

ORIGINAL ARTICLE

Anthropometric Index and Diet Pattern of Fasting Men in Khvormuj

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ABSTRACT

Background: In the month of Ramadan, the type and amount of received food, sleep patterns, and fluid intake change which could have various effects on people's health status. To design a proper diet pattern during Ramadan, the exact changes in dietary pattern should be investigated. We aimed to determine the anthropometric index and food pattern after Ramadan of fasting men in Khvormuj.

Methods: We included 70 men who decided to fast in the whole month of Ramadan were selected from those who referred to the mosques of Khvormuj to pray before Ramadan. To determine their diet status, the 24-hour dietary recall questionnaire for three days before Ramadan and three days after Ramadan was applied. Their body mass index (BMI) and waist circumference (WC) were measured before and after Ramadan. In order to analyze the diet pattern, NUT4 software and for statistical analysis, SPSS 16 software were used.

Results: Mean weights and BMIs of participants before Ramadan were 73.58 ± 11.06 kg, and 23.84 ± 3.51 kg/m², respectively which reduced to 72.53 ± 11.01 kg, and 23.50 ± 3.46 kg/m² after Ramadan (both $P < 0.001$). The mean WC decreased from 89.45 ± 10.46 cm to 88.60 ± 10.66 cm ($P = 0.004$). Mean calorie intake decreased from 2758 ± 547 to 2575 ± 587 Kcal ($P = 0.16$). Also, mean values of protein, fat, and oil decreased and the higher percentage of the total food was obtained from carbohydrates ($P = 0.001$). There were significant changes in consumption pattern of most vitamins and minerals.

Conclusion: The changes in the dietary pattern indicate the necessity of educating people about the food groups to prevent overeating.

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Introduction

Ramadan is the holiest month for Muslims around the world, and they fast as a religious obligation and abstain from eating, drinking, smoking, oral drug intake, and sexual intercourse from dawn to dusk (1). People usually work less and relax more, and the time and pattern of foods and sleep change, thus, Ramadan changes the whole lifestyle of Muslims in one month (2). These changes cause Ramadan fasting to have

significant medical and physiological effects on the body. Previous studies have reported weight loss during Ramadan (3), while it may be soon regained few weeks after Ramadan (3-5). Also, serum levels of glucose have been reported to decrease in most studies (6), although the changes in lipid profile after Ramadan, than pre-Ramadan values, are controversial; some studies have reported decrease in total cholesterol and triglyceride (7-9), while some other studies have

reported no significant change in the serum values of total cholesterol and triglyceride (6, 10, 11).

On the other hand, Ramadan fasting is associated with some complications, such as decreased sleep quality, as well as gastrointestinal complications after meals, including thirst, hunger, bloating, abdominal fullness, constipation, and heartburn (12). Moreover, it has been observed that Ramadan fasting has some deteriorating effects in some patients, such as those suffering from diabetes mellitus, anemia, and cardiac diseases, who should take the suggested precautions for fasting in Ramadan (13, 14).

An important aspect of Ramadan fasting is the change in the type of food that fasting Muslims take that has been identified as the healthiest dietary among 4 conventional diets (15). A Tunisian study has reported consumption of greater amounts of proteins, cholesterol, vitamin E, and polyunsaturated fatty acids during Ramadan (10). Another study has also reported increased consumption of carbohydrates and proteins, decreased fat consumption, and no changes in caloric intake (16). An Indian study on diabetic patients has reported decreases in all food elements (17). Some researchers have hypothesized that the daily energy intakes seem to be less than the expenditures during Ramadan (18, 19). These differences are due to the fact that the dietary habits during Ramadan significantly differ among different Islamic populations. As few studies have focused on the details of food pattern of Iranian Muslims during Ramadan (20), it is necessary to study the details of the change in food patterns in Iranian population, as a Muslim country, where a large population fast during Ramadan. Therefore, the present study aimed to determine the anthropometric index and food pattern after Ramadan in fasting men in Khvormuj.

Materials and Methods

Study Design

The study population consisted of men who went to the mosques of Khvormuj city to pray before Ramadan. The protocol of the study was approved by Ethic committee of Shiraz University of Medical Sciences. The sample size was calculated to be 63 participants by NCSS software considering α to be 0.5, and power of 80% and mean difference of 3.5 ± 0.7 through the

formula:

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2 sd^2}{(\mu_a - \mu_b)^2}$$

Considering 10% lost to follow-up, the final sample size was considered to be 70 individuals. Inclusion criteria consisted of male gender, aged 15-55 years old, who referred to the mosques of Khvormuj city to pray before Ramadan 2014 and decided to fast in the whole month of Ramadan, and had no history of severe or chronic diseases, such as diabetes, hepatorenal diseases, and cancer.

Khvormuj city is the capital of Dashti County, Bushehr Province, Iran, with an estimated population of 4000 residents. The mosques were selected randomly among 20 mosques of Khvormuj city and participants were selected by simple randomization from men who referred to these mosques during May-June 2014. Before recruitment of participants, the study objectives were explained to participants and written informed consent was obtained from them. Any patient who failed to complete the 30 days fasting or did not refer for the post-Ramadan measurements and assessments were excluded from analysis.

In order to determine the dietary habit of participants, the 24 hours' dietary recall questionnaire was completed for three days before Ramadan and three days after Ramadan. Also, their body mass index (BMI), and waist circumference (WC) were measured before and after Ramadan. At the time of enrolling participants into the study, the questionnaires were given to participants and necessary explanations were provided to them, and the second questionnaires were given to them to be completed in the three final days of Ramadan. Also, measurements, which were all performed by one expert, was performed once before Ramadan (at the time of patient enrollment) and the contact information of the participants were recorded and after Ramadan, they were called to determine whether they have completed the 30-day fasting and if so, they were asked to come for post-Ramadan measurements and handing the diet recall questionnaires (the last week of Ramadan, June-July 2014).

Weight of participants were measured by spring scale (Camry Co, China) without shoes and with minimum clothes and height of the

participants were measured by a wall meter without shoes. BMI was calculated as dividing the participant's weight in kilogram by the squared height of the participant in meter; a BMI of $<18.49 \text{ kg/m}^2$ was considered underweight, $18.5\text{-}24.9 \text{ kg/m}^2$ was considered normal weight, $>25 \text{ kg/m}^2$ was considered overweight and obese. WC of the participants was also measured by a non-stretchable meter as the greatest waist circumference on umbilicus.

The mean \pm standard deviation (SD) of values before and after Ramadan were compared using paired samples T test. In order to analyze the 24-hr recall questionnaire, NUT4 software and the food pyramid were used and for statistical analysis, SPSS software version 16 was used. P values less than 0.05 were considered statistically significant.

Results

Among 70 participants who entered the study, 67 participants completed the study protocol (due to lack of referring for follow-up) and entered the analysis.

Mean \pm SD of age of participants was 35.89 ± 11.1 years. Regarding BMI categories, before Ramadan, 5.5% were underweight, 61.6% had normal weight, and 32.9% were obese/overweight, while these percentages changed to 8.2%, 64.4%, and 27.4%, respectively, after Ramadan. Mean \pm SD of weight and BMI of participants before Ramadan was $73.58 \pm 11.06 \text{ kg}$, and $23.84 \pm 3.51 \text{ kg/m}^2$, respectively, which decreased to $72.53 \pm 11.01 \text{ kg}$, and $23.50 \pm 3.46 \text{ kg/m}^2$, respectively (both $P < 0.001$). Mean WC was $89.45 \pm 10.46 \text{ cm}$ before Ramadan that decreased to $88.60 \pm 10.66 \text{ cm}$ after Ramadan ($P = 0.004$).

Mean calorie intake was $2758 \pm 547 \text{ Kcal}$ before

Ramadan that reduced to $2575 \pm 587 \text{ Kcal}$ after Ramadan ($P = 0.16$). Mean \pm SD of food pyramid and macronutrients are demonstrated in table 1 which shows that the intake of fruits decreased, while that of the grains increased after Ramadan (both $P < 0.001$). Also, macronutrients significantly changed after Ramadan and mean values of Protein, fat, and oil decreased. Regarding the percentage of the macronutrient from the total food, the percentage of carbohydrates increased ($P = 0.001$), while the percentage of protein, and fat from the total food decreased after Ramadan (both $P = 0.01$, table 1).

Table 2 demonstrates the different categories of carbohydrates and fats used before and after Ramadan, which indicates significant increase in fibers ($P < 0.001$), sugar ($P = 0.013$), and sucrose ($P < 0.001$) and significant decrease in glucose, and galactose (both $P < 0.001$), as well as significant increase in cholesterol, and significant decrease in (un) saturated fats ($P < 0.001$), and oleic acid ($P = 0.012$), while the increase in linoleic acid was not statistically significant ($P = 0.725$, table 2).

The details of vitamin and minerals are shown in table 3 that indicates statistically significant changes in most vitamins, such as significant decrease in vitamin E, riboflavin, thiamin, folate (all $P < 0.001$), cobalamin ($P = 0.013$), niacin ($P = 0.021$), and vitamin K ($P = 0.007$), and significant increase in pyridoxine ($P = 0.031$), vitamin D ($P = 0.001$), beta-carotene, and vitamin C (both $P < 0.001$), as well as statistically significant changes in most minerals, such as significant decrease in calcium, phosphorus, copper, sodium, iron (all $P < 0.001$), zinc ($P = 0.001$), and manganese ($P = 0.002$), and significant increase in potassium ($P < 0.001$, table 3).

Table 1: Mean \pm SD of food pyramid and macronutrients before and after Ramadan

Variables		Before Ramadan	After Ramadan	p-value
Elements of the food pyramid (Serv/d)	Milk and dairy	0.57 \pm 0.53	0.46 \pm 0.47	0.117
	Vegetables	1.20 \pm 0.86	1.30 \pm 1.00	0.583
	Fruits	5.33 \pm 5.04	9.05 \pm 5.21	<0.001
	Grains	17.32 \pm 3.27	13.52 \pm 3.73	<0.001
	Meat	3.72 \pm 2.08	3.60 \pm 1.52	0.695
	Oil	17.58 \pm 2.90	15.09 \pm 1.54	<0.001
Macronutrients (g/d)	Carbohydrate	399 \pm 108	401 \pm 128	0.860
	Protein	78.70 \pm 20.71	68.97 \pm 19.25	0.001
	Fat	97.16 \pm 15.82	83.08 \pm 8.53	<0.001
Percentage of the consumed macronutrients from the total food (%)	Carbohydrate	56.67 \pm 5.72	59.71 \pm 6.99	0.001
	Protein	11.32 \pm 2.19	10.49 \pm 1.99	0.015
	Fat	31.90 \pm 5.19	29.71 \pm 6.87	0.010

Table 2: Mean±SD of different categories of carbohydrates and fats used before and after Ramadan

Variables		Before Ramadan	After Ramadan	p-value
Carbohydrates (g/d)	Food fiber	20.80±9.98	24.23±9.60	0.013
	Insoluble fiber	6.26±6.89	11.02±7.24	<0.001
	Soluble fiber	1.55±1.70	2.75±1.80	<0.001
	Glucose	11.24±6.46	8.09±3.78	<0.001
	Maltose	1.76±1.66	1.31±0.89	0.037
	Sugar	123±85.57	156±82.79	0.013
	Galactose	2.05±1.97	1.20±1.54	<0.001
	Sucrose	64.46±56.76	91.24±56.34	<0.001
Fats (g/d)	Cholesterol	122±59.75	246±139.52	<0.001
	Mono-unsaturated fat	38.58±5.84	34.30±2.56	<0.001
	poly-unsaturated fat	31.34±5.00	29.06±2.35	<0.001
	Oleic acid	34.58±5.04	32.88±2.08	0.012
	Linoleic acid	35.28±71.40	38.54±49.32	0.725
	Saturated fat	19.70±5.37	13.22±3.51	<0.001

Table 3: Mean±SD of micronutrients' values before and after Ramadan

Variables		Before Ramadan	After Ramadan	p-value	
Vitamins	Vitamin A (mcg/d)	452±280	519±276	0.148	
	Vitamin E (mg/d)	4.72±3.20	2.80±2.44	<0.001	
	Riboflavin (mg/d)	1.87±0.51	1.30±0.42	<0.001	
	Pyridoxine (mg/d)	1.45±0.45	1.61±0.48	0.031	
	Cobalamin (mcg/d)	2.12±2.25	1.43±0.71	0.013	
	Vitamin D (IU/d)	12±0.35	40±0.78	0.001	
	Beta-carotene (mcg/d)	55.75±105.14	209±240.25	<0.001	
	Thiamin (mg/d)	2.14±0.50	1.71±0.45	<0.001	
	Niacin (mg/d)	26.18±7.03	23.78±6.52	0.021	
	Folate (mcg/d)	222±60.86	160±56.14	<0.001	
	Vitamin C (mg/d)	33.46±23.23	64.01±44.16	<0.001	
	Vitamin K (mcg/d)	56.28±44.53	38.32±36.55	0.007	
	Minerals	Potassium (mg/d)	2643±1055	3014±1059	0.010
		Calcium (mg/d)	859±264	600±224	<0.001
Phosphorus (mg/d)		1149±326	909±262	<0.001	
Copper (mg/d)		1.45±0.40	1.25±0.35	<0.001	
Sodium (mg/d)		1971±530	1096±452	<0.001	
Iron (mg/d)		17.63±3.76	14.64±3.62	<0.001	
Magnesium (mg/d)		314±101	301±94	0.359	
Zinc (mg/d)		9.38±2.68	8.04±2.24	0.001	
Manganese (mg/d)	4.50±1.15	3.92±1.27	0.002		

Discussion

The comparison of diet in fasting men in Khvormuj before and after Ramadan indicated increased consumption of fruits and decreased consumption of bread, grain, and oil, as well as total calorie intake. Also, the percentage of received carbohydrates from the total of energy increased. The intake of most of B group vitamins decreased and there was a significant decrease in weight, WC, and BMI.

Mean weight, BMI and WC reduced during Ramadan. In the same way, previous studies on Iranian population have reported decreased

body weight and BMI during Ramadan fasting. Nematy and colleagues have reported significant reduction in body weight, BMI and waist circumference (7), which is consistent with the results of the current study. The study by Ziaee and colleagues has also indicated that among 41 men, body weight and BMI decreased (6), which is in line with the results of the present study, although the statistical insignificance of BMI decrease in Ziaee's study might be due to the small sample size of men in their study. In addition, such differences may be attributable to the demographic differences between studies,

like the fact that they have included subjects with an age of 20-35, while the present study included subjects aged 15-55 years old.

Iranian researchers have declared that training regarding food pattern in Ramadan is necessary (12). The results of the present study demonstrated increased consumption of fruits and decreased consumption of bread, grain, and oils after Ramadan, compared with pre-Ramadan. As far as the authors are concerned, there are very few studies on dietary patterns in Ramadan on Iranian population. Rahmati et.al have published a study on dietary patterns of 117 staff during Ramadan 2011 and have reported limited use of dairy products, vegetables, and liquids, high volume of meat which were associated with weight gain, as well as higher intakes of sugary products (20). But the main limitation of their study was that it was published in Persian with no English abstracts that limits the access of researchers in the world. In addition, they did not compare the dietary pattern with pre-Ramadan and only assessed the diet during Ramadan; thus, the differences in dietary pattern of different people can affect their results as a confounding factor. Nevertheless, comparing the results of the study by Rahmati and colleagues with the results of the present study indicates that the results of their study was consistent with ours regarding low consumption of dairy products and vegetables, although no changes were observed after Ramadan in these two food categories. This indicates the necessity to pay attention to increasing the consumption of dairy products and vegetables in Iranians that should be considered in future educational programs for increasing public awareness.

Also, in the present study, total calorie intake, protein, and fat intake decreased significantly, while carbohydrate intake did not, which is in line with previous Iranian studies, reporting a reduction of 300 Kcal/day in comparison to pre-Ramadan values and significant reduction in calorie intake and nutrients during Ramadan (8, 9). Mean calorie intake before Ramadan in the present study was 2758 Kcal that reduced to 2575Kcal. Similarly Larijaniet.al reported a decline in calorie intake during Ramadan from 1470 to 1191 Kcal in 115 healthy participants in Rey, Iran (21), which is consistent with the results of the present study. On the other hand, an Indonesian study has reported that calorie intake did not change during Ramadan (22).

Another foreign study has also concluded no changes in caloric intake, beside increased consumption of carbohydrates and proteins and decreased fat intake (16). A study on Moroccan population showed an increase in total energy intake due to carbohydrates and proteins, but not fats (23). This differences among studies can be due to the differences in food patterns, and socioeconomic status of different Islamic nations, as well as different climate conditions, study methods, races and genders, health status, and medical history of participants. Moreover, as far as Ramadan can come in any season, the duration of fasting ranges from 11 to 18 hours per day and studies conducted in different years have variable durations of fasting per day that affect the results of the studies.

The strengths of the present study included detailed evaluation of dietary pattern of fasting men and comparison with pre-Ramadan values that can give policy-makers a better prospective through the weak nutritional habits in Ramadan in Iranian population. Nonetheless, the present study had some limitations, such as the limited sample size and the fact that the study was conducted in one district that reduces the generalizability of the results, as dietary pattern of residents of other cities of the country may differ.

Conclusion

Weight, WC, and BMI, as well as total calorie intake significantly decreased in fasting men in Khvormuj, which indicates the advantages of Ramadan fasting anthropometric and dietary indices. Also, the details of dietary habits showed increased consumption of fruits and decreased consumption of bread, grain, and oil, as well as increased percentage of received carbohydrates from the total of energy, and decrease in some vitamins and minerals. These results necessitate proper education regarding healthy diet during Ramadan for the Iranian population.

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Conflict of Interest

None declared.

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