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The Comparison of Biochemical Blood Levels of Athletes and Sedentary

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Abstract: This study was conducted in order to compare the biochemical blood values between handball players who have been playing handball for five years or more and sedentary in the same age group. 10 handball players and 18 healthy sedentary voluntarily participated in the study. After the subjects were briefed about the tests to be conducted, blood samples were taken from the forearm antecubital region into 5 ml yellow-cap gel tubes in line with the hygiene rules and the selected biochemical values were analyzed with the Abbott Architect brand auto-analyzer. The Independent Samples t -Test was used in determining the difference between handball players and sedentary students. The significance level was taken as 0.05. The comparison of biochemical blood values between handball players and sedentary revealed that the blood urine nitrogen (BUN) and creatine levels were higher in handball players whereas LDH level was higher in sedentary students and the difference was statistically significant. In conclusion, the biochemical blood values of handball players and sedentary were within the reference intervals, which suggested that the differences in biochemical blood values were not due to exercise but dependant on the life quality and nutrition habits of the individual.

Key words: Athletes · Sedentary · Blood Biochemical Parameters

INTRODUCTION

A meticulous examination of human body tells us that it is a perfect being with special skills. This perfect being needs continuous movement due to its innate features. As a result of industrialization and mechanization of societies and developments in technology, human beings are adversely affected by an immobile way of life, which leads to physical and physiological disorders. On the other hand, physical and physiological parameters have a positive course in athletes owing to regular exercise and physical activity. In addition to such positive values, elite athletes aim at maximizing their performance as well.

The advanced technological and laboratory methods have a great role to play in giving a scientific dimension to the studies on athlete performances. Competitions are among the field tests which are used to measure the performance of athletes [1]. It is possible to measure motor skills and functions by field tests in handball players [2]. Physiological and blood values, however, need to be measured in laboratories. An analysis of blood biochemistry has shown that the effects of regular exercises on blood profile levels are different from one another. Such differentiation depends on the severity, duration and frequency of the exercise and competition and physical and physiological condition of athletes [3,4]. There are different findings concerning the levels of biochemical parameters depending on the exercise itself. There are studies suggesting that positive developments can be observed through short-term exercise as well as studies suggesting that developments come out not through short-term but long-term exercises [5].

This study was conducted in order to compare the biochemical blood values of handball players who have been playing handball for at least five years or more and those of sedentary university students in the same age group.

MATERIALS AND METHODS

10 handball players and 18 healthy sedentary university students aged between 19 and 23 voluntarily participated in this study which was conducted to compare some selected biochemical blood values between handball players and sedentary university students. ID card information was taken as basis in determining the ages of the subjects. Their body heights were measured with a meter (Rodi Super Quality) in centimeter terms and their body weights were measured (with their shorts and

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t-shirts on) with an electronic weighing machine (premier) in kilogram terms. It was determined through an interview with the subjects that the participating handball players and sedentary subjects had no health problem, did not take medication on permanent basis and did not take any vitamin in three days prior to the measurements. Measurements were made in line with hygiene rules after the subjects were well-briefed about the tests to be conducted and a comfortable environment was established for them for the measurements. Subjects were warned not to eat or drink anything after 10 PM the night before the tests were conducted. Blood samples were taken at 9 to 10 AM in the laboratory. Blood samples taken from the forearm antecubital region into 5 ml yellow-cap gel tubes in line with the hygiene rules were centrifuged in an Abbott Architect brand (USA) auto-analyzer in the central laboratory at 2500 rounds per minute for 10 minutes and some selected biochemical blood values such as albumin, Total bilirubin, direct bilirubin, indirect bilirubin, total protein, glucose, creatine, creatine kinase - myocardial band (CK-MB), alkaline phosphates (ALK), Gama glutamyl transferase (GGT), creatine phospha-kinase (CPK), blood urine nitrogen (BUN), lactate dehydrogenazy (LDH), aspartat aminotranspherase (AST) and alanine amino transferase (ALT) were analyzed. Blood samples were stored at minus 20 degrees Celsius until they were worked out. The ethics board permit required for the study was taken.

SPSS (Statistical Package for the Social Sciences) package software was used for the statistical analysis of the data obtained. The value obtained through the Kolmogorov-Smirnov test, which is carried out to determine whether the values display a normal distribution or not and the histogram graph have shown that values displayed a normal distribution. Measurement results were presented as averages and standard deviation. The Independent t-Test was used in comparison of values of handball players and sedentary subjects. The $P<0.05$ value was considered to be significant.

RESULTS

An analysis of the table which shows us biochemical blood values of handball players and sedentary subjects has shown that the blood urine nitrogen (BUN) and creatine levels were higher in handball players whereas LDH level was higher in sedentary students.

Table 1: Physical Characteristics of Players and Subjects.

Değişkenler	Group	Mean± SD	t	p
Age (year)	A (n=10)	21.80±1.75	1.696	0.102
	S (n=18)	20.77±1.39		
Height (cm)	A (n=10)	180.40±5.18	1.750	0.092
	S (n=10)	177.27±4.12		
Body Weight (kg)	A (n=18)	80.70±12.19	0.279	0.782
	S (n=10)	79.83±4.01		

A: Athletes S: Sedentary

Table 2: Biochemical Blood Values of Athletes and Sedentary Subjects (Values higher in athletes).

Değişkenler	Group	Mean± SD	t	p
Creatine Kinase - Myocardial Band (CK-MB)(u/L)	A (n=10)	12.20±3.48	0.663	0.513
	S (n=18)	11.61±1.14		
Creatine Phospha-kinase CPK (u/L)	A (n=10)	205.20±83.72	0.855	0.400
	S (n=18)	186.55±31.03		
Gama glutamyl transferase GGT)(u/L)	A (n=10)	26.20±7.69	0.994	0.329
	S (n=18)	24.27±2.32		
Creatine (mg/dL)	A (n=10)	1.37±0.10	9.098	0.000
	S (n=18)	0.81±0.17		
Total Bilirubin (mg/dL)	A (n=10)	0.94±0.48	0.718	0.479
	S (n=18)	0.84±0.22		
Aspartat Amino Transpherase AST (u/L)	A (n=10)	24.80±11.35	0.604	0.551
	S (n=18)	23.05±3.71		
Albumin (g/dL)	A (n=10)	4.65±0.18	0.493	0.626
	S (n=18)	4.60±0.29		
Blood Urine Nitrogen (BUN) (mg/dl)	A (n=10)	10.30±1.49	2.805	0.009
	S (n=18)	8.77±1.30		

A: Athletes S: Sedentary

Table 3: Biochemical Blood Values of Athletes and Sedentary Subjects (Values higher in sedentary)

Değişkenler	Group	Mean± SD	t	p
Glucose (mg/dl)	A (n=10)	84.10±9.37	-1.025	0.315
	S (n=18)	86.66±3.89		
Direct Bilirubin (mg/dL)	A (n=10)	0.14±0.07	0.125	0.902
	S (n=18)	0.15±0.02		
Lactate Dehydrogenazy (LDH) (u/L)	A (n=10)	207.00±28.36	-2.706	0.012
	S (n=18)	229.50±15.92		
Alanine Amino Transferase ALT (u/L)	A (n=10)	23.90±10.76	-0.034	0.973
	S (n=18)	24.00±5.01		
Alkaline Phosphates (u/lt) (ALK)	A (n=10)	80.90±13.41	-0.206	0.838
	S (n=18)	82.05±14.61		
Total Protein (g/dL)	A (n=10)	7.52±0.46	-0.884	0.385
	S (n=18)	7.78±0.89		
Indirect Bilirubin (mg/dL)	A (n=10)	0.66±0.12	-0.722	0.477
	S (n=18)	0.70±0.14		

A: Athletes S: Sedentary

DISCUSSION AND CONCLUSIONS

Although increasing and decreasing values were found in subjects in this study, it was detected that variables such as CK-MB, CPK, GGT, Glucose, T. BIL., D. BIL., AST, ALT, ALK Phosphate and Albumin were within normal ranges whereas the change in the BUN, Creatine and LDH levels was statistically significant ($P<0.01$). An increased blood flow during exercise results in metabolic changes. As a result of the increased metabolism products within the intertissue liquid, osmotic pressure increases and the water draws back to in between the tissues. Along with the stress accompanying the exercise, the blood pressure (particularly the systolic blood pressure) increases the liquid infiltration into between tissues from the arterial side of capillaries. When some water leaves the veins for in between the tissues during the exercise, density of erythrocyte, hemoglobin and plasma proteins increases in blood [6-8]. It was found in studies and researches that serum CK activity took place in slow runs and older athletes and this activity was lower during the exercise and higher after the exercise [9 -12]. CK is also used as an indicator for muscular tissue damage like aspartat aminotranspherase and lactate dehydrogenazy enzymes. The muscular content can be estimated in the enzyme amounts [9,13]. Öztaşan and Kaymak [9] stated in a research they conducted after short-term maximal exercise that the average of plasma creatine and the catalyst enzyme CK increased after the exercise compared to the conditions before the exercise. It is very common to have soft tissue injuries due to the collisions, strains and other injuries during the competition. Such soft tissue injuries are also accompanied by injuries at the cellular level. Different types of exercises result in muscular damage at different levels. However, it is more in eccentric contractions than in other contraction types. Distortion in unique structure of myofibrils and ruptures in the band Z are followed by fractures in the myofibril skeleton [14,15]. That the CK-MB amount exceeds 5% of the total CK within the serum is considered as myocardial damage. Brown *et al*. studied the impact of eccentric contraction of knee muscles and the number of repetitions on the muscular damage and found that the serum CK levels increased as the number of repetitions increased [16]. Harbili *et al.* [17]observed that mild eccentric exercise increased the plasma CK level without making any effect on other damage indicators and CK level reached the highest level in three days after the exercise ($P<0.05$) whereas no change was observed in LDH, AST and ALT levels. Glucose, the physical activity-activated sympathoadrenal system, controls the substrate mobilization for the energy needs of the organism [18,19]. As the severity of the activity goes up, sympathetic activity goes up, too and epinephrine and norepinephrine concentrations increase depending on the severity and duration [20,21]. Catecholamines affect pancreatic B-cells and provoke inhibition of insulin secretion, thereby resulting in decreased hepatic glycogenesis and lipogenesis. Thus, glycolysis and free fatty acids concentration increases whereas glycogenolysis increases in the muscles leading to decreased glucose intake from blood [22,23].

Epinephrine inhibits glycogen phosphorylase and glycogen synthesis and provokes glycogenolyses in the liver and increases generation of glucose out of glycogenic substances in the liver. It also activates glycolysis phosphorylase and incepts glycogenolysis in muscles. The glycogenolysis provoked by epinephrine in muscles does not directly increase blood glucose. Due to the lack of glucose 6 phosphatase enzyme in muscles, lactate and pyruvate get metabolized and travel to liver to be translated into glucose. Çakmakçý and Pulur [24] found a significant increase in glucose, AST and ALT before and after camp .

The liver, which is an organ carrying out many functions in synthesizing molecules including AST, ALT and Alkaline phosphatase, is also the detoxification organ of innumerable endogenous and exogenous substances. High enzyme values can be observed in people with no liver disorder. AST and ALT enzymes are also found in many non-liver tissues such as cardiac muscles, other striated muscles, lungs and erythrocytes. Alkaline Phosphatase exists in bones, placenta and intestines [25]. Transaminases vary depending on exercise, body-mass index and age. Karakuşoğlu[26] conducted a study on the effect of anaerobic exercise on the plasma atrial natriuretic peptide level in healthy males and found normal LDL, HDL, ALT, AST, Glucose, Urine and Creatine levels. GGT is an enzyme in liver cells, bile duct, epithelium cells, renal tubules, pancreas, heart, brain, liver, prostate and intestines. Compared to serum, GGT is 100 times more in bile juice and it is in different regions in cellular membrane. No change takes place after exercise or activity. It slightly goes down after having meals, but it is restored in time. Studies have revealed that high GGT level is a risk factor in development of atherosclerosis and GGT deficiency may result in a decrease of amino acids within the cell [27].

Albumin composes nearly half of the serum protein content. Its most important function is to balance the water between blood and tissue fluids. As larger protein cannot pass through the capillaries, it offsets the leaking tendency of blood fluids. Albumin enables intertissue and water-soluble substances to pass through capillaries. It regulates the osmotic (oncotic) pressure and ensures balance between fluids in and outside the veins. Turgut *et al.* [28] reported no significant change in albumin values in their study on athletes and sedentary subjects. Revan and Erol [29] found that LDH levels displayed significant differences only in the values measured before exercise. Machado *et al.*[30] found in a study on fifteen football players to define the effect of caffeine which is taken before the endurance exercises on the muscular damage (CK, LDH, ALT, AST) and leukocyte levels that intake of 4.5 mg/kg (-1) caffeine does not result in an increase in muscular damage and leukocyte levels and the increase would take place only due to the endurance exercises. Huang *et al.* [31] found in their study on the effect of L-arginine addition on the levels of cellular oxidative stress, inflammation and mitochondrial DNA 4834-bp which occurs during exhaustive exercise exhaustive exercise in 14-month old rats that the L-arginine addition decreased oxidative stress in skeletal muscles and renal damage due to exhaustive exercise.

González *et al.* [32] conducted a research on the relation between high liver transaminase and metabolic syndrome (MS) in obese children and adolescents and measured the hunger transaminase (ALT, AST and GGT) levels and found that serum transaminase (ALT, AST and GGT) levels were higher in males than females. Duffield *et al.* [33] found in the outcome of the study they conducted on the effects of compression garments on improvement of muscular performance after high-density sprint and plyometric exercise that CK level remained the same while AST level was lower. Banfi and Morelli [34] expressed in their study on the relation between body-mass index and serum transminase levels of professional athletes that there was a positive, high relation between body mass index and ALT whereas there was a weak relation between body mass index and AST. As a result of the study on the effects of intensive muscular exercise on clinic chemical parameters reflecting the liver functions in healthy male weight-lifters, Pettersson *et al.* [35] conducted liver function tests - AST and ALT - and found that these variables increased significantly in 7 days after the exercise. CK and LD levels were also seen significantly high. They have also stated that intensive muscular practices like weightlifting may be a factor to increase clinical functions of liver tests .

Banister *et al.* [36] increased the serum enzyme activity by one dose in daily exercises and collected blood samples to measure lactate dehydrogenase activity, creatine kinase and asphartate aminotransferase. It was also stated that recovery took place faster during the post-exercise resting period . Salvaggio *et al.* [37] conducted a research on the relation between body mass index and serum liver enzyme (GGT, ALT and AST) activity in 2373 males and 794 females and found a relation between body mass index and serum liver enzyme activity such as GGT, ALT and AST. Song [38]found in the outcome of the study he conducted on the effect of anaerobic exercise on aphartate aminotransferase and serum enzymes dehydrogenase creatin phosphokinase parameters in alpine skiers and found that there was no significant change in the parameters other than CPK . Maughan *et al.* [39] conducted a study to determine the muscular damage and peroxidation in a male running on a sloppy track and found that post-exercise CK, AST and LDH levels recovered to pre-exercise values in 72 hours.

Rotenberg *et al.* [40] found in a study they conducted on elite school basketball players and a control group that the serum CK activity was higher in basketball players than the control group. Priest *et al.* [41] stated that there was not a statistically significant increase in pre- and post-run creatine, CK, LDH, AST, alkaline phosphotase, bilirubin and uric acid levels . Koutedakis *et al.* [42] compared the creatine phosphokinase (CPK), asphartate aminotransferase (AST) and alanin aminotransferase (ALT) activities between Olympic rowers and healthy subject who were not involved in any physical activity .

As a conclusion, Our findings showed that chronic exercise does not have any effect on some selected blood enzymes. We do, however, believe that such studies should be repeated with more subjects to be more decisive.

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