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Original article

The Effect of Ramadan Fasting and Weight-Lifting Training on Plasma Volume, Glucose and Lipids Profile of Male Weight-Lifters

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Abstract

Objective(s)

The purpose of the present study was to evaluate the effect of Ramadan fasting and weight-lifting training on plasma volume, glucose, and lipids profile of male weight-lifter.

Materials and Methods

Forty male weight-lifters were recruited and divided into 4 groups (n=10 each) and as the following groups: control (C), fasting (F), training (T) and fasting-training (F-T). The T and F-T groups performed weight-lifting technique trainings and hypertrophy body building (3 sessions/week, 90 min/session). All subjects were asked to complete a medical examination as well as a medical questionnaire to ensure that they were not taking any medication, were free of cardiac, respiratory, renal, and metabolic diseases, and were not using steroids. Blood samples were taken at 24 hr before and 24 hr after one month of fasting and weight-lifting exercise. The plasma volume, fasting blood sugar (FBS), lipid profiles, and lipoproteins were analyzed in blood samples.

Results

Body weight and plasma volume showed significant ($P< 0.05$) decrease and increase in the F group ($P< 0.05$) respectively. Also, a significant reduction was observed in F-T group body weight ($P< 0.01$). A significant increase was found in FBS level of F group ($P< 0.05$). The lipid profiles and lipoproteins didn't change significantly in C, F, T and the F-T groups.

Conclusion

The effect of Ramadan fasting on body weight and plasma volumes may be closely related to the nutritional diet or biochemical response to fasting.

Keywords: Glucose, Lipids, Plasma, Ramadan

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Introduction

Ramadan is the 9th month of the Islamic calendar and is considered one of the holiest months in the Islamic calender. During this month, all the adult Muslims abstain not only from eating, drinking and smoking but also from oral drug intake and intravenous injection, from sunrise to sunset (1, 2).

During the month of Ramadan, frequency and quantity of food and fluid intake are decreased and the dietary habits are changed to the consumption of foods that contain more carbohydrates and starches (1). The fasting length per day may vary from 10 to 19 hr (3). In addition, sleep and physical activity habits are significantly reduced (10).

There have been many studies about the effect of Ramadan fasting on body weight (4), blood glucose (5), lipids profile and lipoproteins (6).

Ramadan *et al* (7) investigated the effects of the Ramadan fasting on body composition and some plasma components, hematological indices, and responses to steady state sub-maximal exercise. In another study Sweileh *et al* (8) investigated the effect of sub-maximal exercise in nine trained rugby player in three occasions and two situations: before, first week, and last week of Ramadan fasting, and at rest and acute exercise.

Karli *et al* (9) only studied the effect of Ramadan intermittent fasting on some blood lipid markers in judo athletes during a period in which they were maintaining their training load without competing. None of these studies looked at the parallel effect of Ramadan fasting and weight-lifting or resistance training on biochemical parameters.

Hence, we conducted this study in the month of Ramadan on healthy young male weight-lifter to investigate the effects of Ramadan fasting and weight-lifting training on plasma volume, glucose, and lipids profile.

Materials and Methods

Subjects and research design

The study was approved by the research ethics committee of the School of Medical Sciences of Shomal University (Iran), and conducted in accordance with the policy statement of the Declaration of the Iranian Ministry of Health. Written informed consent was obtained from the 40 males young weight-lifters on Ramadan, 2007. All subjects were asked to complete a medical examination as well as a medical questionnaire to ensure that they were not taking any regular medications, were free of cardiac, respiratory, renal, and metabolic diseases, and were not using steroids. Also, all subjects were completely familiarized with all of the experimental procedures and exercise protocol. The volunteers were assigned randomly into 4 groups as follows: a control group (n=10) without exercise and fasting (C), fasting group (n=10) without exercise (F), training group (n=10) without fasting (T), and fasting-training (n=10) group (F-T). T and F-T groups performed weight-lifting technique exercises and hypertrophy body building.

Exercise training procedures

Participants were taken to the practice hall three times before the main trial. Participants performed strength test to determine their one repetition maximum (1-RM) for each of the exercises, employed in the study on each three visits. The 1-RM value was determined by trial and by adding or removing weight after each attempt as required. The subjects were allowed to take as long time as they felt necessary to recover from each attempt. The weight-lifting training session was started in the evening of the first day to 30th day of Ramadan. It included 3 sessions/week, 90 min/session. The subjects were instructed to follow a normal lifestyle, to maintain daily habits, and to avoid any regular medications.

Blood collection and biochemical analysis

Blood samples were obtained from antecubital vein 24 hr before Ramadan's first day, and 30th's day of Ramadan in test tubes containing EDTA. Subjects had 12 hr overnight fast for both of these blood collections. Plasma was separated by centrifugation within 15 min of collection. The aliquots were frozen and stored at -80 °C for subsequent analyses (within 3–4 weeks). The samples were analyzed for FBS, total cholesterol (TC), triglyceride (Tg), High Density Lipoprotein (HDL), Low Density

Lipoprotein (LDL), and Very Low Density Lipoprotein (VLDL). The FBS, Tg, and TC concentrations were measured by the enzymatic methods technique (glucose oxidase, lipoprotein lipase-glycerol kinas reactions, cholesterol esterase-cholesteroloxidase reactions respectively) spectrophotometer assays using Man Co kit, Tehran-Iran. LDL and HDL were measured by the enzymatic method technique, spectrophotometer assays using Man Co kit, Tehran-Iran.

Hemoglobin (Hb) and Hematocrit (HCT) were also determined using the system K-4500 automated hematology analyzer. The changes in plasma volume and correction of plasma volume changes in parameters which were measured in plasma, such as glucose, TC, Tg, HDL, LDL and VLDL were calculated by using the Dill and Costill method based on hemoglobin and hematocrit estimations (10).

Statistical Analysis

All statistical analyses were performed with SPSS (Statistical Package for Social Science) version 15.0. Descriptive statistics including means and SEs for the outcome variables of interest were computed. The probability levels of significance were based on the 2 paired sample t-test and one way ANOVA. Statistical significance was assigned at $P< 0.05$ for all analysis.

Results

The parallel effects of Ramadan fasting and weight-lifting exercise on blood glucose, lipid profile, and lipoproteins, were studied in 40 healthy volunteer weight-lifters (in 4 groups). The mean age was 21.3±1.6 and there were no significant relation and correlation between body weight (BW) changes in four groups of study in the 1 day before Ramadan, compared with 30th day of Ramadan month after the exercise protocol. We didn't find any difference between groups regarding all of the variables; in other words, effect of group factor was not significant on blood parameters.

Plasma volume and body weight

Plasma volume (PV, ml) didn't change significantly in C (52.4±1.79), T (53.26±1.26) and F-T (52.65±1.54) while comparing the 1 day before Ramadan with the 30th day of Ramadan month after the exercise protocol {(54.8±1.7), (64.4±7.03) and (54.2±2.38) respectively}. However, in F group, PV showed significant increase ($P< 0.05$) in the 30th day of Ramadan (55.5±1.11) compared to the 1st day before Ramadan (53.38±1.14). There was a significant reduction in body weight (kg) of volunteers in both F (pre: 90.00±4.55 to post: 89.14±4.48) and FT (pre: 92.28±4.59 to post: 91.40±4.63) groups ($P<0.05$); however it was not significant in either C (pre: 76.38±3.05 to post: 76.22±3.04) and T (pre: 89.28±6.00 to post: 89.47±5.98) (Table 1).

Blood glucose, lipid profiles, and lipoproteins

There was no significant change in blood glucose, lipid profiles and lipoproteins in C, F, and F-T groups. T group showed significant increase ($P< 0.05$) in glucose level (Figure 1).

The other parameters didn't significantly change from the 1 day before fasting months to the 30th day of Ramadan month after the exercise protocol (Table 2).

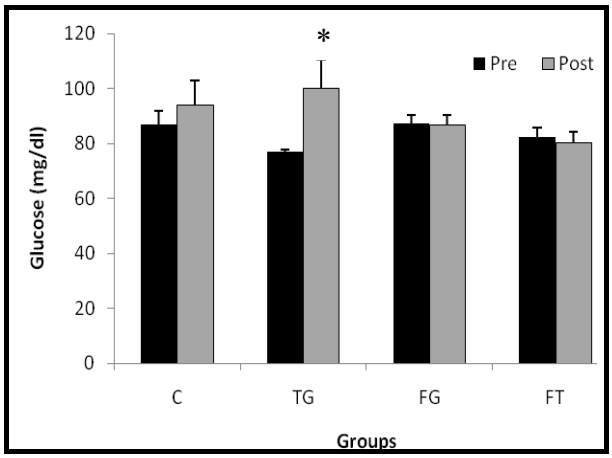

Figure 1. Serum FBS concentration in the 1th day before Ramadan (Pre) compared with 30th day of Ramadan month (Post) after the exercise protocol in different groups (n= 40). *Significant level was set at $P< 0.05$. Data are expressed as mean±SEM. (C): control group without exercise and fasting. (F): fasting group without exercise. (T): training group without fasting. (F-T) fasting training group who performed weight-lifting technique.

Table 1. Values of hematological and body weight factors. (Mean±SE) in the 1 day before Ramadan (pre) compared with 30th day of Ramadan month after (post) the exercise protocol in different groups.

Groups (n=40)	Variables	Pre	Post	*P*-Value
C (n=10)	PV (ml)	52.4±1.79	54.8±1.7	0.43
	BW (Kg)	76.38±3.05	76.22±3.04	0.30
T (n=10)	PV (ml)	53.26±1.26	64.4±7.03	0.12
	BW (Kg)	89.28±6.00	89.47±5.98	0.27
F (n=10)	PV (ml)	53.38±1.14	55.5±1.11	0.034*
	BW (Kg)	90.00±4.55	89.14±4.48	0.013*
F-T (n=10)	PV (ml)	52.65±1.54	54.2±2.38	0.50
	BW (Kg)	92.28±4.59	91.40±4.63	0.007**

*Statistical significance was set at $P \leq 0.05$. **Statistical significance was considered as $P \leq 0.01$. Data are expressed as mean±SEM. (C): control group without exercise and fasting. (F): fasting group without exercise. (T): training group without fasting. (F-T) fasting + training group who performed weight-lifting technique.

Table 2. Values of lipid profiles and lipoprotein (Mean±SD) in the 1 day before Ramadan (pre) compared with 30th day of Ramadan month (post) after the exercise protocol.

Groups (n=40)	Variables (mg/dl)	Pre	Post	*P*-Value*
C (n=10)	Tg	174.6 ± 14.39	156.43 ± 43.74	0.25
	HDL-c	39.0 ± 1.16	42.72 ± 3.39	0.44
	LDL-c	108.16 ± 6.57	96.31 ± 16.43	0.46
	VLDL-c	34.9 ± 8.12	38.53 ± 13.60	0.57
	LDL/HDL	2.77 ± 0.16	2.36 ± 0.39	0.27
	TC/HDL	4.69 ± 0.3	4.30 ± 0.09	0.50
T (n=10)	TC	154.33 ± 6.07	190.72 ± 26.74	0.22
	Tg	156.44 ± 23.05	148.77 ± 26.82	0.77
	HDL-c	39.33 ± 0.53	48.33 ± 6.00	0.17
	LDL-c	89.71 ± 4.59	112.57 ± 16.75	0.21
	VLDL-c	31.28 ± 4.61	29.75 ± 5.36	0.77
	LDL/HDL	2.27 ± 0.09	2.78 ± 0.33	0.16
	TC/HDL	3.91 ± 0.12	4.72 ± 0.52	0.17
F (n=10)	TC	168.7 ± 11.3	167.16 ± 10.94	0.70
	Tg	140.2 ± 25.14	125.06 ± 22.84	0.49
	HDL-c	37.79 ± 0.91	40.35 ± 1.76	0.15
	LDL-c	106.39 ± 9.65	101.98 ± 5.35	0.44
	VLDL-c	27.92 ± 5.05	23.70 ± 4.3	0.36
	LDL/HDL	2.82 ± 0.26	2.67 ± 0.18	0.31
	TC/HDL	4.46 ± 0.28	2.37 ± 0.34	0.56
F-T (n=10)	TC	171.87 ± 8.77	168.94 ± 8.39	0.71
	Tg	180.62 ± 24.44	138.82 ± 32.41	0.13
	HDL-c	39.87 ± 0.77	42.95 ± 1.44	0.09
	LDL-c	97.1 ± 6.01	98.19 ± 7.44	0.86
	VLDL-c	33.81 ± 4.65	31.27 ± 5.25	0.38
	LDL/HDL	2.42 ± 0.12	2.35 ± 0.15	0.54
	TC/HDL	4.32 ± 0.24	4.04 ± 0.17	0.16

*Statistical significance was set at $P \leq 0.05$. (SE): Standard Error of Mean. (C): control group without exercise and fasting. (F): fasting group without exercise. (T): training group without fasting. (F-T) fasting-training group who performed weight-lifting technique exercises and hypertrophy body-bulging. (TC): total cholesterol. (Tg): triglyceride. (HDL-c): high density lipoprotein-cholesterol. (LDL-c): low density lipoprotein-cholesterol. (VLDL-c): very low density lipoprotein-cholesterol.

Discussion

In this study, we observed that the BW of T and T-F groups reduced significantly ($P< 0.05$). Similarly, many studies reported weight reduction during Ramadan fasting (2, 7). Almost similar to our investigation, Chaouachi *et al* (11) study showed the effects of Ramadan fasting in judo athletes who maintained workload of exercises on lower level than competition during Ramadan fasting, and reported that mean body mass decreased significantly.

Maislos *et al* (12) suggested that the decrease in body weight through Ramadan fasting may be related to reduction in fluid intake (8), a decrease in water stores that related to glycogen-bound, short reduction of body tissue with a moderate degree of hypohydration, and extracellular volume contraction.

Our results also showed that plasma glucose level increased significantly ($P< 0.05$) in the 30th day of Ramadan compared with the 1th day before Ramadan only in T group and the other groups didn't show any significant changes. Similarly, Sarraf-Zadegan *et al* (13) showed that fasting blood glucose did not change during Ramadan and two month after. Also, Asgary *et al* (14) results on fasting blood sugar showed insignificant reduction in Ramadan. Indeed Saleh Mansi (4) documented that glucose didn't change significantly due to fasting in Ramadan month. Bouhlel *et al* (15) explored Ramadan fasting and the GH/IGF-1 axis of trained men during sub-maximal exercise in nine trained male rugby players. Ramadan fasting induced a significant reduction in body mass, but plasma glucose did not change significantly, either at rest or following exercise. They concluded that Ramadan fasting induces positive changes in body composition without disturbing glucose regulation.

Hordern *et al* (16) study showed that blood glucose response to short-term (4 weeks) exercise training in patients with Type 2 diabetes didn't change significantly. Ghanbari-Niaki (17) observed that glucose concentration was significantly increased immediately after a single session circuit resistance exercise and was significantly higher at 24 hr post-exercise compared to the pre-exercise value.

In this study, changes in plasma glucose with exercise training were analyzed and it showed a significant ($P< 0.05$) increase. To further investigate the reason for such increase, more studies are needed to measure factors such as plasma insulin level during cardiac hypertrophy induced by exercise. In our opinion, a reason for elevated glucose level could be that blood samples were collected within 24 hr post hypertrophic exercise in these individual.

There is a general agreement regarding the positive effects of aerobic and endurance types of training on lipid and lipoprotein metabolism (18, 19). In contrast to aerobic physical activities and regular endurance training, there was no agreement about the effects of anaerobic-power based sports/physical activities or maximal (high) intensity-short term exercise training on serum/plasma lipid and lipoprotein profiles (20).

Hence, in this study, we expected changes in lipid profiles and lipoproteins during weight-lifting training with moderate intensity as observed in TG. However, this was not the case in our study. This could be due to the correlation of plasma volume with other parameters in this study, whereas, in others similar correlation was not prominent.

Significant increase in PV as hemodilution could show a cardiovascular adaptation to fasting and long-term dehydration during day time. Another likely reason for hemodilution is environmental factors (21) as the month of Ramadan in our study was in autumn. Another reason may be because of the time of blood sampling as blood samples were collected within 24 hr post hypertrophic exercise in these individual after last day of Ramadan fasting.

Conclusion

Although the parallel effect of Ramadan fasting and weight-lifting training on body weight as well as plasma volume may be closely related to the nutritional diet or biochemical response to starvation, the weight-lifting training in this study and Ramadan

fasting had no significant effect on plasma lipids profile. Further studies are required to investigate effects of weight-lifting exercise training through Ramadan month with fasting on energy balance and metabolism of athletes.

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