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EVALUATION OF MUSCLE DAMAGE AND CHANGES IN SOME BLOOD PARAMETERS BEFORE AND AFTER AN INTERCOLLEGUATE FOOTBAL TOURNAMENT

Bayram TEMUR H*

Yüzüncü Yıl University / Van/TURKEY

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ABSTRACT

Aim: This study was aimed towards determination of any changes in creatine kinase (CK) levels of the players, which is the most significant indication of a player's muscle damage, along with the changes in iron-binding capacity, erythrocyte, hemoglobin, hematocrit, mean corpuscular volume (MCV), and mean corpuscular hemoglobin (MCH) after an intercollegiate football tournament.

Method: The study group consisted of 20 players between the ages of 19 and 28. Blood samples of the players were collected twice in the laboratory of a private hospital, one day prior and one day after the tournament, in order to determine their blood parameters. Furthermore, the players' ages, heights, body weights, years of football experience, smoking statuses, and the total in-game time during the study were recorded. Bivariate, correlation, and paired sample t-tests were conducted on the data, using the SPSS 23 package program.

Findings: The analysis of the obtained data revealed no statistically significant CK and iron level differences between pre and post tournament samples ($p<0.05$). On the other hand, iron-binding capacity, erythrocyte, hemoglobin, hematocrit, MCV and MCH values were found to have changed in a statistically significant manner ($p<0.01$). Furthermore, between the smoking and non-smoking players, only the changes in MCV values were relevant ($p<0.01$). The time played had a positive correlation with CK levels ($p<0.01$), and negative correlation with iron levels. Another finding is that the age of players had negative correlation with MCV values ($p<0.05$).

Results: Based on the findings, it was found that some of the blood parameters were altered after the intense match period, while others displayed no statistically significant changes. Play time was found to cause muscle damage and reduction in iron levels.

INTRODUCTION

It is now a well-known fact that physical activity affects all body systems more or less depending on the duration and severity of activity. Work done in this direction is becoming more and more specific. Akgün (1989) concluded that exercise influences the functioning of the cardiovascular system and functions together with muscle, bone and joint structures.

It has been reported that exercises cause injury to the skeletal muscle structure, as well as infarct-like injuries in the heart, according to the study and its characteristics (Konig *et al*., 2003; Rifai *et al*., 1999). Ectopic exercise induced skeletal injury, such as muscle pain (Brown *et al*., 1999), depression (Rinard *et al*., 2000), electromyographic (EMG) signal changes (Berry *et al*., 1990), and creatine kinase and increased serum levels of muscle proteins (Thompson *et al*., 1999). In addition, magnetic resonance imaging (MRI) of the skeletal muscle allows the location and size of the injury to be determined (Nosaka and Clarkson 1996). Recovery of muscle damage following intensive physical activity of eccentric contractions may last for several days or weeks, depending on the severity of the injury (Friden and Lieber, 2001; La Stayo *et al*., 2003). It has been suggested that blood CK levels increase due to race, gender, age, type of exercise and form status (Totsuka *et al*., 2002; Schneider *et al*., 1995) in muscle damage caused by exercise. However, there are studies (Schuttle *et al*., 1994; Worral *et al*., 1990) that suggest that factors such as body mass index, muscle fiber type and muscle mass may also have an effect on CK level. It has been reported that the rate of CK cleansing is affected by the person's lymphatic flow and the severity of the damage. In some studies (Totsuka *et al*., 2002; Havas *et al*., 1997), while the CK concen- tration reached its highest value at the end of 24 hours of exercise after exercise and began to decline at 48 hours and eventually returned to its pre-exercise values after 72 hours, Bryne and Eston) returned to pre-exercise values only after 7 days. They also argued that CK increased the concentration in the congenitally consistent with muscle damage.

It is stated that physical activity can affect biochemical parameters as well as affect many systems (Beydağı *et al*., 1993). It is also known that there are changes in biochemical levels depending on the type, severity and duration of the exercise (Akmakçı and Pulur, 2008). Tran and Weltman (1985) reported that exercising, biochemical parameters were generally less affected in trained individuals than in other individuals.

In this study, it was aimed to evaluate whether there is a change in iron, iron binding capacity, erythrocyte, hemoglobin, hematocrit, MCV and MCH values, especially CK, playing football match for four days or more.

METHOD

20 football players aged between 19 and 28 were included in the football team of Van Yüzüncü Yıl University. These footballers also run balls in different clubs in the amateur league. These were also done in pre-tournament training sessions. The altitude of the footballers included in the study is 1660 m and the altitude of the tournament is 40 m. It was determined that the participants' average age of sports was 9,30 ± 3,48 years. In addition, height, age, body weights and BMI values were determined. We went to the Interuniversity football tournament held in Antalya province. Here, four different days were played with different college teams. In this process, the duration of the player changes in the games was recorded and the time the players played in total was determined. Before going to the tour, the blood samples from the football players were taken to the stomach by the health officers in the Private Lokman Hekim Hospital's laboratory. Blood samples after the tournament were taken to the abdomen in the same hospital about thirty hours after the end of the tournament. All these data were transferred to the computer environment. Analysis of these data was performed using the Bivariate, correlation and Paired-sample t test in the SPSS 23 package program.

Corresponding author:* **Bayram TEMUR H
Yüzüncü Yıl University / Van/TURKEY

Table 1 Average Pre-Tournament-Post-Blood Values of Blood Parameters, Difference between Orders and Significance Levels

Variables	N	Pre-Test	Post-Test	Mean Difference	t	p
		Mean ± Std.	Mean ± Std.			
CK(U/L)	20	274,50 ±119,11	341,20±177,59	-66,70	-1.673	,156
Iron (µg / dL)	20	107,87±33,58	84,21±35,79	23,66	2.262	,701
Iron binding capacity (µg / dL)	20	208,34±63,11	227,36±41,38	-19,02	-1.741	,003
Erythrocyte (mm³)	20	5,23 ±,34	5,17±,35	,06	1.747	,000
Hemoglobin (g / dl)	20	15,43±1,05	15,23±1,06	,20	1.822	,000
Hematocrit (%)	20	44,54±2,53	44,69±2,77	-,14	-.443	,000
MCV (µm³)	20	85,23±2,42	86,54±2,70	-1,31	-7.692	,000
MCH (pg)	20	29,53±1,15	29,49±1,21	,03	.552	,000

Table 2 Average Values of Pre-Tournament and Post-Tournament Between Some Smoking Parameters and Non-Smoking Participants and Their Significance Levels

Variables	Smoking	N	Pre-Test Mean ± Std.	Post-Test Mean ± Std.	Mean Difference	t	p
CK(U/L)	Yes	8	262,12±99,12	394,87± 214,81	-132,75	-1,941	,093
	No	12	282,75 ±134,42	305,42 ± 147,04	-22,67	-,489	,634
Iron (µg / dL)	Yes	8	113,31±30,74	92,83±33,10	20,47	1,069	,320
	No	12	104,25±36,20	78,47±37,75	25,78	2,048	,065
Iron binding capacity (µg / dL)	Yes	8	194,12±62,24	217,15±37,09	-23,02	-1,200	,269
	No	12	217,81±64,58	234,17±44,22	-16,36	-1,200	,255
Erythrocyte (mm³)	Yes	8	5,26±,42	5,17±,28	,08	1,286	,239
	No	12	5,21±,30	5,16±,40	,048	1,127	,284
Hemoglobin(g/dl)	Yes	8	15,49±1,26	15,21±1,08	,27	1,263	,247
	No	12	15,40±,95	15,25±1,10	,15	1,267	,231
Hemotokrit(%)	Yes	8	44,72±2,93	44,71±2,29	,01	,020	,984
	No	12	44,42±2,35	44,67±3,16	-,25	-,650	,529
MCV(µm³)	Yes	8	85,16±3,25	86,47±3,40	-1,31	-5,518	,001
	No	12	85,27±1,85	86,59±2,28	-1,32	-5,370	,000
MCH(pg)	Yes	8	29,49±1,27	29,39±1,37	,10	1,673	,138
	No	12	29,56±1,13	29,57±1,16	-,01	-,085	,934

Table 3 Correlation Coefficent of Some Blood Parameters with Different Variables

Variables	CK	Iron	Iron Binding	Erythrocytes	Hemog lobin	Hemotocrite	MCV	MCH
Age (Year)	-,151	-,009	-,142	-,198	-,145	-,122	,166	,044
Sport Age (Year)	,059	,000	-,204	,117	-,101	-,109	-,466*	-,354
Playing Time(Min.)	,568**	-,697**	,208	-,425	-,368	-,369	,214	,086
Height (cm)	-,333	,207	,042	-,413	-,235	-,199	,490	,253
Weight (kg)	-,308	,058	,129	-,146	,081	-,004	,288	,351

Findings

When Table 1 is examined, it was determined that the pre-tournament CK values of the footballers included in the study were 274.50 ± 119.11 U / L, and the average of these values was 341.20 ± 177.59 U / L after the tournament. The average pre-tournament blood iron level of the participants was 107.87 ± 33.58 µg / dL, while it was 84.21 ± 35.79 µg / dL after the tournament. The iron binding capacity values were determined as 208,34 ± 63,11 µg / dL before the tournament and 227,36 ± 41,38 µg / dL after the tournament. The pre-tournament values of erythrocytes were 5,23 ±, 34 mm³, and 5,17 ± 35 mm³ after the tournament. The hemoglobin values of the participants before the tournament were 15,43 ± 1,05 g / dl and the average values after the tournament were 15,23 ± 1,06 g / dl. The mean hematocrit values before the tournament were 44.54 ± 2.53% and 44.69 ± 2.77% after the tournament. The average values of MVC are 85.23 ± 2.42 µm³ before the tournament and 86.54 ± 2.70 µm³ after the tournament. The average MCH values before the tournament were 29,53 ± 1,15 pg, while those after the tournament were 29,49 ± 1,21 pg. In Table 2, the players of said tournament before and after the average of the blood values, when they are examined according to their smoking habit before tournament smokers average CK value 262.12 ± 99.12 U / L, the tournament after these values are average 394.87 ± 214,81 U / L, and the mean values of these values were 282,75 ± 134,42 U / L and 305,42 ± 147,04 U / L, respectively. Smokers average blood iron levels before the tournament 113.31 ± 30.74 mg / dL after the tournament 92.83 ± 33.10 mg / dl, respectively, of non-smokers, this average value is 104.25 ± 36.20 mg / dL and 78,47 ± 37,75 µg / dL respectively. The pre-test values of smoking cigarette smokers in smoking cigarettes are 194.12 ± 62.24 µg / dL and the post-test mean values are 217.15 ± 37.09 µg / dL. In non-smokers, these mean values were 217.81 ± 64.58 µg / dL and 234.17 ± 44.22 µg / dL respectively. Pre-tournament erythrocyte values of smokers were 5,26 ±, 42 mm³, while post-tournament erythrocyte values were 5,17 ±, 28 mm3. For non-smokers, the average of these values is 5.21 ± 30 mm³ before the tournament, 5,16 ± 40 mm³ after the tournament. Hemoglobin pre-tournament values for smoking soccer players are 15.49 ± 1.26 g / dl, and after tournaments, this value is 15.21 ± 1.08 g / dl. In non-smokers, the mean values of these values are 15,40 ±, 95 g / dl and 15,25 ± 1,10 g / dl, respectively. Before the tournament, the average value of hematocrit in smokers was 44.72 ± 2.93%, while it was 44.71 ± 2.29% after the tournament. These values were 44.42 ± 2.35% before the tournament and 44.67 ± 3.16% after the tournament.

The average MCV values in smokers before the tournament players µm³ 85.16 ± 3.25, 86.47 ± 3.40 µm³ the tournament after, these values are pre-tournament nonsmokers 85.27 ± 1.85 µm³, after the tournament 86, 59 ± 2.28 µm. Finally, the average of the MCH values was 29.49 ± 1.27 pg before the tournament, 29.39 ± 1.37 pg after the tournament, 29.56 ± 1.13 pg before the tournament and 29.56 ± 1.13 pg before the tournament, 57 ± 1,16 pg was observed.

When Table 3 was examined, it was found that the correlation coefficient between football age and MCV values (r = -, 466) was negatively correlated at p <0,05 level and that the correlation coefficient between the playing time of football players and CK levels after tournament was r = (p <0.01) and iron levels (r = -, 697) are negatively related at p <0,01 level.

DISCUSSION

It was determined that the pre-tournament CK values of the soccer players included in the study were 274,50 ± 119,11 U / L and 341,20 ± 177,59 U / L after the tournament. Although the pre-tournament average value increased after the tournament, the difference (-66,70) was not statistically significant. Also in the study, it was found that the pre-tournament CK values of smokers were 262,12 ± 99,12 U / L and the average post-tournament values were 394,87 ± 214,81 U / L (-132,75) <0,05). The pre-tournament CK values of the non-smoking athletes were 282.75 ± 134.42 U / L, while those of the non-smoking athletes were 305.42 ± 147.04 U / L after the tournament. The difference between these two values (-22,67) was statistically significant It was not seen. It can be said that the difference in the average values of pre- and post-tuning CK values of smoking and non-smoking soccer players is much higher than that of smoking footballer. Furthermore, when the CK values were compared according to playing time of the football players, it was found that the correlation coefficient (r) between the two was 568, which was significant at p <0,01 level. Evans et al. (1986) investigated the effects of 45-minute exercise of eccentric bicycle exercise on CK in trained long-distance runners and untrained male subjects. At the end of the study, they reported that the CK values measured five days after exercise were 33 times higher than the resting level in the untreated group and reached to the highest level and returned to the normal level in 9 days. They reported that this increase in the CK value started to double in the same time for the training athletes and reached the highest level after one day and returned to normal level after two days. Thompson et al., (1999) suggested that 90 min, consisting of loads and rests of varying intensity, which are thought to reflect the activities of a football match. Run a 20 m shuttle running test with time. As a result, he reported that the serum CK level increased for 48 hours and the most significant increase was 24 hours after the activity. It was observed that there was an increase in CK values after the training. However, it is thought that if the increase is not meaningful, soccer players may be effective. Although there was no significant difference in the CK values before and after exercise, it was concluded that the CK values increased in parallel with the time played by the soccer players, suggesting that the exercise caused muscle damage, but the severity and duration of the exercise affected this.

It was also determined that pre-tournament pre-tournament blood iron values averaged 107.87 ± 33.58 µg / dL for participants and 84.21 ± 35.79 µg / dL post tournament values. The difference between the first and second measurements (23,66) was not statistically significant. According to the average values of smokers who smoked and not smoked, pre-tournament blood iron values in smokers were 113,31 ± 30,74 µg / dL and 92,83 ± 33,10 µg / dl in post-tournaments, while the mean value of these values in non-smokers , 104,25 ± 36,20 µg / dL and 78,47 ± 37,75 µg / dL, respectively. When the iron values were compared with the playing time of the athletes, it was determined that the concentration of residual iron in the blood during the playing time decreased. Diehl et al., (1986) reported that serum ferritin values were gradually reduced during seasonal season when they performed on women's grass hockey players. Magazanik et al. (1988) found a decrease in serum iron levels after a 7-week heavy exercise program. Excessive intensities in endurance training have been reported to lower serum iron levels (Lehmann et al., 1997).
For footballers, iron binding capacity values were 208,34 ± 63,11 µg / dL before the tournament and 227,36 ± 41,38 µg / dL after the tournament, and these values increased after the tournament (-19,02). This difference was statistically significant (p <0.01). When the iron binding capacity values were compared according to whether the athletes smoked

or not, the pre-tournament iron binding capacity values in smoking soccer players were 194.12 ± 62.24 µg / dL, while the post-tuning values were 217.15 ± 37.09 µg / dL. In non-smokers, these values are 217.81 ± 64.58 µg / dL and 234.17 ± 44.22 µg / dL, respectively. Magazanik et al. (1988) reported that endurance exercises increased the iron binding capacity in their work. Literature supports the study data. The increase in iron binding capacity with consumed effort can be explained as the adaptation of the organism to the exhaust.

The prevalence of erythrocyte values before the tournament was found to be 5,23 ±, 34 mm³ and 5,17 ± 35 mm³ after the tournament. The difference between the mean values before and after the tournament (, 06) was found to be significant at p <0.01. When the average values of erythrocyte values were examined in smokers and non-smokers, pre-tournament erythrocyte values of smokers were 5,26 ±, 42 mm³ and 5,17 ±, 28 mm3 after tournament. In the non-smokers, the mean values were 5,21 ±, 30 mm³ and 5,16 ±, 40 mm³, respectively. However, it was determined that post-tournament erythrocyte values were not significantly correlated with age, bo, body weight, sport age and duration of play in tournament. Uzuner and Sonmez (2009) stated that there was no significant difference between pre and post exercise values in the study of football players, erythrocyte values before and after exercise, and sedantery values before and after exercise. Temur (2018) suggested a significant (p <0.05) increase in erythrocyte values before and after exercise in the study of sedentary women. Magazanik et al. (1988) reported a decrease in erythrocyte count after a 7-week heavy exercise program. It is thought that despite the fact that they play a total of four days in total, which is a total of four days, the study group footballers' training can be effective at altitudes of approximately 1160 m and the tournament at 40 m altitudes.

The hemoglobin values of the participants before the tournament were 15,43 ± 1,05 g / dl and the average values after the tournament were 15,23 ± 1,06 g / dl. The difference between these two mean values (, 20) was statistically significant (p <0.01). However, when pre- and post-tournament values of the smoking and non-smoking tournaments were examined, it was determined that pre-nasal prevalence values were 15.49 ± 1.26 g / dl in the smoking futures and 15.21 ± 1.08 g / dl after the tournament. In non-smokers, the mean values of these values are 15,40 ±, 95 g / dl and 15,25 ± 1,10 g / dl, respectively. It was observed that there was no significant difference (p <0.05) between pre-test and post-test values in smokers and non-smokers. This can be explained by minimizing the negative effects of cigarette training. Uzuner and Sonmez (2009) concluded that both the pre and post-exercise hemoglobin values of footballers and sedans increased significantly. In his study at Temur 2018, he reported a significant increase in hemoglobin values at the end of eight weeks of plate exercises. The increase in hemoglobin values with exercise may be explained by an increase in the ratio of hemoglobin to a decrease in blood plasma.

When the percentages of hemoglobin and erythrocytes in the hematocrit are calculated, it is seen that the hematocrit values before the tournament were 44.54 ± 2.53 and 44.69 ± 2.77% after the tournament, respectively. The increase (-, 14) between these two values appeared to be statistically significant (p <0.01). The mean hematocrit values in smokers were 44.72 ± 2.93% before the tournament, and 44.71 ± 2.29% after the tournament. These values were 44.42 ± 2.35% before the tournament and 44.67 ± 3.16% after the tournament in the non-smokers. Both groups were found to have no anxiety (p <0.05) between pre- and post-tournament values. Uzuner and Sonmez (2009) reported that there was a significant increase in hematocrit values between pre- and post-exercise values in their study of 16 footballers aged 18-24. Based on these findings, it is possible to say that intensive and long-term loading increases serum hematocrit percentage. This can be seen as a reduction of the blood plasma of the fluid, which is also lost during exercise.

The mean value of MCV showing the average size of red blood cells carrying oxygen was 85.23 ± 2.42 µm³ before the tournament and 86.54 ± 2.70 µm³ after the tournament. It was observed that the number between the two mean values (-1,31) was significant (p <0.01). The pre-tournament values of the MCV nonsmoker players were 85,16 ± 3,25 µm³ and 86,47 ± 3,40 µm³ after the tournament, while the average of these values was 85,27 ± 1,85 µm³ before the tournament 86.59 ± 2.28 µm. Both smokers and non-smoking soccer players were significantly different (p <0.01) between pre- and post-tournament average scores. It was also found that MCV values correlated positively with participants' correlation coefficient (r = -, 466) between sports ages and p <0.05 at negative level. Bezci and Kaya (2010) suggested that there was no significant difference (p <0,05) in the MCV values obtained before and after the 4-week campus in the study of 11 female athletes aged 14-17. Previously, we found that the MCV values before and after the exercise program (Temur, 2018) were 75.71 ± 5.80 µm³ and 75.62 ± 6.54 µm³, respectively, when we performed a plate-based exercise program on women (Temur, 2018). The difference between these values was not significant (p <0.05). It is possible to say that the MCV values in females under these findings are lower than in men and that exercise may be related to the severity and intensity of MCV effects.

The pre-tournament averages of 29.53 ± 1.15 pg in the futboculard included in the study were 29,49 ± 1.21 pg after the tournament, while serum MCH values indicating the total hemoglobin amount in red blood cells (in erythrocytes) were included in the study. The difference between the two mean values (, 03) was significant (p <0.01). The prevalence of 29.49 ± 1.27 pg MCH values for smokers among football players was 29.39 ± 1.37 pg after the tournament. For non-smokers, these mean values are 29.56 ± 1.13 pg before the tournament and 29.57 ± 1.16 pg after the tournament. It was determined that the difference between these mean values in both groups was not statistically significant (p <0.05). Bezci and Kaya (2010) reported that the mean value of the MCH before and after the 4 week camp period did not differ (p <0.05). Temur (2018) found that the study conducted on women was 27.03 ± 2.14 pg before the MCH average exercise program and 27.67 ± 2.71 pg after the exercise program. These values were statistically significant. The findings of the study coincide with those of the literature.

It has been concluded that the resultant exercise may cause an increase in serum CK and other blood parameters included in the study, but the level of this change depends on the intensity, duration, frequency and most importantly the training level of the exercise. Furthermore, although there are different periods of time for CK and other blood parameters to return to their normal values, it is thought that the recovery period can be determined by the training level of the person again. Again, no significant difference was observed in smoking cessation, which accelerated the increase in CK levels.

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