



The Impact of Ramadan Fasting on the Sports Activities, Diet, and Anthropometry of Basketball Players in Eastern Algeria

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ABSTRACT

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Introduction: During Ramadan, Muslims abstain from eating and drinking from sunrise to sunset. In this period, meals become exclusively nocturnal, and the traditional dishes served are often rich in fats and carbohydrates. The present study aimed to evaluate the effects of Ramadan fasting on the sports activities, diet, and anthropometry of the basketball players of the clubs of eastern Algeria.

Methods: This transversal study was conducted on 32 basketball players. Data were collected on the sports activities, diet (24-hour food recall, frequency of usual food consumption), and length of sleep using questionnaires. In addition, anthropometric measurements were performed.

Results: The basketball players trained more frequently during normal periods compared to Ramadan (4.3 ± 0.4 vs. 2.0 ± 0.1 day/week; $P < 0.001$) and hydrated in the evening during Ramadan (2.7 ± 0.7 liters/day). The contribution of carbohydrates exceeded the recommendations. A significant difference was observed in the frequency of food consumption between normal periods and Ramadan for the fruits and vegetables group ($P < 0.001$), fatty and sweet products ($P < 0.001$), and beverage group ($P < 0.01$). However, no significant difference was observed in the length of sleep between the two periods ($P = 0.621$), and the body components did not change (weight, body mass index, brachial muscle circumference, and total muscle mass).

Conclusion: According to the results, Ramadan fasting had no significant effects on the diet, sports activities, and anthropometry of the basketball players.

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Introduction

Ramadan is one of the five pillars of Islam. During this holy month, the adult Muslims who are in good health abstain from taking oral food and medications and sexual intercourse from sunrise until sunset. Ramadan fasting involves many changes in lifestyle, and the frequency of food intake reduces and becomes strictly nocturnal [1], which in turn leads to the abrupt delay of the meal schedule, affecting the circadian rhythms of the body temperature and sleep [2].

During Ramadan, the conditions to practice intense sports remain unknown. The effects of Ramadan fasting on the health and physical performance of athletes, which has attracted the attention of sports researchers since the number of Muslim athletes is on the rise in the western countries, and the requirements of modern sports have increased considerably,

relying on the constraints imposed by competitions on physical preparation and various aspects of the physical performance of athletes [3, 4]. Therefore, studies in this regard could help Muslim athletes and their coaches to prepare their matches at different times during the day and optimize the load of training.

The present study aimed to evaluate the effects of Ramadan fasting on the diet, sports activities, and anthropometry of club basketball players.

Materials and Methods

Population and Location of the Investigation

The target population of the present study was all the basketball players of the clubs in a selected region of eastern Algeria, which included 32 athletes. The investigation proceeded at the level of a training room on four passages (three passages during Ramadan and one passage after Ramadan) during June 21-July 14, 2015.

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The inclusion criteria were club basketball players and willingness to participate in the study. The athletes playing basketball for less than one year were excluded from the study.

Study Procedure

The period of this investigation was spread over four passages. The first questionnaire was specified for the first passage, which concerned the general information of the subjects and their sports activities, 24-hour food recall, frequency of usual food consumption, length of sleep, and the anthropometric indices. The 24-hour food recall and frequency of usual food consumption were combined to improve data accuracy and facilitate data interpretation [5].

The second questionnaire was applied in the last three passages, which only concerned the 24-hour food recall, length of sleep, and anthropometric measurements in addition to the frequency of usual food consumption in the last passage (after Ramadan). The general information provided an indication to determine seniority in terms of sports activities and tobacco consumption in the participants. The section of the questionnaire containing the sports activities outside and during Ramadan fasting allowed the assessment of the frequency of training and viewpoint of the athletes regarding their performance in the comparison of the fasting state, normal state, and hydration.

24-Hour Food Recall

To determine the energy and nutritional intake of the subjects, the 24-hour food recall method was used, which enable the qualitative and quantitative description of the food consumption of the athletes in the previous years. In order to specify the quantities of the consumed food, the subjects referred to the book images of the SU.VI.MAX. study [6]. The obtained food quantities were converted into quantities of nutrients using a food composition table [7].

The Frequency of Usual Food Consumption

A tabular questionnaire was used to record most of the foods that could be consumed, which were classified into six food groups, including milk and dairy products, cereals, legumes, and starchy foods, meat, fish, and eggs, fruits and vegetables, fats and sweets, and beverages. The pre-established list allowed us to determine the share of each food group in the diet of the basketball players.

Anthropometric Measurements

Weight (kg) and height (cm) were recorded for the evaluation of the body mass index (BMI). To characterize the nutritional state of the subject based on corpulence, the classification of the World Health Organization (WHO) was used [8]. Other anthropometric measurements were also carried out, including brachial circumference (BC) and triceps skinfold (TS). The measurement of the BC and TS was used to calculate the brachial muscle circumference (BMC), which allowed the estimation of the muscle mass, which represents the thin mass, protein reserves, and nutritional status.

The TS thickness represented twice the thickness of the skin and subcutaneous fat. Therefore, the part attributable to this compartment could be calculated, which was the part to be subtracted from the BC using the following formula [9]:

$$BMC (cm) = BC (cm) - [\pi \times TS (mm)]$$

The normal theoretical values of BMC were within the range of 25-27 centimeters in men, while the total muscle mass (TMM) was calculated using the following formula [10]:

$$Men: TMM (kg) = Height(m) [0,00264 + 0,0029 \times (BM-10)]$$

where BM is the brachial muscle area, which was calculated using the following formula:

$$M = BMC / 4\pi$$

Treatment and Statistical Analysis

Data analysis and processing was performed in R software version 3.2.4. The quantitative data were expressed as mean and standard deviation, and the qualitative variables were expressed as number and percentage. The statistical differences were determined using t-student and analysis of variance (ANOVA) at the significance level of 95%.

Results

Characteristics of the Subjects

In total, 32 basketball players with the mean age of 24.9±1.9 years and extreme values within the range of 21.0-29.0 years were enrolled in the study. The subjects practiced sports and were accustomed to sports training for 13.5±2.5 years (range: 7.0-19.0 years). The mean seniority relative to the current team was 3.0±1.6 years, with the minimum of 1.0 year and maximum of 8.0 years. All the subjects stated that they had no smoking habits.

Sports Activities outside and during Ramadan

Fasting Training

Table 1 shows the frequency and weekly duration of training in normal periods and during Ramadan in the basketball players. In Ramadan, training was carried out before the meal for breaking the fast (*Iftar*), and the basketball players trained more frequently

during normal periods compared to during Ramadan (P<0.001). The same finding was noted for the duration that was longer during the period outside Ramadan (P<0.001). During Ramadan, only 11 basketball players (34.4%) were satisfied with their sports performance (P=0.206).

Table 1. Frequency and duration of training outside and during the fasting month of Ramadan among basketball players

	Frequency (day/week)	Duration (hour/day)
	m ± SD	m ± SD
Normal period	4.3 ± 0.4	1.9 ± 0.2
During Ramadan	2.0 ± 0.0	1.2 ± 0.2
p	0.0000	0.0000

m: average; SD: standard deviation; p: comparison between normal period and during Ramadan

Hydration

Table 2 shows the quantity of water and frequency of water consumption during and outside Ramadan in the basketball players. According to the findings, the quantity of water

was more important during Ramadan compared to normal periods (P=0.006). On the other hand, the frequency of water consumption had no difference between these periods (P=0.274).

Table 2. Hydration in water outside and during the fasting month of Ramadan among basketball players

	Quantity (liter/day)	Frequency (times/day)
	m ± SD	m ± SD
Normal period	2.2 ± 0.7	5.9 ± 1.5
During Ramadan	2.7 ± 0.7	5.5 ± 1.4
p	0.0057	0.2741

m: average; SD: standard deviation; p: comparison between normal period and during Ramadan

Dietary Intake

Table 3 shows the results of the 24-hour food recall concerning the intake of energy, carbohydrates, fats, and proteins during the three passages for Ramadan and normal periods (passage 4). Accordingly, no significant difference was observed between the three periods during Ramadan (P=0.112). The comparison of normal periods with Ramadan

indicated that energy intake remained unchanged (P=0.227). In addition, the intake of carbohydrates, fats, and proteins had no significant differences between the three passages during Ramadan (P=0.957, P=0.947, and P=0.752, respectively) compared to normal periods (P=0.988, P=0.933, and P=0.842, respectively) (Figure 1).

Table 3. Energy intake of basketball players during the month of Ramadan and outside

	Period during Ramadan			p1	Normal period	p2
	Passage 1	Passage 2	Passage 3			
	m ± SD					
Energy intake (Kcal/day)	3079.2 ± 1134.7	2589.2 ± 946.5	2945.5 ± 755.1	0.1123	2857.5 ± 991.0	0.2266

m: average; SD: standard deviation; p1: comparison between period during Ramadan; p2: comparison between normal period and during Ramadan

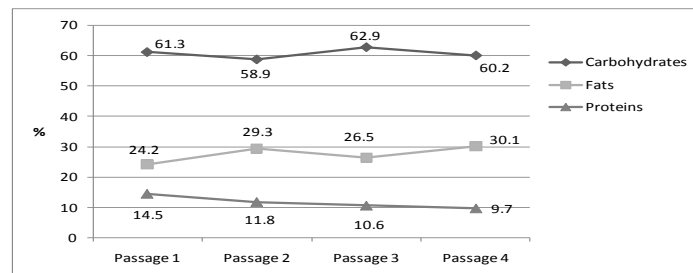


Figure 1. Passages 1-3 (during Ramadan) and Passage 4 (after Ramadan)

The Frequency of Food Consumption

The results of this section were expressed in terms of the number of the times of food consumption during normal periods and

Ramadan. Table 4 shows the differences between the two periods regarding the fruits and vegetables group ($P<0.001$), fats and sweets ($P<0.001$), and beverages ($P<0.01$).

Table 4. Frequency of food consumption outside and during the month of Ramadan fasting among basketball players

Food groups	Frequency (number of times/day)		p
	m ± SD		
	Normal period	During Ramadan	
Milk and dairy products group	4.6 ± 0.4	4.9 ± 0.8	0.0621
Group cereals, legumes and starchy foods	3.3 ± 1.2	2.8 ± 0.9	0.0637
Group meat, fish and eggs	2.6 ± 1.0	2.7 ± 0.9	0.6755
Fruit and vegetable group	2.6 ± 0.5	3.1 ± 0.4	0.0000
Fat and sweet products	2.6 ± 1.3	4.7 ± 2.7	0.0002
Beverage group	2.3 ± 0.3	2.5 ± 0.3	0.0096

m: average; SD: standard deviation; p: between normal period and during Ramadan

Length of Sleep

No significant difference was observed in the length of sleep of the basketball players during normal periods and Ramadan ($P=0.621$) (Table

5). Furthermore, the length of sleep remained unchanged between the three passages during Ramadan ($P=0.630$).

Table 5. Duration of sleep during and outside Ramadan of the basketball players

	Period during Ramadan			p1	Normal period	p2
	Passage 1	Passage 2	Passage 3			
	m ± SD					
Sleep duration	8.2 ± 1.4	8.1 ± 1.2	8.4 ± 1.3	0.6296	8.0 ± 1.1	0.6210

m: average; SD: standard deviation; p1: comparison between period during Ramadan; p2: comparison between normal period and during Ramadan

Anthropometry

Based on the weight status, two basketball players (6.3%) were thin, 17 cases (53.1%) were normal, and 13 subjects (40.6%) were overweight. The basketball players with normal

weight were predominant ($P=0.002$). The results of weight, BMI, BMC, and TMM are presented in Table 6. No significant differences were observed between the first passage and fourth passage in this regard.

Table 6. Anthropometry of basketball players during and outside Ramadan

	Period during Ramadan			p1	Normal period	p2
	Passage 1	Passage 2	Passage 3			
	m ± SD					
Weight (kg)	86.0 ± 6.0	86.2 ± 5.8	85.5 ± 5.2	0.8790	86.1 ± 4.9	0.9584
BMI (kg/m ²)	24.2 ± 1.9	24.2 ± 1.9	24.1 ± 1.8	0.9698	24.2 ± 1.6	0.9947
BMC (cm)	26.5 ± 1.7	26.5 ± 1.7	26.4 ± 1.6	0.9623	26.5 ± 1.7	0.9935
TMM (kg)	23.4 ± 1.9	23.4 ± 1.9	23.4 ± 1.8	1.0000	23.2 ± 1.9	0.9645

m: average; SD: standard deviation; BMI: Body Mass Index; BMC: Brachial Muscle Circumference; TMM: Total Muscle Mass; p1: comparison between period during Ramadan; p2: comparison between normal period and during Ramadan

Discussion

In the present study, the basketball players had seniority in the sports (7.0-19.0 years), which indicated that they started practicing sports and integrating a team since their young age. None of the subjects had smoking habits. It is well established that tobacco consumption by athletes has deleterious effects on their ability to recover from post-exercise, and nicotine and carbon monoxide play a pivotal role in this regard [11].

In total, all the basketball players (n=32) trained during the day before *Iftar* in order to spend the evening of Ramadan resting and compensate for

their energy and hydric loss by giving the digestive system time to transform the consumed food in the evening, while also fulfilling their religious duties during this crowned month of prayer and religious fervor.

According to the current research, the frequency of training during Ramadan was relatively low due to fasting and summer heat. Unfortunately, basketball games could be played at different times of the day, from the morning until night, under projectors. These moments are sometimes poorly synchronized with the optimal moments of training, which may affect athletic performance. For basketball players,

Ramadan is a period out of competition in order to avoid any decline in the physical performance during matches.

In the present study, all the basketball players hydrated by drinking more water during Ramadan compared to normal periods. The incapacity to ingest fluids during exercise may be associated with the loss of performance [12]. Ramadan fasting induces hypoglycemia, which causes hydric and electrolytic losses and deteriorates the physical performance by decreasing metabolic energy production and muscle perfusion [13].

According to the results of the present study, the energy intake of the basketball players did not decrease in any of the surveyed periods. The energy intake recommendations are 3,500 kcal/day for a male athlete while training [14]. Compared to the values obtained in the current research, the recommended intakes were far from the real reports of the surveyed subjects.

A balanced diet should provide 50-55% of carbohydrates, 25-30% of fats, and 11-15% of protein [15]. In the present study, carbohydrates provided more than 55% of the energy intake. In addition, the frequency of the consumption of sweets (especially soft drinks) was important. During Ramadan, the dietary habits of Muslims at *Iftar* are inclined toward the intake of high-carbohydrate dishes [16].

High-quality proteins are also essential to the recovery sessions of training in resistance training (or bodybuilding) and must be incorporated into the meal composition of *Iftar* [17]. The frequency of milk and dairy consumption is also important during Ramadan as these products are abundant sources of the proteins of animal origin. A balanced diet should also include the recommended amounts of fat (<30%), and the balance of fatty acids is not maintained with higher fat content than 35%, which in turn increases the risk of fat storage in the body [18,19]. In the study by El Ati et al. [20], the energy intake was reported to remain stable during Ramadan despite the decreased frequency of food intake. In the present study, no reduction was observed in the frequency of food consumption during Ramadan.

In addition to food restriction, modifications of the day cycle before sleep and social and psychological habits may cause disturbances in the rhythms of several factors (e.g., hormones and biological parameters) during Ramadan

[21]. According to Reilly and Edwards [22], the performance of athletes changed substantially due to sleep disorders. In the current research, 21 basketball players (65.6%) were not satisfied with their athletic performance probably due to sleeping late, disturbances in the rhythm of life, heat, and dehydration.

In the present study, the evaluation of the anthropometric parameters indicated no changes in the body weight, BMI, BMC, and TMM, which could be attributed to the reduced energy expenditure caused by the lack of physical activity while fasting, particularly due to the decreased load of training imposed by the coach, along with the stability of the energy intake during Ramadan. Another reason could be the fact that the mean composition before dawn (*Souhour*) was satisfactory. According to a study conducted on 10 male athletes, if strength training is performed regularly, and daily food intake, body fluid balance, and daily sleep time are maintained as before Ramadan, Ramadan fasting has no adverse effects on the body composition [23].

This preliminary study, which was performed on a small sample size, could broaden the horizons for more in-depth research in order to elucidate the adaptation mechanisms that fasting Muslim athletes could develop. It would have been interesting if our study had estimated the performance and recovery factors associated with physiological metabolism during sports competitions.

Conclusion

According to the results, the frequency and duration of training decreased during Ramadan in order to preserve the physical performance of the basketball players and avoid the risk of dehydration during the diurnal period. Our findings lay the groundwork for thorough investigations to elucidate the adaptation mechanisms that could be developed Muslim athletes during Ramadan.

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Conflicts of interest

None declared.

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