

## Effects of Ramadan Fasting on Physical Activity Level and Body Composition in Young Males

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### ARTICLE INFORMATION

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### ABSTRACT

**Purpose:** The purpose of this study was to investigate the effects of Ramadan intermittent fasting on body composition, dietary intake and physical activity level of young males. **Materials and Methods:** Thirty three healthy young males aged between 18-25 years were participated as volunteers in this study. The study focused on three periods: the week before Ramadan (BRF), the first week of Ramadan (RF-FW) and the last week of Ramadan (RF-LW). Dietary intake (caloric and liquid intake, protein, fat and carbohydrate content), body composition measurements (body mass, body fat percentage and fat free mass) were conducted during BRF and RF-LW and physical activity questionnaire was completed during each period. Paired t test and Friedman test were used for statistical analysis. **Results:** According to the statistical analyses, body mass, body fat percentage, daily caloric intake, protein and carbohydrate content of the diet were significantly ( $p<0.05$ ) reduced in Ramadan. On the contrary, no influence was seen on fat free mass, liquid intake and fat content of the diet. Moreover, there was a significant decrease ( $p<0.05$ ) in total caloric expenditure caused by physical activity during RF-FW. However, no difference was shown between BRF and RF-LW regarding to total caloric expenditure. Similar to total caloric expenditure moderate PA was also decreased in RF-FW. On the other hand, caloric expenditure caused by high intensity physical activity was significantly ( $p<0.05$ ) dropped both during RF-FW and RF-LW. **Conclusion:** Ramadan intermittent fasting was effective on body weight loss with just fat mass. Intensive physical activity patterns, total caloric intake and diet consumption except liquid and fat intake were reduced during Ramadan. As a consequence, performing moderate intensity activity during the month of Ramadan could be advised to the people, because of the beneficial effect on body composition.

### 1. Introduction

Ramadan is the ninth month of Islamic lunar calendar consisting 29-30 days. Fasting during Ramadan is one of the five pillars of Islam and more than one billion Muslim adults abstain from consuming food, fluids, medications, drugs, smoking and sexual relations between sunrise and sunset. Intermittent fasting was required which can be extended between 13 to 18h per day depending on the geographical location and season of the year [1].

Muslims responsible for fasting usually eat two main meals called iftaree, the evening meal and suhoor, the meal before dawn during the month of Ramadan. Food and fluid intake is nocturnal and only permitted between iftaree and suhoor during night. This situation leads to changes in eating habits [2-3], sleeping patterns [4-5] and lifestyles. Those changes can affect body composition [6-7], daily mode [4, 8] and athletic performance [8-9] during the month of Ramadan.

The decrease of food frequency and quantity during the month of Ramadan leads researchers to investigate the effects of Ramadan fasting on body composition. Some of the studies conducted in this context showed decrease in body weight during the month of Ramadan [10-14] whereas some others showed increase [15]. In addition to these studies, there are also several other studies that shows no difference on body weight or body composition [16-22].

Another issue of interest among researchers is the variation of physical activity level of Muslims during Ramadan. As a consequence of long fasting period and disorders of sleep patterns, it is assumed that Ramadan could affect daily routines such as physical activity habits of people. Mainly, the studies conducted on the effect of Ramadan fasting reported decrease in physical activity level [23-25]. On the other hand, there are also studies narrated no change on physical activity level as a result of Ramadan fasting [1, 26]. For instance, in the study of Lessan et al [12] significant decrease was reported in physical activity levels of non-obese individuals during the month of Ramadan. In another previous study conducted with female college students showed significant decline in body weight, body mass index and body fat percent whereas no difference was reported in physical activity level in the month of Ramadan [1].

As mentioned before the effect of Ramadan fasting on body composition and physical activity level was not clearly investigated. Therefore the purpose of this study was to investigate the effects of Ramadan intermittent fasting on body composition, dietary intake and physical activity level of young males.

## 2. Materials And Methods

### 2.1. Participants

Thirty three healthy young male [ $(\bar{X} \pm SS)$  age:  $21.85 \pm 1.87$  years; height:  $172.90 \pm 4.68$ cm; body weight:  $70.94 \pm 6.09$ kg; body fat percentage:  $13.09 \pm 4.74\%$ ] regularly fasting in Ramadan volunteered to participate in this study. Each participant provided written informed consent to participate in the study, which was approved by the Ethics Committee of Human Researches in Social Sciences.

### 2.2. Experimental Design:

After giving information about the study, body composition measurements were clarified to individuals. Participants were asked to complete the International Physical Activity Level Questionnaire (IPAQ) before Ramadan (BRF), at the first week of Ramadan (RF-FW) and the last week of Ramadan (RF-LW) to determine the physical activity (PA) level. Furthermore, body composition measurements and quantity of nutrition intake data were collected at BRF and RF-LW.

### 2.3. Anthropometric and Body Composition Measurements

Height and body weight (BW) were measured to the nearest  $\pm 0.1$ cm via a stadiometer and  $\pm 0.1$ kg via a scale (Seca 700, Germany), respectively. Body fat percentage (BF %) and fat free mass (FFM) were assessed by using bioelectrical impedance analyser (BIA) (TanitaBC-418 MA; Tanita Corp., Japan). BIA measurements were conducted following minimum eight hours of hunger. In order to standardize the measurements, participants were asked to disuse any diuretics in last seven days before the test and urinate completely within 30 minutes to test. Also they were told to refrain any physical activity in last 12 hours before the measurements [27]. Participants were allowed to wear only light shorts and t-shirts in bare foot without any jewellery while conducting body composition measurements.

### 2.4. Diet

Participants were requested to record food and fluid intake in depth for three consecutive days (two days in the weekday and one in weekend) at BRF and RF-LW [1]. Afterwards all data were saved in nutrition data system and total energy consumption was calculated from quantity of carbohydrate (CHO), protein and fat consumption [28].

### 2.5. International Physical Activity Level Questionnaire (IPAQ)

In the study, self-reported short form of IPAQ was used to estimate the physical activity level. IPAQ was shown reliable ( $r=0.72$ ;  $p<0.001$ ) and validity was between  $r=0.36$  and  $r=0.73$  ( $p<0.001$ ) for index in Turkish population [29]. The questionnaire was comprised of sections including high intensity PA, moderate PA and walking activity at least 10 minutes during the previous seven days.

Evaluation of IPAQ was done by calculating the metabolic equivalent (MET) values. The equation of frequency X intensity X time was used to calculate the data. Frequency is referred to number of activity days in a week, time is referred to minutes of activity duration and intensity is referred to MET values of the activity. Calculation of the total score in short form of IPAQ include total time and days of walking activity, moderate and high intensity PA. In the present study, 8 MET for high intensity PA, 4 MET for moderate PA and 3.3 MET for walking activity were used for calculation [30]. PA variables were converted to Kcal/week before statistical analysis.

## 2. Statistical Analysis

For descriptive statistics mean and standard deviations (SD) were calculated for all variables. Paired samples t test was used for the comparison of body composition (BW, BF% and FFM) and dietary intake (total calorie, liquid, protein, fat and CHO) variables. Friedman and Wilcoxon signed-rank tests were conducted for determination of the difference between BRF, RF-FW and RF-LW with respect to physical activity levels. Significance level of alpha was accepted as 0.05 and all analyses were performed on statistical package for the social sciences (SPSS version 20.0, SPSS Inc., Chicago, IL, USA).

## 3. Results

A total of thirty three males were participated in this study. Two participants were excluded from the statistics applied to dietary intake variables due to incomplete records.

### 3.1 Anthropometric Measurements

According to the paired t test significant reduction were determined in BW ( $t= 3.898$ ;  $p= 0.001$ ) and BF% ( $t= 4.573$ ;  $p= 0.001$ ) mean scores at RF-LW compared to BRF. However there was no significant difference between BRF and RF-LW ( $t= -0.921$ ;  $p= 0.364$ ) with respect to FFM mean scores (Table 1).

**Table 1:** Anthropometric status

Variable	BRF (mean±SD)	RF-LW (mean±SD)	T	df	P
BW (kg)	70.94 ± 6.09	70.10±5.94	3.898	32	0.001
BF%	13.09 ± 4.74	11.77±4.90	4.573	32	0.001
FFM (kg)	61.48 ± 4.25	61.69±4.51	-0.921	32	0.364

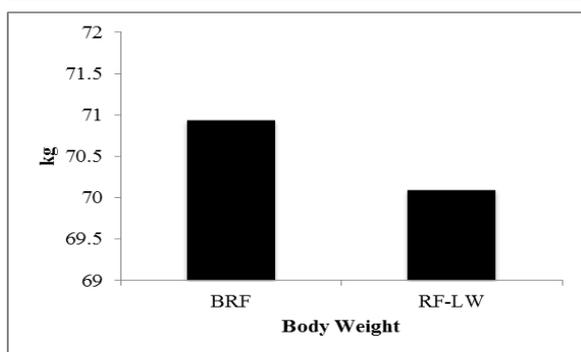


Fig 1 Variation of BW due to Ramadan fasting

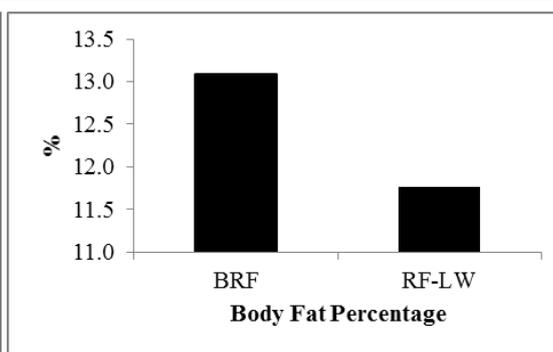


Fig 2 Variation of BF % due to Ramadan fasting

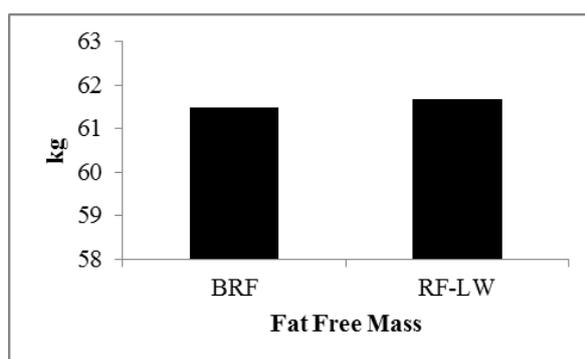


Fig 3 Variation of FFM due to Ramadan fasting

### 3.2 Dietary Variables:

According to the paired t test there was a significant drop in Total Calorie Intake ( $t= 3.093$ ;  $p= 0.004$ ), Protein ( $t= 2.570$ ;  $p= 0.015$ ) and CHO ( $t= 2.383$ ;  $p= 0.024$ ) consumption mean scores at RF-LW compared to BRF. Nevertheless, there were no significant difference between BRF and RF-LW with respect to Liquid Intake ( $t= -0.977$ ;  $p= 0.336$ ) and Fat ( $t= 1.481$ ;  $p= 0.149$ ) consumption mean scores (Table 2).

**Table 2:** Dietary information

Variable	BRF (mean±SD)	RF-LW (mean±SD)	t	df	P
<b>Total Calorie Intake (kcal/day)</b>	2595.02 ±547.90	2218.37 ±667.30	3.093	30	0.004
<b>Liquid Intake(ml/day)</b>	2701.26 ±907.31	2881.78 ±721.97	-0.977	30	0.336
<b>Protein (gr/day)</b>	109.22 ±33.24	89.02 ±32.05	2.570	30	0.015
<b>Fat (gr/day)</b>	106.36 ±29.06	96.79 ±31.60	1.481	30	0.149
<b>CHO (gr/day)</b>	333.50 ±249.68	242.03 ±92.38	2.383	30	0.024

### 3.3 Physical Activity Level

There was a statistically significant difference in high intensity PA depending on Ramadan fasting,  $\chi^2(2)=20.195$ ;  $p=0.001$ , regarding to calorie expenditure. Post hoc analysis with Wilcoxon signed-rank tests was conducted with a Bonferroni correction applied, resulting in a significance level set at  $p<0.017$ . Median (IQR) high intensive PA levels for the BRF, RF-FW and RF-LW were 2995.2, 506.4 and 519.2, respectively. There was no significant differences between RF-FW and RF-LW ( $Z=-0.016$ ;  $p=0.987$ ) in high intensity PA depending on Ramadan fasting. However, there were statistically significant reduction in high intensity PA in RF-FW ( $Z=-3.354$ ;  $p=0.001$ ) and RF-LW ( $Z=-3.939$ ;  $p=0.001$ ) compared to BRF regarding to calorie expenditure (Table 4).

Statistically significant difference was found in moderate PA depending on Ramadan intermittent fasting,  $\chi^2(2)=16.788$ ;  $p=0.001$ , regarding to calorie expenditure. Median (IQR) moderate PA levels for the BRF, RF-FW and RF-LW were 429.0, 0.0 and 0.0, respectively. There were no significant differences between the BRF and RF-LW ( $Z=-1.562$ ;  $p=0.118$ ) or between the RF-FW and RF-LW ( $Z=-1.860$ ;  $p=0.063$ ) regarding to moderate PA level depending on Ramadan fasting. However, there was a statistically significant reduction in moderate PA of RF-FW vs BRF ( $Z=-3.000$ ;  $p=0.003$ ), with respect to calorie expenditure (Table 3).

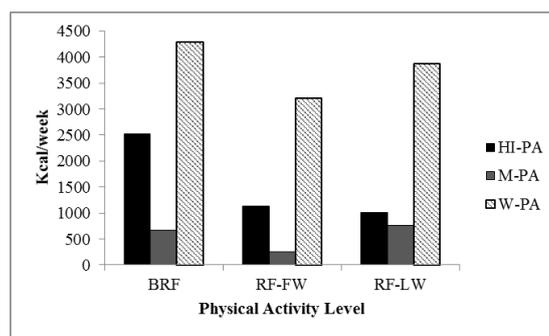
There was a statistically significant difference in amount of walking due to the Ramadan fasting,  $\chi^2(2)=7.200$ ;  $p=0.027$ . On the other hand, according to post hoc analysis no significant differences were determined between BRF, RF-FW and RF-LW in amount of walking depending on Ramadan fasting regarding to calorie expenditure (Table 3).

Statistically significant difference was found in PA level depending on Ramadan fasting,  $\chi^2(2)=13.273$ ;  $p=0.001$ , regarding to total calorie expenditure. Median (IQR) PA levels for the BRF, RF-FW and RF-LW were 6465.50, 4255.86 and 4523.42, respectively. There were no significant differences between the BRF and RF-LW ( $Z=-2.135$ ;  $p=0.033$ ) or between the RF-FW and RF-LW ( $Z=-0.491$ ;  $p=0.623$ ) regarding to PA depending on Ramadan fasting. However, there was a statistically significant decrease in PA of RF-FW compared to BRF ( $Z=-3.833$ ;  $p=0.001$ ), with respect to total calorie expenditure (Table 3).

**Table 3: Physical Activity Level**

Variable	BRF mean±SD	RF-FW mean±SD	RF-LW mean±SD	Chi-square	p
High intensity PA calorie expenditure (Kcal/week)	2519.76 ±2042.66 b, c	1136.21 ±1708.86 a	1006.84 ±1350.65 a	20.195	0.001
Moderate intensity PA calorie expenditure (Kcal/week)	669.58 ±747.80 b	249.23 ±522.26 a	761.83 ±1653.36	16.788	0.001
Walking PA calorie expenditure (Kcal/week)	4283.89 ±3941.33	3213.93 ±2280.66	3874.15 ±3320.27	7.200	0.027
Total calorie expenditure PA (Kcal/week)	7473.24 ±4637.18 b	4599.36 ±2686.61 a	5642.82 ±4237.48	13.273	0.001

a: significant different from BRF; b: significant different from RF-FW ; c: significant different from RF-LW



**Fig 4 Graphics of the variation of PA Level due to Ramadan fasting.**

#### 4. Discussion

The main findings of this study were the existence of reduction of body weight, body fat percentage, total nutrient caloric intake and physical activity level during the month of Ramadan compared to non-fasting days before Ramadan.

In the present study, body weight (Fig 1) and body fat percentage (Fig 2) of the participants were decreased significantly in the last week of Ramadan compared to pre-Ramadan period. However, no significant change was observed between the pre-Ramadan and the last week of Ramadan with respect to fat free mass (Fig 3). Most of the findings of the previous researches which investigated the effects of Ramadan fasting on body composition showed similarities with the results of the current study. A study conducted by Ziaae et al [31] with 81 university students showed a significant decrease in body weight and body mass index in the last week of Ramadan. Also Poh et al [26] investigated the effects of Ramadan fasting on body weight in 117 students aged between 10 to 13 years and reported significant body weight reduction. This reduction was %3.4 and %4.2 in males, %2.8 and %3.7 in females on the second and fourth weeks of Ramadan, respectively. However there are also some other studies which the results are not in agreement with the present study. For instance in the study of Ramadan [16] conducted on sixteen healthy men no significant changes were investigated on body weight and body composition due to fasting in the month of Ramadan. In the specified study the month of Ramadan came across to winter season when the fasting period was short. Thereby, because of short fasting period notable changes may not be occurred in eating habits, thus the body weight of individuals has not changed. Contrarily to the present study, Frost & Pirani [15] reported significant increase in body weight and energy intake during Ramadan. The possible explanation for the increment of body weight might be the cultural eating habits that affect the type and amount of food consumption.

Similar to other studies [24, 26], in current study a significant decrease in total calorie intake, protein and carbohydrate consumption was observed in the last week of Ramadan compared to pre-Ramadan. However, no significant difference was found in fat consumption and fluid intake. Depending on the prolongation of the fasting duration, individuals may prefer to eat fatty foods to be satiated for longer time periods. Moreover, Ramadan may have caused people to consume more water trying to cope with thirst due to the fact that the time of Ramadan coincides with the summer season and the long fasting period.

Another subject of the current study was the examination of the physical activity levels in the holy month of Ramadan. In this respect, short form of International Physical Activity Level Questionnaire related to sports was used to asses PA level of participants in Ramadan. Significant reduction was determined in high intensity PA, moderate intensity PA and total calorie expenditure in Ramadan. It is well known that Ramadan caused night sleep pattern disturbances, daytime sleepiness and changes in daily habits [32]. In the present study moderate PA was decreased in the first week of Ramadan and then increased again in the last week of Ramadan. Only, high intensity PA values were decreased throughout all Ramadan period (Fig 4). This might be an indication that people have been adapted to fasting

in the last weeks of Ramadan and kept on doing low and moderate intensity PA. Therefore, this might be the reason why there is no loss on muscle mass while body weights of individuals were dropping down.

Some previous studies in literature are in agreement with the present study with regard to participation in physical activity during Ramadan. In one of those studies 117 students were asked to record their daily dietary intake and physical activity layout in pre-Ramadan and in the third week of Ramadan. Fat and CHO consumption and total energy intake was significantly decreased in all participants. Significant drop in moderate intensity PA was observed in boys. Although it was not significant, similar reduction in physical activity was seen also in girls [26]. In another study, Bahammam [24] specified expressive drop in the percentage of students who participated twice or more exercise sessions in the week before Ramadan from 24% to 7% in first week, 9% in second week and 5% in third week of Ramadan in 56 medical undergraduates. Moreover, in the study of Soh et al [25] physical activity level of 54 Malesian women aged between 22 to 55 years were followed with pedometer during five consecutive days in a week in the non-fasting month before Ramadan, second and third weeks of Ramadan and in the month after Ramadan. Following the analyses significant reduction was observed in mean step numbers (6.716 vs 5.829). Furthermore 79.6% of participants were noted that they had poor self-motivation to join in any physical activity.

During Ramadan, people get up early before the sunrise to eat Sahure or stay awake until the sunrise. As a result of this they can suffer from insomnia within the day leading to poor mood. Roky et al [4-5] advocated that the reason of performance decline during Ramadan was associated with poor mood. Thereby, the reason for the decrease in physical activity in the current study may be due to decrease of daily mood related to changing sleeping patterns, so that participants may not have claim to perform physical activity during Ramadan.

Consequently, it was observed that individuals lost body weight during Ramadan due to the low caloric intake related to decreased quantity and amount of meal. Body weight reduction was realized by decrease in fat mass. Participants refrained from performing high intensity PA during the month Ramadan due to fasting. On the other hand whereas significant decline was seen in the first week of Ramadan they started to continue to perform moderate intensity PA in the last week of Ramadan. This situation prevented the reduction of fat free mass by saving muscle mass and exposed to body weight reduction depending on decrease with just fat mass. As a consequence, performing moderate intensity activity during the month of Ramadan could be advised to the people, because of the beneficial effect on body composition.

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