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Impact of Ramadan Fasting on Body Composition and Peripheral Anthropometric Parameters According to Playing Lines in U17 Football Players

تأثير صيام رمضان على تكوين الجسم والقياسات الأنثروبومترية حسب مراكز اللعب لدى لاعبي كرة القدم فئة اقل 17 سنة

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Abstract:

The main research axes that have to contain the following elements:(aim of the research, the adopted methodology, the sample, the tools used to achieve and the principal results.

This longitudinal study investigated changes in body composition and peripheral anthropometric parameters in U17 football players during Ramadan fasting using a pre–mid–post test design. Eighteen players competing at the regional level were classified according to their playing lines (defenders, midfielders, and forwards). Measurements of body mass, body mass index, fat mass, muscle mass, total body water, and selected limb circumferences were collected before Ramadan, during mid-Ramadan, and after Ramadan. Statistical analysis was conducted using repeated-measures ANOVA, including a two-way interaction model (Time × Playing Line), with effect sizes calculated using partial eta squared (η^2). Significant time effects were observed for body mass, total body water, and fat mass ($p < 0.05$), while muscle mass remained relatively stable across the three measurement points. Significant interaction effects (Time × Playing Line) indicated differentiated physiological responses according to positional demands, particularly among midfield players. Ramadan fasting induces moderate and transient alterations in body composition among U17 football players, with variations influenced by playing lines. These findings underline the importance of position-specific monitoring and individualized nutritional strategies during fasting periods.

Keywords: Ramadan fasting; Youth football; Playing lines; Body composition; Anthropometry.

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1-Introduction:

Ramadan, the ninth month of the Islamic lunar calendar, is characterized by a period of diurnal fasting during which healthy adult Muslims abstain from all food and fluid intake from dawn until sunset. Due to the lunar nature of the Islamic calendar, Ramadan shifts annually by approximately 10–11 days, which means that it may coincide with any season of the year, including periods of intensive training and competitive sports.

As international sporting calendars are rarely adjusted to accommodate religious observances, Muslim athletes are often required to maintain regular training and competition schedules while fasting. This situation poses a substantial physiological challenge, as Ramadan fasting may disrupt habitual dietary patterns, sleep–wake rhythms, hydration status, and energy metabolism. Such disruptions can influence several physiological and anthropometric variables that are closely linked to athletic performance. If not appropriately managed, prolonged periods of food and fluid restriction may negatively affect training quality, recovery processes, and competitive outcomes.

Nutrition plays a central role in supporting training adaptations and athletic performance. Adequate energy availability, as well as the timing and quality of nutrient intake, are essential for muscle repair, glycogen resynthesize, and metabolic regulation. Consequently, the dietary modifications imposed by Ramadan fasting may induce measurable changes in body mass and body composition, particularly in physically active individuals.

According to (Aïssa, 2017), the effects of Ramadan fasting on body weight remain controversial in the scientific literature. Several studies have reported a reduction in body mass during Ramadan (Hallak M. H., 1988); (Sweileh, 1992), (Ramadan J. T.-Z.-N., 1999); (Bouhlel, (2006)); (Al-Hourani, 2007), whereas others have observed an increase in body weight during the fasting month (Frost, 1987); (Siddiqui, 2005). In contrast, numerous investigations have found no significant changes in body mass or body composition throughout Ramadan (El Ati, 1995); (Finch, 1998); (Grantham, 2007); (Fouad, 2008).

Similarly, research focusing on body composition during Ramadan has produced inconsistent findings. Some studies have reported decreases in body fat percentage, whereas others have documented increases or no significant changes, largely depending on dietary intake, energy balance, and training load during the fasting period (Haouari M, 2008) (Kul S, 2014). (Aloui A, 2019)reported a general reduction in body fat percentage during Ramadan without significant changes in total body mass. In addition, (Trabelsi K, 2020), in a study involving athletes under 19 years of age, found no significant changes in fat mass or lean body mass during Ramadan fasting.

Overall, the available evidence suggests that athletes are generally able to maintain body mass during Ramadan and may, in some cases, reduce body fat percentage when appropriate nutritional and training strategies are implemented (MOHAMED SAAD, 2021).

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However, fasting during Ramadan may still induce noticeable changes in anthropometric measurements, particularly body weight and its components, which can pose challenges for both athletes and the physically active population. A common perception persists that Ramadan fasting negatively affects training and competitive performance, potentially placing observant Muslim athletes at a disadvantage if adequate support strategies are not applied (Karim Chamari, 2023).

In football, anthropometric characteristics vary significantly across playing positions due to the specific physical and tactical demands associated with each line of play. Defenders generally present greater body mass, height, and muscle mass, attributes that enhance their ability to engage in physical duels, aerial challenges, and defensive coverage. Midfield players, by contrast, tend to exhibit more balanced anthropometric profiles, combining moderate body mass with lower fat mass and higher aerobic efficiency, which supports sustained running, frequent directional changes, and continuous involvement in both defensive and offensive phases. Forwards often display lower body mass and body fat percentage alongside high levels of muscular power and speed, characteristics that facilitate rapid accelerations, explosive movements, and goal-scoring actions. These positional differences in anthropometric measurements reflect long-term training adaptations and selection processes that optimize performance according to the functional requirements of each playing line.

Athletic practice during the holy month of Ramadan represents a unique intersection where high physical demands meet specific religious and social requirements. This is particularly evident in sports such as football, which rely on high-intensity efforts and consume significant amounts of energy and water. This issue becomes even more sensitive when focusing on youth players (under 17 years old). As they are in a critical stage of biological and psychological development, this period requires a delicate balance between nutrition, rest, and physical activity, making the effects of fasting more complex and varied compared to those observed in adults.

The existing discrepancies in scientific literature lead us to explore how the young body adapts to physical activity in the absence of daytime food and fluid intake. Furthermore, it raises the questions:

Does Ramadan fasting induce significant changes in body composition variables (body weight, fat mass, muscle mass, total body water, body volume, and density) in U17 football players competing at the regional level?

Are there statistically significant differences in anthropometric and body composition measurements between the pre-Ramadan and post-Ramadan periods in the same group of players?

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2-Research Hypotheses

Ramadan fasting leads to significant changes in selected body composition parameters (body weight, fat mass, muscle mass, total body water) and circumference measurements according to Playing Lines in U17 football players.

3- Defining Study Terms:

. Fasting (As-Siyam)

- Terminological Definition: The act of abstaining from food, drink, and all other actions that nullify the fast, from dawn until sunset, with the intention of worship (Holy Qur'an, Surah Al-Baqarah, Verse 183).
- Operational Definition (in this research): In this study, fasting refers to the total abstinence from food and liquids from dawn until sunset throughout the month of Ramadan, as observed by the athletes in the study sample (Ibn Manzur, 2003, p. 112).

. The Month of Ramadan

- Terminological Definition: The ninth month of the Hijri (Islamic) calendar, during which fasting was prescribed for healthy and capable adult Muslims.
- Operational Definition (in this research): It represents the specific time frame of the field study and serves as a primary variable during which the impact of fasting on the physical measurements of the sample is evaluated.

. Anthropometric Measurements

- Terminological Definition: A set of standardized physical measurements used to assess body size, shape, and proportions, such as weight, height, arm circumference, body fat percentage, and muscle mass (Bousaha, 2019, p. 41).
- Operational Definition (in this research): This refers to the specific physical data tracked before, during, and after the month of Ramadan for the players, including:
    - Body Weight.
    - Stature (Height).
    - Body Mass Index (BMI).
    - Body Composition (Fat mass, muscle mass, and water percentage, as determined **by the available equipment)** (Marfell-Jones, 2008).)

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4-Methodology

4-1 Study Design

A longitudinal repeated-measures design was employed to examine variations in body composition and anthropometric parameters across three measurement points: pre-Ramadan, mid-Ramadan, and post-Ramadan.

4-2Participants

The study sample consisted of **18 male U17 football players** competing in the Constantine regional league. Players were stratified according to their primary playing lines:

- Defenders (n = 6)
- Midfielders (n = 6)
- Forwards (n = 6)

Table No. (01): Characteristics of the Study Sample

Variable	positions	Min	Max	Mean	Standard Deviation (SD)
Age(Years)	Defenders	16	17	16.17	0.41
	Midfielders	16	17	16.33	0.52
	Forwards	16	17	16.33	0.52
Height(cm)	Defenders	1.68	1.82	1.75	0.06
	Midfielders	1.65	1.83	1.75	0.06
	Forwards	1.68	1.82	1.75	0.06
Weight(kg)	Defenders	52.30	69	61.70	6.20
	Midfielders	48.50	68.10	60.42	6.71
	Forwards	54.70	75.40	61.53	7.09

All participants had at least two years of systematic training experience and observed Ramadan fasting throughout the study period.

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4-3Measurement Protocol

Measurements were conducted at three standardized time points:

- **Pre-test:** Before the onset of Ramadan
- **Mid-test:** During the middle phase of Ramadan
- **Post-test:** At the end of Ramadan

All assessments were performed at the same time of day and under identical conditions to minimize circadian and hydration-related variability.

4-5 Spatial Scope (Study Setting)

The study was carried out in two distinct environments to ensure data accuracy:

- **Measurement Site:** All anthropometric and morphological measurements were performed in a controlled environment within the **Physical Education Teacher's Office at Jaber Ibn Hayyan High School in Zighoud Youcef**. This setting ensured privacy and the accuracy of results away from external influences.
- **Training Site:** The participants' regular training sessions took place at the **Zighoud Youcef Municipal Stadium**, which features an **artificial turf** surface. This is where the players maintained their physical activity under the effects of fasting.

4-6Data Collection Tools:

The researcher employed a comprehensive set of metrics to evaluate physical changes, categorized into two main areas:

1. Body Composition Analysis

Key biological indicators were measured to assess internal physiological changes in the athletes' body structures:

- Body Mass Index (BMI): To evaluate the relationship between weight and height.
- Body Fat Percentage: To determine fluctuations in the body's primary energy stores.
- Muscle Mass Percentage: To monitor the impact of fasting on the essential muscle tissue required for athletic performance.
- Total Body Water (TBW) Percentage: To assess hydration status and the effects of daytime fluid restriction.

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2. Circumference Measurements (Girths)

Localized measurements can be taken to identify morphological differences in the upper and lower limbs. Examples include:

- Mid-Upper Arm Circumference
- Forearm Circumference
- Thigh Circumference
- Calf Circumference

4-7ody Weight and Composition Analysis

- Measurement Objective: To determine total body weight and analyze essential body components, including fat mass, muscle mass, and hydration levels (body water percentage).
- Equipment Used: A Kalenji SCALE 500 electronic impedance scale.
- Description: This device utilizes Bioelectrical Impedance Analysis (BIA) technology to provide detailed data on body structure, which is crucial for monitoring the subtle morphological changes in athletes throughout the study period.



5-Statistical Analysis:

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) v27 to calculate the following: arithmetic mean, standard deviation, repeated measures analysis (NR), and effect size.

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7-Analysis of Results:

Table No. (02): Descriptive statistic and differences in (Body Mass Index, body fat percentage, muscle mass percentage, body water percentage, weight) one day before Ramadan for U-17 football players according to playing positions.

Variable	positions	Min	Max	Mean	Standard Deviation (SD)	Shapiro-Wilk (Sig.)	Levene (Sig.)	sig
BMI	Defenders	18.30	21.50	20.05	1.33	0.21	0.22	0.50**
	Midfielders	17.90	20.30	19.60	0.88	0.04		
	Forwards	18	23.30	20.20	1.85	0.77		
Body Fat%	Defenders	05	7.80	6.28	1.14	0.51	0.11	0.53**
	Midfielders	05	6.20	5.48	0.50	0.37		
	Forwards	05	10.40	6.48	2.11	0.04		
Muscle Mass%	Defenders	53.50	56.10	54.58	1.12	0.20	0.24	0.15 *
	Midfielders	54.30	56.50	55.17	0.75	0.49		
	Forwards	52.10	55.90	54.45	1.43	0.56		
Body Water%	Defenders	66.50	70.50	68.72	1.66	0.33	0.27	0.30**
	Midfielders	67.90	70.70	68.72	1.01	0.02		
	Forwards	64.50	69.40	67.45	1.72	0.50		
Weight kg	Defenders	52.30	69	61.70	6.20	0.82	0.99	0.86**
	Midfielders	48.50	68.10	60.42	6.71	0.36		
	Forwards	54.70	75.40	61.53	7.09	0.01		

***One-Way ANOVA ** Kruskal-Wallis Test.**

Table No: (05)shows a close convergence of mean values for most physical indicators across playing positions (Defenders, Midfielders, and Forwards). For instance, the average weight ranges between 60.42 kg and 61.70 kg. Midfielders exhibit the lowest body fat percentage (5.48%). Conversely, Forwards show the highest standard deviation in body fat (2.11), indicating that fat levels in this group are more variable (heterogeneous) compared to Defenders and Midfielders.

The results of Levene's test indicate that all significance values are greater than 0.05 (specifically: 0.22, 0.11, 0.24, 0.27, and 0.99). This confirms the homogeneity of variance across the groups, which justifies the potential use of parametric tests. The Shapiro-Wilk test reveals that some values are below 0.05 (e.g., 0.04 for BMI in Midfielders and 0.01 for Weight in Forwards). This signifies that the data does not follow a perfectly normal distribution for all variables. Consequently, it is methodologically recommended to use non-parametric tests, such as the Kruskal-Wallis Test, as an alternative to ANOVA for these specific cases.

The statistical analysis of measurements taken one day before Ramadan concludes that U-17 football players constitute a homogeneous and similar group in terms of their physical characteristics (Weight, Fat, Muscle, etc.), regardless of their playing positions. The slight variations observed in the arithmetic means are not statistically significant.

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Table No. (03): Descriptive statistics and differences in circumferences one day before Ramadan for U-17 football players according to playing positions.

Circumference	positions	Min	Max	Mean	Standard Deviation (SD)	Shapiro-Wilk (Sig.)	Levene (Sig.)	sig
Upper Arm	**Defenders**	**22.10**	**25.30**	**24.27**	**1.16**	0.21	0.23	** **0.75**
	Midfielders	**21**	**29.10**	**24.70**	**2.69**	**0.04**		
	Forwards	**23.10**	**27.50**	**25.47**	**1.93**	0.77		
Forearm	**Defenders**	**22.40**	**25.80**	**24.48**	**1.60**	0.51	0.99	** **0.72**
	Midfielders	**21.50**	**26.30**	**23.77**	**1.77**	0.37		
	Forwards	**22.50**	**26.40**	**24.13**	**1.66**	**0.04**		
Thigh	**Defenders**	**49**	**55.60**	**52.75**	**2.65**	0.20	0.81	***0.82**
	Midfielders	**46.50**	**54.80**	**52.55**	**3.19**	0.49		
	Forwards	**48.80**	**57.40**	**51.67**	**3.42**	0.56		
Calf	**Defenders**	**31.40**	**38.60**	**35.07**	**2.70**	0.33	0.47	****0.52**
	Midfielders	**30.90**	**34.90**	**33.63**	**1.79**	**0.02**		
	Forwards	**33.50**	**37.50**	**34.73**	**1.56**	0.50		

***One-Way ANOVA ** Kruskal-Wallis Test.**

Forwards recorded the highest mean for upper arm circumference (25.47 cm), while midfielders showed the greatest data dispersion with a standard deviation of (2.69), indicating variability in muscle size within this line. Defenders stood out with the highest mean for forearm circumference (24.48 cm), with a significant convergence of results across the three positions. Results also converged remarkably in thigh circumference between the defense (52.75 cm) and midfield (52.55 cm), whereas forwards had the lowest mean (51.67 cm). As for the calf circumference, defenders recorded the highest mean value (35.07 cm), which is a vital muscular area for defensive players during jumping and physical challenges.

Homogeneity of Variance (Levene's Test): All Levene's significance values were greater than (0.05), ranging between (0.23)and(0.99). This confirms the homogeneity of the study sample regarding body circumferences, supporting the use of parametric tests.

Normality of Distribution (Shapiro-Wilk Test): The results indicated that some variables do not follow a normal distribution (p-value ,(0.05 > namely: Upper Arm for Midfielders (0.04), Forearm for Forwards (0.04), and Calf for Midfielders (0.02). Consequently, the Kruskal-Wallis test was employed as a non-parametric alternative for comparison in these cases.

In the test of differences, all values were greater than 0.05, meaning there are no statistically significant differences attributable to the playing position (Defenders, Midfielders, Forwards). This indicates that the players possess very similar physical structures in terms of limb muscular development at this age stage.

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Table No. (04): Descriptive statistics and differences in (Body Mass Index, body fat percentage, muscle mass percentage, body water percentage, weight) results in the middle of Ramadan for U-17 football players according to playing positions.

Variable	positions	Min	Max	Mean	Standard Deviation (SD)	Shapiro-Wilk (Sig.)	Levene (Sig.)	sig
BMI	Defenders	18,20	21,50	19,72	1,52	0,13	0.29	*0.94
	Midfielders	17,90	20,50	19,53	0,90	0,34		
	Forwards	17,70	22,90	19,82	1,77	0,59		
Body Fat%	Defenders	5	7,80	6,00	1,37	0,01	0.30	0.82**
	Midfielders	5	6,50	5,42	0,66	0,01		
	Forwards	5	9,80	6,08	1,87	0,000		
Muscle Mass%	Defenders	53,50	56,00	54,93	1,16	0,09	01	0.71*
	Midfielders	53,90	57,10	55,37	1,25	0,65		
	Forwards	52,50	56,20	54,80	1,32	0,54		
Body Water%	Defenders	66,60	70,50	68,65	1,72	0,23	0.34	*0.92
	Midfielders	67,70	70,80	68,88	1,07	0,44		
	Forwards	65	70,90	68,50	2	0,56		
Weight kg	Defenders	52,60	71,20	62,08	6,83	0.73	0.95	*0.87
	Midfielders	48,80	68,70	60,08	6,61	0.47		
	Forwards	53,00	74,10	60,67	7,10	0.10		

***One-Way ANOVA ** Kruskal-Wallis Test.**

A high convergence is observed across the three playing positions in the Body Mass Index (BMI), where forwards recorded the highest mean (19.82), followed by defenders (19.72). As for the body fat percentage (Body Fat%), midfielders maintained the lowest mean (5.42%), while forwards recorded the highest standard deviation (1.87), indicating variability in fat levels within the forwards group in the middle of the month.

Midfielders recorded the highest mean body water percentage (68.88%), which is a positive indicator of their hydration status during the fasting period. On the other hand, defenders were the heaviest with a mean weight of (62.08 kg), while midfielders recorded the lowest mean weight (60.08 kg).

All Levene's significance values were greater than (0.05) (such as 0.29 for BMI and 0.95 for weight), confirming the homogeneity of the study sample in the middle of Ramadan and the validity of using parametric tests. However, the results showed that the body fat percentage across all positions did not follow a normal distribution (Sig. values less than 0.05, reaching 0.000 for forwards). Therefore, the Kruskal-Wallis test must be used for comparison specifically for this variable, while the remaining variables follow a normal distribution.

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In the analysis of differences, we note that all significance values (Sig.) in the final column are much larger than the significance level (0.05): BMI (0.94), Body Fat % (0.82), Muscle Mass % (0.71), Body Water % (0.92), and Weight (0.87).

This means there are no statistically significant differences between defenders, midfielders, and forwards in all these indicators in the middle of Ramadan. This indicates that the players' responses to dietary and training changes during fasting were similar, with the sample maintaining a high state of physical homogeneity.

Table No. (05): Descriptive statistics and differences in body circumference results in the middle of Ramadan for U-17 football players according to playing positions

Circumference	positions	Min	Max	Mean	Standard Deviation (SD)	Shapiro-Wilk (Sig.)	Levene (Sig.)	sig
Upper Arm	Defenders	23,50	27,00	24,75	1,21	0,22	0.22	*0.69
	Midfielders	21	28,60	24,77	2,57	0,98		
	Forwards	21,70	26,00	23,95	1,53	0,99		
Forearm	Defenders	19,50	22,50	21,20	1,05	0,61	0.09	*0.37
	Midfielders	19,50	23,50	21,25	1,33	0,70		
	Forwards	20	26,50	22,50	2,53	0,53		
Thigh	Defenders	48	57,50	53,17	3,40	0,84	0.63	*0.67
	Midfielders	48	56	52,60	3,24	0,56		
	Forwards	48,50	56	51,58	2,56	0,72		
Calf	Defenders	32,00	39,50	34,92	2,94	0,52	0.06	*0.69
	Midfielders	31,50	35,50	34,00	1,61	0,15		
	Forwards	33,80	36,00	34,80	0,86	0,78		

***One-Way ANOVA ** Kruskal-Wallis Test.**

The results indicate a clear convergence in the mean values of body circumferences across the three playing positions during the middle of Ramadan. Midfielders recorded the highest mean for Upper Arm circumference (24.77 cm), while Forwards showed the highest mean for Forearm circumference (22.50 cm). Regarding the lower limbs, Defenders recorded the highest means for both Thigh (53.17 cm) and Calf circumferences (34.92 cm), reflecting the physical demands of defensive roles which rely heavily on lower-body muscular strength.

Homogeneity of Variance (Levene's Test): All significance values (Sig.) were greater than 0.05 (0.22, 0.09, 0.63, and 0.06), confirming the homogeneity of the study sample and justifying the use of parametric tests (ANOVA). All significance values were greater than 0.05, indicating that the body circumference data mid-Ramadan followed a normal distribution across all groups.

The analysis reveals that all significance values for the four circumferences (Upper Arm, Forearm, Thigh, and Calf) are greater than the 0.05 threshold (0.69, 0.37, 0.67, and 0.69, respectively). There are no statistically significant differences in body circumferences between Defenders, Midfielders, and Forwards in the middle of Ramadan. This suggests that the morphological changes resulting from fasting were consistent among all players regardless of their positions**.**

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Table No. (06): Descriptive statistics and differences in (Body Mass Index, body fat percentage, muscle mass percentage, body water percentage, weight) results at the end of Ramadan for U-17 football players according to playing positions.

Variable	positions	Min	Max	Mean	Standard Deviation (SD)	Shapiro-Wilk (Sig.)	Levene (Sig.)	sig
BMI	Defenders	18	22,20	20,17	1,77	0,34	0.42	* 0.46
	Midfielders	17,90	20,50	19,37	0,96	0,83		
	Forwards	17,80	23,40	19,70	2,04	0,22		
Body Fat%	Defenders	5	8,70	6,58	1,54	0,45	0.52	**0.73
	Midfielders	5	10,60	6,10	2,24	0,000		
	Forwards	5	10,50	6,74	2,41	0,03		
Muscle Mass%	Defenders	53	56,30	54,53	1,43	0,20	0.22	** 0.45
	Midfielders	51,50	56,30	54,75	1,74	0,11		
	Forwards	52,10	65,50	56,00	4,89	0,04		
Body Water%	Defenders	65,90	70,50	68,08	1,93	0,35	0.66	* 0.65
	Midfielders	64,50	70,50	68,45	2,10	0,15		
	Forwards	64,50	70,70	68,17	2,59	0,36		
Weight kg	Defenders	51	72,70	61,93	7,96	0,905	0.89	** 0.22
	Midfielders	48,70	68,50	59,75	6,77	0,823		
	Forwards	53,80	75,80	61,15	7,58	0,045		

***One-Way ANOVA ** Kruskal-Wallis Test.**

The results at the end of Ramadan show a continued convergence in arithmetic means across the three playing positions. Defenders recorded the highest mean Body Mass Index (20.17) and the highest mean Weight (61.93 kg). Forwards exhibited the highest muscle mass percentage (56.00%) and the highest body fat percentage (6.74%). Body water percentages remained stable at the end of the month, ranging between (68.08% and 68.45%), indicating good physiological adaptation to the fasting regimen.

All significance values (Sig.) were greater than 0.05 (0.42, 0.52, 0.22, 0.66, and 0.89), confirming that the study sample remained homogeneous until the end of the month, justifying the use of parametric tests.

Body fat percentage for Midfielders and Forwards, as well as muscle mass and weight for Forwards, did not follow a normal distribution (Sig. < 0.05). Consequently, the Kruskal-Wallis test is required for comparisons involving these specific variables.

The analysis reveals that all significance values for the five indicators (BMI, Fat%, Muscle%, Water%, and Weight) are greater than the (0.05)threshold (0.46, 0.73, 0.45, 0.65, and 0.22, respectively).

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There are no statistically significant differences between Defenders, Midfielders, and Forwards at the end of Ramadan. This suggests that the cumulative physical changes throughout the month were uniform across all players, regardless of their playing positions.

Table No. (07): Descriptive statistics and differences in body circumference results at the end of Ramadan for U-17 football players according to playing positions.

Circumference	positions	Min	Max	Mean	Standard Deviation (SD)	Shapiro-Wilk (Sig.)	Levene (Sig.)	sig
Upper Arm	**Defenders**	**23**	**26**	**24,12**	**1,09**	0,25	0.33	***0.53**
	Midfielders	**18,70**	**28,60**	**24,13**	**3,30**	0,87		
	Forwards	**21,70**	**27,50**	**24,20**	**2,16**	0,59		
Forearm	**Defenders**	**20,50**	**26,40**	**22,37**	**2,14**	0,10	0.69	* **0.17**
	Midfielders	**20**	**23,50**	**21,58**	**1,35**	0,80		
	Forwards	**19,50**	**26,50**	**22,15**	**2,49**	0,54		
Thigh	**Defenders**	**47,50**	**57,00**	**52,67**	**3,50**	0,93	0.97	* **0.17**
	Midfielders	**45,20**	**55,30**	**51,05**	**3,47**	0,75		
	Forwards	**48,50**	**57,60**	**51,17**	**3,47**	**0,06**		
Calf	**Defenders**	**32,00**	**39,90**	**35,35**	**3,13**	0,48	0.07	* **0.18**
	Midfielders	**32,30**	**36**	**34,13**	**1,52**	0,54		
	Forwards	**32,70**	**36**	**33,92**	**1,16**	0,25		

***One-Way ANOVA** ** **Kruskal-Wallis Test.**

The results at the end of Ramadan indicate a high convergence in body circumference means across the three playing positions. For Upper Arm circumference, values were nearly identical, averaging (24.12 cm to 24.20 cm), with Midfielders showing higher dispersion (SD = 3.30). Defenders recorded the highest means for Forearm (22.37 cm), Thigh (52.67 cm), and Calf (35.35 cm), suggesting a relatively better maintenance of limb muscle mass by the end of the month.

All significance values (Sig.) were greater than 0.05 (0.33, 0.69, 0.97, and 0.07), confirming the homogeneity of the study sample at the end of Ramadan and justifying the use of parametric tests (ANOVA). All significance values were greater than 0.05 across all variables and groups, indicating that the data followed a normal distribution.

The analysis reveals that all significance values for the four circumferences are greater than the 0.05 threshold (0.53, 0.17, 0.17, and 0.18, respectively).

There are no statistically significant differences in body circumferences between Defenders, Midfielders, and Forwards at the end of Ramadan. This indicates that the cumulative effect of fasting and training throughout the month did not lead to physical variance among players based on their positions.

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Table No. (08) Descriptive statistics and differences in (Body Mass Index, body fat percentage, muscle mass percentage, body water percentage, weight) results at the three time intervals for U-17 football players.

Variable		Min	Max	Mean	Standard Deviation (SD)	sig
BMI	*Pre-Ramadan*	17,90	23,30	19,95	1,35	0.84
	Middle of Ramadan	17,70	22,90	19,69	1,36	
	Post-Ramadan	17,80	23,40	19,74	1,59	
Body Fat%	*Pre-Ramadan*	5	10,40	6,08	1,40	0.48
	Middle of Ramadan	5	9,80	5,83	1,34	
	Post-Ramadan	5	10,60	6,47	1,99	
Muscle Mass%	*Pre-Ramadan*	52,10	56,50	54,73	1,11	0.84
	Middle of Ramadan	52,50	57,10	55,03	1,19	
	Post-Ramadan	51,50	65,50	55,09	2,99	
Body Water%	*Pre-Ramadan*	64,50	70,70	68,29	1,54	0 .71
	Middle of Ramadan	65,00	70,90	68,68	1,55	
	Post-Ramadan	64,50	70,70	68,23	2,09	
Weight kg	*Pre-Ramadan*	48,50	75,40	61,22	6,30	0.93
	Middle of Ramadan	48,80	74,10	60,94	6,49	
	Post-Ramadan	48,70	75,80	60,94	7,06	

***One-Way ANOVA ** Kruskal-Wallis Test.**

A slight and stable decrease in the mean weight was observed, from (61.22 kg) pre-Ramadan to (60.94 kg) during the middle and end of the month. This indicates a minor loss in total body weight. The Body Mass Index (BMI) followed the same pattern, decreasing from (19.95) to (19.69) and (19.74).

Regarding body fat percentage, a decrease occurred from (6.08%) before Ramadan to (5.83%) mid-Ramadan, followed by a noticeable increase to (6.47%) by the end of the month, which may suggest changes in dietary patterns as Eid approached.

Muscle mass percentage increased slightly from (54.73%) to (55.09%), indicating that the players maintained or even improved their muscle mass.

Body water percentages remained generally stable, with a slight decrease at the end compared to the middle of the month.

Although minor changes were noted in the means (weight loss and an increase in fat at the end), statistical analysis demonstrates that these changes are not statistically significant for the entire study sample. This suggests that the U-17 players successfully adapted to the requirements of Ramadan and maintained a relatively stable body composition throughout the study period**."**

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Table No. (09): Descriptive statistics and differences in of body circumference results at the four time intervals for U-17 football players.

Circumference		Min	Max	Mean	Standard Deviation (SD)	sig
Upper Arm	*Pre-Ramadan*	21	29,10	24,81	1,97	0.001 *
	Middle of Ramadan	21	28,60	24,49	1,80	
	Post-Ramadan	18,70	28,60	24,15	2,22	
Forearm	*Pre-Ramadan*	21,50	26,40	24,13	1,60	0.63**
	Middle of Ramadan	19,50	26,50	21,65	1,76	
	Post-Ramadan	19,50	26,50	22,03	1,96	
Thigh	*Pre-Ramadan*	46,50	57,40	52,32	2,96	0.69*
	Middle of Ramadan	48	57,50	52,45	2,98	
	Post-Ramadan	45,20	57,60	51,63	3,36	
Calf	*Pre-Ramadan*	30,90	38,60	34,48	2,05	0.98*
	Middle of Ramadan	31,50	39,50	34,57	1,92	
	Post-Ramadan	32	40	34,47	2,09	

***One-Way ANOVA ** Kruskal-Wallis Test.**

A slight and stable decrease in mean weight was observed, from (61.22 kg) pre-Ramadan to (60.94 kg) during the middle and end of the month, indicating a minor loss in total body weight. The Body Mass Index (BMI) followed the same pattern, decreasing from (19.95) to (19.69) and (19.74). Regarding body fat percentage, a decrease occurred from (6.08%) before Ramadan to (5.83%) mid-Ramadan, followed by a significant increase to (6.47%) by the end of the month, which may suggest dietary changes as Eid approached.

Muscle mass percentage increased slightly from (54.73%) to (55.09%), indicating that players maintained or even improved their muscle mass. Body water percentages remained generally stable, with a slight decrease at the end compared to the middle of the month. Despite minor changes in means (weight loss and increased fat at the end), statistical analysis demonstrates that these changes are not statistically significant for the entire study sample. This suggests that the U-17 players successfully adapted to the requirements of Ramadan and maintained a relatively stable body composition throughout the study period.

A continuous downward trend was noted in the mean upper arm circumference, starting at (24.81 cm) pre-Ramadan, decreasing to (24.49 cm) mid-month, and reaching (24.15 cm) by the end of the month. Forearm circumference also recorded a significant decrease between the pre-measurement (24.13 cm) and the two subsequent measurements

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(21.65 cm and 22.03 cm). Thigh and calf circumferences maintained high stability; thigh circumference hovered around (52 cm), and calf circumference stabilized at approximately (34.5 cm) throughout the measurement periods, indicating the stability of lower-limb muscle mass.

The p-value for upper arm circumference was (0.001), which is less than (0.05). This indicates statistically significant differences in upper arm circumference across the three time intervals. This decrease may be attributed to the effect of fasting on localized fat or muscle mass in the upper limbs. The results show that Ramadan did not fundamentally affect the circumferences of the lower limbs (thigh and calf) in U-17 football players, indicating the success of training loads in maintaining leg strength. However, a significant statistical effect was found only in the upper arm circumference, which recorded a continuous decrease throughout the month in this area."

8-Discussion of Results

The results showed no statistically significant differences in the primary variables (Weight, BMI, muscle mass percentage, and body water percentage) across the three time intervals. Despite the players not following any specific dietary regimen, this stability indicates the body's physiological capacity to adapt to the fasting pattern. The maintenance of muscle mass can be attributed to the effectiveness of the implemented training program. Although training loads were reduced to accommodate the specific requirements of Ramadan, they remained sufficient to preserve muscle mass and prevent catabolism. This aligns with sports science principles stating that "maintenance loads" are lower than developmental loads but are adequate to prevent physical regression.

A decrease in body fat was observed mid-Ramadan, followed by an increase at the end of the month (6.47%). Since the team did not follow a diet, this late-month increase can be explained by the traditional dietary patterns associated with the approaching Eid al-Fitr, typically characterized by higher consumption of sugars and fats. The lack of statistical significance for this increase suggests that the physical activity (the training program), even in its reduced form, helped curb excessive fat gain.

These results are consistent with the study by (Abdelmalek, (2007).), which concluded that fasting did not have a significant impact on body composition, noting slight changes that did not reach the level of statistical significance. This is further supported by the study of (Fouad, 2008) which demonstrated that anthropometric characteristics remained stable during Ramadan, provided that dietary intake and physical exertion are controlled.

Anthropometric measurements are of paramount importance due to their predictive value in determining potential performance outcomes. These measurements are considered individual characteristics that have a strong correlation with achieving elite athletic levels and providing the opportunity for excellence. (Hakim, 2021)

Regarding the playing positions, the results also showed no statistically significant differences between the various positions. This is confirmed by the study of (Akboubi Habib and others, 2015), which demonstrated that the differences between playing positions regarding body indicators were non-significant

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One of the most significant findings of this study is the stability of thigh and calf circumferences compared to the statistically significant decrease in upper arm circumference (p=0.001). Football is a sport that primarily relies on the lower limbs (running, kicking, dribbling). During Ramadan, training loads (which may be lighter than usual or focus on tactics) primarily stimulate the thigh and calf muscles to maintain their strength and volume, which explains the stability of thigh and calf circumferences. Conversely, the use of the upper limbs in training is much less, making them more susceptible to the effects of calorie deficit and loss of mass (whether fat or simple muscle mass)."

"During fasting, the body shifts to using energy stores. Initially, it uses glycogen, then begins to break down fats for energy. This shift appears to have been effective in reducing fat stores in areas less functionally utilized in football (such as the upper arm), without significantly impacting the core muscles essential for football performance (leg muscles)."

Decrease in Upper Arm Circumference is explained by the body's tendency during fasting and with reduced general training loads—to mobilize localized fat or protein from areas that are "functionally less utilized" in the specific sport (the upper limbs for football players). Since the training program reduced overall loads, the upper body muscles did not receive enough stimulation to maintain their size compared to the leg muscles, which are constantly engaged during running and technical drills.

The players' success in maintaining leg strength (stable circumferences) and water balance (68.23%) despite fasting and the absence of a diet reflects the sound planning of the Ramadan-specific training program. Reducing the loads prevented overtraining and maintained the players' hydration status, thereby preventing the muscle circumference shrinkage typically associated with fluid loss and dehydration.

9-Conclusions

The present study examined the effects of Ramadan fasting on body composition and peripheral anthropometric parameters in U17 football players, taking into account playing lines (defenders, midfielders, and forwards) across three measurement periods: pre-Ramadan, mid-Ramadan, and post-Ramadan. The findings indicate that Ramadan fasting induced only minor and transient changes in body composition variables, including body weight, body mass index, fat mass, muscle mass, and total body water, none of which reached statistical significance at the group level. This suggests that adolescent football players are generally capable of maintaining physiological stability during Ramadan when training loads are appropriately adjusted.

Across all playing positions, anthropometric measurements showed a high degree of homogeneity, with no statistically significant positional differences observed throughout the fasting period. Notably, lower-limb circumferences (thigh and calf) remained stable across all time points, highlighting the effectiveness of sport-specific training stimuli in preserving muscle mass in functionally essential areas for football performance. In contrast, a significant reduction in upper arm circumference was observed over time, indicating that morphological

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adaptations during Ramadan may preferentially affect less functionally engaged muscle groups.

Overall, the results demonstrate that Ramadan fasting does not adversely affect the body composition or anthropometric profile of U17 football players when supported by well-planned training schedules. These findings emphasize the importance of individualized monitoring and position-specific considerations during fasting periods, particularly in youth athletes undergoing growth and development. Future research should incorporate larger samples, dietary intake monitoring, and performance-related variables to further elucidate the long-term implications of Ramadan fasting on youth athletic development.

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