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Full Length Research Paper

A study on serum leptin, lipoproteins and glucose levels of judoists and cyclists of Turkey

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Fat metabolism is important for judo in weight loss and recovery and for cycling in the energy production and recovery during workouts and competitions. Leptin controls the size of fat stores by inhibiting appetite. The purpose of this study was to compare serum leptin, lipoproteins and glucose levels between male national judoists and cyclists. The subjects of this study consist of totally 61 athletes, including 24 Turkish National junior judoists and 37 senior national cyclists. The mean age, training age and body mass index (BMI) of two groups are different from each other. Both judoists and cyclists were training before international competitons. Analyses of serum lipoproteins, triglycerides, total cholesterol, LDL-cholesterol and HDL-cholesterol, were determined by an automated chemistry analyzer kits. The differences between two groups was tested by Mann-Whitney U test and the correlations among parameters was obtained from Pearson Correlation formula. There were statistically significant differences in the mean age, training experience and BMI between judoists and cyclists statistical analyzes showed no significant difference among the means of total cholesterol, triglyceride, LDL and leptin between two groups. Significant differences were observed in the mean glucose, insulin and HDL values between judoists and cyclists. Significant difference was found only at 0.01 level in the mean of insulin and at 0.05 level in other parameters. Judoists had a higher insulin, total cholesterol, triglyceride and LDL levels than the cyclists, whereas cyclists had higher values than judoists In the mean of insulin, HDL and leptin. Cyclists also had lower insulin sensitivity than judoists. In conclusion, neither judo nor cycling had an effect on leptin, LDL, triglyceride, total cholesterol level. But glucose, insulin and HDL levels were changed depending on type of sports.

Key words: Judo, cycling, leptin, homeostasis model assessment, lipoproteins, insulin resistance, serum leptin, glucose levels judoists, cyclist.

INTRODUCTION

Judo needs the short duration, high intensity bursts of activity, and discontinuity with reactive strength and agility to respond to an opponent's strategy, whereas cycling requires endurance capacity including nonstop maximal continuous activity and working hard over a long distance, generating constant rotations per minute to maintain speed and power against the resistance of the pedals, environment, and terrain. Dominant energy systems for judo are anaerobic alactic and lactic respectively. In cycling there is only the dominance of aerobic energy system. For both sports, significant aerobic fitness is the base to make workouts and to have fast recovery after training and competitions. While cyclists have the highest aerobic endurance among all sports. Judoists perform within a moderato-level of aerobic system (Bompa and Carrera, 2005; Bompa, 2006) . Carbohydrate is used as substrate in alactic and lactic anaerobic energy production systems whereas fat is used only in aerobic system from low to sub maximal intensities with long duration. Aerobic exercises increase use of free fatty acids, decreasing at the same time fat tissue of the body.The fat metabolism is important for judoists not only in losing weight, but also in refulling energy stores during recovery as well as in the preparing to the workouts in warm up. In addition, fat metabolism for cyclists is very dominant in training and competitions under maximal efforts. Plasma leptin is associated with satiety and leptin. It stimulates lipid metabolism, and

increases energy consumption during rest and exercise. So leptin is accepted as a major regulator of energy homeostasis, serving to limit excess energy storage. Exercise influences the energy balance and the amount of body fat by increasing energy expenditure. As regular exercise reduces body fat rate and then decreases the serum leptin levels. It is also used in the treatment of diabetes mellitus as a suitable therapeutic method. The intensity of exercise and the amount of energy spent during exercise are very important factors affecting the serum leptin level (Unal et al., 2005; Hulver and Houmard, 2003; Derouich and Boutayeb, 2002; Bonneau and Guezennec, 2002; Wasserman et al., 1999).

Many researchers studied the effects of leptin on metabolism due to its relation with food intake, energy consumption and weight reduction. In earlier study, Umeda et al. (1999) measured blood parameters in 22 male Japanese college judoists aged 18 to 22 years and they found that the mean glucose, triglyceride, total cholesterol and HDL cholesterol were decreased after training and weight lost.

In the latest study done by Yamaner et al. (2010) the serum leptin, glucose homeostasis and serum lipoproteins levels were found different between Turkish male national wrestlers and sedentaries. Recent studies conducted in Turkey showed that the leptin/body mass index (BMI) value in trained males was four times greater than trained females, whereas the same value for the male sedantaries was five times greater than sedentary females (Sutken et al., 2006; Kecetepen and Dursun 2006). A comparative study between intermittent (anaerobic) and endurance (aerobic) type sports can make possible to understand the effect of sport type factor on the metabolic characteristics including glucose homeostasis, serum leptin, glucose and lipoprotein levels of judoists and cyclists. Therefore, the purpose of the present study was to compare the metabolic parameters including glucose homeostasis, serum leptin, glucose and lipoprotein levels between male national judoists and cyclists.

MATERIALS AND METHODS

Selection of the subjects

The subjects of this study consist of totally 61 athletes, including 24 Turkish National junior judoists and 37 senior national cyclists. Both judoists and cyclists were at the end of training camp before international competitions. The mean and SD of the participants (n=61) were 22.72±3.76 years for age, 13.02±6.00 years for training experience, 175.26±6.64 cm for body height, 72.48±11.60 cm for body weight and 23.57±3.30 cm for BMI, respectively. The mean age, training age and BMI of two groups are different from each other. The subjects were taken for medical examination before the study. They were non- smokers and they had no medical problems. All the subjects were asked not to eat, drink alcohol, and use antioxidant drugs for 8 h before providing blood samples. The aim of this study in details was explained to the subjects and the study was approved by the ethics commission.

Body height and weight measurements

All anthropometric data including age, body weight, height, and BMI were collected before taking blood samples. The body height of the subjects was measured by a metal scale with 0.1 cm sensitivity, and the body weight measurement was taken by a digital weight with 0.1 kg sensitivity.

Blood analysis

All data were collected at training camps. Blood samples were withdrawn into heparinised tubes from a cubital vein after overnight fasting and immediately stored in ice. Plasma was separated from cells by centrifugation at 3000 rpm for 10 min and the plasma samples were stored at -80°C until analysis.

Analyses of serum lipoproteins, triglycerides, total cholesterol, LDL-cholesterol and HDL-cholesterol, were determined by an automated chemistry analyzer (Spectrophotometric enzymatic method, Roche Integra 800) using commercial kits. Moreover, as an indicator of insulin sensitivity, the homeostasis model assessment (HOMA) value was calculated by formula of “Homeostasis Model Assessment = fasting insulin level (U/ml) * fasting serum glucose (mg/dl) /405” (Aslan, 2003). Leptin levels were assessed by the ELISA method.

Statistical analysis

Statistical analyses were performed by SPSS version 15.0. In this study descriptive statistics presents the mean, standard deviation, and minimum and maximum values. Mann-Whitney U test was used to test the differences between male judoist and male cyclists at 0.05 confidence level. Pearson correlation was conducted among variables.

RESULTS

Table 1 presents the anthropometric characteristics of the judoists and cyclists. There were statistically significant differences in the mean age, training experience and BMI between judoists and cyclists. Judoists had a lower mean age and training experience than cyclists but they had higher mean BMI mean value than cyclists. No significant difference was observed in the mean body height and weight between two groups. Table 2 shows serum leptin, lipoproteins and glucose levels between national judoists and cylists. No significant difference was observed among the means of total cholesterol, triglyceride, LDL and leptin between two groups. Significant differences were observed in the mean glucose, insulin and HDL values between judoists and cyclists. Significant difference was found only at 0.01 level in the mean of insulin and at 0.05 level in other parameters. Judoists had a higher insulin, total cholesterol, triglyceride and LDL levels than the cyclists. In the mean of insulin, HDL and leptin, cyclists had a higher values than judoists. HOMA values were 1.48±1.11 for judoists and 1.18±0.57 for cyclists respectively. Cyclists had a lower insulin sensitivity than judoists. Both groups had a HOMA values under the critical level of 2.5 which means the higher insülin sensitivity. The body weight were well correlated

Table 1. The anthropometric characteristics of the judoists and cyclists.

Parameter	Group	N	Mean±SD	Min-Max.	Z	P
Age (years)	Judoists	24	18.50±1.67	16.00-23.00	-6.577	0.000**
	Cyclists	37	25.46±1.48	21.00-29.00		
	Total	61	22.72±3.76	16.00-29.00		
Training experience (years)	Judoists	24	7.54±2.38	3.00-11.00	-6.138	0.000**
	Cyclists	37	16.57±4.85	7.00-27.00		
	Total	61	13.02±6.00	3.00-27.00		
Body height (cm)	Judoists	24	173.42±7.37	157.00-184.00	-1.465	0.143
	Cyclists	37	176.46±5.91	164.00-190.00		
	Total	61	175.26±6.64	157.00-190.00		
Body mass ndex (BMI)	Judoists	24	25.21±4.20	20.11-38.27	-3.093	0.002*
	Cyclists	37	22.51±1.97	19.23-29.00		
	Total	61	23.57±3.30	19.23-38.27		
Body weight (kg)	Judoists	24	76.33±16.58	58.00-124.00	-1.117	0.264
	Cyclists	37	69.97±5.67	63.00-85.00		
	Total	61	72.48±11.60	58.00-124.00		

*Significant difference between groups at 0.05 level, ** Significant difference between groups at 0.01 level.

Table 2. Serum leptin, insulin, lipoproteins and glucose levels between national judoists and cylists.

Parameter	Group	N	Mean±SD	Min-Max.	Z	P
Glucose (mg/dl)	Judoists	24	83.75±9.48	73.00-122.00	-4.458	0.000**
	Cyclists	37	92.78±7.87	78.00-109.00		
	Total	61	89.23±9.56	73.00-122.00		
nsulin (mU/L)	Judoists	24	7.09±5.09	1.80-28.00	-2.220	0.028*
	Cyclists	37	5.15±2.54	2.30-10.60		
	Total	61	5.91±3.84	1.80-28.00		
HOMA	Judoists	24	1.48±1.11	0.32-6.08	-1.469	0.142
	Cyclists	37	1.18±0.57	0.50-2.33		
	Total	61	1.29±0.83	0.32-6.08		
Total cholesterol (mg/dl)	Judoists	24	160.75±32.77	95.00-239.00	-0.052	0.959
	Cyclists	37	158.51±21.28	120.80-197.60		
	Total	61	159.39±26.17	95.00-239.00		
HDL (mg/dl)	Judoists	24	49.67±10.76	32.00-71.00	-1.997	0.046*
	Cyclists	37	55.03±7.75	41.00-68.00		
	Total	61	52.92±9.35	32.00-71.00		
Triglyceride (mg/dl)	Judoists	24	108.63±58.89	29.00-278.00	-0.15	0.988
	Cyclists	37	98.43±29.50	57.00-178.00		
	Total	61	102.44±43.32	29.00-278.00		

Table 2. Contd.

LDL (mg/dl)	Judoists	24	89.28±27.08	46.40-151.20		
	Cyclists	37	92.23±26.50	40.80-132.00	-0.413	0.679
	Total	61	91.07±26.54	40.80-151.20		
Leptin (ng/ml)	Judoists	24	2.09±2.12	1.00-8.30		
	Cyclists	37	1.82±1.35	1.00-5.60	-0.576	0.564
	Total	61	1.92±1.68	1.00-8.30		

*Significant difference between groups at 0.05 level.** Significant difference between groups at 0.01 level.

with insulin (r=0.255, p<0.05), HDL (r=-0.422, p<0.01), triglyceride (r=0.330, p<0.01) and leptin (r=.0277, p<0.05), while there was only meaningfull correlation between the mean age and glucose level (r=0.508, p<0.05). In addition, the mean training experience was correlated with glucose (r=.291, p<0.05) and HDL (r=0.285, p<0.05). Glucose were also correlated with LDL (r=0.302, p<0.05) and leptin (r=0.271, p<0.05) whereas insulin were correlated significantly with HDL (r=- 0.327, p<0.05) and triglyceride (r=0.498, p<0.05). The correlations of total cholesterol with triglyceride (r=0.390, p<0.01) and LDL (r=0.512, p<0.01) were statistically significant. Moreover, HDL was correlated with triglyceride (r=-0.388, p<0.01). HOMA value were correlated following variables; BMI (r=0.32, p<0.05), ınsulin (r=0.99, p<0.01), triglyceride (r=0.52, p<0.01), HDL (r=-0.33, p<0.05) and leptin (r=-0.29, p<0.05).

DISCUSSION

In the present study, results showed no significant difference among the means of total cholesterol, triglyceride, LDL and leptin between two groups. Judoists had a higher insulin, total cholesterol, triglyceride and LDL levels than the cyclists, whereas cyclists had a higher value than judoists in the mean of insulin, HDL and leptin. Cyclists also had a lower insulin sensitivity than judoists.

The only variables of the study conducted by Yamaner et al. (2010) were very similar and comparable to the results of the present study. In the present study, judoists had a lower mean age and training experience than cyclists but they had higher mean BMI mean value than cyclists. No significant difference was observed in the mean body height and weight between two groups. Unal et al. (2005) investigated the leptin levels between professional football players and sedantery males and they found that the serum leptin levels in football players are lower than sedanteries in spite of their higher BMI values. Conversely, Yamaner et al. (2010) investigated that wrestler had a lower BMI and lower leptin levels than sedanteries.

The mean leptin values for judoists (2.09±2.12 ng/ml) and cyclists (1.82±1.35 ng/ml) were lower than the results of the wrestlers (2.3±4.0 ng/ml) and sedanteries (3.0±2.76 ng/ml) in the study of Yamaner et al. (2010). In the mean values of leptin, triglycerides and HOMA, the results of the present study were lower than wrestlers, whereas LDL values of the present study were higher than wrestlers and were similar to the sedanteries (Yamaner et al., 2010). Also, similar results were observed with the total cholesterol, HDL- cholesterol and glucose of the wrestlers, while there were similarities between the results of this study and the findings for sedanteries in total cholesterol, LDL- cholesterol and glucose. Wrestlers had significantly higher fasting insulin, HDL-cholesterol, triglyceride, and HOMA levels, but a lower LDL cholesterol level compared to the sedentaries (Yamaner et al., 2010). Similarly, judoists in this study had a higher insulin, triglyceride, and HOMA levels, but a lower LDL cholesterol level compared to the cyclists. These results were also in agreement with the study done by Gippini et al. (1999). They reported that the endurance type exercise lowered the plasma leptin levels after two days, whereas intense exercise had no effect on plasma leptin level. Commonly highly-trained endurance athletes showed decreased serum leptin levels compare with sedentaries (Gippini el al., 1999). Although there was no significant difference between two groups, cyclists as endurance athletes had a lower plasma leptin level than judoists as high intensity intermittent athletes in this study.

Many researchers reported that athletes had a higher leptin level than sedanteries and the leptin response of athletes in anaerobic sports was not sensitive to acute short or prolonged submaximal exercise. Reduced leptin level, mostly depends on not only the level of energy expenditure, but also glucoregulatory factors including improvements in insulin sensitivity as well as lipid metabolism, and unknown factors (Gippine et al., 1999; De Oliveira et al., 2009; Kraemer et al., 2002; Bouassida et al., 2009).

Body composition or body fat percent changes as a result of regular exercise programs. Especially upper body obesity were higher risk factor developing cardiovascular disease than lower body obesity or lean body. This may in part be caused by greater hepatic

secretion of very-low-density-lipoprotein-triglycerides (Fujioka et al., 1987; Seppala et al., 2002; Sinha et al., 2002). Earlier studies reported that exercise and dietary restriction improved lipid metabolism (Merrill and Friedrichs, 1990; Wood et al., 1991). Yamaner et al. (2010) reported higher fasting insulin and HOMA values for wrestlers than sedentaries and they also reported that higher insulin resistance with the increased serum triglycerides is the characteristics of wrestlers in intensive trainings. Moreover, they found that as expected HDL-cholesterol for wrestlers were higher than sedanteries. Kishali et al. (2005) examined the blood parameters and they found that there was no significant differences between wrestlers and male students in HDL-cholesterol, LDL-cholesterol, apolipoprotein Al (Apo-Al), and apolipoprotein B100 (Apo-B) values.

Aguiló et al. (2003) investigated the effect of different intensity of exercise and different training status on cholesterol profile in 33 male amateur cyclists and professional cyclists. They found that there were only mild increases in the amateur cyclists' total cholesterol after maximal and submaximal exercise, whereas a positive change in HDL- cholesterol was only found after maximal exercise, no changes was observed in professional cyclists. Regular exercises can cause increasing HDL-cholesterol which is one of the positive effects of on lipoproteins in the atherosclerosis. Increased physical activity is related to reduce risk of cardiovascular disease, possibly because it leads to improvement in the lipoprotein profile. The improvements were related to the amount of activity and not to the intensity of exercise or improvement in fitness (Kraus et al., 2002). In this study, cyclists had higher values than judoists in the mean of insulin, HDL and leptin. HOMA values were 1.48±1.11 for judoists and 1.18±0.57 for cyclists respectively. Cyclists had lower insulin sensitivity than judoists. Both groups had a HOMA values under the critical level of 2.5 which means the higher insülin sensitivity.

Blood glucose, total cholesterol, and LDL- cholesterol were decreased after overnight fasting in wrestlers (Yamaner et al., 2010). The liver secretes the glucose by glycogenolysis and gluconeogenesis. So, the amount of glucose releasing into blood to maintain the blood guloce at a given level depends on the increasing energy demand of muscles (Van Aggel-Leijssen et al., 1999; Thomas et al., 2001).

Yamaner et al. (2010), stated that compared to sedentaries, the higher value of HDL-cholesterol and lower value of LDL- cholesterol for wrestlers may indicates the effects of regular exercise on lipoproteins. The decreased insulin sensitivity of wrestlers is accompanied with higher levels of triglycerides and HOMA values. Similarly, judoists in this study had a higher HOMA values with elevated triglyceride levels than cyclists. This indicates that the expenditure of carbohydrates as substrate during exercise was limited by increasing fat metabolism in order to prevent early exhaustion. Because, Stannard and Johnson (2004) reported that there was a strong association of the elevated intramyocellular triglyceride with insulin resistance although a cause and effect relationship had not been totally represented. Insulin sensitivity and intramyocellular triglyceride content were dynamic process and were quickly changed in response to dietary variation, physical activity, and thermoregulatory factors (Stannard and Johnson, 2004).

The comparison of the findings of the present study was possible to the results of the sedantery males in the study conducted by Yamaner et al. (2010). The glucose level of sedanteries was higher than judoists and lower than cyclists. Both judoists and cyclists had a higher HOMA values, insulin and HDL levels and than sedanteries. There were no significant differences in total cholesterol among judoists, cyclists and sedanteries. Both judoists and cyclists had a lower values of triglycerides, LDL and leptin values than sedanteries.

The body weight were well correlated with insulin ($p<0.05$), HDL ($p<0.01$), triglyceride ($p<0.01$) and leptin ($p<0.05$), while there was only meaningfull correlation between the mean age and glucose level ($p<0.05$). In addition, the mean training experience was correlated with glucose ($p<0.05$) and HDL ($p<0.05$). Glucose were also correlated with LDL ($p<0.05$) and leptin ($p<0.05$), whereas insulin were correlated significantly with HDL ($p<0.05$) and triglyceride ($p<0.05$) . The correlations of total cholesterol with triglyceride ($p<0.01$) and LDL ($p<0.01$) were statistically significant. Moreover, HDL was correlated with triglyceride ($p<0.01$). HOMA value were correlated following variables; BMI ($p<0.05$), ınsulin ($p<0.01$), triglyceride ($p<0.01$), HDL ($p<0.05$) and leptin ($p<0.05$).

In conclusion, neither judo nor cycling had an effect on leptin, LDL, triglyceride, total cholesterol level. But glucose, insulin and HDL levels were changed depending on type of sports. Interestingly, cyclists had a higher insulin sensitivity than judoists below the statistical confidence level. Both in judo and cycling, aerobic and anaerobic trainings in long duration can cause significant changes in metabolism and lipoprotein levels. In the present study, both judoists and cyclists had a HOMA values, fasting insulin, and triglycerides levels, which were not higher risk factors developing cardiovascular disease. Further studies are warranted to clarify the role of leptin and other blood parameters in different sport performance, gender and groups.

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