

Effect of Ramadan Fasting on Body Composition and Dietary Intake: A Prospective Study in the State of Qatar

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Abstract

There were significant reductions in weight, BMI, Fat mass, Fat-free mass in most of participants ($P < 0.05$). Fat mass reduced in more than half of participants, ranging from 4.3% to 6.7% from baseline, while, non-significant reduction in muscle mass was reported. Waist and hip circumferences insignificantly decreased in most participants. Dietary intake of most nutrients except protein including fat, saturated fat, fiber, sodium, and calcium was significantly increased during Ramadan fasting in most of participants. On the other hand, significant reduction in carbohydrate intake (25%) and total energy consumption (10%) was reported ($P < 0.05$).

Ramadan fasting leads to weight loss and body composition also changes including fat mass and fat-free mass reductions. Dietary intake varies depending on age, sex, culture, and dietary behaviour of participants.

Keywords: Anthropometry; Body analyser; Body composition; Nutritional assessment; Ramadan; Fasting

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Introduction

Ramadan is the holiest month in the Islamic calendar [1]. Muslims abstain from all intakes of food, water, beverages and smoking from approximately one hour before sunrise till sunset, from 8 to 18 hours for 29-30 days. The period of fasting may vary depending on the geographical location of the country and the season of the year. During Ramadan fasting, the food frequency, quantity, sleeps duration at night, as well as exercise is reduced, and the consumption of food and liquids are mainly nocturnal. Food habits, during Ramadan and the proportion of macronutrients and energy consumption can differ, as well, quality of ingested nutrients and tendency to consume foods and drinks that are richer in carbohydrates than those consumed during other months of the year. Previous studies demonstrated that macronutrient and micronutrient intake during Ramadan are changed but some are not different compared with non-Ramadan period [2-7]. In the recent years, several studies have examined the effects of fasting on health and disease [8-13]. However, few studies have been conducted on healthy nutrition and dietary intake in fasting people. Al-Hourani et al. found that energy and macronutrients intake of 22 people did not change significantly during Ramadan fasting [6]. Besides that, Ati et al. reported that energy macronutrient intake remained unchanged in fasting people [13-15]. A study indicated that diet diversity and

food consumption in Iranian fasting people were significantly different from the recommended values [16]. It seems that reduction in each food group may diminish the dietary intake of some nutrients. Therefore, one of the aims of this study is to investigate the nutrient intake of fasting people with reference to Daily Values (DVs). Dietary habits and lifestyle are changed during Ramadan, consumption one large meal after sunset and one lighter meal before dawn is the most common practice [17]. Special festive foods that are richer in fat, protein and sugar may be consumed more [18].

In Arabian Gulf countries during the month of Ramadan, Muslim people usually go for very high calorie food; they neither diet nor exercise and they sleep and work for less hours [19-23]. Despite the large number of Muslims worldwide, there is lack of data on their food intake in Ramadan, to the best of our knowledge, we are not aware of any previous published reports on the effect of Ramadan fasting on the subject's food intake in this region. Therefore, the present study was undertaken at Hamad Medical

Corporation (HMC) to evaluate the effect of Ramadan fasting on dietary intake in diabetic and non-diabetic patients attending dietetics clinics at AL-Khor hospital in the state of Qatar. Nutrients intake was analyzed and compared the daily intake with DVs to determine the percentage of each nutrient [24].

Body weight, height, waist, and hip circumferences were measured; Body Mass Index (BMI), Waist Hip Ratio (WHR), and Waist Height Ratio (Wht.R) were calculated. Fat mass, fat-free mass, muscle mass and percentage body fat were assessed by body analyzer for fasted participants between sunrise and sunset for at least 20 days. Measurements were taken before, during and after Ramadan. Energy and macronutrient intakes were assessed using a 24 hour recall through face-to-face interview of participants in each stage.

Materials and Methods

This was a prospective observational study that was conducted among Muslim type 2 diabetic and non-diabetic patients above 18 years of age, with no chronic diseases e.g.: Renal, liver or thyroid disease. Moreover, the women were not pregnant, lactating or receiving contraceptives following the dietetics clinics at AL-Khor hospital – Hamad Medical Corporation-Qatar in holly Ramadan from May 2019 to June 2019. Of the total 95 eligible participants, 92 (96.7%) (62 males and 30 females) with (M/F ratio 2: 1) agreed and gave their consent to take part in this study. This study was approved by the Ethical Committee and IRB from Medical Research Center MRC in Hamad Medical Corporation (protocol No.MRC-01-18-083) before commencing data collection. Three female patients were excluded from the study because they got pregnancy. The sample size was calculated according to a power of 80% and a confidence level of 95%.

Data collection methods

Qualified clinical dietitians were assigned to administer the questionnaires and perform anthropometric measurements. A standardized questionnaire-based face-to-face interview was conducted by the clinical dietitians for each participant. The questionnaire was composed of: (a) sociodemographic data such as age, sex, nationality, marital status, education level, occupation and medical history. (b) Anthropometric data such as height, weight, BMI, waist circumference hip circumference, Waist Hip Ratio (WHR), and Waist Height Ratio (Wht.R) (c) Body composition such as fat mass, % fat mass, muscle mass, % muscle mass, fat free mass, % fat free mass and body water. Data related to anthropometry based on actual measurements, all these data were done over three stages of the study: Before, during and after Ramadan fasting.

Anthropometric measurements

Height was measured in centimeters using electronic height scale (SECA, Germany) while the patient was standing bare feet and with normal straight posture. Weight was measured in kilograms using a weight scale (SECA), (BMI) was calculated as the ratio of weight (kg) to the square of height (m). A person was considered obese if the BMI value was at least 30 kg/m² and overweight if BMI was greater than 25 kg/m² and less than 30 kg/m² [25-

27]. Waist Circumference (WC) was measured midway between the lower rib margin and the iliac crest. Body composition was determined based on actual measurements by a medical body composition Analyzer Seca mBCA514 (Germany) including Fat Mass (FM), Muscle Mass (MM), Fat Free Mass (FFM) and Total Body Water (TBW). The analysis was performed each time under standardized conditions i.e, 2 hours fasting and no intense physical exercise 12 hours prior to the test. Nutrient intake using 24-hour recall in the three stages of the study one week prior the study (Before-Ramadan), after two weeks of fasting (During-Ramadan) and one week later (after-Ramadan) through face-to-face interview with each participant. Food quantities were explained using household measurements (slice, plates, glass, spoons, cups, etc.) and food models to get the correct quantities of each food item consumed. All the food recalls were reviewed by clinical dietitians and nutrient analysis was carried out using My Net Diary 2019.

Statistical analysis

Data were entered and analyzed using SPSS version 21 (IBM Corp., Armonk, New York, USA). The nominal or ordinal variables were reported as proportions, and the numerical variables were reported as mean values and standard deviations or medians with minimum and maximum values. The numerical variables that were measured at, before, during and after Ramadan were compared using paired t tests for normal data distribution (parametric analysis). For the abnormal data distribution, the Wil-coxon test was used as the non-parametric analysis. Unpaired t tests, one-way Analysis of Variance (ANOVA) and repeated ANOVA were used for two independent, K-independent and K-dependent sample analyses, re-spectively. Statistical significance was associated with a P value below 0.05.

Results

The participants' age range was 21-64 years and the mean age was 42.0 ± 9.5 years old. Most of the participants (70.4%) were at middle-aged. Two third of participants, 62 (67.4%) were males and 30 (32.6%) were females. Male participants were significantly older than female (43.66 ± 16.1 vs. 39.00 ± 14.5, respectively). Overall, about three-third of the participants were non-Qatari, with significantly higher proportion among male participants as compared with female participants (males: 93.7% non-Qatari and 6.3% Qatari, whereas females: 66.7% non-Qatari and 33.3% Qatari). In addition, about three quarters of the participants were married and three fourth of them were at secondary or above level of education. The mean weight of participants was 82.61 ± 11.25 kilograms. Almost three fourth of participants were overweight or obese (76.3%). Based on the measurement, the mean of the BMIs of the subjects was 30.05 ± 3.96 kg/m², and the mean of the WHR and Wht.R was (0.92 ± 0.06 and 0.58 ± 0.21) respectively.

Effect of Ramadan fasting on daily energy and nutrients intake of participants is shown in **Table 1**. There was a significant decrease in the total energy consumption and carbohydrates intake. Total fat, saturated fat, fiber, sodium, and calcium intake were significantly increased during Ramadan fasting (P<0.05), while

protein intake slightly increased but this change did not reach significance level ($P>0.05$).

Nutrient	Before Ramadan	After Ramadan
	(BR)	(AR)
	Mean \pm SD	Mean \pm SD
Energy (Kcal)	2402.46 \pm 708.28	2159.14 \pm 398.73
Carbs (gm)	382 \pm 98.41	285.67 \pm 59.87
Proten (gm)	84.85 \pm 22.96	85.5 \pm 24.57
Fat (gm)	59.82 \pm 13.53	75.28 \pm 17.80
Sat.fat (gm)	8.94 \pm 9.60	11.20 \pm 7.25
Fiber (gm)	15.49 \pm 10.95	22.85 \pm 9.80
Sodium (mg)	1690.85 \pm 788.49	2000.75 \pm 679.20
Calcium (mg)	957.53 \pm 500.48	1538.39 \pm 645.24

Table 1: Effect of Ramadan fasting on daily energy and nutrients intake in participants (n=92).

Our findings indicated that significant reduction of energy and carbohydrates intake by (10% and 25%) during Ramadan fasting respectively. On the other hand, fat, saturated fat, fibre, sodium and calcium intake were significantly increased by (18.3%-60%) because of Ramadan fasting, while protein intake was insignificantly increased by (1%) only (**Figure 1**). Our findings indicated that macronutrients intake including carbohydrate and protein before Ramadan fasting was higher than the recommended values, while fat, dietary fibre, sodium, and calcium were lower than the recommended amounts (**Table 2**).

Nutrients	Daily intake	Daily value	%
Carbohydrate (g)	382	300	127.3
Protein(g)	84.8	50	169
Fat(g)	59.8	65	92
Dietary fiber(g)	15.5	25	62
Sodium(mg)	1690	2400	70.4
Calcium (mg)	957	1000	95.7

Table 2: Daily nutrients intake in participants.

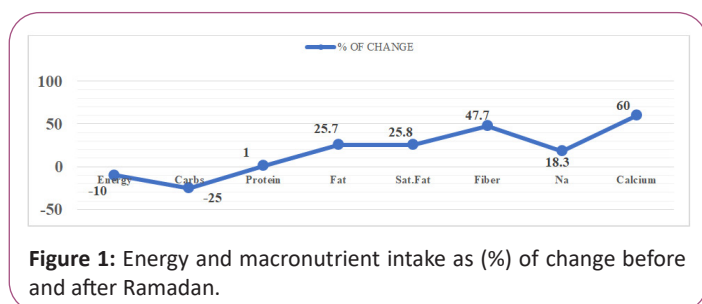


Figure 1: Energy and macronutrient intake as (%) of change before and after Ramadan.

Anthropometric and body composition changes during Ramadan fasting

Anthropometric measurements and body composition before, and after Ramadan fasting are presented in **Table 3**. Weight, Body Mass Index (BMI), Waist-Circumference (WC), Hip-Circumference (HC) were significantly decreased during Ramadan fasting. Waist Hip Ratio (WHR) and Waist Height Ratio (WHtR) also decreased but was not statistically significant ($P>0.05$). Body composition measurements including Fat Mass (FM), Fat Free Mass (FFM) was

significantly reduced, while Muscle Mass (MM) reduction was not reached the significant level after Ramadan fasting.

	Before Ramadan (BR)	After Ramadan
	(BR)	(AR)
	Mean \pm SD	Mean \pm SD
Weight (kg)	84.80 \pm 18.89	83.17 \pm 18.39
BMI (kg/m ²)	30.21 \pm 5.75	28.38 \pm 5.66
Waist Circumference (WC) (cm)	94.69 \pm 1.84	93.04 \pm 15.05
Hip circumference (HC) (cm)	105.01 \pm 13.01	103.20 \pm 13.15
Waist-Hip Ratio (WHR)	0.95 \pm 0.06	0.94 \pm 0.03
Waist-Height Ratio (WHR)	0.57 \pm 0.09	0.548 \pm 0.09
Fat Mass (FM) (kg)	27.93 \pm 10.58	26.19 \pm 10.89
Fat Free Mass (FFM) (kg)	53.12 \pm 11.14	52.06 \pm 11.12
Muscle Mass (MM) (kg)	25.26 \pm 5.45	24.62 \pm 5.69

Discussion

During the Ramadan fast, Muslims eat two meals a day, one before the sunrise and the other shortly after sunset. During Ramadan, most Muslims change their lifestyle [28], sleep hours [29], physical activities [30], food consumption, frequency of meals, and dietary patterns for different reasons [31]. The general opinion is that fasting has a potential non-pharmacological intervention for improving health and increasing longevity [32]. While religious fasting is often a time of great spiritual growth, it can also be a time of great improvement to one's physical health. Previous research indicated that a significant reduction was found in total body weight despite insignificant changes in the total energy intake. This weight loss is partly attributed to efficient utilization of body fat during Ramadan fasting.

In this study, total energy intake was significantly decreased during Ramadan periods; this observation was consistent with many studies [33-36]. Our findings indicated that macronutrients intake including carbohydrate and protein before Ramadan fasting was higher than the recommended values (127.3% and 169%) respectively, a significant reduction of carbohydrates intake (25%) during Ramadan fasting was reported by this study, while fat, dietary fiber, sodium and calcium intake were lower than the recommended amounts before Ramadan fasting, these nutrients intake was significantly increased after Ramadan fasting while protein intake was insignificantly increased by (1%) only, these observations were consistent with many studies [37-39], and it can probably be attributed to the unique food habits peculiar to different Islamic countries, as well meals are exclusively nocturnal and less frequent, and consequently, this may affect energy and nutrient intake.

Weight and body composition changes during and after Ramadan fasting

Our study reported that Ramadan fasting can decrease body fat without the loss of muscle mass. This could be significant for

addressing the safety and benefit of Ramadan fasting and could be considered a rule of fasting for a patient with a metabolic disturbance, i.e. diabetic patients. Our study findings indicated Ramadan fasting affected body weight, BMI, and body fat percentage. This study showed a significant weight reduction with Ramadan fasting, which was consistent with findings of other Studies [33,34,37-41]. It has been suggested that this decrease in body weight could be attributed to a decrease in fluid intake [34,41] and to decrease in glycogen-bound water stores [42]. Regarding body composition changes, in the present study, we found that, lost a significant amount of fat mass and fat free mass during Ramadan, these changes could be attributed to changes in total energy and macronutrient intake. The reduction in fat-free mass during Ramadan may also be attributed to an increased rate of protein breakdown in relation to protein synthesis in the post absorptive state leading to loss of lean tissue [43]. In our study, fat component contributing the greatest proportion of weight loss, this finding is consistent with Hosseini et al. [41] and Sadiya et al. [3], who reported a significant decrease only in body fat. In this study, we found a non-significant decrease in WHR, WHtR and muscle mass. The insignificance of muscle mass loss in our study was consistent with the findings of other researchers. These findings suggest that in Ramadan fasting, the body metabolism is switched to li-polysis but not gluconeogenesis. A decrease in body fat, especially visceral body fat, is beneficial, as an increase in abdominal adipose tissue confers an independent risk of cardiometabolic and cerebrovascular disease.

Conclusion

The findings of this study show that Ramadan fasting has some positive effects outcomes on body weight and composition including fat mass and fat-free mass in a healthy Muslim population. However, one should consider limitations of this study while interpreting the results. In future, further researches are required to determine whether these changes are long-lasting and should be updated to increase the number of participants. More investigations are necessary to show sustainability of this positive effect. Also, it is necessary to show the effect of Ramadan fasting on health outcomes in people with chronic conditions, especially diabetes and obesity.

Conflict of Interest

The authors declare that they have no competing interests.

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