Hematologic and Biochemical Profiles and Correlations Among Lipid Values, Erythrocyte and Platelet Indices in Young Soccer Players

Genç Futbolcuların Hematolojik ve Biyokimyasal Profili ile Eritrosit ve Trombosit İndeksleri ve Lipid Değerleri Arasındaki İlişkiler

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ABSTRACT Objective: New hematologic analyzers have provide new indices related to erythrocytes and platelets, but platelet indices such as mean platelet volume, plateletcrit and platelet distribution width in the football players has not been adequately studied. This study was carried out to investigate the hematologic and biochemical parameters and correlations of erythrocyte and platelet indices in young players. **Material and Methods:** The current study was performed on twenty two male volunteer young players. The players were playing in amateur league. The voluntary participants involved in investigation were 23.50±0.59 years-old, 67.66±1.52 kg body weight and 1.74±0.03 m height. Respiration and pulsation rates (resting state), the values of vertical jumping test, quickness test, speed test and Cooper test were measured in all participant. The values of cholesterol, high density lipoprotein-cholesterol, low density lipoprotein-cholesterol, triglyceride, glucose, urea, creatinin, uric acid, total bilirubin, direct bilirubin, indirect bilirubin, total protein, albumin, globulin, aspartate transaminase, alanin transaminase, gamma gluthamile transaminase, alkaline phosphotase, amylase, creatine phosphokinase, lactate dehydrogenase, acid phosphtase, iron, iron percentage, total bind capacyte of iron, bind capacyte of unsaturated-iron, transferin, calcium, phosphorus, sodium, potassium, chloride and magnesium in blood plasma were measured by automated analyser. Lipid peroxides was measured spectrophotometrically. The counts of erythrocyte, haemoglobin concentration, haematocrit-values (%) erythrocyte indices such as mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, red cell distribution width; platelet counts, platelet indices such as mean platelet volume, plateletcrit and platelet distribution width; white blood cell, counts and percentage of neutrophil, lymphocyte, monocyte, eosinophil and basophil in whole blood were determined by automatic cell counter. **Results:** Hematologic and biochemical results in present study were basically in resemble with the reference values determined on young players. There were significant correlations ($p<0.05$-$p<0.01$) between lipids, erythrocyte and platelet indices. **Conclusion:** The results may provide the reference data for physiologic, hematologic and biochemical parameters and correlations between lipids, erythrocyte and platelet indices in young footballers. Sports diminishes the ratio of trigliceride/high density lipoprotein-cholesterol, one of an important indicator in evaluation of coronary atherosclerosis, and so, it may decrease the provoking risk of coronary atherosclerosis.

Key Words: Biochemical values; erythrocyte; platelet indices; leucocyte; lipids; soccer

ÖZET Amaç: Yeni hematolojik analizörler, alyuvar ve trombositlere ilişkin olarak yeni indeksler sağlamış, ancak sporcularda ortalama trombosit hacmi, trombokrit ve trombosit dağılım genişliği gibi indeksler yeterli düzeyde çalışılmamıştır. Bu çalışma, genç futbolcuların hematolojik ve biyokimyasal profili ile lipid düzeyleri, eritrosit ve trombosit indeksleri arasındaki ilişkileri araştırmak amacı ile yapıldı. **Gereç ve Yöntemler:** Çalışmaya amatör ligde futbol oynayan ortalama yaşı 23,50±0,59, vücut ağırlığı 67,66±1,52 ve boy uzunluğu 1,74±0,03 m olan yirmi iki gönüllü erkek futbolcu katıldı. Tüm sporcuların solunum ve nabız sayıları, dikey sıçrama, çabukluk, 20, 40 ve 60 metre sürat ve Cooper testi değerleri kaydedildi. Kan plazmasında kolesterol, yüksek dansiteli lipoprotein-kolesterol, düşük dansiteli lipoprotein-kolesterol, trigliserid, total protein, albumin, globulin, glukoz, üre, ürik asit, kreatinin, total bilirubin, direk bilirubin, indirek bilirubin, aspartat transaminaz, alanin transaminaz, gama glutamil transaminaz, alkalen fosfotaz, amilaz, kreatin fosfokinaz, laktat dehidrogenaz, asit fosfataz, demir, demir satürasyonu (%), total demir bağlama kapasitesi, unsature demir bağlama kapasitesi, transferrin, kalsiyum, fosfor, potasyum, klorür ve mağnezyum değerleri otomatik analizör ile, lipit peroksidasyonu düzeyleri ise spektrofotometrik yöntemle ölçüldü. Ayrıca alyuvar sayısı, hemoglobin miktarı, hematokrit değer ile alyuvar hacmi, ortalama alyuvar hemoglobini, ortalama alyuvar hemoglobin yoğunluğu, alyuvar dağılım genişliği gibi alyuvar indeksleri; trombosit sayısı, ortalama trombosit hacmi, trombokrit (plateletkrit) değeri ve trombosit dağılım genişliği gibi trombosit indeksleri; ayrıca akyuvar sayısı, nötrofil, lenfosit, monosit, eozinofil, bazofil sayıları ve bunların formül lökosit değerleri (%) otomatik hücre sayım cihazı ile belirlendi. **Bulgular:** Bu çalışmada belirlenen hematolojik ve biyokimyasal sonuçlar sporcularda belirlenen referans değerler ile uyumludur. Lipit değerleri, alyuvar ve trombosit indeksleri arasında istatistiksel olarak önemli ($p<0,05$-$p<0,01$) ilişkiler belirlenmiştir. **Sonuç:** Elde edilen fizyolojik, hematolojik ve biyokimyasal veriler, genç futbolcular üzerinde yapılacak yeni çalışmalarda referans olarak kullanılabilir. Koroner aterosklerozun önemli bir belirteci olan trigiliserit/yüksek dansiteli lipoprotein-kolesterol oranını düşüren spor, koroner aterosklerozu provake eden riski azaltabilir.

Anahtar Kelimeler: Biyokimyasal parametreler; eritrosit; trombosit indeksleri; lökosit; lipid; futbol

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There are considerable variations for hematologic and biochemical parameters of humans in different populations.[1-4] These variations may be related to differences in participant age, gender and training or timing of sample collections.[5-9] Therefore, extensive studies were performed to investigate normal reference values for haematologic and biochemical parameters in young and adult humans.[2-4] However, it has been investigated to reference values and indices of erythrocyte and platelets, and their correlations with other hematologic and biochemical parameters.[1-4,9-11]

Haematocrit, haemoglobin concentration (HGB), erythrocytes or red blood cells (RBC) and RBC-indices such as mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) are useful in elucidating the etiology of anemia in humans. In addition, these indices are valuable in the morphologic classification of anemias. Red blood cell distribution width (RDW) is more available in evaluation of variation in the size of red blood cells.[12] Platelet counts (PLT) and platelet indices such as mean platelet volume (MPV), plateletcrit (PCT) and platelet distribution width (PDW) are avaliable in evaluating the etiology of cardiovasculary diseases. MPV, an important indicator of platelet activation, may increase in occlusive insufficiency of coronary vessels.[13,14] Coronary insufficiencies and cardiovascular diseases may decrease with exercise and antioxidants.[15] In addition, exercise may affect some hematological and biochemical parameters in the different players.[16-19] Increasing values of indicator parameters for human health may be return to the physiological levels with exercise and an active life in humans. Therefore, this study was carried out to investigate the reference values and correlations among lipid values, RBC and PLT-indices. In addition, some physical, hematological and biochemical parameters were evaluated in amateur young footballers.

MATERIAL AND METHODS

SUBJECTS

This study was carried out on twenty two male volunteer young soccer players (23.5±0.6 years-old, 67.7±1.5 kg body weight and 1.74±0.03 m height) at the School of Physical Education and Sports, Harran University, Şanlıurfa. None of the players had obvious health problems and they were non-smokers. All players were informed about the aim of the study prior to giving their consent. This study was confirmed to the code of Ethics of the World Medical Association (Declaration of Helsinki). These players were playing in amateur football league. The soccer players trained for an hours per day in three times per week in amateur football league season.

EXPERIMENTAL PROCEDURES

Respiration and pulsation rates (resting state), vertical jumping test, quickness test, speed test and Cooper test were applied and measured in this order in all players with one day interval before the starting of the training season. Players performed standart warming up (10 to 15 min) before each tests. One day after of these tests the blood and plasma samples were measured.

Respiration rates: This test is the number of taking breath per minute. Respiratory rate is the number of the chest rises for one full minute while breathing normally (resting state). In this study, breath numbers in one minute were recorded as the respiration rates.

Pulsation rates: For this test, it was gently placed the sign and middle fingers of one hands on radial artery. This pulsation was counted on radial artery for 60 seconds in resting. Number of arterial beats was recorded as the pulsation rates per minute.

Vertical jump test: The vertical jump test is an excellent indicator of leg power. Player stands in front of a wall and reaches up with his/her hand to the wall. The point of fingertips is marked or recorded the standing height. The athlet jumps vertically as high as possible using both arms and legs to project the body upwards. The difference of distance between the standing height and the jump height (cm) was recorded as the score of vertical jump.

Quickness test: It was marked out a rectangle 2.44 by 4.88 m with four cones and placed a cone

in the centre of the rectangle. Then, the players warmed up for 10 to 15 minutes. The assistant gived the command "GO" and started the stopwatch. The players commenced the test at the Start/Finish cone and followed the slalom route indicated in the rectangle. The assistant stopped the stopwatch and recorded the time when the athlete crossed the Start/Finish cone. The results were recorded as score (sec) of quickness test.

Speed tests: This test involves running a single maximum sprint over a set distance, with time recorded. The test was conducted in the distances of 20, 40 and 60 meters. Initially, the athletes warmed up for 10 to 15 minutes, then they run in distance for 20, 40 and 60 m. It was recorded as the test score of the players for the time (sec) to run each split distances in 20, 40 and 60 m.

Cooper test: This test is used to evaluate the development of the athlete's aerobic endurance and to estimate of the VO2 maximum. Initially, the athlete warmed up for 10 to 15 minutes and then the assistant gave the command "GO", the stopwatch was started and the athletes commenced to the Cooper Test. They run as far as possible in 12 minutes in a running track (400 m). The assistant kept the athlete informed about the remaining time at the end of each lap in 400 m. Then, the assistant blowed the whistle when the 12 minutes has elapsed and the distance (km) was recorded as the results of Cooper test.

Blood and plasma samples: The whole blood samples was drawn into vacutainer tubes (Beckon Dickinson System, France) containing disodium salt of ethylene diamine tetraacetic acid (EDTA) as anticoagulant. The blood from ante-cubital veins (0.5 ml) in the tubes were used for analysis of hematological parameters, and the other portion of the blood was centrifuged (1500 g, 15 min; Heraus Inst., Mega Fuge 1.0) and their plasma samples was removed using disposable pipettes.

Biochemical and hematological parameters: Cholesterol (CHOL), high density lipoprotein-cholesterol (HDL-C), low density lipoprotein-cholesterol (LDL-C), triglyceride (TG), glucose (GLU), urea (URE), uric acid (URA) creatinin (CRE), total bilirubin (T-BIL), direct bilirubin (D-BIL), indirect bilirubin (I-BIL), total protein (TP), albumin (ALB), globulin (GLOB), iron (Fe), iron percentage (Fe%), total bind capacyte of Fe (TBC), bind capacyte of unsaturated Fe (UBC), transferin (TRF), calcium (Ca), phosphorus (P), sodium (Na), potassium (K), chloride (Cl) and magnesium (Mg), the activities of aspartate transaminase (AST), alanin transaminase (ALT), gamma gluthamile transaminase (GGT), alkaline phosphotase (ALP), acid phosphtase (ASP), amylase (ALZ), creatine phosphokinase (CPK) and lactate dehydrogenase (LDH) were determined by automated chemistry analyzer using commercially available kits in all plasma samples. Plasma lipid peroxides (TBARS) was determined spectrophotometrically as described previously by Ohkawa et al.[20] In addition, ratios of HDL-C/CHOL, LDL-C/CHOL, and TG/ HDL-C, HDL-C/LDL-C were calculated for the values of CHOL, TG, HDL-C and LDL-C.

Erythrocyte counts (RBC), haemoglobin concentration (HGB), haematocrit (HCT), erythrocyte indices such as mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and red blood cell distribution width (RDW); platelet counts (PLT), platelet indices such as mean platelet volume (MPV), plateletcrit (PCT) and platelet distribution width (PDW); white blood cell counts (WBC) as well as counts and percentage of neutrophils (NEU), lymphocytes (LYM), monocytes (MON), eosinophils (EOS) and basophils (BAS) were measured using cell counter in the blood samples.

STATISTICAL ANALYSIS

Statistical analysis was carried out using the SPSS 11.5 statistical program (SPSS Inc, Chicago, IL, USA). Means, standard deviations, minimum and maximum levels and Pearson correlation coefficients of hematological and biochemical parameters were determined by this statistical program. The data were considered to be significant at $p<0.05$.

RESULTS

Physical, biochemical and hematological parameters in all samples are presented in Tables 1-4. The

TABLE 1: Mean values of physical parameters and variation ranges (n=22)*.

Parameters	Means±SD	Variation ranges
Ages, *year*	23.5±0.6	20.00-28.00
Height, *meter*	1.74±0.03	1.62-1.82
Body weight, *kilogram*	67.7±1.5	55.00-77.00
Pulsation rates, *minute (resting)*	70.80±2.50	66.00-75.00
Respirasyon rates, *minute (resting)*	23.61±1.07	21.00-25.00
Vertical jumping, *cm*	52.90±1.65	48.40-55.00
Quickness, *second*	7.50±0.26	7.00-7.90
Speed-20 m, *second*	3.25±0.21	3.00-3.75
Speed-40 m, *second*	5.50±0.11	5.30-5.71
Speed-60 m, *second*	7.87±0.17	7.50-8.20
Cooper test, *km/12 minute*	3.00±0.09	2.75-3.20

* Mean values, standart deviations (SD) and variation ranges in all parameters.

TABLE 2: Mean values of some minerals and variation ranges (n=22)*.

Parameters	Means±SD	Variation ranges
Fe, *µg/dl*	129.44±33.36	89.00-208.00
Fe, *%*	34.96±10.20	21.00-62.00
TBC, *µg/dl*	340.56±46.64	255.00-407.00
UBC, *µg/dl*	222.56±62.03	129.00-297.00
TRF, *mg/dl*	273.56±19.96	240.00-305.00
Ca, *mg/dL*	9.44±0.42	8.50-10.20
P, *mg/dL*	3.66±0.37	3.10-4.30
Mg, *mg/dL*	1.93±0.24	1.58-2.49
Na, *meq/L*	144.39±2.60	138.00-147.00
K, *meq/L*	4.45±0.19	4.00-4.90
Cl, *meq/L*	108.83±2.27	102.00-112.00

* Mean values, standart deviations (SD) and variation ranges in all parameters.

correlations between lipids, RBC and PLT-indices were submitted in Table 5. Correlation cofficients were determined for the following parameters: These correlations are between CHOL, HDL-C, LDL-C and PDW, Fe%; between TG and TBC, RBC, MCV, MCH; between Fe and TBC, Fe%; between TBC and RBC, MCV, MCH, PLT, PCT; between TRF and UBC, PLT, PCT; between RBC and HGB, HCT, MCV, MCH, MCHC; between HGB and HCT; between MCV, MCH, MCHC and RDW, PCT; between PDW and PLT, PCT and PDW. The correlations among these parametes were statistically significant at the $p<0.05$-$p<0.01$ levels (Table 5).

DISCUSSION

Humans are characterised by individual changes of hematologic and biochemical parameters because of physical activity. These hematologic and biochemical changes may be due to several factors such as training, gender, socio demographic characteristics and laboratory methods which may contribute to variations in reference intervals.[1-6,21] It has been reported that there were considerable variations in hematological and biochemical parameters of different humans.[1-6] Therefore, extensive studies were performed to investigate normal reference values for haematological and biochemical parameters in young and adult humans in the different population.[1-4] However, it has been investigated to reference values and indices of ery-

TABLE 3: Mean values of biochemical parameters and varaiation ranges (n=22)*.

Parameters	Means±SD	Variation ranges
GLU, *mg/dL*	90.74±7.26	78.00-103.00
URE, *mg/dL*	32.65±3.83	27.00-42.00
CRE, *mg/dL*	1.12±0.10	0.90-1.30
URA, *mg/dL*	5.03±1.11	3.00-8.00
TBL, *mg/dL*	1.02±0.38	0.25-1.90
DBL, *mg/dL*	0.51±0.21	0.12-0.82
IBL, *mg/dL*	0.47±0.11	0.23-0.66
TP, *mg/dL*	7.71±0.40	7.10-8.80
ALB, *mg/dL*	5.44±0.36	4.60-6.00
GLOB, *mg/dL*	2.27±0.34	1.60-3.10
TG, *mg/dL*	78.07±28.78	30.00-146.00
CHOL, *mg/dL*	152.00±22.88	107.00-186.00
HDL-C, *mg/dL*	40.91±8.68	31.00-63.00
LDL-C, *mg/dL*	99.47±20.09	63.00-146.00
CHOL/HDL-C, *ratio*	3.80±0.66	2.54-5.29
LDL-C/CHOL, *ratio*	0.65±0.09	0.53-0.90
HDL-C/LDL-C, *ratio*	0.421±0.09	0.25-0.64
TG/ HDL-C, *ratio*	1.99±0.78	0.48-3.67
TBARS, *µmol/L*	1.12±0.14	0.97-1.53
AST, *U/L*	36.91±8.07	21.00-56.00
ALT, *U/L*	25.26±11.03	16.00-69.00
ALP, *U/L*	187.17±39.74	119.00-263.00
ASP, *U/L*	3.59±0.78	2.50-5.94
ALZ, *U/L*	180.09±42.51	115.00-270.00
CPK, *U/L*	177.61±19.13	148.00-210.00
GGT, *U/L*	15.83±5.18	10.00-34.00
LDH, *U/L*	347.35±29.33	281.00-388.00

* Mean values, standart deviations (SD) and variation ranges in all parameters.

TABLE 4: Mean values of haematologic parameters, erythrocyte and platelet indices (n=22).*

Parameters	Means±SD	Variation ranges
RBC, $10^6/\mu L$	5.04±0.39	4.26-5.59
HGB, *gr/dL*	14.58±0.98	13.00-16.70
HCT, *%*	44.05±2.96	39.20-48.90
MCV, *fL*	87.52±3.27	83.00-95.60
MCH, *pg*	28.99±2.05	25.20-32.90
MCHC, *g/dL*	33.07±1.53	29.00-36.00
RDW, *%*	17.37±0.93	16.00-19.00
PLT, $10^3/\mu L$	197.52±37.42	155.00-296.00
MPV, *fL*	10.70±1.45	8.00-13.00
PCT, *%*	0.19±0.04	0.13-0.28
PDW, *%*	52.21±9.99	47.00-55.00
WBC, $10^3/\mu L$	6.09±0.92	4.60-8.40
NEU, $10^3/\mu L$	3.24±0.70	2.10-4.50
NEU, *%*	54.46±2.57	49.10-59.00
LYM, $10^3/\mu L$	2.07±0.42	1.60-3.00
LYM, *%*	33.73±2.37	27.30-38.20
MON, $10^3/\mu L$	0.30±0.07	0.20-0.50
MON, *%*	4.91±0.74	3.60-6.10
EOS, $10^3/\mu L$	0.42±0.22	0.10-0.80
EOS, *%*	5.59±1.79	1.80-8.50
BAS, $10^3/\mu L$	0.08±0.05	0.00-0.20
BAS, *%*	0.92±0.57	0.10-2.00

* Mean values, standart deviations (SD) and variation ranges in all parameters.

throcyte and platelets, and their correlations with the other biochemical parameters.[4,10,11] In our study, we determined the minimal and maximal values and means of physical, physiologic, hematologic and biochemical parameters in young soccer players. The results obtained in this study will briefly be evaluated. Several factors such as obesity, dietary lipids, carbohydrates, alcohol, smoking, hormones, various drugs and physical activity may alter HDL-C levels in humans. LDL-C carries the major component of plasma cholesterol responsible for transportation of cholesterol to peripheral tissues and also HDL-C carries the blood borne cholesterol responsible for transportation of extra hepatic cholesterol to LDL-C.[18] Some investigations have been performed to explain the possible mechanism of the relations in serum lipids with exercise and using of antioxidant vitamins.[22-24] One of these mechanisms may be an increase in the transfer of cholesterol from lipoproteins and tissues to HDL-C as due to increase in lecithin cholesterol-acyltransferase activity induced by exercise. The other hand, exercise may decrease the serum levels of LDL-C and total triglyceride. Decrease of these biochemical substances may be due to the increase of triglyceride uptake by the tissues because of the increase in lipoprotein lipase-activity after exercise in men and animals.[25,26]

Training of longitudinal physical activity has elevated HDL-C and reduced LDL-C in serum. Low levels of HDL-C and high levels of LDL-C are two important risk factors for cardiovascular diseases. The intensity, period of the sample collections and of the exercise training is important factors that are positively associated with increases in serum levels of HDL-C and decrease of LDL-C. It has been reported that ratios of CHOL/HDL-C and LDL-C/HDL-C may be important risk factors for coronary artery diseases. Decrease of the two ratios is considered as lower risk for cardiovascular disease than that of total cholesterol and only HDL-C. This effect of long time on lipids may minimize by analyzing all samples after a few hours from exercise.[27,28] The lipid profiles and lipid ratios are extremely avaliable in laboratory evaluation of coronary atherosclerosis in humans.[28-31] As a matter of fact, these considerations are confirmed by the results determined in patients with coronary atherosclerotic lesions.[31]

Recent years, new indices related to erythrocytes and platelets have been provided by automotic haematologic analyzers. These indices such as MCV, MCH and MCHC are useful in morphologic classification and elucidating the etiology of anemias.[12,32] Platelet count is a part of complete blood cell count, one of the most frequently ordered laboratory tests in medicine. However, platelet indices such as PCT, MPV and PDW in the football players has not been adequately studied before. Activation of platelets at the site of vascular injury is the main pathogenesis of occlusive arterial disease.[13] Circulating platelets vary in both size and functional activity. Larger platelets are probably younger, more reactive and produce more thrombogenic factors. MPV, an important indicator of platelet activation may, increases in myocardial infarction and acute

TABLE 5: Correlation coefficients and statistically significant among lipid values, erythrocyte and platelets indices in all players (n=22).

	CHOL	HDL-C	LDL-C	TG	Fe	Fe%	TBC	UBC	TRF	RBC	HGB	HCT	MCV	MCH	MCHC	RDW	PLT	MPV	PCT	PDW
CHOL	1																			
HDL-C	0.58**	1																		
LDL-C	0.77**	0.39	1																	
TG	-0.41	-0.14	-0.30	1																
Fe	-0.24	-0.33	-0.05	-0.21	1															
Fe%	-0.46*	-0.45*	-0.33	-0.16	0.56**	1														
TBC	0.17	-0.15	0.15	-0.57**	0.44*	0.28	1													
UBC	0.07	0.34	0.32	0.20	-0.03	-0.26	-0.03	1												
TRF	0.18	0.35	0.28	-0.11	0.29	-0.17	0.38	0.70**	1											
RBC	-0.07	-0.09	-0.06	-0.49*	0.23	0.27	0.49*	0.29	0.35	1										
HGB	-0.33	0.05	-0.20	-0.09	0.18	0.32	-0.04	0.19	0.12	0.55**	1									
HCT	-0.27	-0.04	-0.12	-0.30	0.16	0.28	0.24	0.34	0.32	0.89**	0.75**	1								
MCV	-0.33	0.15	-0.11	0.53**	-0.19	-0.07	-0.66**	0.01	-0.14	-0.53**	0.19	-0.09	1							
MCH	-0.24	0.18	-0.13	0.50*	-0.11	-0.03	-0.63**	-0.10	-0.24	-0.59**	0.34	-0.27	0.81**	1						
MCHC	-0.05	0.17	-0.09	0.30	0.03	0.03	-0.44*	-0.18	-0.27	-0.49*	0.34	-0.37	0.41	0.87**	1					
RDW	0.37	0.36	0.30	-0.02	-0.11	-0.15	-0.05	0.01	0.01	-0.09	0.29	-0.09	0.04	0.36	0.51*	1				
PLT	0.28	0.17	0.23	-0.14	0.35	-0.11	0.57**	0.33	0.58**	0.31	-0.02	0.17	-0.37	-0.37	-0.27	-0.11	1			
MPV	-0.09	-0.05	-0.10	-0.13	-0.02	-0.23	0.15	-0.09	-0.21	0.17	0.05	0.09	-0.22	-0.18	-0.09	-0.01	0.09	1		
PCT	0.20	0.15	0.28	0.02	0.16	-0.23	0.44*	0.45*	0.57**	0.08	-0.31	-0.03	-0.19	-0.37	-0.42*	-0.37	0.76**	0.22	1	
PDW	-0.43*	-0.49*	-0.42*	0.07	-0.03	0.37	-0.07	-0.27	-0.34	0.05	0.14	0.12	0.11	0.07	0.02	-0.13	-0.68**	-0.03	-0.42*	1

**Correlation is significant at the 0.01 level.

*Correlation is significant at the 0.05 level.

coronary syndromes. MPV correlated with platelet function increases in certain vascular risk factor states, including hypercholesterolaemia and diabetes mellitus.[33] Increased MPV is associated with higher mortality following cardiac diseases.[14,15] There were significantly ($p<0.05$-$p<0.01$) correlations among the values of lipids, Fe, RBC and PLT-indices (Table 5). These correlations in our study were in agreement with the values of correlations determined among hematologic-indices.[32,34]

In conclusion, the hematologic and biochemical results in present study are basically in resemble with the results of previous studies performed on the resemble subjects.[1-4,16-19] Therefore, the present study may provide the reference values of hematologic and biochemical parameters and correlations on the RBC and PLT-indices. Sports diminishes the ratio of trigliceride/high density lipoprotein-cholesterol, one of an important indicator in evaluation of coronary atherosclerosis, and so, it may decrease the provoking risk of coronary atherosclerosis. However, these data are primary observations and further studies are necessary in order to evaluate the relationships of lipids, RBC and PLT-indices. Thus, we are presently ongoing such our studies investigating relationships of different conditions affecting hematologic indices and biochemical parameters.

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