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Khelifa Fillali
Ph.D., Associate Professor in Exercise Physiology, Department of Basic Sciences, Deanship of the Common Year and Basic Sciences, Muzahimya Branch, King Saud University, Riyadh, Saudi Arabia

Corresponding Author:
Khelifa Fillali
Ph.D., Associate Professor in Exercise Physiology, Department of Basic Sciences, Deanship of the Common Year and Basic Sciences, Muzahimya Branch, King Saud University, Riyadh, Saudi Arabia

Effect of Ramadan intermittent fasting on body composition in athlete

Khelifa Fillali

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Abstract
Every year Muslims fast the holy month of Ramadan, which lasts about 30 days. This fasting may affect the athlete's body and physical fitness positively or negatively. This research aims to identify the extent of body composition changes that can occur in athlete due to Ramadan fasting, especially body weight, muscle mass, and fat mass. 10 students from the Department of Physical Education and Sports at the University of Mostaganem (Algeria) were tested before and after the fast of Ramadan. Parameters were tested one week before fasting, and one week after fasting. Results showed no significant differences between the two tests for the majority of studied parameters, except fat mass.

Keywords: Ramadan fasting, athlete, body composition, body weight

1. Introduction
The month of Ramadan is one of the most important months of the year for Muslims because of the benefits known to human body. Ramadan fasting is not a lack of food and drinks as some claim, but a reorganization of time of meals in the day; instead of consuming 3 to 4 meals a day and divided between day and night, consuming at night only 2 or 3 meals and sometimes more. Some do not stop eating all night in the form of snacks. As a result, a person can consume more food than usual. In another way, it can be said that the month of Ramadan fasting is a period of special maintenance of the human body in all its aspects (enough for a full year).
Among health benefits of Ramadan fasting in athlete:

1. It Affects the function of the heart in terms of improving the length of work during the short term, relatively improves heart rate during the rest, the recovery ability for physiological functions, and physical ability [7].
2. Physiological adaptations of endocrine and metabolic system in order to preserve the energetic efficiency during daytime [8], including lipid profile improvement [13]
3. Ramadan intermittent fasting represents an effective strategy to modify appetite-regulating hormones, leading to improved body composition indices and reduced obesity [18]
4. According Chaouachi A. *et al*., [5] the small numbers of well-controlled studies that have examined the effects of Ramadan on athletic performance suggest that few aspects of physical fitness are negatively affected, and only modest decrements are observed. In all, the majority of physical performance parameters were not influenced by Ramadan fasting. [2]

This research aims to know the extent of changes in body composition that can occur in body of athlete due to Ramadan fast.

2. Materials & Methods
2.1 Participants
10 students were randomly selected from department of physical education and sports at Mostaganem University before and after the month of Ramadan fasting. The mean data for this sample was as follows; height: 177.40 cm (168- 187), age: 21.1 years (19-24), maximal oxygen uptake, Vo2max = 2.77 l / min), and Body Surface Area: 1.81 m^2.

To eliminate all other influences, students were randomly selected from the university dormitory. Students lived in the university dormitory throughout the study period: they ate the same food and fasted the same period, which lasted from about an hour and a half before sunrise until sunset.

2.2 Procedure

The first test was one week before Ramadan. The second test was one week after Ramadan. Measurements were limited to certain morphological parameters: body weight, muscle mass and lipid mass. Measurements and tests were carried out in physiological laboratory of the department of physical education and sport, University of Mostaganem.

Body Surface Area was calculated from Du Bois formula [6]:

$$BSA = 0.007184 \times W^{0.425} \times H^{0.725} \quad (1)$$

Where W= weight and H= height

Maximal oxygen uptake was estimated using the Astrand-Rhyming sub-maximal exercise test [4]; The subject performs a physical effort by ascending and descending on the stepping box (40 centimeters height) for 5 minutes at a rhythm of 22.5 times per minute. At the end of the effort, heart rate is recorded. After this, we use Astrand Nomogram to determine the maximal oxygen consumption by reaching the two points heart rate and weight of subject to determine the estimated maximal oxygen consumption, which is multiplied by a factor according to age to correct it.

Fat mass was estimated by using body fat percentage method using Brozek *et al*. (1963) Formula [9]:

$$\% Fat = ([4.57/BD] - 4.142) \times 100 \quad (2)$$

BD = Body Density

$$BD - 1.112 - 0.00043499(SUM7) + 0.00000055(SUM7)^2 - 0.00028826 (Age) \quad (3)$$

SUM7 = chest + axilla + triceps + suprascpular + abdomen + suprailiac + thigh skinfold thickness in mm.

Skinfolds measurements are taken at 7 different sites on the body (chest, midaxillary, triceps, suprascpular, abdomen, suprailiac, and thigh) [9, 15]. Caliper used in this study: Lange.

$$\%BF = \text{fat mass weight / total body weight} \quad (4)$$

Muscle mass was determined using the anthropometric measures of girth and skinfolds [10].

$$\text{Muscle mass (g)} = H(0.0553CTG^2 + 0.0987FG^2 + 0.0331CCG^2) - 2445 \quad (5)$$

where: H = height, FG = forearm girth, CG = calf girth, CCG = corrected calf girth, TG = mid-thigh girth, CTG = corrected mid-thigh girth, ϖ = Pi.

CTG = TG - ϖ(mid-thigh skinfold/10)
CCG = CG - ϖ(calf skinfold/10)

2.3 Statistics

SPSS Version 20 (IBM Corp) was applied for data analysis.

3. Results & Discussion

Table 1: Descriptive data (mean ± SD) statistics are presented in Table

Parameter	Pre-test	Post test	Signification
Body weight (kg)	64.83± 3.18	64.66 ± 2.94	0.1
Muscle mass (kg)	27.75 ±1.19	28.402.44 ±	0.71
Muscle mass (%)	43.64 ± 2.07	44.84 ± 4.99	0.36
Fat mass (kg)	14.99± 2.74	14.89 ± 3.27	0.04
Fat mass (%)	23.06 ± 3.36	23.00 ±4.67	0.01

3.1 From the results obtained, we observe

1. Relative decrease in body weight but this difference is not statistically significant (p = 0.1).
2. Muscle mass increase (absolute (p = 0.71) and relative value (p = 0.36)) by a small percentage, but the difference is not statistically significant.
3. A statistically significant decrease in fat mass (absolute (p = 0.04) and relative value (p = 0.01)).

According Zerguini Y, *et al*., [17]. There is contradicting results in the effect of Ramadan fasting on body mass and body composition:

As Shephard, R. J. [14] and Zarrouk N, *et al*., [16] body mass remains unchanged. But it decreased at the end of Ramadan according Abedelmalek S, *et al*., [1] and Mirzaei B. *et al*., [11].

According Aloui A, *et al*., [3] body fat and body fat percentage were generally lower during Ramadan compared to before Ramadan, while lean mass was unchanged during Ramadan. Also according Norouzy A., *et al*. [12]. Ramadan fasting leads to weight loss and fat-free mass reductions. Body composition changes vary depending on age and sex.

4. Conclusions

Results indicate that Ramadan fasting affect fat mass positively that may improve body health, but not body weight, and muscle mass in athlete. This is consistent with the results of some studies and contradicts others. I think because of different food and drink intake, the level of physical activity and the environment in which we live. Results of this study may be of interest for all sports scientists and researchers. I recommend that rigorous studies should be investigated in this area taking in consideration mentioned above notes, and provide more important information.

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6. Conflict of Interest

No potential conflict of interest was reported by the author.

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