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The Effect of Ramadan Fasting and Physical Activity on Homocysteine and Fibrinogen Concentrations in Overweight Women

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ABSTRACT

Introduction: Increased levels of certain markers like fibrinogen and Homocysteine are independently associated with an increased risk of cardiovascular diseases. Considering the numerous favorable effects of healthful nutrition and physical activity on reducing the risk of atherosclerosis, in this study we intend to take into account fasting and physical activity during the month of Ramadan and their impacts on Homocysteine and fibrinogen concentrations in overweight women.

Methods: In this experiment, 22 overweight and obese women with a body mass index (BMI) of greater than 25 kg/m^2 aging from 20 to 45 years were enrolled into two groups by means of targeted-sampling method. One group involved fasting accompanied with regular physical activity (12 subjects) and the other group involved only fasting (10 subjects).

The protocol for the physical activity group consisted of three 60-minute sessions of aerobic exercise per week with a 50% to 65% of heart rate reserve. Towards the end of Ramadan, the anthropometric and blood levels of Homocysteine and fibrinogen were closely measured. Data were analyzed using repeated measures and the significance level of P≤0/05 was considered.

Results: A month of fasting along with regular physical activity did not prove to have any noticeable effects on the level of fibrinogen while a significant increase in the Homocysteine levels was discovered (P <0/05). Comparing the two protocols lead us to the conclusion that one month of fasting with or without regular physical activity did not seem to make a noteworthy difference on the levels of fibrinogen and Homocysteine.

Conclusion: The results of this study demonstrated that fasting with or without regular exercise could not significantly decrease the body fat percentage. Furthermore, it seems that unhealthy and inadequate nutrition during Ramadan as well as insufficient intensity and duration of exercise are the causes of this fact.

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Introduction

Today, obesity and being overweight are among the most critical issues in the world and they are the immediate result of inactivity and unfavorable changes in lifestyle (1). Epidemiological evidence indicates that 65 percent of the world population is overweight and women are suspected to be more prone to the risk of obesity than men (2).

Obesity is associated with many disorders and diseases. Some examples are disorders of fat metabolism, type II diabetes and cardiovascular diseases (3).

For a long time, lipid profile was recognized as an indicator of cardiovascular diseases. However, there is growing evidence suggesting that some people, despite their appropriate levels of low-density lipoprotein (LDL) and high-density lipoprotein-cholesterol (HDL-C), have been affected by cardiovascular risks (5, 4).

In a study conducted in 2008, it was found that nearly half of the heart attacks occur among those without Hyperlipidemia (6). Therefore, researchers have come to pay closer attention to the indicators that are more sensitive so that they could predict the risk of cardiovascular diseases more precisely.

In this regard, the findings of recent research studies propose that some parameters like the

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concentration of Homocysteine and fibrinogen are associated with the development of cardiovascular diseases (8,7).

Epidemiological studies have also revealed that a high level of plasma Homocysteine is an independent risk factor of cardiovascular diseases (9-11).

Homocysteine is a sulfur-containing amino acid with a molecular weight of 135/2 Daltons and it is produced out of the Demethylation of an essential amino acid called Methionine (12). Damages to endothelial cells, activated platelets, activated C-reactive protein, tissue factor activation and increased spontaneous oxidation of LDL are the procedures through which Homocysteine becomes capable of causing Atherosclerosis and Thrombosis (13-15).

It has been reported that an increase in the blood levels of Homocysteine by 5 micromoles more than that of the normal levels is likely to heighten the risk of mortality by almost 80% in women and by 60% in men (16).

On the other hand, a 25% reduction of Homocysteine to 3 micromoles per liter is associated with an 11% decline in ischemic heart diseases (17). On this subject, several studies have discovered that the relationship between total Homocysteine levels and Atherosclerosis is even stronger than the association between Atherosclerosis and cholesterol (11).

With respect to the markers of coagulation, fibrinogen is the most reliable indicator of coronary artery problems (18, 19). Fibrinogen, which is synthesized by liver cells under the induction of interleukin 6 (IL-6), exerts certain effects on plasma viscosity, platelet aggregation and the formation of fibrin laying the grounds for the development of coronary heart diseases (20).

Consequently, an increase of one gram per liter of fibrinogen concentration, apart from other factors, is likely to enhance the risk of coronary heart diseases by up to 1.8 times (18). Moreover, the concentration of this substance is largely affected by the amount and quality of fat intake (21).

Many scientists and researchers believe that maintaining health and well-being through a healthy lifestyle as well as remaining active with exercise and regular physical activity is the key to prevent primary and secondary chronic diseases, especially coronary artery diseases and their underlying cause Atherosclerosis. However, studies on the impact of physical activity on cardiovascular risk factors and Homocysteine and fibrinogen blood levels present conflicting results.

In their research, Jahangard et al (2009) noted a significant decrease in the levels of plasma fibrinogen in postmenopausal women after 10 weeks of sub maximal regular exercise with 70% of the maximum heart rate for 30 minutes (22).

On the other hand, in another study by Furukawa et al (2008), it was concluded that 12 weeks of brisk walking of moderate-intensity for 20 to 30 minutes on a daily basis did not seem to affect the fibrinogen concentrations in middle-aged women (23).

In his research, Herman (2003) claimed that a three-week swimming training resulted in a slight increase in the Homocysteine level (24). By contrast, Taghian's experiment (2011) proposed that a 12-week program of regular, moderate-intensity exercise could help control the weight and reduce Homocysteine levels in elderly women through enabling skeletal muscles to use the body fat (25).

Regarding the information above on the subject of fasting and physical activity, changes in the daily diet and lifestyle (for instance, the changes that take place during the fasting month of Ramadan) are known to be able to reduce Atherosclerosis and thus, reduce the risk of cardiovascular diseases to a great extent.

Today, the Islamic fasting is recognized as a way of improving eating habits and controlling weight. Islamic fasting is a must-do the physical and mental benefits of which are countless. In spite of the fact that the favorable impacts on the body have not yet been fully established (26), it is evident that the changes made in eating habits and sleep patterns during Ramadan lead to remarkable refinements in the physiological structure of the human body (27).

Nonetheless, studies on the effects of Ramadan fasting on cardiovascular risk factors present conflicting results (28, 29).

Considering the levels of fibrinogen and Homocysteine as the potential heart disease risk factors on the one hand and the limited research done on the effects of regular exercise during Ramadan on the other hand, the present study aimed to investigate the actual effects of regular

physical activity on the body composition during Ramadan. The role of fibrinogen and Homocysteine levels while fasting were additionally surveyed in overweight women.

Materials and Methods

This quasi-experimental study was conducted on 27 overweight and obese women with a body mass index (BMI) of greater than 25 kg/ m^2 aging from 20 to 45 years. The subjects were selected through available, targeted sampling. All participants were in a healthy condition with no history of respiratory, metabolic, cardiovascular, renal or hepatic disorders. They were all non-smokers and had no previous experience of participation in any regular exercise programs.

The exclusion criteria for the study were as follows:

1) any long-term use of certain medications;
2) orthopedic injuries;
3) absence of more than 2 consecutive sessions from the experiment;
4) interruption of more than 10 days in fasting.

It is also noteworthy that all the subjects were allowed to leave the experiment at any time without question.

Before the consent forms were filled out by the subjects, they were fully informed about the nature of the research and their cooperation regarding the essential points about exercise, nutrition, drugs, tobacco consumption and the use of any supplements and doping drugs. Afterwards, the demographic data and health status questionnaires were completed in a self-expressive fashion. Following that, the samples were randomly divided into two groups of fasting-only (n=12) and fasting accompanied with regular physical activity (n=15).

It should be highlighted that during the experiment, two of the subjects in the fasting-only group and three of the subjects in the fasting and physical activity group were excluded due to their not following the criteria of the study.

A week before the beginning of Ramadan, we used the scale and height gauges of Sega Model (SEGA) in order to measure the weight and height of the subjects.

Hip and waist circumference were calculated by tape measure in centimeters and the body fat percentage was quantified based on the percentage of the overall body weight using bioelectrical impedance (IN-body model 720 made in South Korea).

By dividing the body weight into the square of height, the BMI into square feet and waist-to-hip circumference, the waist-to-hip ratio (WHR) was obtained.

At the last week of Ramadan, all measurements were repeated at 11:00 a.m just as they had been a week before the start of Ramadan. For the current study, the first blood samples were taken three days before the beginning of Ramadan and blood sampling was repeated for the second time at the end of the fasting month.

Before starting the experiment, all the subjects, especially the subjects of the active group were asked not to do any exercise at least two days before blood sampling. The blood samples were obtained from the subjects' right arm vein by an expert for as much as 10 ml while they had already been fasting for 12 hours from 8:00 to 10:00 in the morning. Afterwards, the blood levels of Homocysteine and fibrinogen were closely assessed by enzyme immunoassay (EIA) in micromoles per liter using the chronometric method in milligrams per deciliter.

In this study, the duration of fasting in the month of Ramadan (August/Mordad) was approximately about 16 hours per day and the fasting-only group had no regular exercise during the month of fasting. However, the fasting with regular exercise group began their exercise protocol from the first week of Ramadan and continued until the end of the fourth week.

The training program was performed under the researcher's monitoring and direct supervision each week. The program consisted of three sessions each lasting for 60 minutes. Each session included a 10-minute warm-up, 45 minutes of walking or running on the treadmill with an intensity interval between 50 to 65 percent of heart rate reserve and finally, 5 minutes of cooling. The exercise intensity was managed by Electronic Stethoscope Model Polar (Polar Team Sports System - Finland Polar) made in Finland.

In the end, the data were analyzed using SPSS software (version 16). After checking the normality of data distribution using the Wilk-

Shapiro test and inspecting the homogeneity of the variances via the Exploratory Levene test, the repeated measures analysis of variance (ANOVA) was applied in order to compare the mean of intra-group and inter-group. To determine the significance, a significance level of P≤0.05 was considered.

Results

According to Table 1, a month of fasting along with regular physical activity was associated with a significant decrease in the body weight, BMI and the WHR circumference (P<0.05). Furthermore, there was a decrease in the body fat which was not significant. A whole month of only fasting made significant changes in the body weight.

Comparing the two protocols, we discovered that a month of fasting with or without regular physical activity did not seem to bring about any considerable changes in the body weight, the waist circumference to hip ratio, BMI (Body Weight Index) and the overall body fat percentage.

As is illustrated in Table 2, the variables of changes in fibrinogen and Homocysteine in the fasting with activity group indicate that a month of fasting along with regular physical activity does not have any significant effects on fibrinogen while it is likely to increase Homocysteine levels (P<0.05).

The results also revealed that the two protocols, with or without regular physical activity, did not seem to differ greatly with regards to fibrinogen and Homocysteine levels while fasting.

Discussion

This study conveys that a month of fasting along with regular physical activity lead to a significant decrease in the body weight, BMI and WHR. For another thing, although a month of fasting without any regular exercise might exert a notable effect on the Body weight, it did not seem to affect the percent of body fat in the active and inactive group significantly during the month of Ramadan.

On this subject, the studies of Saleh Mansi (2007), Al-Hourani and Atom (2007), Haghdoost (2009) and Tayeby (2010) also reported of the participants' weight loss during the fasting month of Ramadan which is a finding consistent with the results of the current research (28-31).

By contrast, Ramadan (2002) claimed to have observed no significant changes in the body weight after the month of Ramadan. On the

Table 1. Changes in body size and body composition of the active (n=12) and inactive (n = 10) during different stages and changes in averages of within and between groups

Variables	Groups	Stages*		Within groups		Between groups	
		Before the Ramadan M±SD	End of Ramadan M±SD	F	P-value	F	P-value
Weight (Kg)	Exe. + fasting	79.9±13.2	78.4±13.2	25.358	0.001‡	2.899	0.105
	Fasting	71.1±9.6	69.9±9.0	08.628	0.017‡		
BMI (kg/m²)	Exe. + fasting	32.0±4.4	31.4±4.7	25.041	0.001‡	3.786	0.067
	Fasting	28.6±3.2	28.1±2.9	0.925	0.365		
WHR	Exe. + fasting	0.94±0.06	0.92±0.07	8.275	0.010‡	1.005	0.329
	Fasting	0.91±0.06	0.90±0.06	0.991	0.344		
Body fat per. (%)	Exe. + fasting	44.4±5.7	43.9±5.2	0.526	0.477	1.328	0.264
	Fasting	41.6±4.4	41.7±4.5	0.231	0.641		

*Data presented as mean ± standard deviation
‡The mean difference is significant at the 0.05 level.

Table 2. Changes in Fibrinogen and Homocysteine of the active (n=12) and inactive (n = 10) during different stages and changes in averages of within and between groups

Variables	Groups	Stages*		Within groups		Between groups	
		Before the Ramadan M±SD	End of Ramadan M±SD	F	P-value	F	P-value
Fibrinogen (mg/dl)	Exe. + fasting	240.9±36.18	275.6±50.27	4.050	0.069	0.762	0.394
	Fasting	258.7±22.03	278.8±46.08	0.976	0.352		
Homocysteine (µmol/L)	Exe. + fasting	10.16±3.06	15.68±4.82	14.151	0.004‡	1.121	0.305
	Fasting	10.94±2.13	12.14±3.44	0.726	0.423		

*Data presented as mean ± standard deviation
‡The mean difference is significant at the 0.05 level.

other hand, Yousef Boobes (2009) and Maislos (1993) reported to have detected an increase in the body weight during the fasting month of Ramadan which is inconsistent with the findings of our study (32-34). According to their results, since the body fat percentage does not seem to change significantly, we could attribute the weight loss during Ramadan to the minimized water intake as well as the decrease in hydro glycogen supplies.

Furthermore, the present study demonstrated that fasting without physical activity and/or accompanied with regular physical exercise can increase fibrinogen concentration although fibrinogen blood levels in any of the participants in either groups did not seem to change significantly.

The findings of this study are correspondent with those of Aksungar's (2005) and Saleh's (2004) research (35, 36). However, they are inconsistent with the results of Sarrafzadegan's (2000) and Vahdat Shariat Panahi's (2012) studies (37, 38).

Studies have additionally verified that fibrinogen acts as a clotting factor and is a major independent risk factor for ischemic heart diseases strongly affected by the amount and quality of the fat intake. In general, excessive fat intake could cause inflammation in the body stimulating blood fibrinogen to rise.

For another thing, the loss of body fat is probably due to the decrease in plasma fibrinogen and regular exercise (21). Diminishing body fat could help lower IL-6 made in the adipose tissue. IL-6 is the stimulating facet of fibrinogen synthesis and its reduction ultimately causes fibrinogen levels to drop (20).

Nevertheless, in the current study, the percentage of body fat did not seem to change noticeably. In other words, a poor diet during Ramadan is likely to bring about significant changes in the percentage of body fat and fibrinogen concentrations. Having two proper meals of nutritional variety per day during Ramadan instead of three meals could help improve such mechanisms (39).

On the impact of physical activity on fibrinogen, a number of studies propose that regular physical activity might not be associated with lowering the levels of this particular risk factor. Health conditions as in the presence of such factors as hypertension and obesity, especially the obesity around the abdominal area and inheritance are among the effective components affecting blood fibrinogen concentrations (40, 41).

Another variable under study is blood Homocysteine. The findings of the current study lead us to the idea that blood Homocysteine levels in inactive, fasting subjects tended to increase slightly which of course, is of no significance.

The results of our study are consistent with those of Chaouachi's (2009) and Nematti's (2012) (42, 43). However, they are inconsistent with the findings of Aksungar (2007) (44). In the present study, the increased Homocysteine levels might have been due to poor nutritional patterns during Ramadan.

As for the limitations of our study, the precise supervision of the subjects' diet who were fasting was lacking. The reason is that an increase in Homocysteine concentration in healthy adults could be an immediate result of many factors like a decline in serum folate concentration or an increase in the prevalence of vitamin B12 and pyridoxine deficiency as a result of malabsorption of vitamins (25, 45).

Our findings also demonstrated that fasting accompanied with exercise leads to a significant increase in the Homocysteine levels and other mechanisms to be investigated in this regard are the intensity and volume of training.

Several studies have claimed that prolonged, strenuous exercise is likely to alter protein metabolism and blood levels of certain amino acids as well as reduce the levels of Methionine.

On the other hand, when Methionine becomes less available, its synthesis heightens which eventually leads to the accumulation of Homocysteine (11, 25).

In a study conducted by Bailey et al. in 2000, the effects of a 4-week endurance training with the intensity of 85-70% of the maximum heart rate were investigated in men (46).

In the experiment of Herman et al. (2003), the impact of a 3-week intense interval training workout of high volume was examined on swimmers (24).

All of these studies have come to indicate that these forms of exercise are likely to increase Homocysteine blood levels which is a finding compatible with that of the present study.

In conclusion, our findings manifest that fasting with or without regular exercise is not likely to decrease the levels of body fat percentage and such indicators as fibrinogen and Homocysteine noticeably. Moreover, proper nutrition and a healthful diet are known to be the most essential elements affecting the changes in the body fat volume and cardiovascular risk factors. Therefore, it is suggested that further research be done as to investigate the actual effects of exercise and controlled diet on these variables.

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