

Effect of Yoga Exercises on the Body Composition of Fasting Females

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ARTICLE INFO	ABSTRACT
<p><i>Article type:</i> Original article</p> <hr/> <p><i>Article History:</i> Received: 04 July 2013 Revised: 06 Aug 2013 Accepted: 08 Aug 2013 Published: 25 Dec 2013</p> <hr/> <p><i>Keywords:</i> Body composition Fasting Female Weight loss Yoga training</p>	<p>The purpose of this study was to investigate the effect of one-month fasting along with yoga training on the body composition of novice female athletes. Twenty trained women were randomly assigned to experimental (n=10) and control (n=10) groups. The experimental group participated in yoga training classes for 4 weeks, two 60-min sessions per week; the control group did not participate in any regular exercise programs. This study was conducted on two fasting groups in the month of Ramadan, 2012. The study variables including body fat percentage, body mass index (BMI), waist circumference and waist-to-hip ratio (WHR) were measured in three stages: a week before Ramadan, the fifteenth day of Ramadan, and a week after Ramadan. The results showed that BMI in the fasting yoga group decreased; however the changes of BMI in the control group were not significant. Also, subcutaneous fat showed significant reduction in both experimental and control groups, though the changes were more significant in the exercise group; also, the results showed that waist-to-hip ratio significantly changed in the experimental group. As to the results, yoga exercises along with fasting can help overweight people to experience ideal weight loss; also for the athletes who stop exercising in Ramadan, yoga can be used as an alternative to maintain their weight.</p>

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Introduction

Ramadan is considered a holy month for Muslims, and fasting is one of the most important principles of Islam (1). Each year during this month, Muslims avoid eating or drinking from dawn (Sahar) to sunset (Iftar), which is approximately 14 hours, on average. Metabolic and physiological responses to physical exercise have been well elucidated (2). In this month, Muslims eat and drink mostly during the night, after Iftar; therefore, reduced frequency of meals leads to elevated concentrations of free fatty acids (3). On the other hand, the amount of sleep through the night (5, 6), food intake (4), and daily physical activities (7) reduce by fasting. Previous studies have shown that fasting can cause significant

changes in the body weight (1, 8), lipid profile (9, 10) and multiple physiological variables in many subjects who did not have any health problems.

Various changes have been reported in Ramadan including (13): decrease in resting metabolic rate, dehydration (28), changes in metabolism and eating habits (depending on the climate and geographical area) (11), and hormonal changes (12). During Ramadan, women stop exercising due to their household chores; they also assume that physical activity can cause health issues. However, research has shown that fasting is not a barrier to non-professional sports.

It seems the best time to exercise during

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Ramadan is after Iftar, since water and food are available to the body after doing physical exercises. Several studies have shown that during Ramadan, cardiovascular responses to exercise and other activities vary from an individual to another. Another study showed that in fasting subjects, metabolic changes and exercise-induced reductions of fat metabolism depend on the level of physical activity. Also, after a month of fasting, a significant decrease in maximal oxygen uptake was reported in sedentary and active (soccer players) participants (2).

One of the most important factors which can affect fasting and exercise is participants' body composition. Body composition includes various factors, among which body mass index (BMI), skin fold and waist-to-hip ratio (WHR) are the most significant. The use of BMI as a variable for body composition is suitable for most people; BMI > 30 indicates obesity, and <20 is indicative of being underweight (9, 10).

Michel and colleagues (2008) in a study on 19 fasting male soccer players, observed a significant increase in the body fat mass, though their weight did not significantly change. Al-Hourani and Atoum (2007) reported that the mean body weight and BMI declined during Ramadan fasting, while the average energy intake and physical activity of the subjects did not vary (14). In a different study by Karli *et al* (2007), it was reported that body composition in athletes who had regular physical activities while fasting, underwent no significant changes (15); Trabelsi *et al* (2011) also reported that the mean BMI significantly decreased by fasting (2). Also Mirzaei *et al* in 2012 investigated the effect of fasting on the body composition of 14 students of wrestling; it was revealed that fasting is accompanied with a significant reduction of the athletes' weight. Meanwhile, Abdelfattah (2005) showed that after a period of fasting, waist-to-hip ratio in men decreased notably, although no significant changes were observed in women (16). Also, some researchers reported that WHR of fasting people has not changed significantly. Since fasting is obligatory for Muslims, the decrease in body water and electrolytes is very important (14); however, studies have been inconsistent in this regard.

Diet in Ramadan is often associated with

reduced food intake and weight loss (17, 18); on average, it is reported that 2 kg of body weight is lost during this period (19, 1). The fasting-induced weight loss in overweight people is more significant than normal-weight or underweight people (20). Unfortunately, this reduction in energy intake is associated with decreased physical activity; thus, the weight change is not proportional to the reduction of energy intake (21). In Ramadan, water supplies and glycogen concentration also reduce, compared to the usual situation. Fluid intake (21, 22) is decreased and dehydration occur in this month. Therefore, there is a possibility that part of the weight loss is due to dehydration. Surely, the negative balance of water and energy does not affect the individual's health (23).

Furthermore, increase in daily energy intake and weight gain in Ramadan has been reported (24). This increase is due to the higher energy intake at iftar and in most cases, the extra energy comes as fat and protein (not carbohydrates) (25). In some studies, changes in energy balance, body weight, subcutaneous fat, and waist-to-hip ratio have not been observed (26).

Regarding the physical exercises which people can do in Ramadan, yoga has received less attention from the researchers. Yoga has an ancient scientific origin in Aryan and Hindu cultures of India. In a book called "Yogasutra" which is collected by Patanjali, Yoga is divided into 8 parts (27):

- 1) Rules of life: avoidance and control of social orders;
- 2) Nyama: biological principles, personal obligation;
- 3) Asana: status, and coordination of the body;
- 4) Pranayama: breathing exercises, control of prana, and maintaining and providing vital energy;
- 5) Pratyahara: control and withdrawal from the senses;
- 6) Dharana: concentration;
- 7) Dhyana: meditation;
- 8) Samadhi: to be one with the truth and integrity of the whole universe.

In other words, yoga exercises affect one's whole being: body, soul and mind.

Yoga through asana detoxifies the body and strengthens the bones, muscles, joints, and the nervous system; it also regulates various body systems such as the endocrine, and immune systems. Through breathing exercises, the cardio-pulmonary efficiency increases and

breathing and heart rate gradually become slower and deeper; via these exercises, enough oxygen gets into the bloodstream, reaches the cells, and heals depression and anxiety. Mental exercises also help the nervous system to have a better function.

In Western countries, yoga is one of the most important methods of alternative medicine. Although many studies have been conducted on the effects of yoga on healing ailments such as back pain, hypertension, cancer, insomnia and restlessness, there have been a few studies focusing on the its impact on healthy individuals (27, 20, 22).

In Ramadan, yoga has great gradual effects on the health status of an individual including: decreasing the blood pressure, resting heart rate, body mass index, and lipids (2, 28, 29). Savasana in yoga, which includes body movements and breathing, is an important aid to weight loss and stress reduction through relaxation, stretching, and healthy eating (30).

Yoga is one of the most effective treatments for stress. It seems that neural system control is achieved via yoga training, and by production and internal secretion of hormones (31-33). Regarding the effect of yoga, Nidhi and colleagues (2012) conducted a study on two groups of females (90 females); one group did aerobic exercises and the other practiced yoga. They reported that the WHR in both groups decreased (34), although the change was not significant; these changes in the yoga group were more than the other.

Also a study by Moliver *et al* (2011) on the effects of yoga on women's body mass index, reported that BMI in the experimental group significantly decreased in comparison with the control group. (31) In another study, it was also found that yoga helps the individuals to lose weight, get less frequently sick, feel less stressed and improve their quality of life. It was also reported that yoga is very effective in improving and maintaining the body stature. Several studies have been conducted on adult and middle-aged people, and positive results were obtained from these exercises (34); for instance, people who did yoga exercises, two 30-min sessions a week for 4 consecutive years, were able to maintain a normal BMI; also, in case they were overweight, they could reach the optimal

weight (1).

The current study was conducted on the impact of fasting and yoga exercises on body composition index in athletes. More attention should be paid to the effect of fasting alone, and with yoga on the body composition of female athletes. The importance of this research is in the selection of right exercises during the hot season, for fasting subjects. The present study sought to examine the effect of one-month fasting along with yoga exercises on the body composition of female athletes, who were beginners in yoga.

Materials and Method

Participants

The study sample was selected from female athletes who were beginners in aerobic training. In a public meeting, advantages and disadvantages of the study were fully explained to the participants. Afterwards, the participants were asked about their willingness to participate in the study, and finally, the written consents were obtained from 20 participants; the subjects also filled out the health questionnaires. The subjects were randomly divided into control (n=10) and experimental (n=10) groups. Although at the beginning, 28 subjects were enrolled in the study, 8 of the participants were excluded from study due to their illness.

Research design

The aim of the present quasi-experimental field study was to investigate the effect of one-month fasting along with yoga exercises on the body composition of novice female athletes. A week before starting the exercises, the athletes attended the exercise room. First, the subjects completed the consent forms to participate in the class, and then filled out the sports medical history questionnaire. A week before starting any exercise program, weight and subcutaneous fat thickness of the participants were measured.

After a week, the experimental group participated in classes of yoga exercises, two training sessions per week, at the Gil Send gym in Rasht; the second analysis of the variables was conducted in the middle of Ramadan. The control group did not do any exercises except

Table 1. Description of the subjects' demographics.

		Age (years)	Weight (kg)	Height (cm)			Age (years)	Weight (kg)	Height (cm)
Experimental group	Mean	41	68.9	154.60	Control group	Mean	39.4	72.10	161.70
	Sd	9.30	5.68	6.53		Sd	8.08	10.43	4.80
	Min	30	60	143		Min	29	56	157
	Max	54	77	163		Max	56	87	169

for their daily chores. The subjects were asked to write down their food intake for three days, and the caloric intake was calculated accordingly; also nutritional suggestions (isocaloric) were offered to the participants. All the participants followed a sedentary lifestyle during the study.

In this study, yoga exercises (60-min sessions) included: stretching exercises, pranayama, asana and meditation. Some asana exercises were as follows: tadasana (standing right), trikonasana (plain triangles), vrikshasana (a tree pose), uttanasana (standing and bending forward), dandasana (sitting right) and sayyidasana (master mode). Meditation (relaxation) was conducted in the last ten minutes of each training session.

To calculate BMI, the weight and height of subjects were measured, and then data were analyzed in the BMI formula. Subcutaneous fat thickness was measured in three body parts including triceps, thigh and above the pelvis; the subcutaneous fat was measured by caliper (Saehan skinfold caliper, SH5020, Korea). It should be noted that all measurements were taken from the right side of the body. The three rotational measurements in each body part (to the nearest 0.1 mm) were recorded; four seconds after the release of folding handle, caliper measurements were read. In order for the measurements to be reliable and valid, the analysis was performed at a particular time of day, preferably in the afternoon; an expert measured the skinfold thickness of all subjects. Measurements were obtained using Jackson-Pollock nomogram, and finally, the ratio of waist-to-hip circumference was measured.

Data analysis

The data were analyzed using descriptive and inferential statistics. Kolmogorov-Smirnov test was used for checking the normality of the data. Independent t-tests, analysis of variance, post hoc Bonferroni test and repeated measure ANOVA were used for testing the research

hypotheses; the significant level was considered less than 0.05.

Results

Data regarding the characteristics of the subjects including age, weight and height are presented in Table 1. The descriptive information related to the body composition variables, including subcutaneous fat, BMI and WHR are shown in Tables 1 to 3.

Repeated measures analysis of variance (Table 2) indicated significant differences between the measurements of BMI in the experimental group; the measurements were taken a week prior to Ramadan, on the fifteenth day of Ramadan, and a week after it. On the other hand, the results showed that there is no significant difference between various measures of BMI in the control group ($P > 0.05$).

Table 2. Three measured BMI in two groups

BMI(kg/m ²)	Measures	Mean	P-value
Experimental group	1	28.89	0.00*
	2	27.84	
	3	27.79	
Control group	1	27.40	0.14
	2	27.04	
	3	27.35	

*significant differences within the group ($P \leq 0.05$)

Table 3. The results of the post hoc Bonferroni test for BMI in the experimental group

BMI	Group Comparisons		Mean Differences	P-value
Experimental group	First measure	Second measure	1.04	0.00*
	First measure	Third measure	1.10	0.00*
	Second measure	Third measure	0.05	1.00

*significant differences ($P \leq 0.05$)

Bonferroni post hoc test results (Table 3) showed significant differences in the experimental group between the first and second measurements, and also the first and third measurements; subjects' BMI significantly decreased in both periods, while no significant differences were observed between the three

measurements in the control group.

According to the repeated measures analysis of variance (Table 4), there were significant differences between the amounts of subcutaneous fat, in different measurement times of the experimental group. On the other hand, regarding the fat percentage of the control group, the results showed no significant differences at different measurement times.

Table 4. Body fat percentage in two groups

Fat%	Measures	Mean	P-value
Experimental group	1	39.75	0.00*
	2	37.15	
	3	37.45	
Fat%	Measures	Mean	P-value
Control group	1	38.90	0.00*
	2	37.80	
	3	38.90	

*Significant differences within the group ($P \leq 0.05$)

In the experimental group, as to Bonferroni post hoc test results (Table 5), significant differences are observed between the first measurement of subcutaneous fat and the second and third ones. Subcutaneous fat significantly decreased in the subjects of both groups; although there were no significant differences between the second measure of the skin fold (during Ramadan) and the third measurement (after Ramadan). According to Bonferroni post hoc test results, the percentage of body fat decreased significantly from the first to the second test. This variable increased significantly from the second to the third measurement ($P \leq 0.05$).

Table 5. The results of post hoc Bonferroni test of body fat percentage

Fat%	Group Comparisons		Mean Differences	P-value
Experimental group	First measure	Second measure	2.60	0.00*
		Third measure	2.30	0.00*
	Second measure	Third measure	-0.30	0.77
Control group	First measure	Second measure	1.10	0.01*
		Third measure	0.00	1.00
	Second measure	Third measure	-1.10	0.01*

*Significant differences within the group ($P \leq 0.05$)

The differences between the experimental and control groups were compared using

independent t-test (Table 6). The results showed that subcutaneous fat loss in the experimental group, between the first and second measurements, was significantly higher than the control group. However, this increase in subcutaneous fat between the second and third measurements was significantly greater in the control group. In the experimental group, subcutaneous fat experienced lesser increase after Ramadan, compared with the control group.

Table 6. Differences in the fat percentage of groups during three measurements

Fat%	Mean Differences	t	P-value
Diff 1	1.50	4.23	0.00*
Diff 2	0.80	2.60	0.02*
Diff 3	2.30	6.14	0.00*

*Significant differences between the groups ($P \leq 0.05$)

With respect to the impact of yoga exercises along with fasting on WHR of women, the results of the analysis of variance with repeated measures showed significant differences (Table 7). On the other hand, the results indicated that WHR measurements in the control group did not change significantly.

Table 7. The results of WHR during three measurements

WHR	Measures	Mean	P-value
Experimental group	1	0.830	0.00*
	2	0.800	
	3	0.793	
Control group	1	0.853	0.06
	2	0.849	
	3	0.861	

*Significant differences within the group ($P \leq 0.05$)

Based on Bonferroni post hoc test (Table 8), it is indicated that in the experimental group, there were significant differences between the first and second measurements, and also between the first and third measurements; however, waist-to-hip ratio in subjects significantly decreased, while the second and the third measurements didn't show any significant differences.

Table 8. Post hoc results of WHR in the experimental group

WHR	Group Comparisons		Mean Differences	P-value
Experimental group	First measure	Second measure	0.03	0.01*
		Third measure	0.073	0.01*
	Second measure	Third measure	0.007	0.67

*Significant differences ($P \leq 0.05$)

Discussion

The results of the present study showed that in the experimental group, there were significant differences in BMI, a week before Ramadan, on the fifteenth day, and finally a week after it; however, no significant differences were observed in BMI of the control group. In fact, in the experimental group, Bonferroni post hoc test results showed a significant reduction in BMI from a week before Ramadan until 15th, and also from a week before Ramadan until a week after it; while in the control group, no significant differences were observed between Ramadan 15th and a week after this month.

Trabelsi and colleagues (2011) reported a significant decrease in body mass index (2). In a study by Mirzaei et al. in 2012, the effect of fasting on the body composition of 14 wrestlers was analysed at the University of Gilan, and a statistically significant reduction in weight was observed (6). However, Karli and colleagues (2007) didn't observe any significant differences in the athletes' body mass indices (15).

Fasting causes changes in the size and number of meals, and thus affects the amount of calorie and nutrient intake. However, it can be inferred from the results of some previous studies that fasting may have a significant impact on body mass index. In fact fasting is only one factor, and other agents such as the activity level, calorie and water intake, gender and specific conditions are also effective in this regard.

The results of our study showed that yoga training causes significant changes in body mass index, and these results indicated the specific effect of yoga. In this study, the control group which was only fasting and did not participate in yoga training sessions did not experience significant changes in BMI. Nagra et al. (1998), Namony et al. (1997), and Adlon et al. (1997) reported that by daily control of energy intake, BMI will significantly decrease (10). Also, Memari and colleagues (2009) reported that BMI of fasting individuals significantly decreases. Moliver et al. in their (2011) study regarding the effects of yoga on women's body mass index reported that BMI in the experimental group significantly reduced, compared to the control group. (31). Brown et al. in an investigation found that yoga exercises

help the individuals to lose weight, less frequently get sick, and improve their quality of life; he reported that yoga is very effective in improving and maintaining the body stature (30).

Several studies conducted on adults and middle-aged people have obtained positive results from these exercises. Many studies have shown that people who practiced yoga for 4 consecutive years (twice a week, half an hour per session), were able to maintain the normal body mass index; if they were overweight, their weight reduced to the desired level (1). Unlike the results of this study, Al-Hourani and Atoum (2007) reported that BMI significantly reduced in Ramadan, while the average energy intake and physical activity level of the subjects did not significantly change; therefore, the weight loss may be due to the loss of body water (14). The conflicting results of the studies may be related to the subjects' differences of age, gender, dietary habits and duration of fasting.

As to the results of the present study, there were significant changes in body fat percentage of the experimental group in different measurements. However, the results showed that the amount of subcutaneous fat of the control group significantly changed in various measurements. Our findings revealed that in the experimental group, body fat reduced significantly in the second measurement compared with the first one, also a reduction was observed in the third measurement in comparison with the first one; though there were no significant differences between the second and third measurements. In the control group, as to Bonferroni post hoc test results, a significant reduction was observed from the first measurement of subcutaneous fat to the second one; also there were significant differences between the second and third measurements; however, the fat percentage increased. On the other hand, between the first (prior to Ramadan) and the third measurements (after Ramadan), no significant differences were observed.

Due to the significant changes in both experimental and control groups, the differences between the two groups were compared, using independent t-test. The results showed that loss of subcutaneous fat in the first

and the second measurements was significantly greater in the experimental group in comparison with the control group. On the other hand, this increase in the amount of subcutaneous fat, between the second and third measurements in the control group was significantly higher than the experimental group, and subcutaneous fat levels after Ramadan in the experimental group increased less significantly compared with the control group.

By the same token, Mirzaei et al. (2012) investigated the effect of fasting on the lipid profiles of 14 wrestlers in Gilan University, Iran (6). The results of their study showed that fasting significantly reduced subcutaneous fat, weight and lipid profile. Karli and colleagues (2007) tested the effect of fasting on the amount of body fat; no significant changes were observed in the measured parameters. In their study, they concluded that if the athletes pay attention to the amount of food and water intake, and sleep during Ramadan, fasting will have an impact on their performance; this study showed that active individuals can their plasma water in normal rate (15). It can be concluded that by limiting the amount of calories, body fat percentage reduces.

The results showed that WHR of the experimental group, was significantly different at various times of measurement (a week before Ramadan, on 15th day and a week after Ramadan). On the other hand, in the control group, the results indicated that there were no significant differences in WHR between three measurements. In the experimental group, there was a significant difference between the first measurement of WHR and the second measurement, and also between the first and third measurements; WHR reduced significantly in subjects of the experimental group, while there were no significant differences between the second and third measurements of WHR. Meanwhile, Abdelfatah (2005) showed that after a period of fasting, WHR of men decreased significantly, but no noticeable change was observed among women (16).

Memari et al. in their study (2009) reported that the changes in WHR of fasting subjects were not significant. In relation to the effects of yoga, Nidhi Ram and colleagues (2012) conducted a

study on 90 girls in two groups during Ramadan. The first group practiced aerobic exercises, and the second group did yoga. They reported some changes in the body mass index and waist to hip ratio in both groups; however the changes were not significant; according to the results, the changes were greater in the yoga group. The results of this study demonstrated the effectiveness of meditation and stretching in yoga on body composition especially the waist-to-hip ratio.

Conclusion

The main finding of the present study is that yoga exercises, two sessions per week, can be a reasonable option for fasting athlete women, to maintain their ideal weight, WHR, and body fat percentage. In the experimental group, the desirable changes are maintained during a week after Ramadan; however, some of the changes are related to other factors rather than exercise, We conclude that female athletes, who stop exercising during Ramadan, can consider yoga as an alternative to control their body weight.

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