. During the post-test, an arithmetic mean of 15.6500 is included in the reported data and a standard deviation of 1.07115. With 19 degrees of freedom, the t-value was 0.195, and the Sig. value was 0.847, which is greater than the level of relevance α . This indicates that there is no statistically significant disparity between the outcomes of the maximal aerobic speed test's pre- and post-tests. Therefore, the hypothesis proposed by the researcher was not confirmed.

5.2.2 Effect Size Study:

	Pre-Test Mean	Post-Test Mean	Mean Difference	Standard Deviation Difference	Cohen's Test	Effect Size
Maximum Aerobic Speed	15.65	15.66	0.01	0.28	0.03	Weak

Source: Author, 2024.

Table 04 shows the effect size of fasting during Ramadan on maximum aerobic speed. From the table, we notice that the mean difference is 0.01, and the standard deviation difference is 0.28. When applying Cohen's test, which is used to determine the effect size, the result was 0.03, which corresponds to a weak effect size, indicating that fasting during Ramadan did not affect maximum aerobic speed.

5.2.3 Effect Percentage Study:

	Pre-Test Mean	Post-Test Mean	Effect Percentage
Maximum Aerobic Speed	15.65	15.66	0.06%

Source: Author, 2024.

Table 05 shows the effect percentage of fasting during Ramadan on maximum aerobic speed. The table shows that the pre-test mean for the maximum aerobic speed test is 15.65, and the post-test mean is 15.66, with an effect percentage of 0.06%, which is almost negligible.

5.3 Presentation and Discussion of the Body Fat Mass Test: TANITA PRO

Table 06: The body fat mass test findings for the study sample before and after are compared in this table.

Decision-making	Degrees of freedom	α	sig	t-value	S.D	Mean	Test result
Statistically significant	19	0,05	0.043	2.167	3.07110	10.2700	pre-test
					3.23954	9.9250	post-test

Source: Author, 2024.

Based on Table 06, it is evident that the sample in the pre-test measurement of the mental mass test achieved a mean of 10.2700 and 3.07110 as the standard deviation. In comparison, a mean of 9.9250 was found in the post-test measurement and the standard deviation is 3.23954. The t-value obtained was 2.167 with 19 degrees of freedom, with a sig value of 0.043, which is less than the significance level α . This suggests that there are statistically significant differences between the results of the first and final measures in the mental mass assessment, favoring the pre-test measurement. Therefore, the hypothesis proposed by the researcher has been confirmed.

5.3.1 Effect Size Study:

	Pre-Test Mean	Post-Test Mean	Mean Difference	Standard Deviation Difference	Cohen's Test	Effect Size
Fat Mass	10.27	9.92	0.43	0.67	0.64	Moderate

Source: Author, 2024.

Table 07 shows the effect size of fasting during Ramadan on fat mass. From the table, we observe that the mean difference is 0.43, and the standard deviation difference is 0.67. Using Cohen's test, which is employed to determine the effect size, the result was 0.64, which corresponds to a moderate effect size, indicating that fasting during Ramadan had a moderate impact on fat mass.

5.3.2 Effect Percentage Study:

	Pre-Test Mean	Post-Test Mean	Effect Percentage
Fat Mass	10.27	9.92	-3.52%

Source: Author, 2024.

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Table 08 shows the effect percentage of fasting during Ramadan on fat mass. The table shows that the pre-test mean for the fat mass test is 10.27, and the post-test mean is 9.92, with an effect percentage of -3.52%, indicating that fasting during Ramadan had a negative impact on the fat mass of the football players studied.

6. Discussion of Hypotheses

6.1 Discussion of the First Hypothesis

The research hypothesis was to find statistically significant discrepancies between the outcomes of the previous and subsequent tests measurements in the maximum aerobic speed test among football players under 19 years of age. However, the study findings indicated that the pre-test findings showed no statistically significant differences from the post-test between the outcomes of the previous and subsequent tests measurements in the maximum aerobic speed test among football players under 19 years of age. It was observed that the maximum aerobic speed did not decrease after fasting during the month of Ramadan and was not affected after fasting for a whole month. This aligns with the study by (Chiha, 2008), which indicated no change in aerobic endurance capacity. The study by (Zarzouri, 2019) also confirmed this, stating that despite a slight decrease in maximum aerobic speed during the third week, there were no statistically significant differences observed between the periods of fasting and feeding, nor between fasting periods throughout the month.

From the results derived based on the measures taken before and after the test, as shown in Table 04, it is clear that the p-value (sig) is greater than the significance level of 0.05. Therefore, it is evident that the hypothesis was not confirmed.

6.2 Discussion of the Second Hypothesis

Our research hypothesis was to determine the presence of statistically significant disparities between the outcomes of the first and final test measurements in body fat mass among football players under 19 years of age. This was confirmed by our study's results, which showed statistically significant disparities between the outcomes of the measurements taken before and after the test in body fat mass among football players under 19 years of age.

It was observed that there was a decrease in body adipose mass that is statistically significant after the post-test measurement compared to the pre-test measurement, i.e., after observing the practice of abstaining from food and drink throughout the Islamic month of Ramadan. This decrease may be due to fat consumption during exercise in the fasting phase, which was confirmed by the study by (Correia & et al, 2020). Additionally, these findings are in accordance with the investigation by (Slimani, 2021) and contradict the study by (Chiha, 2008), which did not report any changes in body fat mass.

As can be seen from Table 05's data, the p-value (sig) is below the 0.05 significance threshold. Therefore, it is evident that the hypothesis was verified.

7. Conclusions and suggestions

Through the research procedures, stated goals and quantitative examination of the outcomes, we have drawn the following conclusions:

- It was found that the body is capable of adapting during the fasting period without affecting its physical abilities. There was no impact of fasting during the month of Ramadan on the maximum aerobic speed among football players under 19 years of age, indicating that the athletes' aerobic capacity is not influenced by food and drink during fasting.
- The results obtained showed a significant and statistically significant decrease in body fat mass among football players under 19 years of age. This decrease may be attributed to changes in dietary and hydration patterns during fasting, leading the body to use fat stores as energy.

7.1 Recommendations and Suggestions:

- Adjust training programs according to the specific conditions of fasting during the month of Ramadan.
- Include a balanced and appropriate nutritional program for players during the fasting period of Ramadan.
- Continuously monitor players' physical abilities, muscle mass, and fat mass by conducting various tests and measurements.
- Provide guidance sessions for players on healthy eating and lifestyle during Ramadan, which would positively affect their physical and psychological well-being.
- Conduct further studies and research on the effects of Ramadan fasting across different age groups to develop more accurate and comprehensive programs.

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