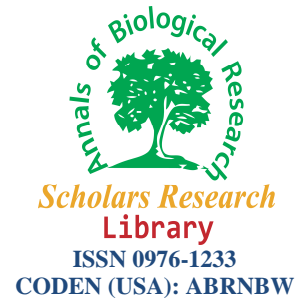




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## The Effects of Ramadan fasting on the body fat percent among adults

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### ABSTRACT

Ramadan is the holiest month for Muslims all over the world. In this month, they fast for about 10 to 19 hours per day depending on their geographical locations. 13 male (age:  $28 \pm 4$ Yr, body mass  $70 \pm 10$  kg) and 10 female (age:  $27 \pm 3$  Yr, body mass  $58 \pm 12$  kg) respondents volunteered to take part in this study. Estimation of body density (BD) was determined by using the skin fold technique. A Holtain skin fold caliper (John Bull, British Indictors Ltd, UK) was used to measure the adipose layer on the dominant side of the body surface at seven sites: chest, abdomen, midaxillary, subpariliac, triceps, sub scapular and thigh. Skin folds were measured at all the seven sites and the procedure was repeated three times. The skin fold measurement was done a week before Ramadan, during each week of Ramadan (4 weeks totally), and at the end of the first week of Shawwal (the month after Ramadan). Results indicated that both male and female adults had a positive effect on their body fat during Ramadan (decrease in BF). The BF of the subjects reduced gradually from the first week of the study towards the fifth week (end of the Ramadan). However, during the sixth week (first week of Shawwal), the BF increased in both groups. This clearly indicates that fasting during Ramadan caused positive effect on controlling the BF.

**Keywords:** Ramadan, fasting, skin fold, body density, body fat percentage

### INTRODUCTION

Millions of Muslims all over the world are compelled to fast during Ramadan. Ramadan is the holiest month and the ninth month of the Hijri Calender [1, 2, 3]. Fasting during Ramadan is unique; because it is totally different from total starvation. During the holy month which lasts 29 to 30 days, Muslims would not consume food and water from Fajr to Maghrib. However, depending on geographical position of each specific country and the season in which Ramadan falls, the length of fasting duration may vary from 10 to 19 hours(h) [4, 5, 6].

There are some studies suggesting that performing alternate-day fasting it may prolong the life span of an individual [7]. Body weight and metabolism may change during and after Ramadan in healthy subjects. A study by [3], had found out that although there were no significant difference in weight and abdominal fat distribution during Ramadan fasting, there was a reduction in visceral fat compartment. Moreover, other positive effects on health were reported such as decrease in glucose, weight [8], body fat percentage (BF) and total body water (TBW) [4].

Fasting in Ramadan period can also cause significant difference in body weight between pre-Ramadan and the final week [2]. This study tends to determine the effect of fasting Ramadan month on body fat percent and comparing the fasting effect between males and females. The null hypothesis is that fasting has no effect on body fat percent. The other null hypothesis is that there is no different between males and females in amount of losing fat.

## MATERIALS AND METHODS

### Respondents and sampling method

This study was carried out in Ramadan in September 2011 (Hijri 1432), and the average duration of fasting was 13 hours a day. Before Muslims start fasting, they have a predawn meal at about 4:00 a.m which is called "Sahur". The second meal, which is a combination of lunch and dinner is served at maghrib at about 7:30 p.m and is called "Iftar". During the fasting time, participations didn't eat and drink anything between these two meals. Thirteen male (age:  $28 \pm 4$ Yr, body mass  $70 \pm 10$  kg) and 10 female (age:  $27 \pm 3$  Yr, body mass  $58 \pm 12$  kg) respondents volunteered to take part in this study. The measurement of skin fold was done at night between 10 to 12.00 p.m. The skin fold measurement was done in a week before Ramadan, during each week of Ramadan (total of 4 weeks) and at the end of the first week of Shawwal (the month after Ramadan).

### Body Density (BD) and Body Fat Percentage (BF)

Estimation of body density (BD) was determined by using the skin fold technique. Holtain caliper (John Bull, British Indictors Ltd, UK) [9] was used to measure the adipose layer on the dominant side of the body surface at seven sites: chest, abdomen, midaxillary, subpariliac, triceps, sub scapular and thigh by the same investigator. Skin folds were measured at all seven the sites and the procedure were repeated three times. For a given site, the mean of three measurements was used for the skin fold-thickness value. First, BD was calculated according to Jackson and Pollock's equation [10, 11] as shown in Equation 1 (for male) and 2 (for female).

Equation 1

$$\text{Body Density} = 1.112 - (0.00043499 \times \text{sum of skinfolds}) + (0.00000055 \times \text{square of the sum of skinfold sites}) - (0.00028826 \times \text{age})$$

Equation 2

$$\text{Body Density} = 1.097 - (0.00046971 \times \text{sum of skinfolds}) + (0.00000056 \times \text{square of the sum of skinfold sites}) - (0.00012828 \times \text{age})$$

Then, the percentage of body fat was calculated using the age-specific equation of Siri Equation (Equation 3) [12, 13, 14].

Equation 3

$$\% \text{ Body Fat} = (495 / \text{Body Density}) - 450$$

However, there were some limitations in this study; some factors such as food intake and daily activities were not measured precisely due to lack of cooperation.

### Statistical Analysis

Statistical analysis was done using a SPSS version 17.0 statistical program. One factor repeated measures ANOVA conducted to assess the impact of Ramadan fasting on the BF during period of skin fold measurement (six times) and *t-test* was used for comparison between males and females.

## RESULTS AND DISCUSSION

To analysis of body fat percent, since the chi square statistics Mauchy's test of Sphericity female has a value of 109.93 and p-value of .000, and male has a value of 158.94 and p-value of .000, test of Within-Subjects Effects was followed (Table 1).

Table 1: Tests of Within-Subjects Effects of Male and Female

Measure:MEASURE_1		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time (Male)	Sphericity Assumed	28491.68	5	5698.336	1453.276	0	0.992
	Greenhouse-Geisser	28491.68	1.047	27206.469	1453.276	.000.*	0.992
Time(Female)	Sphericity Assumed	6654.225	5	1330.845	325.206	0	0.973
	Greenhouse-Geisser	235.262	1.058	6288.558	325.206	.000.*	0.973

\*: Significant differences on  $P \leq 0.05$

The Greenhouse-Geisser adjust F test is commonly used. The test statistic (F) equals 1453.27, with corresponding p-value of .000. Evidence indicated that null hypothesis were rejected and alternative hypothesis were accepted. There

is evidence that body fat percent of male changed during Ramadan fasting month (a week before Ramadan, the first week of Ramadan, the second week of Ramadan, the third week of Ramadan, the fourth week of Ramadan, and the end of the first week of Shwal (after Ramadan). On the other hand, tables 1 illustrated female statistic. The test statistic (F) equals 325.206, with corresponding p-value of .000. Evidence indicated that null hypothesis were rejected and alternative hypothesis were accepted. There is evidence that body fat percent of female was significantly changed during Ramadan fasting month and increase of BF during the first week of Shawl. Finally, finding indicated that body fat percent of male and female individual change significantly during the Ramadan Fasting Month.

The significance of the interaction effect is supported in the profile plots (figure 1) which show the lines for the mean total income by computer usage to show body fat percent change during Ramadan fasting. There is a significant difference in reduction the body fat percent (BFP) during Ramadan month, especially on the fourth week of Ramadan which was shown better in 2 groups (figure 1). The result also showed those in third and fourth weeks of Ramadan BFP in female (figure 1) decreases more than male (figure 1) and returning BFP after Ramadan among females was faster than men indicated in (figure 1). The results also indicated that, with comparing groups (male and female) there is a significant difference at confidence level 95% before Ramadan. On the other hand, in the fourth week of the Ramadan month, there is a significant difference between groups. In addition, in the first week of the Shawwal, there is a significant difference between groups.

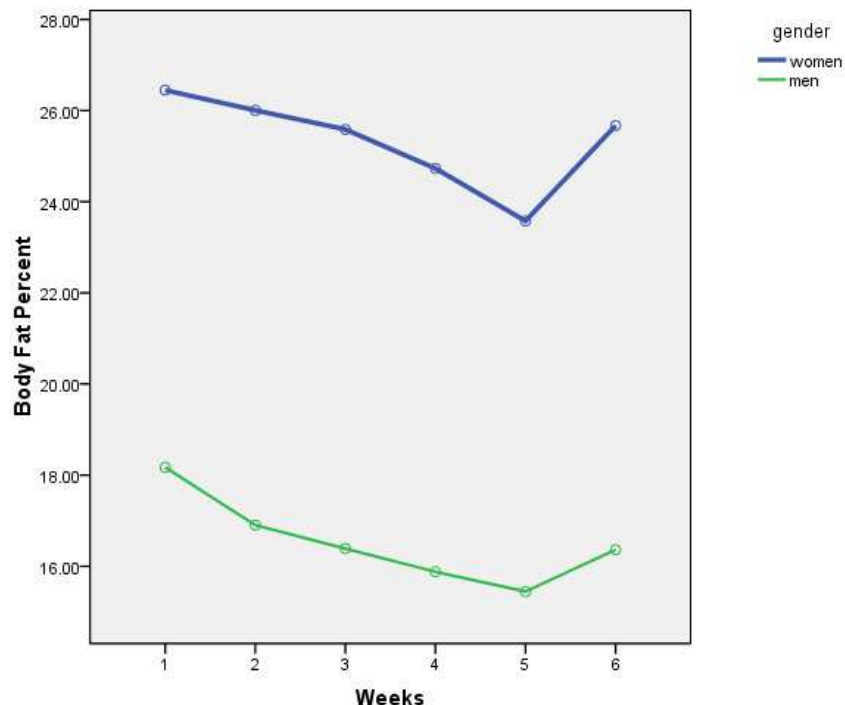


Figure 1: Mean changes of Body Fat percent of male and female during the six weeks of BF measurement.

## CONCLUSION

In the Ramadan, eating habit changes. The rate of body mass in humans decreases during starvation and some changes take place in several anthropometric and physiological measures [1, 15]. Total body metabolism, lipid metabolism and blood lipid level also change during Ramadan [3, 12].

This is the study that has assessed the effects of fasting in Ramadan upon the body fat percentage. The data shows decreases in BFP during Ramadan and also increases in BFP in the first week of Shawwal. In the beginning of fasting and starvation process, glucose of liver and glycogen of muscles is released, the blood glucose is fallen further, insulin secretion is slowed, and glucagon secretion is increased. These hormonal signals motivate triacylglycerols, which now become the primary fuel for muscle and liver [16]. As a matter of fact, fat oxidation is increased while carbohydrate oxidation decreased to some extent during the fasting month [12, 16].

In healthy humans, starvation is associated with a shift in body consumption from carbohydrate to fat, and a significant reduction in insulin sensitivity [17, 18]. Some studies indicate that metabolic and liver adaptation occurs during Ramadan [1, 5]. Moreover, weight decrease, significant reduction in BMI, significant decrease of

homeostasis model assessment of insulin resistance (HOMA-IR) and fasting blood glucose (FBG) were observed during Ramadan fasting [19, 20].

Body fat reduction was statically faster in females in comparison with male. There is consistent support for this result in previous study of [3] which asserted that, during a short period of reduction in food intake, women lose body fat especially from abdominal visceral section. It also noted that 3 factors of BMI, fat lose and body weight changes have closely relations with starvation. [21]. This findings were supported by the study of [3] that mentioned, daily housework as cooking, cleaning, ironing, and laundry cause female to use more energy than males; consequently fat reduction in female is more obvious during Ramadan.

These findings illustrated that; body fat percentage was affected during Ramadan. Thus, the results are in line with another study [8] which has emphasized that Ramadan fasting cause decrease in glucose and weigh; they also reported that BMI and HDL decrease during Ramadan fasting. Another study, however, exposed an opposite result; food intake increases significantly during Ramadan hence significant increase in body weight is reported during Ramadan [22].

In conclusion, in spite of finding that supposed change of body fat and weight during Ramadan, we discovered significant decreases of body fat percentage during Ramadan. Although in Ramadan, where Muslims are compelled to fast and perform religious activity, they should not avoid physical activity during the month as it can reduce stress [23] and prevent obesity [24] In can be concluded that Ramadan fasting had a significant effect of body fat percent especially on women, because they have more work out such as house work that they did during the time before and after breaking of fast.

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