

## A COMPARISON OF THE BLOOD LIPID PROFILES OF PROFESSIONAL SPORTSPERSONS AND CONTROLS

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**Abstract :** Total cholesterol (TC), triglyceride (TG), high density lipoprotein-cholesterol (HDL-C), low density lipoprotein-cholesterol (LDL-C) and HDL-C/TC levels are important in determining the risk of coronary heart disease. The serum lipids and lipoprotein levels of regularly training sportspersons and non-sporting controls were determined and compared with each other to investigate the effects of exercise and sex on these factors. HDL-C levels of male and female training groups were higher than those of corresponding non-sporting groups (respectively  $P < 0.01$ ,  $P < 0.001$ ). The sportswomen's HDL-C levels were higher ( $P < 0.05$ ); and TC, TG, and LDL-C levels were lower ( $P < 0.001$ ) than those of sportsmen's levels. The non-sporting women's TC and TG levels were lower than those of non-sporting men's levels ( $P < 0.001$ ). HDL-C/TC ratio of active females was higher than that of control females ( $P < 0.01$ ). The corresponding difference in males was also significant. We conclude that physical activity and sex have effects on risk factors for cardiovascular disease.

**Key words :** serum lipid levels  
exercise

HDL-C  
sex

LDL-C

### INTRODUCTION

Coronary heart disease (CHD) is one of the most important causes of mortality (1). Besides the factors such as hypertension, hyperglycemia, obesity, smoking and emotional stress, hyperlipidemia and inactivity contribute to CHD (2). It has been demonstrated that there is a correlation between CHD and plasma lipid concentrations. It is accepted that high levels of TG, TC, LDL-C and low level of

HDL-C are the risk factors for CHD. Research studies show that the correlation between TC level and CHD is primarily due to correlation between LDL-C level and CHD. While CHD has a positive correlation with TG and LDL-C levels, it has a negative correlation with HDL-C level (3). Besides the intrinsic factors such as age, genetic heritage and sex, modifiable factors such as diet, smoking, psychological stress and a sedentary lifestyle affect the plasma lipid and lipoprotein levels. Most of the studies

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have shown that physical exercise, performed with sufficient frequency and intensity, is effective in lowering the level of TG and LDL-C and raising the level of HDL-C (4, 5, 6, 7, 8, 9, 10, 11, 12).

There are several recent reports on the effects of physical exercise on lipid profile (13, 14, 15). In most of the studies, the effects of walking, jogging, distance running, skiing and similar aerobic exercises on lipids and lipoprotein profile, were studied (10, 11, 12, 16, 17, 18, 19). In this study, young adult sportsmen and sportswomen, who has been participating in team sports in which anaerobic energy use is dominate, were investigated. Lipids and lipoproteins profiles of the physically active groups were compared both for sex-differences for effects of physical activity.

## METHODS

### Subjects

This study consisted of 57 non-smoking adults comprising 17 professional Turkish male soccer players who had been in sports for an average of 11 years, 20 professional Turkish female basketball and handball players who had been in sports for an average of 9.5 years and two control groups composed of 10 male and 10 female individuals not involved in competitive sports. The sportsmen and sportswomen were spending 2 hours a day on training, 5 days a week.

### Anthropometry

Height and body mass were determined, and body fat was evaluated by measuring skinfold thickness at four sites, namely

triceps, abdomen, subscapular region and suprailiac region. Percentage body fat (%BF) was calculated by the Yuhasz method (20).

### Blood biochemistry

Both male and female subjects attended the laboratory in the morning, after a 12 h fast. A 10 ml blood sample was obtained by venipuncture. When blood samples were collected from female subjects, they were not having menstruation. Analyses were made from the serums. A modification of McGovan method was used form determining TG. According to this method, TGs are hydrolysed into glycerol and fatty acids by lipase. Emergent glycerol is measured by an enzymatic reaction catalysed by glycerol kinase, glycerol phosphate oxidise and peroxidase. Normal values are 30-190 mg/dl (21).

TC was determined by an enzymatic method (22). Normal TC value is 140-250 mg/dl.  $Mg^{+2}$  and dextran sulfate method of Sclavo, were used in order to measure HDL-C. CHOL-HDL of Sclavo, which is a commercial name of HDL analyses, is based on the methods defined by Finely and Kostner (23, 24).  $Mg^{+2}$  and dextran sulfate precipitate all the fractions of serum lipoproteins except HDL. After centrifugation, HDL fraction remains in the supernatant. The amount of cholesterol in this fraction is analysed by a total cholesterol enzymatic reaction. Normal HDL-C values for males are 35-59 mg/dl, and for females they are 38-75 mg/dl (25).

The amount of LDL-C was calculated by Friedwald equation (26). Normally, LDL-C should be less than 150 mg/dl.

**Statistical analysis**

In statistical analysis the comparisons between groups were made by using Student's 't' test.

**RESULTS**

Table I summarizes the physical characteristics of the subjects. The profiles of the serum lipids and lipoproteins are also shown in the Table.

In this study, %BF of sportsmen was found to be lower than %BF of non-sporting males (P<0.01) and sportswomen (P<0.001). When the correlation between %BF and levels of lipid and lipoprotein was examined,

a positive correlation was found between %BF and TG for sportsmen (P<0.01). While %BF showed a negative correlation with HDL-C (P<0.01), it showed a positive correlation with LDL-C for sportswomen (P<0.05). HDL-C levels of sportsmen and sportswomen were found to be higher than the levels of the corresponding non-sporting groups (P<0.01 and P<0.001 respectively). When the lipid profiles were compared in terms of sex, it was found out that while %BF of sportswomen was higher than %BF of sportsmen (P<0.001), HDL-C levels of females were higher (P<0.05) and TC, TG and LDL-C levels were lower than those of males (P<0.001, P<0.01 and P<0.001 respectively). Also, TC and TG values of the females control group were found to be lower

TABLE I : Physical characteristics and serum lipid profiles of subjects.  
(Values represent means ± SD)

Parameters	Sportsmen	Non sporting males	Sportswomen	Non sporting females
age(year)	24.82±3.94 <sup>ππ</sup>	25.70±3.59	20.95±3.50	25.20±3.33 <sup>#</sup>
height(cm)	175.97±4.76 <sup>ππ</sup>	174.85±5.02 <sup>δδ</sup>	170.52±6.85	163.30±4.47 <sup>#</sup>
weight(kg)	72.28±5.50 <sup>πππ</sup>	72.35±10.83 <sup>δ</sup>	62.14±6.08	51.55±4.79 <sup>ππ</sup>
%BF(%)	10.84±1.44 <sup>πππ</sup>	14.54±4.09 <sup>**</sup>	13.82±2.19	15.10±1.90
LBM(kg)	64.43±4.77 <sup>πππ</sup>	61.55±7.18 <sup>δδ</sup>	54.00±4.04	43.70±3.44 <sup>ππ</sup>
TC(mg/dl)	225.35±34.45 <sup>πππ</sup>	192.30±23.71 <sup>*, δδ</sup>	178.00±23.73	180.10±30.09
TG(mg/dl)	148.70±67.20 <sup>ππ</sup>	99.60±24.95 <sup>*, δδ</sup>	99.55±21.48	86.40±22.88
HDL-C(mg/dl)	49.94±7.73 <sup>π</sup>	33.90±10.76 <sup>**</sup>	57.60±9.70	44.00±4.85 <sup>ππ</sup>
LDL-C(mg/dl)	140.06±32.16 <sup>πππ</sup>	132.90±28.58	100.00±26.97	119.00±28.26
HDL-C/TC	0.22±0.30 <sup>πππ</sup>	0.21±0.07	0.32±0.07	0.24±0.04 <sup>#</sup>

%BF: Percentage body fat      LBM: Lean body mass      TC: Total cholesterol  
 HDL-C: High density lipoprotein-cholesterol      LDL-C: low density lipoprotein-cholesterol

\*: P<0.05 Sportsmen vs non sporting males  
 \*\*: P<0.01 Sportsmen vs non sporting males  
 #: P<0.01 Sportswomen vs non sporting females  
 ##: P<0.001 Sportswomen vs non sporting females  
 π: P<0.05 Sportsmen vs sportswomen  
 ππ: P<0.01 Sportsmen vs sportswomen  
 πππ: P<0.001 Sportsmen vs sportswomen  
 δ: P<0.01 Non sporting males vs non sporting females  
 δδ: P<0.001 Non sporting males vs non sporting females

than those the male control group ( $P < 0.001$  and  $P < 0.001$ , respectively). It was found that HDL-C/TC ratio of sportswomen was higher than that of the control group ( $P < 0.01$ ) and sportsmen ( $P < 0.001$ ).

### DISCUSSION

In this study, %BF of sportsmen was found to be lower than that of non sporting males ( $P < 0.01$ ) and sportswomen ( $P < 0.001$ ). It is known that exercise decrease %BF, and that %BF of males is lower than that of females (1).

When the correlation between %BF and levels of lipid and lipoprotein is examined, a positive correlation between %BF and TG was found for sportsmen ( $P < 0.01$ ). While %BF showed a negative correlation with HDL-C ( $P < 0.01$ ), it showed a positive correlation with LDL-C for sportswomen ( $P < 0.05$ ). These findings are in accordance with the literature (10, 27).

HDL-C levels of sportsmen and sportswomen were found to be higher than the levels of the non-sporting groups (respectively  $P < 0.01$ ,  $P < 0.001$ ). Many studies have shown that exercise increases HDL-C level (5–11, 16, 28–33). When the observations compared according to sex, it was found that while %BF of sportswomen was higher than that of sportsmen ( $P < 0.001$ ), HDL-C levels of females were higher ( $P < 0.05$ ), and TC, TG and LDL-C levels were lower than those of males ( $P < 0.001$ ,  $P < 0.01$  and  $P < 0.001$  respectively).

Also, TC and TG values of the female control group were found to be lower than those of the male control group ( $P < 0.001$  and  $P < 0.001$ , respectively). Most of the previous studies have shown that CHD risk for females is lower than for males (8, 27). It is believed that this is due to the effect of sex hormones on plasma lipid levels. Although %BF and HDL-C values are higher for females, their TC, TG and LDL-C values are lower than for males. These differences have been attributed to endogenous sex hormones. While oestrogens decrease LDL-C and increase HDL-C, androgens have the opposite effect (27, 34).

It is likely that certain lipoprotein ratios are more valid as criteria for risk of CHD than individual lipoprotein levels. One of these ratios is HDL-C/TC ratio (7, 8, 17, 30, 32, 33, 35). It has been reported that physical activity increases HDL-C/TC ratio (8). In the present study, it was found that HDL-C/TC ratio of sportswomen is higher than that of the control group ( $P < 0.01$ ) and sportsmen ( $P < 0.001$ ).

In continuation with the previous studies showing that various aerobic physical activities have a protective effect on CHD (8–11, 36, 37), the present study shows that team sports involving anaerobic exercise such as basketball, handball and soccer also have protective effect against CHD with respect to lipid profile. Moreover, it was observed that females have a lower risk of cardiovascular disease than males as judged from their lipid profiles.

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