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Original article

Evaluation of end-seasonal vitamin d, plasma lipid and other biochemical measurements in professional football players: The case of sivas province in turkey

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Abstract. *Study Objectives:* This study aimed to evaluate the end-seasonal blood lipids and some metabolic parameters of the athletes who play football professionally. *Methods:* Thirty six male professional footballers playing in the Super League and TFF 2nd League (Turkish Football Federation Second League) in Sivas province, aged between 19 and 32 (mean age 23.33±3.49 years), participated in this research. The athlete age of the players participating in the study is 11.66±3.72 years. In addition, the athletes participating in the study regularly train 90-120 minutes a day, 6-7 times a week, and approximately 11 months a year. All measurements and venous blood sampling of the participants were collected between 09:00 and 10:00 in the morning after 12-hour fasting in June. The biochemical tests of the participants were obtained with the Beckman DXC-800 model autoanalyzer in the Private Clinical Biochemistry Laboratory and the enzymatic-colorimetric method. IBM SPSS Statistics 24 package software was used to analyze the obtained data. Descriptive statistics of the obtained data were given as mean and standard deviation. *Results:* Albumin, ALP, ALT, AST, B12 vitamin, Ca, Phosphorus, Creatinine, Mg, Free T3, Sodium, TSH, Ferritin, Folic Acid, Potassium, Free T4, and Uric Acid values of the participant athletes were found to be within normal limits. *Conclusion:* it was concluded that the HDL cholesterol levels of the smoker athletes were low due to smoking and vitamin D values were low in professional football players.

Keywords: HDL Cholesterol, Vitamin D, Plasma Lipid, Biochemical, Professional Soccer Players

Introduction

Knowing the biochemical and hematological parameters of athletes helps trainers and sports scientists to determine their energy needs and to prepare training programs accordingly. Biochemical and hematological blood parameters should be at appropriate levels to exhibit optimum performance. Among these blood parameters, values such as vitamin D and blood lipids have a significant place in branches such as football (1).

Vitamin D has a key role in maintaining the health of the musculoskeletal system. Contemporary research points out that vitamin D deficiency/insufficiency is a general health problem not only for the general world population but also for athletes (2). In sports that require high effort such as football, the musculoskeletal systems of elite athletes are overloaded. Therefore, professional football players need optimal musculoskeletal function (3). Besides, as vitamin D deficiency may cause the regulation of the muscular system of athletes to be impaired, it may cause injuries,

stress fractures, and deterioration of tendon structures in athletes. Possible effects include decreased training quality, prolongation, and duration of injury and disease, and thus decreased athletic performance (4).

Football is a sport that requires high aerobic and anaerobic power both in training and matches (5-7). Football players are under high physiological stress, especially during the match. In some studies (8,9), it was stated that football players' total cholesterol and triglyceride levels decreased, led to relatively small improvements in LDL levels, and HDL levels increased during intense and repetitive exercises. On the other hand, it was proven that short or long-term exercise could alter lipoprotein metabolism (10).

Interest in studies on biochemical and hematological parameters, especially lipid profiles of football players and vitamin D in football, has been increasing over time (11-13). Based on this fact, this study aims to evaluate the end-seasonal blood lipids and some metabolic parameters of the athletes who play football professionally.

Material and Method

Participants

Thirty six male professional footballers playing in the Super League and TFF 2nd League (Turkish Football Federation Second League) in Sivas province, aged between 19 and 32 (average age 23.33±3.49 years), participated in this research. The athlete age of the players participating in the study is 11.66±3.72 years. In addition, the athletes participating in the study regularly train 90-120 minutes a day, 6-7 times a week, and approximately 11 months a year. When we look at the mean scores of the body measurement parameters of the participant athletes, it was found out that the mean height was 181.02±6.29 cm, the mean weight was 75.27±6.88 kg, and the average BMI was 22.95±1.59.

Collection of Data

The volunteers were informed about how the tests were carried out, and possible risks, and their written consent was obtained. All measurements and venous blood sampling of the participants were collected between 09:00 and 10:00 in the morning after 12-hour fasting in June. The values of the height, body weight (BW), body mass index [BMI = BW (kg) / (height, m)^2] of the athletes were determined. The biochemical tests of the participants were obtained with the Beckman DXC-800 model autoanalyzer in the Private Clinical Biochemistry Laboratory and the enzymatic-colorimetric method.

Statistical Analysis

IBM SPSS Statistics 24 package software was used to analyze the obtained data. Descriptive statistics of the obtained data were given as mean±standard deviation.

Results

According to Table 2, the HDL cholesterol values of the smoker athletes were 26.7% below 40 mg/dL, 53.3% between 40-45 mg/dL, 6.7% between 45-50 mg/dL, and 13.3% of them were found to be >50 mg/dL. HDL cholesterol values of non-smoking athletes were 23.8% below 40 mg/dL, 19% between 40-45 mg/dL, 19% between 45-50 mg/dL and 38.1% of them were found to be >50 mg/dL.

According to Table 3, the Hydroxy Vitamin D value of 50% of the athletes was found below 20, 38.9% between 20-30, and 11.1% 30-above. High Density Lipoprotein (HDL) Cholesterol value of 25% was found to be below 40, 33.3% between 40-45, 13.9% between 45-50, and 27.8% above 50. Low Density Lipoprotein (LDL) Cholesterol value of 69.4%

Table 1. Body measurement parameters of the study participants

Variable	N	Mean ± S.D.
Height (cm)	36	181.02±6.29
Weight (kg)	36	75.27±6.88
BMI	36	22.95±1.59

Table 2. HDL cholesterol distribution of athletes

Variable		HDL Cholesterol (mg/dL)	N	Percentage (%)
Smoking	Yes	<40	4	26.7
		40-45	8	53.3
		45-50	1	6.7
		>50	2	13.3
		Total	15	100
Smoking		**HDL Cholesterol (mg/dL)**	**N**	**Percentage (%)**
	No	<40	5	23.8
		40-45	4	19
		45-50	4	19
		>50	8	38.1
		Total	21	100

was found to be below 100, 22.2% between 100-130, 5.6% between 130-160, and 2.8% between 160-190. The mean value of Fasting Blood Glucose of 25% was determined as below 84 and 75% between 84-100. Given the Albumin values of the athletes, 91.7% were found to be between 35-52, and 8.3% were found to be 52-above. On the other hand, it was seen that the Alkalen Fosfataz (ALP) value of 5.6% was below 45, 77.8% between 45-87, and 16.7% above 87. The Alanin Transaminaz (ALT) value of 86.1% of the athletes was found between 0-33 and 13.9% above 33. The Aspartat Transaminaz (AST) value of 77.8% was found to be between 0-32 and 22.2% above 32. Vitamin B12 values of 30.6% were found in the range of below 197, 66.7% between 197-771, and 2.8% between 771 above. Ca value in all athletes was found in the range of 8.6-10.2, phosphorus value in the range of 2.5-4.5, creatinine value in the range of 0.5-1, Mg value in the range of 1.6-2.6, Free T3 in the range of 2.56-5.00, Sodium in the range of 135-145, and Tiroid Stimule Hormone (TSH) in the range of 0.51-4.3. Ferritin value of 80.6% was found between 13-150 and 19.4% above 150. The folic acid value of 19.4%, on the other hand, was found to be in the range of under 3.89 and 80.6% in the range of 3.89-27. Potassium values of 97.2% were between 3.5-5.1 and 2.8% above 5.1. Free T4 values of 91.7% were between 0.98-1.63, and 8.3% were above 1.63. Triglyceride values of 86.1% have below 150, and 13.9% have values between 150-300. The uric acid values of 63.9% of athletes were found to be between 2.4-5.7 and 36.1% above 5.7.

Discussion

From the point of view of training science, the complete determination of the physical and physiological characteristics of athletes makes a significant contribution in terms of adaptation to different forms of training. All the characteristics of athletes should be taken into account in the preparation of training programs to achieve the expected performance of athletes and ensure success (14). Biochemical and hematological parameters, as well as many factors, can play an important role in the cardiovascular and blood circulation in our circulatory system in exercising adaptation and providing physical and physiological balance (15, 16).

Knowing the biochemical parameters of athletes helps trainers and sports scientists to determine their energy needs and to prepare training programs accordingly (17). In the field of sports sciences, studies are describing the effects of competition performances on biochemical parameters in different sports branches (14-18). However, studies on biochemical parameters collected at the end of the season in professional football players are regarded as limited.

Table 3. Biochemical distributions of the participants

Variable	Value	N	Percent (%)	Mean ± S.D.
Hydroxy Vitamin D (ng/mL)	<20	18	%50	20.78 ± 6.30
	20–30	14	%38.9	
	>30	4	%11.1	
	Total	36	%100	
HDL Cholesterol (mg/dL)	<40	9	%25	45.25 ± 7.86
	40–45	12	%33.3	
	45–50	5	%13.9	
	Above 50	10	%27.8	
	Total	36	%100	
LDL Cholesterol (mg/dL)	<100	25	%69.4	88.42 ± 27.24
	100–130	8	%22.2	
	130–160	2	%5.6	
	160–190	1	%2.8	
	Total	36	%100	
Fasting Blood Glucose (mg/dL)	<84	9	%25	87.16 ± 6.37
	84–100	27	%75	
	Total	36	%100	
Albumin	35–52	33	%91.7	48.24 ± 3.13
	>52	3	%8.3	
	Total	36	%100	
ALP (U/L)	<45	2	%5.6	70.03 ± 16.99
	45–87	28	%77.8	
	>87	6	%16.7	
	Total	36	%100	
ALT (U/L)	0–33	31	%86.1	19.77 ± 9.69
	>33	5	%13.9	
	Total	36	%100	
AST (Unit/L)	0–32	28	%77.8	24.17 ± 20.76
	>32	8	%22.2	
	Total	36	%100	
B12 (pg/mL)	<197	11	%30.6	300.93 ± 155.45
	197–771	24	%66.7	
	>771	1	%2.8	
	Total	36	%100	
Ca (mg/dL)	8.6–10.2	36	%100	9.33 ± 0.38
Ferritin (ml/ng)	13–150	29	%80.6	106.15 ± 54.48
	>150	7	%19.4	
	Total	36	%100	

(continued)

Table 3. (continued)

Folic acid (ng/mL)	<3,89	7	%19.4	5.64 ± 2.21
	3.89–27	29	%80.6	
	Total	36	%100	
Phosphorus (mg/dl)	2.5–4.5	36	%100	3.73 ± 0.41
Creatinine (mg)	0.5–1	36	%100	0.98 ± 0.106
Mg (mg/dl)	1.6–2.6	36	%100	1.98 ± 0.13
Potassium (mg/dl)	3.5–5.1	35	%97.2	4.33 ± 0.33
	>5,1	1	%2.8	
	Total	36	%100	
Free T3 (pg/mL)	2.56–5.00	36	%100	3.84 ± 0.36
Free T4 (pg/mL)	0.98–1.63	33	%91.7	1.35 ± 0.19
	>1.63	3	%8.3	
	Total	36	%100	
Sodium (mEq/L)	135–145	36	%100	139.27 ± 2.47
Triglyceride (mg/dl)	<150	31	%86.1	94.91 ± 46.96
	150–300	5	%13.9	
	Total	36	%100	
Uric acid (mg/dl)	2.4–5.7	23	%63.9	5.58 ± 0.87
	>5.7	13	%36.1	
	Total	36	%100	
TSH (mL)	0.51–4.3	36	%100	1.97± 0.72

According to the results of the study, the average height of the athletes was 181.02 cm, their average weight was 75.27 kg, and their BMI was 22.95 (Table 1). Considering their smoking status, 41.7% of the athletes smoke, 58.3% do not (Table 2). According to the findings, the HDL cholesterol value of 26.7% of the smoker athletes was found to be below 40, 53.3% between 40-45, 6.7% between 45-50, and 13.3% above 50. The HDL cholesterol value of 23.8% of non-smoking athletes was found to be below 40, 19% between 40-45, 19% between 45-50, and 38.1% above 50 (Table 2). It was observed that the triglyceride, glucose, and total cholesterol values of the participant athletes were found as normal (Table 3). According to these results, it can be said that smoking athletes have low HDL cholesterol levels, while non-smoking athletes have high levels. Besides, the finding that active training decreases LDL cholesterol and increases HDL cholesterol in non-smoking athletes shows that it will once again contribute to lipid therapy. Smoking has negative effects on lipid levels. Free radicals in cigarette smoke target polyunsaturated fatty acids. Cigarette smoke affects lipid metabolism with its linoleic acid conversion and desaturation effects and also changes de novo lipid synthesis from free cholesterol (19). In the literature (19-22), fasting blood glucose, Total Cholesterol, and Triglyceride values of smokers were found to be higher than non-smokers, and HDL values were lower. In a study of 1012 patients in which the effect of smoking on HDL in young adult healthy individuals was examined, it was concluded that smoking decreased HDL levels even in non-heavy smokers (20). These results are consistent with our study. In the athletes who participated in our study, the HDL values of smokers were found to be lower than the non-smokers. Arslan et al. (21) found that HDL decreased with smoking in their study on a total of 102 healthy young male cases. Smoking

generally leads to the regression of sportive performance and the timely end of sports life. Adverse changes in body functions due to smoking reduce the individual's quality of life by directly affecting exercise capacity or physical exercise capacity (23). According to the findings of our study, it is interesting that smoking is so common among football players. It will negatively affect the performance and health of the players. We think that measures should be taken in this regard.

According to the vitamin D findings of our study, it was observed that approximately 50% of 18 athletes had below 20 ng/ml. The best parameter that shows the vitamin D status of the body is the serum 25 (OH) vitamin D level (24). Although there is no consensus on the optimal level of 25 (OH) vitamin D, the optimal level of 25 (OH) vitamin D, most researchers regard the level of vitamin D above 30 ng/ml (75 nmol/L) as sufficient, between 20 and 30 ng/ml (50-75 nmol/L) as insufficient, and below 20 ng/ml (50 nmol/L) is considered as a deficiency (24,25). When 25 (OH) D level is >150 ng/ml, it is considered as vitamin D intoxication (24,26). However, Close and Fraser argue that supplements should be considered by the American Medical Institute (IoM) guidelines for athletes with a serum calcidiol concentration of <50 nmol/L (27). Some studies indicate that calcidiol concentrations greater than 100 nmol/L in athletes may be necessary for the extra-skeletal positive effect of vitamin D, but there is currently no strong evidence for these effects (28,29). Some evidence supports that serum calcidiol concentrations should be kept between 80-100 nmol/L for muscle function, bone health, and prevention of respiratory tract infections (30,31). In a review by Todd et al., it was stated that athletes might be prone to low vitamin D levels (32). In the study conducted by Malczewska-Lenczowska et al. (33) (219 elite women in different branches), vitamin D values of 54.3% of the athletes were found as insufficient (<75 nmol/L) (In the relevant study, <25 nmol/L means deficiency, 25-75 nmol/L means insufficiency). In the review by Sikora-Klak et al., it was stated that there was a deficiency or insufficiency in athletes in dance, taekwondo, wheelchair, handball, athletics, weightlifting, swimming, and volleyball branches. In the context of Turkey, Dönmez et al. (34) studied on 56 male football players living in Ankara (39°57'N) and found out that the vitamin D values of 23.2% of football players were deficient (<10 ng/mL) and 66.1% were insufficient (10-24.9 ng/mL), and 10.7% of them were sufficient (≥25 ng/mL) (35). As a result, we found severe vitamin D deficiency and insufficiency. The importance of our study is significant in that it is the first study conducted with professional football players in Sivas and shows a severe deficiency of vitamin D.

Conclusion

Albumin, ALP, ALT, AST, B12 vitamin, Ca, Phosphorus, Creatinine, Mg, Free T3, Sodium, TSH, Ferritin, Folic Acid, Potassium, Free T4, and Uric Acid values of the participant athletes were found to be within normal limits. According to the results, it can be concluded that smoking athletes have low HDL cholesterol levels, while non-smoking athletes have high levels. It was also found out that the triglyceride, glucose, and total cholesterol values of the athletes participating in the study were within normal limits. Nevertheless, athletes have low vitamin D values, and LDL cholesterol values were found to be low in them. As a result, it was concluded that the HDL cholesterol levels of the smoker athletes were low due to smoking and vitamin D values were low in professional football players. Consequently, we think that knowing and continuously monitoring the biochemical parameters of professional football athletes can provide better performance in training and matches and protect them from injuries.

Conflicts of Interest

The authors declare that there is no conflict of interest in this manuscript.

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