



291

ENERGY INTAKE, DIETARY PATTERN AND PHYSICAL ACTIVITY DURING THE HOLY MONTH OF RAMADAN AND THEIR IMPACT ON BODY WEIGHT

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Abstract

Purpose – The aim of this study was to evaluate the impact of changes in energy intake, dietary pattern and mode of physical activity while fasting during Ramadan on the change in body weight of adult males and females.

Design/methodology/approach – This study included 207 males and 229 females from the administrative staff of Alexandria University using a systematic random sampling technique. Data were collected on total calorie intake, including the contribution of carbohydrates, fat and protein to the total calorie intake before and during fasting. The exact intake from foods commonly consumed in Ramadan was determined. Body weight was measured before fasting and after the end of Ramadan. The age, sex and educational level of the subjects were recorded. The intake of Ramadan specialities, mode of physical exercise and afternoon napping were also collected.

Findings – By the end of fasting, the body weight of males increased by 1.7 Kg and females by 2.6 Kg. The rate of weight gain was 17.9% among males and 27.9% among females, the corresponding rates of weight loss



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was 10.1% and 9.6% respectively. Fasting subjects increased their total calorie intake during Ramadan. They increased their intake from animal protein and fats and reduced the intake from carbohydrates. The intake from sugar, meat and dairy products was increased while fruit and vegetable consumption was reduced. The percentage gain in body weight was significant among illiterate subjects (3.75%) and in the age group older than 50 years (5.36%). The regular consumption of oriental sweets and soft drinks contributed significantly to weight gain. Regular practice of exercise during fasting was associated with a limited rate in weight gain among males (12.2%) and females (18.4%). The rate was higher among males and females who did not exercise, 22.4% and 38.1% respectively. While exercise after Iftar did not affect the body weight of fasting males and females, afternoon napping was associated with weight gain among females (49.2%). Weight loss during Ramadan was associated with higher educational level, younger age, and limited intake of oriental sweets, soft drinks and regular physical exercise during fasting.

Originality/value – This study revealed that fasting during Ramadan was associated with weight gain, and presents data on caloric intake, sources of calories, exact consumption from popular and selected foods and the factors affecting the rates of weight gain or loss during fasting.

Keywords *Fasting, Ramadan, Egypt, Food intake, Sources of energy, Body weight, Exercise*

INTRODUCTION

Fasting the holy month of Ramadan is one of the five pillars of Islam. Fasting from dawn to sunset is obligatory for all healthy adult Muslim males and females. While fasting, individuals are required to abstain from eating, drinking and any form of intimate behaviour for at least 12 hours. The duration of fasting depends on the geographic location and changes along the solar year (Al Hourani *et al.*, 2009).

Fasting during Ramadan is partaken primarily for religious purposes. However it also has the potential to affect the health and nutritional status of the individual. It is common practice during Ramadan to consume a large meal after sunset (Iftar) and a lighter meal before dawn (Sohour) (Ibrahim *et al.*, 2008). It is also common practice to consume at least one snack between both meals (Rocky *et al.*, 2001).

The nature and composition of the meals varies significantly from ordinary meals. Muslims consume a wide variety of foods in their main meals, which usually consist of foods rich in protein, fat, at least one cooked vegetable, sweets and sugary drinks. Tea, coffee and soft drinks are also consumed frequently between meals (Fedail *et al.*, 1982). The nature of the pre-fasting meal (Sohour) also varies considerably. Some prefer to have a large meal, others prefer a light meal composed of cheese, yoghurt and fruits and a few individuals skip the Sohour meal completely.

Few definitive conclusions have been made regarding the effect of Ramadan fasting on human health and nutrition. The collective body of research has noted mostly heterogeneous findings regarding both dietary intake and health related outcomes (Trepanowski and Bloomer, 2010).

Fasting during the month of Ramadan causes a decrease in calorie intake, which is correlated with a decrease in meal frequency (Bouguerra *et al.*, 2003). Other studies found that consumption of larger meals during Ramadan compensated for the lower frequency of food intake. As a result, the total energy intake did not differ when compared with that consumed prior to the initial fasting (Sadiya *et al.*, 2011; Frost and Pirani, 1987). However, contradictory results were reported in Algeria (Lamri-Senhadji *et al.*, 2009) and among Indian Muslims (Benanj *et al.*, 2006). The variability in the results is probably attributed to several confounding variables like ethnicity, hours of fasting, climatic conditions, cultural influences, physical activity and most commonly the dietary pattern.

The impact of fasting during Ramadan on body weight is quite controversial. Weight loss was reported by Ziaee *et al.* (2006) and Hajek *et al.* (2012) and has been associated with lower body fat percentage, elevated levels of high density lipoprotein cholesterol (Trabelis *et al.*, 2011) and a significant reduction in meal frequency (Finch *et al.*, 1988). Other studies showed that fasting during Ramadan did not cause any change in body weight (Haouari *et al.*, 2008). Weight gain at the end of Ramadan has also been reported (Bakhotmah, 2011). However, it should be noted that most of the studies included a small sample size and focused on minority groups.

For Egyptians, the holy month of Ramadan is the most special occasion of the year. It is a spiritual, religious and nutritional feast that lasts the whole month. A few days before the start of Ramadan and all the way to the end of the month Ramadan specialities including oriental sweets such as Qatayef, Kunafa and Qamar, Eldin (Apricot

juice), Medames (fava beans), Zabadi (yogurt), pickles, meat and chicken are bought.

Every year, the government supplies the market with lower price food commodities to meet the surge in consumption. The Ministry of supply and domestic trade increases the supply of flour and establishes temporary distribution points which sell subsidised meat and vegetables. The quantities of subsidised oil and sugar dispensed through ration cards are almost doubled in Ramadan.

Egypt is quite different from any other Muslim country in that few studies have been carried out to evaluate the health and nutritional impact of fasting (Saleh *et al.*, 2004). This study was initiated to investigate the food intake, dietary pattern and physical activity during Ramadan and their impact on the change in body weight of fasting adult males and females.

SUBJECTS AND METHODS

The study was implemented during the month of Ramadan which began on July 20th and ended August 18th 2012. The study was carried out in Alexandria where the temperature averaged between 25°C and 30°C with a relatively high humidity (65–75%). During this period, the daily length of abstinence from food and water experienced by the subjects was approximately 15 hours.

The study sample was taken using a systematic random sampling technique from the administrative male and female staff of Alexandria University. The sample size was determined using G power programme and using a 5% level of significance in order to yield a mean change of 1 Kg in body weight before and after Ramadan (Hajek *et al.*, 2012). Using an alpha error of 5% and 95% power and a small effect size of 0.18, the minimum required sample size amounted to 405 people. The sample size was increased to 450 (10%) to avoid the attrition factor. Each subject was informed about the objective of the study and his or her personal consent to participate in the study was obtained.

A pre-designed questionnaire was formulated and tested through a pilot study that included 25 subjects. According to their responses the questionnaire was modified, finalised and used in data collection.

The study was implemented in three phases. The first phase was carried out one week before fasting during which each subject was privately interviewed and the questionnaire was used to collect personal data such as age, sex and educational level. The daily dietary intake was evaluated using a 24 hour recall method. Each subject was asked to recall as accurately as possible the exact food or drink intake during the last 24 hours. Exact amounts of food consumed were determined by using common household measures. The body weight of each subject was measured to the nearest 0.1 Kg using a standard technique (Gibson, 2005).

The second phase was carried out during the last two weeks of Ramadan using a modified questionnaire to collect data on exact food intake, dietary pattern during Ramadan in addition to the frequency of consuming Ramadan special foods. This included the quantities of food and drinks consumed during Iftar, in the pre-fasting meal, and in snacks between meals. Each subject was asked about the frequency of afternoon napping, the pattern of physical exercise during fasting and after having the Iftar meal. Subjects were classified according to the frequency of exercise or afternoon napping into 3 groups; daily, occasional (2–3 times weekly) and never.

The data were analyzed using the Egyptian food composition table issued by the National Nutrition Institute, 2006. Daily calorie intake was calculated and the percentage energy derived from carbohydrate, fat and protein were estimated. The relative contribution of animal and plant sources to daily protein and fat intake were also estimated. The exact intake from food items which are commonly consumed throughout the month of Ramadan was calculated; this included sugars, fruits, vegetables, meat, dairy products and eggs. The frequency of consumption of some special foods which are usually consumed during the Iftar meal was determined. This includes oriental sweets, green salad, pickles and soft drinks. Subjects were classified into three groups according to the frequency of consumption: daily; 2–3 times weekly; and never consumed such foods.

The third phase was implemented during the first week after Ramadan during which the body weight was measured and the change was calculated relative to the weight before fasting. A subject was classified as having gained weight if their body weight increased by two kilograms or more during fasting, and lost weight if their body weight was two kilograms less than their pre-fasting weight. The body weight was classified as unchanged if the change was within plus or minus two kilograms.

Statistical analysis was performed using the computer facilities at The High Institute of Public Health, Alexandria University. Descriptive data were calculated as frequencies. Chi square tests were used to evaluate the association between variables. Data on the intake of selected foods are presented in the form of means and standard deviations. T-tests were used to evaluate the significance of the difference between variables. *P* values less than 0.05 were considered significant.

RESULTS

Table 1 illustrates the mean daily caloric intake and the major sources of calories before and during fasting by adult males and females. The results showed that the mean daily caloric intake by males significantly increased from 2982 calories before fasting to 3251 calories during fasting ($t=16.03$, $P=0.000$). Female daily caloric intake significantly increased from 2715 calories before fasting to 2932 calories during fasting ($t=16.25$, $P=0.00$). The percentage of calories derived from carbohydrates by males significantly decreased from 60.1% before fasting to 54.9%

Sources of Calories	Male (n=207)		Female (n=229)		Total	
	Before	During	Before	During	Males (t)	Females (t)
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	(P)	(P)
Total caloric intake	2982 ±162	3251±179	2715±132	2932±153	16.03 0.00	16.25 0.00
Percentage energy from carbohydrates	60.1±3.1	54.9±4.4	61.6±3.0	58.9±2.9	13.9 0.00	9.79 0.00
Total fat	26.8±2.3	31.3±3.0	26.6±2.1	29.9±2.6	17.13 0.00	14.94 0.00
Animal fat (%)	20.8±1.8	21.7±1.9	20.5±2.1	21.1±2.2	7.95 0.00	2.99 0.00
Plant fat (%)	79.2±6.7	78.3±7.2	79.5±7.3	78.9±7.6	1.32 0.189	0.862 0.389
Total protein	13.1±0.91	13.8±0.92	11.8±0.76	12.2±0.81	7.78 0.00	5.45 0.00
Animal protein (%)	23.8±1.6	28.6±2.1	21.5±1.7	24.9±8.9	26.16 0.00	20.18 0.00
Plant protein (%)	76.2±6.3	71.4±5.9	78.5±7.1	75.1±6.8	8.0 0.00	5.23 0.00

Table I. Mean daily calorie intake and percentage energy derived from different nutrients by fasting males and females before and during Ramadan

during fasting ($t=13.9, P=0.00$), and in females significantly decreased from 61.6% to 58.9% respectively ($t=9.79, P=0.00$). Calories derived from fat increased significantly by males from 26.8% before fasting to 31.3% during fasting ($t=17.13, P=0.000$). Females reported a lower but significant increase from 26.6% to 29.9% ($t=14.94, P=0.00$). The results show a significant increase in the percentage contribution of animal fat to total fat intake during fasting for both males ($t=7.95, P=0.00$) and females ($t=2.99, P=0.00$), whereas, a slight decrease in the contribution of vegetable fat was reported ($P=$ not significant [NS]).

The percentage calories derived from protein by males increased significantly from 13.1% before fasting to 13.8% during fasting ($t=7.78, P=0.000$). The corresponding figures for females were 11.8% and 12.2% respectively. A significant change was reported in the type of protein consumed. The percentage contribution of animal protein to total protein intake of males increased from 23.8% before fasting to 28.6% during fasting ($t=26.16, P=0.000$) a corresponding decrease in the contribution of vegetable protein was reported from 76.2% to 71.4%. The same trend was reported for the percentage calories derived from protein and the nature of protein consumed by adult females.

The mean daily intake of food items commonly consumed before and during Ramadan by males and females is presented in Table 2. The results show that the mean daily intake of sugar by males increased from 112 g before fasting to 143 g during fasting ($t=39.99, P=0.000$). Females reported a significant increase from 83 g to 106 g over the same period ($t=37.7, P=0.000$). Fruits and vegetables consumption by both males and females decreased significantly during fasting when compared with the quantities consumed before fasting. Meat consumption by males increased significantly from 58 g before fasting to 67 g during fasting ($t=14.68, P=0.000$). A much lower but significant increase was reported by females from 41 g before fasting to 44 g during fasting ($t=6.32, P=0.000$). Dairy products followed a similar trend as the mean intake for males increased from 142 g before fasting to 169 g during fasting ($t=28.26, P=0.000$) A significant increase was also reported by females ($t=29.98, P=0.00$). The results show that the mean daily intake of eggs by males significantly increased from 61 g before fasting to 73 g during fasting ($t=27.07, P=0.00$), whereas the corresponding figures for females were 49 g and 59 g respectively ($t=26.74, P=0.00$).

The mean body weight of fasting males and females before and immediately after ending fasting is presented in Table 3. The data

Quantity consumed (g/day)	Male (n=207)		Female (n=229)		Total	
	Before	During	Before	During	Males	Females
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	(t) (P)	(t) (P)
Sugar	112±7.1	143±8.6	83±5.9	106±7.1	39.99 0.00	37.7 0.00
Fruits	271±16.5	231±17.1	196±11.2	157±9.1	24.219 0.00	40.90 0.00
Vegetables	461±21.8	409±19.1	407±19.7	372±15.2	25.81 0.00	21.29 0.00
Meat	58±5.1	67±7.2	41±4.5	44±5.6	14.68 0.00	6.32 0.00
Dairy products	142±9.1	169±10.3	118±7.8	141±8.6	28.26 0.00	29.98 0.00
Eggs	61±4.2	73±4.8	49±3.9	59±4.1	27.07 0.00	26.74 0.00

Energy intake, dietary pattern and physical activity during the holy month

298

Table 2. Mean daily intake of selected food items commonly consumed by fasting males and females before and during Ramadan

show that the mean body weight for the whole sample significantly increased from 76.61 Kg before fasting to 78.79 Kg after Ramadan ($t=4.234, P=0.000$). The results show that the percentage increase in body weight was modified by several factors. The body weight of females increased at a higher rate (3.47%) as compared with a modest increase of 2.16% among males. The highest increase in body weight was recorded among illiterate subjects as their body weight significantly increased from 79.9 Kg before fasting to 82.9 Kg after fasting, an increase of 3.75% ($t=3.11, P=0.002$). University graduates recorded the lowest increase in body weight of 1.52% ($t=1.231, P=NS$). The results show that body weight of young adults under the age of 30 years slightly increased after fasting (0.42%). The per cent increase in body weight after fasting increased with age to reach its highest level in the age group older than 50 years. The body weight of this age group was initially high (80.1 Kg) and significantly increased to 84.4 Kg after fasting ($t=3.636, P=0.000$).

Results presented in Table 4 show that the consumption of food items which are specially consumed during the month of Ramadan by fasting males did not have a significant effect on the change in body weight. However a clear trend could be identified. In males the daily consumption of oriental sweets and soft drinks was associated with 29.8% and 21.4% weight gain respectively. Weight loss was most prevalent among fasting males who never consumed oriental sweets

Table 3. Impact of sex, educational level and age on the change in body weight during fasting Ramadan

	No.	Mean body weight (kg)		%gain	(t)	(P)
		Before Fasting $\bar{X} \pm SD$	End of Fasting $\bar{X} \pm SD$			
<u>Sex</u>						
Males	207	78.5±6.1	80.2±6.2	2.16	2.81	0.005
Females	229	74.9±7.3	77.5±7.6	3.47	3.73	0.000
<u>Educational level</u>						
Illiterate/primary	129	79.9±7.6	82.9±7.9	3.75	3.11	0.002
Middle	168	77.8±8.1	80.3±8.4	3.20	2.78	0.006
University	139	72.1±7.4	73.2±7.5	1.52	1.231	0.219
<u>Age (years)</u>						
<30	62	70.7±6.4	71.0±6.3	0.42	0.263	0.793
30-39	141	74.2±7.1	75.4±7.2	1.62	1.409	0.150
40-49	126	79.2±8.1	81.9±8.4	3.41	2.597	0.010
50<	107	80.1±8.6	84.4±8.7	5.36	3.636	0.000
Total	436	76.61±7.4	78.79±7.8	2.84	4.234	0.000

or soft drinks, with a percentage loss of 17.9% and 15.5% respectively. The daily consumption of fresh green salad was associated with limited weight gain (15.5%) and average weight loss (11.3%). The frequency of consuming pickles was not associated with changes in body weight during the month of Ramadan.

Data presented in Table 5 show that the consumption of special foods during Ramadan had a significant impact on the change in body weight of fasting females. The daily consumption of oriental sweets was associated with a significant increase in body weight (38.1%) and a very limited weight loss (9.5%). On the other hand, females who never consumed oriental sweets were significantly more likely to lose weight (17.9%) and less likely to gain weight (10.7%) ($X^2= 15.34, P=0.004$). The results show that the frequency of consuming green salad and pickles was not significantly associated with the change in body weight during fasting. However, the data suggest that the daily consumption of green salad was associated with a lower probability of weight gain. The consumption of soft drinks was significantly associated with the change in body weight ($X^2=25.79, P=0.000$). Table 5 shows that 35.8% of females consuming soft drinks daily gained weight as compared with 19.1% among the group that did not consume soft drinks. The latter group was more susceptible to weight loss (28.6%) and was less likely to gain weight (4.7%).

Activity pattern	Change in body weight							
	Weight loss		No change		Weight gain		Total	
	No.	%	No.	%	No.	%	No.	%
Oriental sweets								
Daily	5	10.6	28	59.6	14	29.8	47	22.7
2-3 times weekly	9	7.4	83	68.5	19	15.7	121	58.5
Never	7	17.9	28	71.8	4	10.3	39	18.8
	suming special foods on the change in bodyweight of as							
	$X^2=8.42$				$P=0.077$			
Green salad								
Daily	8	11.3	42	59.2	11	15.5	71	34.3
2-3 times weekly	7	9.2	57	75.0	12	15.8	76	36.7
Never	6	10.0	40	66.6	14	23.3	60	29.0
	$X^2=1.93$				$P=0.749$			
Pickles								
Daily	7	10.8	44	67.7	14	21.5	65	31.4
2-3 times weekly	9	9.7	68	73.1	16	17.2	93	44.9
Never	5	10.2	37	75.5	7	14.3	49	23.7
	$X^2=1.18$				$P=0.882$			
Soft drinks								
Daily	9	8.7	72	69.9	22	21.4	103	49.8
2-3 times weekly	5	8.5	45	76.3	9	15.3	59	28.5
Never	7	15.5	32	71.1	6	13.3	45	21.7
	$X^2=3.32$				$P=0.505$			
Total	21	10.1	149	72.0	37	17.9	207	100

Table 4. The frequency of consumption of special foods on the change in body weight of fasting males

The impact of activity during the month of Ramadan on the change in body weight of fasting males is illustrated in Table 6. The overall results show that 17.9% of the males gained weight, 10.1% lost weight and 72.0% maintained the same weight during fasting. The results show that exercise during fasting had a significant effect on the change in body weight ($X^2=9.73$, $P=0.045$). The data show that 18.4% of males exercising regularly during fasting lost weight and 12.2% gained weight. In males that never exercised, only 4.7% lost weight and 22.4% gained weight. The data show that the pattern of exercise after having Iftar, whether regular, occasional or never practiced did not have a significant effect on the change in body weight, however the rate of weight gain was relatively higher among the group who never practiced exercise after having breakfast (22.6%).

Table 5. The frequency of consumption of special foods on the change in body weight of fasting females

Activity pattern	Change in body weight							
	Weight loss		No change		Weight gain		Total	
	No.	%	No.	%	No.	%	No.%	%
<u>Oriental sweets</u>								
Daily	4	9.5	22	52.4	16	38.1	42	18.3
2-3 times	8	6.1	81	61.8	42	32.1	131	57.2
Weekly	10	17.9	40	71.4	6	10.7	56	24.5
	$X^2=15.34$				$P= 0.004$			
<u>Green salad</u>								
Daily	11	14.5	48	63.2	17	22.3	76	33.2
2-3 times weekly	5	6.1	56	68.3	21	25.6	82	35.8
Never	6	8.5	39	54.9	26	36.6	71	31.0
	$X^2=6.62$				$P= 0.157$			
<u>Pickles</u>								
Daily	8	12.5	33	51.6	23	35.9	64	27.9
2-3 times weekly	9	9.6	62	66.6	22	23.7	93	40.6
Never	5	6.9	48	66.6	19	26.3	72	31.4
	$X^2=4.91$				$P= 0.297$			
<u>Soft drinks</u>								
Daily	5	4.7	63	59.4	38	35.8	106	46.3
2-3 times weekly	5	6.2	58	71.6	18	22.2	81	35.4
Never	12	28.6	22	52.3	8	19.1	42	18.3
	$X^2=25.79$				$P= 0.000$			
Total	22	9.6	143	62.5	64	27.9	229	100

Afternoon napping did not significantly affect the change in body weight of fasting males. The rate of weight loss varied from 8.1% among the group napping regularly to 11.7% among the group that never take an afternoon nap. On the other hand an evident increase was noted in the rate of weight gain in the group taking regular afternoon naps (21.3%) as compared with 14.9% among those who never took an afternoon nap; however, the difference was not statistically significant (Table 6).

Regular exercise was significantly associated with weight loss among fasting females (23.7%) as compared with 4.4% among the females who did not exercise (Table 7). Members of the latter group gained more weight than any other group (38.1%), and the difference was statistically significant, ($X^2= 20.84, P=0.000$). The data did not reveal a significant association between exercise after having breakfast and the change in body weight, however the data indicated that regular exercise after having breakfast was associated with limited weight gain. The results show that 49.2% of fasting females gained weight if they took an afternoon nap; this was significantly higher than the rate observed among females who never take an afternoon nap

Table 6. The impact of activity pattern during Ramadan on the change in body weight of fasting males

Activity pattern	Change in body weight							
	Weight loss		No change		Weight gain		Total	
	No.	%	No.	%	No.	%	No.	%
Exercise while fasting								
Regular	9	18.4	34	71.4	6	12.2	49	23.7
Occasional	7	13.7	37	72.5	7	13.7	51	24.6
Never	5	4.7	78	72.9	24	22.4	107	51.7
	X ² =9.73				P= 0.045			
Exercise after Iftar								
Regular	7	13.2	39	73.6	7	13.2	53	25.6
Occasional	6	9.8	46	75.4	9	14.8	61	29.5
Never	8	8.6	64	68.8	21	22.6	93	44.9
	X ² =3.09				P= 0.542			
Afternoon napping								
Regular	5	8.1	43	70.5	13	21.3	61	29.5
Occasional	5	9.6	37	71.2	10	19.2	52	25.1
Never	11	11.7	69	73.4	14	14.9	94	45.4
	X ² =1.44				P= 0.839			
Total	21	10.1	149	72.0	37	17.9	207	100

(12.6%) (X²=29.11, P=0.000). Weight loss was relatively comparable between females regardless of their afternoon napping habit.

DISCUSSION

Egyptians have inherited an indigenous food system and traditional food habits that are commonly practiced during the month of Ramadan. The main feature of the traditional Ramadan meals favours excessive food intake. Fast is broken each day when rich meals are consumed in a social context. It is a common habit to increase the consumption of meat, eggs and dairy products. Animal fat is more expensive than vegetable oil and gives an excellent taste to the food and is frequently used in cooking and preparing Ramadan special foods.

Data presented in this study show that both males and females increased their calorie intake, including the intake of animal fats and protein. In contrast, their intake from carbohydrates, vegetable fats and plant protein was reduced. Such changes were more pronounced among males, who reduced their intake from carbohydrates by 5.2% as compared with 2.7% among females. Gharbi *et al.* (2003) similarly reported that during Ramadan there was an increase in total energy intake as a result of protein and lipid but not carbohydrate as compared

Table 7. The impact of activity pattern during Ramadan on the change in body weight of fasting females

Activity pattern	Change in body weight							
	Weight loss		No change		Weight gain		Total	
	No.	%	No.	%	No.	%	No.	%
Exercise while fasting								
Regular	9	23.7	22	57.9	7	18.4	38	16.6
Occasional	8	10.2	56	71.8	14	18.0	78	34.1
Never	5	4.4	65	57.5	43	38.1	113	49.3
	X ² =20.84				P= 0.000			
Exercise after Iftar								
Regular	4	11.1	26	72.2	6	16.6	36	15.7
Occasional	6	7.1	51	60.7	27	32.1	84	36.7
Never	12	11.0	68	60.6	31	28.4	109	47.6
	X ² =3.67				P= 0.452			
Afternoon napping								
Regular	5	7.9	27	42.9	31	49.2	63	27.5
Occasional	6	10.9	30	54.5	19	34.6	55	24.0
Never	11	9.9	86	77.5	14	12.6	111	48.5
	X ² =29.11				P= 0.000			
Total	22	9.6	143	62.5	64	27.9	229	100

with the diet consumed throughout the rest of the year. Energy intake during Ramadan has been reported to increase among Saudi Muslims and decrease among Indian Muslims; these discrepancies are believed to be due to the differences in food choice between the two groups (El-Ati *et al.*, 1995).

The results show that while the percentage of calories derived from carbohydrates was reduced, sugar consumption was significantly increased. Sugar is used for preparing Ramadan special oriental sweets, which are frequently consumed between meals. Sugar is also added in large quantities to brewed minted dark tea which is consumed after the Iftar meal and frequently thereafter. The frequent consumption of sugary foods and drinks during Ramadan is a common habit in other countries (Hallak and Nomani, 1988). The excessive consumption of Ramadan sweets has led to the reduced consumption of fruits as families prefer Ramadan special sweets, such as Kunafa and Qatayef.

Vegetable consumption was reduced during Ramadan. Families prefer an Iftar meal rich in fried and packed foods rather than cooked vegetables, which are usually prepared in the form of stew cooked in tomato juice or paste. The diversification of the diet leaves little space for the consumption of cooked vegetables.

The price of meat is very high in Egypt relative to the limited per capita income. The price soared during the last few years and led to a reduced consumption of local and imported meat. However, because Egyptians consider Ramadan a very special occasion, the intake of meat is significantly increased. This was more commonly practiced by males, who increased their daily meat consumption by 9 grams as compared with an increase of 3 grams by females.

Conflicting results were reported concerning the nature of the diet consumed during Ramadan in several Muslim countries. It was reported that the daily energy intake derived from carbohydrate, fat and protein were reduced during Ramadan compared with the pre-Ramadan values (Al Nuwair, 2006). Another study reported an increase in fat and a decrease in protein intake, and as observed in the present study, the total carbohydrate shifted from complex carbohydrates to more simple sugar (sweets and drinks) (Khaled and Belbraouet, 2009). Heterogeneous findings exist regarding fat consumption during Ramadan. Studies have reported decreased consumption (Aldouni *et al.*, 1997) and no change in consumption (Bouguerra *et al.*, 2003). Such drastic differences in the nature of the diet consumed in Ramadan may explain the diversification of the results describing the health impact and outcome of fasting in different Muslim countries.

The consumption of egg and dairy products was significantly increased by both males and females. Both foods items are commonly consumed in the Sohour meal. Eggs are usually consumed boiled and are offered with other food items such as cheese, beans and yoghurt followed by a glass of tea. Some individuals who care to regulate their body weight may have yoghurt and fruits for the pre-fasting meal. Others have a glass of milk and some individuals do not take the Sohour meal.

Fasting during Ramadan may provide an opportunity to reduce the frequency and quantity of food intake, both of which may lead to health benefits including weight loss and favourable metabolic changes (Shehab *et al.*, 2012). The results of this study show that by the end of fasting Ramadan, 10.1% of the males and 9.6% of the females lost more than two kilograms. On the other hand, 17.9% of the males and 27.9% of the females gained more than two kilograms as compared with pre-fasting body weight. The increase in body weight at the end of fasting was a natural outcome of the dietary pattern and the excessive food intake. Several other factors modified the extent of weight gain. Fasting

females gained more body weight during Ramadan (3.47%) when compared with their male counterparts (2.16%). This may be a function not only of excessive calorie intake but also a result of reduced physical activity by females. The results of the present study show that while 23.7% of the males were regularly exercising while fasting, only 16.6% of fasting females regularly exercised. The level of education was a significant factor in determining the degree of weight gain. Illiterate individuals who do not pay much attention to their body weight scored the highest weight gain (3.75%), whereas university graduates did not show a significant increase in body weight (1.5%). At the higher levels of education, individuals are better informed about the health hazards of obesity and try to control any increase in their body weight. A nutrition education programme on sound dietary practices during Ramadan could have a significant positive health impact.

Age was also a significant factor in determining the limit of weight gain. Young adults in the age group less than 40 years reported no or slight increases in body weight. Older subjects in the age group above 50 years reported the highest weight gain (5.36%). This may also be related to the limited physical activity practiced by older subjects. The voluntary prayers performed daily after having Iftar meal (Tarawih) which is comparable to moderate exercise and lasts for at least one hour is usually practiced more frequently by young adult males than by either older males or females. This form of exercise may also contribute to minimizing the rate of weight gain among males.

Data presented in the present study show that the loss of body weight was associated with limited consumption of sweets and soft drinks; this trend was evident for both males and females. The relative weight loss during Ramadan was explained, in part, by a mild dehydration due to fluid restriction during fasting. This was confirmed by the findings that weight loss during Ramadan is frequently gained four weeks post-Ramadan (Leiper *et al.*, 2003). On the other hand, weight gain among males was associated with the daily consumption of sweets (29.8%) and soft drinks (21.4%). The consumption of both food items also contributed significantly to weight gain among females. It is a common bad food habit in Egypt to have a large Iftar meal followed by oriental sweets and sweet minted tea. When feeling full, a bottle of soft carbonated beverage may give a sense of temporary relief. The results show that slightly less than 50% of the subjects drink at least one bottle of soft drinks daily. Pickles are also considered a Ramadan speciality. The results show that 31.4%

of the males and 27.9% of the females consume pickles daily mostly in the Iftar meal. Pickles usually replace green salad in the Iftar meal and represent a threat to fasting hypertensive patients (Brown *et al.*, 2009).

Physical activity is not popular in Ramadan. During the first few days of fasting, many individuals suffer from severe headaches because of the deprivation of coffee, tea, smoking, and the onset of hypoglycemia and are least likely to practice any sort of physical activity. The results presented in this study show that 51.7% of the males and 49.3% of the females do not exercise during fasting hours. Females are usually involved in preparing the Iftar meal and do not have the time to exercise. The results also show that females were practicing physical exercise less frequently than males after having Iftar, which was not associated with the change in body weight as it is always restricted to walking for a short distance at a slow rate. Afternoon napping was practiced at a comparable rate by both sexes. Weight gain was significantly associated with the lack of physical activity while fasting among males and with the lack of physical exercise and afternoon napping among females.

The results suggest that weight loss during Ramadan is significantly associated with physical exercise while fasting both in males and females. Those who are keen to exercise while fasting are rewarded by a higher rate of weight loss and limited weight gain. Fasting the month of Ramadan could have beneficial or harmful health effects. The increased intake of animal fat, protein and sugar will lead not only to an increase in body weight but could also elevate blood lipids. On the other hand, if a sound dietary pattern associated with moderate exercise is followed, fasting will induce a moderate reduction in body weight and may reduce blood lipids. A nutritional education programme should be implemented using mass media shortly before the month of Ramadan. The main objective of the programme would be to inform the public about the health hazards of the current dietary practices and food habits followed during the fasting month. They should be advised how to use fasting Ramadan as a tool to improve their nutrition and health status by following a sound dietary pattern.

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