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BLOOD LIPOPROTEIN PROFILE CHANGES OF ELITE HANDBALL PLAYERS FOLLOWING THE SEASONAL PREPARATION PERIOD

İlhan TOKSÖZ[*], Kut SARPYENER[**], S. Oğuz KARAMIZRAK[***]

SUMMARY

In the present study, it was aimed to investigate the relationship between a training model applied on athletes playing in the Turkish national handball super league, and their serum lipoprotein levels. The six weeks aerobic training preparation for the season was expected to improve the lipoprotein profile. Nine trained elite handball players and ten respective controls participated in the study. Besides physical parameters and physical working capacity (PWC_{170}), blood haemoglobin, serum total cholesterol, its HDL- and LDL- subfractions (HDL-C and LDL-C), and triglycerides (TG) were compared between groups at the start and following the training period. Significant decrease in serum TG ($p<0.05$), non-significant decreases in total cholesterol and LDL-C, and increases in HDL-C ($p>0.05$) were observed in athletes, together with significant increases in PWC_{170} ($p<0.001$). A decrease in LDL-C ($p<0.05$) was found for the control group.

Key words: Preparation trainings, handball players, serum lipoproteins, PWC_{170}

ÖZET

SEZONA HAZIRLIK ANTRENMANLARININ ELİT HENTBOLCULARIN KAN LİPOPROTEİN PROFİLİNE ETKİLERİ

Bu çalışmada hentbol süperliginde oynayan oyunculardaa bir hazırlık dönemi antrenman modelinin serum lipoprotein düzeylerine etkisinin araştırılması hedeflendi. Altı haftalık aerobik antrenman periyodunun lipoprotein profilini olumlu etkilemesi bekleniyordu. Dokuz

[*] Trakya University Kırkpınar Physical Education and Sports Department, Edirne, Turkey
[**] Haliç University, Physical Education and Sports Department, Istanbul, Turkey
[***] Ege University Medicine Faculty Sports Medicine Department, Izmir, Turkey

antrene elit hentbol oyuncusu ve on sağlıklı eşdeğer kontrol çalışmanın deneklerini oluşturdu. Fiziksel parametreler ve fiziksel iş kapasitesi (PWC_{170})'nin yanı sıra kanda hemoglobin, serum total kolesterol, HDL- ve LDL- subfraksiyonları (HDL-C ve LDL-C) ve trigliserid (TG) düzeyleri antrenman periyodu öncesi ve sonrasında gruplar için kıyaslandı. Hentbolcularda PWC_{170} düzeylerindeki anlamlı artışlara ($p<0.001$) serum TG düzeylerinde anlamlı ($p<0.05$); total kolesterol ve LDL-C'da anlamlı olmayan ($p>0.05$) düzeydeki düşüşler ve HDL-C'da artışlar ($p>0.05$) eşlik etti. Kontrol grubunda LDL-C'da düşüşler ($p<0.05$) belirlendi.

Anahtar sözcükler: *Hazırlık antrenmanları, hentbolcu, serum lipoproteinler, PWC_{170}*

INTRODUCTION

The effects of exercise on blood lipids and lipoproteins have long time attracted the attention of several researchers. The total plasma cholesterol level range of 140-320 mg/dl in humans tends to increase a little with aging. Differences in these levels have indicated a variation according to activity styles. The role of exercise is very important in this respect (1,2,12,13,25). It is proved that exercise decreases serum lipid levels and its storage, and that it prevents from some cardiovascular risk factors (4). The effect of regular physical activity on serum lipid profiles and body fat nature makes it necessary to examine the effects of aerobic exercise in a detailed way. When the loss of body fat and weight resulting from training are combined, they contribute to the protection of the cardiovascular system and to serum lipid profiles (16).

The American College of Sport Medicine (ACSM) and the American Heart Association (AHA) advise physical activity to healthy adults at least twice a week. Many studies observing the effects of various exercise on fat oxidation were published (5,7,9,10,11,14,16,18,19,24), including the present group (20,21,23).

It was aimed in the present study to investigate the relationship between the pre-season general preparation period trainings and serum lipoprotein profiles, in an attempt to provide more information for future studies with the aid of previous results.

MATERIAL and METHODS

Subject selection: The experimental group consisted of nine healthy handball players from the national superleague clubs, who

volunteered to participate in the general preparation training period of this study. A control group of ten volunteering Ege University students was formed according to lifestyle similarity. The experimental procedure was in agreement with the 1964 Helsinki Declaration of Consent, and was granted Human Research Ethics Committee's approval. All subjects underwent an ECG stress test with blood pressure monitoring during a standard clinical check-up, to exclude any illnesses.

Testing equipment: The study was carried out at the Ege University Medical Faculty Sport Medicine and Physical Education and Sport Department premises. The testing room average temperature was 20°C. The handball players trained at the Celal Atik Sports Hall in Izmir. A bicycle ergometer (Monark 868, Monark Inc., Sweden) was used for the determination of aerobic capacity using the indirect physical working capacity (PWC_{170}) test, targeting a 170 bpm heart rate. Body fat ratios were assessed using a 0.2 mm sensitivity skinfold caliper (Holtain Ltd. Crymypch, UK). All tests were run between 09:00-10:00 a.m.

Blood analysis: A spectrophotometer (LKB Ultraspek 24050 UV/VIS, Bioctrom, Denmark) was used for the analysis of blood parameters. Subjects did not train hard in the last 24 hours, and applied to the centre following an overnight fast. Blood specimens were received between the 15^{th} to 20^{th} minutes of resting. They were allowed to clot for 30 min and centrifuged, before being analyzed.

Capillary blood samples were received from the third finger of the left hand for haemoglobin (Hb) measurements. Blood Hb analyses were carried out by means of a standard cyanmethaemoglobin method, using appropriate kits (Randox Inc.).

The total cholesterol (TC) analysis was carried out by means of the enzymatic spectrophotometric method, using kits (Randox Inc.). For the determination of HDL-cholesterol (HDL-C) levels, the same kit uses phosphotungustic acid and Mg precipitation. LDL-cholesterol (LDL-C) levels were calculated by means of the Friedewald (6,15) equation: LDL-C = TC-(HDL-C)-TG/6.

Triglyceride (TG) analyses were carried out using kits (Boehringer Mannheim) according to the enzymatic spectrophotometric method. Subjects were advised not to change their routine dietary habits, keeping their daily energy intake between the estimated 2500-3200 kcals.

In this respect, subjects were provided with nutrient lists giving caloric values as guidance.

Seasonal preparation period programme: The intensity of the exercises is similar to that of continuous slow running in Akgün's (1) classification, with more involvement of the O_2-aerobic energy system. The six weeks training model was applied five days a week. It was aimed to keep the intensity of the exercises at 60-70% of maximal O_2 consumption and a heart rate of 120-130 bpm for the 30 min daily workload (1,20,21,23).

Statistical analysis: The statistical analysis of the study data was done at the Ege University Computer Research Centre, by means of the Minitab programme, using the two sample Student t-test and correlation coefficient evaluations.

RESULTS

Physical and physiological parameters of the experimental (n=9) and control (n=10) groups at the start and the end of the training period are given in Table 1.

Table 1. Physical and physiological parameters of the handball players and controls at the pre- and post- preparatory training period, as means ± SD (min-max).

Parameters	Handball players	Controls
Age (yr)	19.1 ± 1.1 (18-21)	21.9 ± 1.9 (18-24)
Sport age (yr)	4.6 ± 1.5 (3-7)	-
Height (cm)	176.0 ± 5.5 (169-186)	176.0 ± 3.8 (170-181)
Weight (kg) Pre-	74.4 ± 6.9 (67-87)	68.5 ± 8.5 (54-83)
Post-	73.6 ± 7.0[a] (66-85)	68.1 ± 8.7 (54-83)
Body fat (%) Pre-	12.3 ± 3.0 (8.9-18.7)	12.4 ± 2.0 (10.0-17.4)
Post-	12.0 ± 3.9 (9.8-18.8)	12.4 ± 1.9 (10.2-17.0)
PWC_{170} (W/kg) Pre-	2.58 ± 0.50 (1.51-3.28)	2.41 ± 0.40 (1.61-2.90)
Post-	2.95 ± 0.30[b] (2.15-3.39)	2.42 ± 0.30 (1.80-2.86)

[a]: $p < 0.05$, [b]: $p < 0.001$

Serum lipoprotein parameters of the experimental (n=9) and control (n=10) groups at the start and the end of the training period are listed in Table 2.

Table 2. Serum lipoprotein parameters of the handball players and controls at the pre- and post- preparatory training period, as means ± SD (min-max).

Group	Handball players	Controls
Hb (g/dl) Pre-	15.1 ± 0.9 (14.3-17.0)	14.1 ± 1.0 (12.0-15.6)
Post-	15.3 ± 1.0 (14.1-17.1)	14.5 ± 1.1[b] (12.1-16.1)
TC (mg/dl) Pre-	130.3 ± 29.0 (78-184)	166.9 ± 45.4 (119-264)
Post-	125.2 ± 34.0 (92-197)	155.4 ± 34.3 (120-240)
HDL-C (mg/dl) Pre-	31.6 ± 7.8 (22-44)	38.9 ± 4.6 (33-47)
Post-	35.7 ± 5.7 (26-44)	39.7 ± 4.1 (32-47)
LDL-C (mg/dl) Pre-	79.3 ± 22.9 (40-117)	109.8 ± 24.7 (64-207)
Post-	74.9 ± 25.8 (49-125)	99.1 ± 34.7[a] (65-182)
TG (mg/dl) Pre-	97.3 ± 42.0 (42-175)	90.7 ± 34.7 (45-157)
Post-	73.6 ± 22.7[a] (41-140)	85.2 ± 34.4 (45-159)

[a]: $p < 0.05$, [b]: $p < 0.001$

DISCUSSION

In the handball training programme group, the expected decrease recorded in TC and the increase in HDL-C were not significant ($p>0.05$). Nevertheless, the results are within the general optimum limits given by Åstrand and Rodahl (3) for various sports branches. They are similar to those observed by Williams (24) and Huttunen et al (8), suggesting a low intensity in the training model. The small increases in HDL-C can be sufficient to compensate risks for cardiovascular heart disease (10,23).

Kokkinos and Fernhall (11) had also noted positive alterations just following endurance training. Moreover, Stea et al (18) who assessed the effect of eight weeks endurance training had detected an improved serum lipid profile in healthy young male students. BMI levels were in inverse proportions with HDL-C, direct ones with LDL-C, and TG concentrations in inverse relation with running performance. This is similar with the inverse relations of the post-training TG concentrations and PWC_{170} measurements in the study. The decrease in body weight after the training period was also significant.

Data provided by these researchers (11,18) and the post-training lipoprotein data obtained in the present study are thus in parallel. Improvements in serum triglycerides ($p<0.05$), and the PWC_{170} test ($p<0.001$) were as expected too. Pinheiro and co-workers had also observed marked increases in $maxVO_2$ and decreases in body fat

amount in military academy students and controls (14). The maxVO_2 changes in this study are in accordance with our PWC_{170} ($p<0.001$) results. The levels in the present study are less than those of the National Football Team for the pre-training period. Following training, they were higher that the team in question (3,5).

Tran and Weltman (22) had analyzed 66 investigations, indicating changes in parameters such as beginning level, age, training period and intensity, maxVO_2, body weight and fat ratio. Comparing with average values determined by these researchers, one may express that the high reductions in TC, LDL-C and TG levels, and the increases in HDL-C levels in the experimental group are meaningful. Obtaining favourable results in lipoprotein and TG levels following only six weeks of preparatory training is noteworthy, considering that the initial levels of all cardiovascular risk parameters (Table 2) were within normal limits.

It may be concluded that the training programme applied to the present experimental group led to more positive results than those obtained by other researchers (17,20,21), considering both PWC_{170} and serum lipoprotein levels.

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Address for correspondence: Assist. Prof. Dr. İlhan Toksöz
Kırkpınar PE and Sports Dept.,
Trakya University Balkan Campus,
22030 Edirne/TURKEY
E-mail: toksoz@trakya.edu.tr