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The Acute Effect of Anaerobic Peak Power and Capacity on Antioxidant Parameters in Basketball Players: Cross-Sectional Research

Basketbolcularda Anaerobik Zirve Güç ve Kapasitenin Antioksidan Parametrelere Etkisi: Kesitsel Çalışma

Recep SOSLU[a], Ömer ÖZER[b], Murat TAŞ[c], Abdullah UYSAL[d], Kerem GÜNDÜZ[e]

[a]Department of Coaching Education, Karamanoğlu Mehmetbey University Faculty of Sports Sciences, Karaman, Türkiye
[b]Department of Physical Education and Sports Teaching, Karamanoğlu Mehmetbey University Faculty of Sports Sciences, Karaman, Türkiye
[c]Department of Coaching Education, Manisa Celal Bayar University Faculty of Sports Sciences, Manisa, Türkiye
[d]Department of Coaching Education, Karamanoğlu Mehmetbey University Faculty of Sports Sciences, Karaman, Türkiye
[e]Department of Physical Education and Sports Teaching, Karamanoğlu Mehmetbey University Faculty of Sports Sciences, Karaman, Türkiye

ABSTRACT Objective: The aim of this study is to determine the free radical formation and the acute response of the antioxidant mechanism in the neuromuscular fatigue test applied to basketball players. **Material and Methods:** A total of 27 professional basketball players (Age: 21.40±2.02 years, Height: 187.93±8.84 cm and Body Weight: 82.51±12.55 kg), actively playing in the Turkish Second Basketball League, constituted the study population. The Wingate anaerobic strength test was used to determine the acute neuromuscular fatigue index of the athletes. Superoxide Dismutase, Glutathione, Catalase, Malondialdehyde and blood Lactate values were determined before and after the Want test. Analyzes of intergroup and in group parameters were performed with the Two-Way Repeated Measures MANOVA test. **Results:** It was determined that the athletes had an increase in the post-test Superoxide Dismutase and Glutathione value and there was a statistically significant difference between them and the pre-test (P=0.000). There was no statistically significant difference between the pre-test and post-test Catalase values of the athletes (P=0.217). It was determined that the athletes had an increase in the post-test Malondialdehyde value and there was a statistically significant difference between them and the pre-test (P=0.016). It was observed that there was a statistically significant difference of 1.91±0.815 (mmol.L) in the lactate pre-test value and 6.44±2.25 (mmol.L) in the post-test value of the athletes (P=0.000). **Conclusion:** As a result, it can be said that high anaerobic power and capacity cause an increase in antioxidant enzymes in acute neuromuscular fatigue and prevent free radical formation by forming reaction chains.

Keywords: Anaerobic power; antioxidant; basketball; oxidative stress

ÖZET Amaç: Bu çalışmanın amacı basketbolculara uygulanan nöromüsküler yorgunluk testinin serbest radikal oluşumunu ve antioksidan mekanizmanın verdiği akut yanıtı belirlemektir. **Gereç ve Yöntemler:** Türkiye İkinci Basketbol Ligi'nde aktif olarak oynayan (Yaş: 21.40±2.02 yıl, Boy: 187.93±8.84 cm ve Vücut Ağırlığı: 82.51±12.55 kg), toplam 27 profesyonel basketbolcu, çalışma popülasyonunu oluşturdu. Sporcuların akut nöromüsküler yorgunluk indeksini belirlemek için Wingate anaerobik güç testi kullanıldı. Want testi öncesi ve sonrası Süperoksit Dismutaz, Glutatyon, Katalaz, Malondialdehit ve kan Laktat değerleri belirlendi. Gruplar arası ve grup içi parametrelerin analizleri İki Yönlü Tekrarlanan Ölçümler MANOVA testi ile yapıldı. **Bulgular:** Sporcuların, son test Süperoksit Dismutaz ve Glutatyon değerinde artış olduğu ve ön test ile arasında istatistiksel olarak anlamlı fark olduğu saptandı (P=0.000). Sporcuların, ön test ve son test Katalaz değerleri arasında istatistiksel olarak anlamlı bir fark saptanmadı (P=0.217). Sporcuların son test Malondialdehit değerinde artış olduğu ve ön test ile arasında istatistiksel olarak anlamlı fark olduğu saptandı (P=0.016). Sporcuların laktat ön test değerinde 1.91±0.815 (mmol.L) ve son test değerinde 6.44±2.25 (mmol.L) istatistiksel olarak anlamlı fark olduğu gözlendi (P=0.000). **Sonuç:** Sonuç olarak, yüksek anaerobik güç ve kapasitenin oluşan akut nöromüsküler yorgunlukta antioksidan enzimlerde artışa neden olduğu ve reaksiyon zincirleri oluşturarak serbest radikal oluşumunu engellediği söylenebilir.

Anahtar Kelimeler: Anaerobik güç; antioksidan; basketbol; oksidatif stres

Correspondence: Recep SOSLU
Department of Coaching Education, Karamanoğlu Mehmetbey University Faculty of Sports Sciences, Karaman, Türkiye
E-mail: recepsosli@gmail.com

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Basketball is a sports branch in which includes high intensity, sudden rotations and deflections and in which high-level biomotoric properties are used.[1] Of this sports branch, 20% requires an aerobic and 80% an anaerobic energy system.[2] Therefore, anaerobic performance (AP) is of great importance for team sports which are completed in a short time and require explosive strength.[3] In basketball, skills such as jumping, throwing, and quick starts are needed during the match to produce the necessary energy [adenosine diphosphate- phosphocreatine (ATP-PC) and lactic acid].[4] Regular training leads to an increase in the AP of athletes. In other words, the increase in AP expresses the increase in the ATP-PC stores and the efficiency of the lactic acid system (LAS). Therefore, the energy resources of the athlete appear as an important element for sportive performance.[5] The amount of oxygen consumed during exercise changes according to the intensity and type of the exercise, and it usually increases significantly compared to rest.[6] A high metabolic rate, as a result of exercise, significantly increases oxygen consumption. The increase in oxygen in the muscles during exercise is known to be around 2-5% of the total oxygen consumption.[7] Free radicals (FR) are formed in the cell depending on the increased amount of oxygen during exercise. The formation of free oxygen radicals increases depending on the intensity, duration, and type of acute exercises during which the metabolism is highly accelerated.[8] Cells constantly produce FR and reactive oxygen species (ROS) as a part of the normal metabolic process. Production of FR causes oxidative damage in macromolecules (lipids, proteins and DNA), immune dysfunction, muscle damage, and a pathophysiological condition.[9-12] The organism usually has sufficient reserves of antioxidants and can cope with these oxidative species under physiological conditions. Against FR, the antioxidant defense system is neutralized by a detailed defense system comprised of various enzymes such as superoxide dismutase (SOD), glutathione peroxidase (GPX), glutathione transferase, glutathione (GSH) and catalase (CAT).[12] Although it is known that acute exercise produces oxidative stress and impairs both the physiological and homeostatic balance between oxidative products and the antioxidant defense system, an increase is also observed in the antioxidant levels of individuals who are given regular and continuous training.[13]

AP is a crucial term for basketball, which is completed in a short time or requires explosive strength, because the athlete's performance can be affected by environmental factors and individual.[14] Trainers and sports experts can enhance the athlete's performance by determining the power and capacity of the athlete they train and preparing a training program suitable for him/her. Regular training leads to an increase in the AP of athletes. In other saying, this increase in AP is the increase in ATP-PC stores and the efficiency of the LAS. Therefore, the athlete's ATP-PC stores and ability to use these resources appear as an important parameter for the athlete's sportive performance.[15] Although anaerobic power is important for all kinds of sportive activities, its importance increases even more in some sports ranches in which anaerobic power is predominantly used. In this sense, numerous methods have been tried for the measurement of personal anaerobic capacity. In this context, the method often preferred in recent years has been the Wingate (WAnT) test.[16] The indirect determination of muscle strength, independent of biochemical, histochemical and physiological criteria, giving information about the maximal strength, endurance and fatigue of the muscle, being simple, safe and objective, applicability with inexpensive ubiquitous tools and equipment, requiring no special skills and applicability for people of all ages, genders, different sports branches and physical fitness levels, as well as upper extremities as well as lower extremities constitute the advantages of this test. Moreover, it is estimated that in the Wingate test, which is widely used to evaluate anaerobic power and capacity, anaerobic energy systems meet 70-80% of the energy used. Beneke et al. reported that the energy contributions of aerobic, anaerobic alactic and lactic acid metabolism during the Wingate anaerobic test were 18.6%, 31.1%, and 50.3%, respectively.[17] They explained the energy sources from lactic acid metabolism for peak and average power (anaerobic capacity) in the Wingate anaerobic test as 83% and 81%, respectively. However, for the correct measurement of these values in the WAnT, the constant

load to be applied must be determined to provide the highest mechanical power. This load influences AP values. Therefore, in the assessment of maximal anaerobic power, it is extremely important to determine the load at which the athlete taking the test can reach the highest AP and anaerobic capacity values. It appears as a value of great significance for a sports branch such as basketball, where AP is used intensively.

Studies investigating the effect of exercise on oxidative stress and antioxidant defense system have mostly focused on the aerobic exercise form. Despite different results, long-term regular aerobic exercises can be said to strengthen the antioxidant defense system and reduce cellular damage caused by oxidative stress.[18] However, there are limited studies on the antioxidant enzyme activity of anaerobic exercises and anaerobic capacity. The aim of this study is to determine the free radical formation and the acute response of the antioxidant mechanism in the neuromuscular fatigue test applied to basketball.

MATERIAL AND METHODS

STUDY STRUCTURE

Aim of the study to determine the FR formation and the response of the antioxidant mechanism of the anaerobic test applied to basketball players. A total of 27 professional basketball players, playing in the 2nd Basketball League of Türkiye (age: 21.40±2.02 years, height: 187.93±8.84 cm and weight: 82.51±12.55 kg), comprised the study population. Athletes were given information about the study, and voluntary participation was ensured. For the study, the volunteering form was obtained in accordance with the Helsinki Declaration principles, and the Ethical approval numbered (date: April 20, 2021, no: 02-2021/08) was received from the Ethics Committee of Karamanoğlu Mehmetbey University Faculty of Medicine. Athletes did not use any ergogenic aids or drugs that would affect their performance during the test. In the study, an "Experimental Research" model was employed, including the application of the factor, the relationship of which would be measured, to the athletes under certain conditions and rules, the measurement of athletes' responses to the factor, comparison of the results obtained, and making a decision.

ANTHROPOMETRIC VARIABLES

The body weights and heights of the athletes were measured with a stadiometer (SECA-Mod. 220, Seca GmbH&Co. KG, Hamburg, Germany).

BIOCHEMICAL ANALYSES

Venous blood samples from the athletes were taken into ETDA tubes before and immediately after the Want test. Samples collected into ETDA tubes were shaked 3-5 times. After the samples in biochemistry tubes were kept at room temperature for 20 minutes, they were centrifuged at 3500 rpm for 10 minutes, and shaped elements were precipitated and stored at -80 C until the day of analysis. SOD, GSH, CAT and MDA levels were specified colorimetrically from plasma samples containing biochemical parameters.

SOD ANALYSIS

SOD enzyme accelerates the dismutation of toxic superoxide radicals created during oxidative energy production into hydrogen peroxide and molecular oxygen. The activity of SOD was performed using reagents from kits Cayman Chemical Company (USA): SOD Kit (No. Cat. 706,002). In the method, superoxide radicals that react with 2-(4-iodophenyl)-3-(4-nitrophenol)-5-phenyltetrazolium chloride and form red-colored formazan dye are produced by using xanthine and xanthine oxidase. The enzyme activity measurement is based on the inhibition of the reaction by the SOD enzyme in the medium at 505 nm. The measurement was performed spectrophotometrically.

GSH ANALYSIS

GSH catalyzes the reduction of GSSG to GSH by nikotinamid adenin dinükleotid fosfat (NADPH). The activity of Glutathione was performed using reagents from kits Cayman Chemical Company (USA): GSH Assay Kit (No. Cat. 709,001). In the measurement of GSH, the measurement kits measure by the enzymatic recycling method, and the reaction is optimized using glutathione reductase. In the measurement taken, the absorbance differences of NADPH oxi-

dized during the reaction were identified spectrophotometrically at 37ºC and a wavelength of 340 nm.

CAT ANALYSIS

CAT catalyzes the breakdown of H_2O_2 into water and molecular oxygen. The activity of CAT was determined by the set of reagents OxiSelect Catalase Activity Assay Kit, (No. Cat. STA-341) produced by the Cell Biolabs company in USA. By making use of H_2O_2s absorbance of light, the breakdown rate of the enzyme at 230 nm was measured by the spectrophotometric method.

MALONDIALDEHYDE ANALYSIS

A secondary product of malondialdehyde (MDA) is formed as a result of lipid peroxidation. The activity of MDA concentration was performed using reagents from kits Cayman Chemical Company (USA): Malondialdehyde Assay Kit (No. Cat. 10,009,055). The measurement was performed by identifying the spectrophotometric absorbance differences at 532 nm of the pink complex formed as a result of the incubation of MDA with thiobarbituric acid at 95ºC at pH 3.4 under aerobic conditions.

WANT TEST

The Wingate AP and capacity test (WAnT) was used to form the fatigue index in the lower extremities of the athletes. The Wingate test protocol has 5 different time phases. These are preparation, recovery interval, acceleration, wingate test and cool-down phase, respectively. Preparation phase; it is generally recommended in this test, as in other anaerobic tests. This phase is a 5-minute period of low-intensity pedaling involving sprints of 4-6 seconds and 4-5 maximal pedal speeds. The recovery phase should not be less than 2 minutes or more than 5 minutes after the preparatory exercise. In order to recover the fatigue that may occur during the warm-up, at least 2 minutes should be provided; this period should not exceed a maximum of 5 minutes to maintain muscle temperature and blood flow. The recovery phase may include simple rest, such as low-intensity resistance pedaling (10-20 rpm 1kg or 10N) or simply sitting on the bike. Although the acceleration phase is quite short, it begins immediately after the recovery phase and consists of 2 phases. In the first phase, it is based on pedaling with a resistance of 1/3 of the previously determined resistance, with 20-50 rpm for 5-10 seconds, while in the second phase, the rpm is gradually increased for 2-5 seconds and the resistance is increased to the specified resistance to be used during the test. It is for this reason that; the acceleration phase cannot be less than 7 seconds and more than 15 seconds. The WAnT test was administered for 30 seconds and resistance was set at 7.5% of body mass. During the applied test, the measurements are made automatically at 5 seconds and 6 equal time intervals. As a result of these measurements, some data are obtained that allow us to learn about AP.[16] The following variables were determined;

Peak Power (Maximum Anaerobic Power)

It is the highest mechanical power achieved in any 5-second time frame generated during the test [MAP=Maximum Anaerobic Power, (W)].

Average Power (Maximum Anaerobic Capacity)

It is the average power generated during the test [MAC=Maximum Anaerobic Capacity, (W)].

Minimum Power

It is the lowest mechanical power achieved in any 5-second time frame generated during the test [MinP=Minimum Power, (W)].

Blood Lactate Analysis

Blood lactate concentrations were measured with Lactate Scout 4 (Germany), an electro-enzymatic analyzer. The analyzer gives a 0.1 $mmol.L^{-1}$ margin of error during the measurement and the measurement result in 13 seconds. Low (1-1.6 $mmol.L^{-1}$ La) and high (4-5.4 $mmol.L^{-1}$ La) control solutions with known concentrations were employed for calibration. Blood samples were taken from fingertips using a lancet gun.[3]

Procedure

Before initiating the test, the athletes were given comprehensive information about the benefits and risks that might arise from participating in the study. Anthropometric measurements were recorded. Blood lactate values of the athletes were determined before WAnT. Afterward, venous blood samples were taken

into tubes to identify the blood antioxidant levels, and the tubes were turned upside down several times and placed in a centrifuge device to prevent hemolysis. After the blood samples were collected, the athlete's WAnT preparations were made, and the test was completed in accordance with the protocol. For the post-test blood lactate value, lactate test and final venous blood samples were taken 1 minute after the test ended. After the end of the test, the athletes were kept under observation for 15 minutes (Figure 1).

STATISTICAL ANALYSIS

Statistical analyzes of the obtained data were completed with SPSS 24.0 (IBM Co., Armonk, NY, USA) version program. Descriptive statistics of results were reported as mean of mean differences and standard error (±). Normal analysis was determined by Kolmogorov-Smirnov test and skewness/kurtosis values. The resulting yield was homogeneous. Analyses of intergroup and intragroup parameters were performed with two-way repeated measures MANOVA. Significant values were determined via the Bonferroni test for post-hoc comparisons. To estimate effect sizes, eta squared (η2) was computed with η2≥.01 indicating small, ≥.06 medium and ≥.14 large effects. Statistical significance was set at α<.05.

RESULTS

As a result of the analysis of the data obtained, findings related to the oxidative stress parameters formed by the WAnT (SOD, CAT, GSH and MDA), average body fat values of athletes [Body Mass Index, body fat percentage (%), body fat kilograms (kg), free fat muscle (kg)] and AP values [peak power (W), average power (W), minimum power (W)] were obtained.

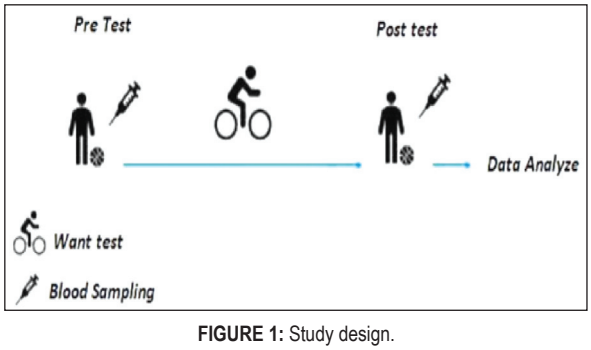

FIGURE 1: Study design.

TABLE 1: Average values of body fat and anaerobic power of athletes.

Parameter	n	mean	sd
Body Mass Index	27	23.28	2.42
Body fat (%)		9.78	3.44
Body fat (kg)		8.36	4.06
Free fat muscle (kg)		74.21	9.63
Peak power (W)		766.14	123.28
Average power (W)		601.85	55.05
Minimum power (W)		374.51	71.73

Upon reviewing Table 1, the mean body fat values of the athletes were obtained as (23.28±2.42) for the Body Mass Index, (9.78±3.44) for the body fat (%), (8.36±4.06) for body fat (kg), and (74.21±9.63) for free fat muscle (kg). Anaerobic power values of the athletes were obtained as (766.14±123.28) for peak power (W), (601.85±55.05) for average power (W), and (374.51 as ±71.73) for minimum power (W).

Upon reviewing Table 2, a statistically significant increase was observed in athletes' SOD pre-test value 16.91±0.815 (µmol/L) and post-test value 32.64±2.25 (µmol/L) (p=0.000). This increase was found to be effective in the neuromuscular fatigue test (d=2.63). A statistically significant increase was identified in athletes' glutathione pre-test value 0.16±.012 (µmol /L) and post-test value 1.62±0.02 (µmol/L) (p=0.000). This increase was found to be effective in the neuromuscular fatigue test (d=1.97). No statistically significant difference was detected between athletes' catalase pre-test value 0.39±0.226 (µmol /L) and post-test value 0.61±.018 (µmol/L) (p=0.217). A statistically significant increase was revealed in athletes' malondialdehyde pre-test value 0.91±0.30 (µmol/L) and post-test value 1.62±0.62 (µmol/L) (p=0.016). This increase was found to be effective in the neuromuscular fatigue test (d=1.47). A statistically significant increase was observed in athletes' lactate pre-test value 1.91±0.815 (mmol.L) and post-test value 6.44±2.25 (mmol.L) (p=0.000). This increase was found to be effective in the neuromuscular fatigue test (d=0.75).

TABLE 2: Average values of oxidative stress parameters of athletes.

Parametre	Test	n	Mean±sd	md	F	p value	d
Superoksit dismutaz (µmol/L)	Pre test	27	16.91±0.815	15.73	84.342	0.000**	2.63+
	Post test		32.64±2.25				
Glutatyon (µmol/L)	Pre test	27	0.16±0.012	1.46	356.865	0.000**	1.97+
	Post test		1.62±0.02				
Catalase (U/gHb)	Pre test	27	0.39±0.226	0.22	1.598	0.217	0.13
	Post test		0.61±0.018				
Malondialdehyde (µmol/L)	Pre test	27	0.91±0.30	0.71	6.606	0.016*	1.45+
	Post test		1,62±0.62				
Laktat (mmol.L)	Pre test	27	1.91±0.815	4.53	53.632	0.000**	0.75+
	Post test		6.44±2.25				

*Statistically significant differences (p≤0.05); **Statistically significant differences (p≤0.001); +Cohen d effect size where ≤0.2=small; ≤0.5=medium; and ≤0.8=large.

DISCUSSION

The aim of this study is to determine the free radical formation and the acute response of the antioxidant mechanism in the neuromuscular fatigue test applied to basketball. Anaerobic power is one of the important factors for basketball and WanT is the most preferred method in determining anaerobic power recently. In the wingate test, which is widely used to evaluate anaerobic power and capacity, it is estimated that anaerobic energy systems meet 70-80% of the energy used. This result is consistent with the results of previous studies. For instance Baker and Nance investigated the relationship between strength and power in rugby players and determined a strong positive correlation between maximum strength and maximum power.[19] In another study Thorland et al. determined significant strong correlation between isokinetic knee strength and anaerobic power and capacity of female sprinters and middle distance runners.[20] Hoffman et al. showed that mean power output during WAnTs had a moderate positive correlation with line drill (also known as "suicides") performance.[21] Lyons et al. reported that higher levels of fatigue led to decreases in basketball-passing scores in both novice and expert players.[22] The success level of basketball players depends on the quality level and the number of repetitions of high-intensity exercises. The ability to recover effectively and quickly enhances the performance level of basketball players by improving the quality and speed of high-intensity exercises repeated in the game.[23] It is thought that the anaerobic power values of basketball players (Table 1) obtained in our study are similar to the literature, and the power values of the athletes affect the biochemical parameters of the muscle.

It is reported that the increase in oxygen consumption with loading during exercise increases oxidative stress, and FR have a significant impact on both skeletal muscle and metabolically active organs.[22] The combination of the Wingate test and a submaximal aerobic exercise test resulted in an increased in TAS, which persisted through 20 minutes of exercise recovery. Many studies in the literature have reported that the oxygen amount of enzymatic antioxidants (SOD, GSH and CAT) consumed during exercise varies according to the intensity and type of exercise.[23,24] Maximum high-intensity exercise increases oxidative damage owing to increased ROS production. Groussard et al., erythrocyte SOD activity was reduced immediately after the Wingate test.[25] Although erythrocyte GPX did not change significantly, erythrocyte GSH was lowered.[25] This was confirmed by Cuevas et al. who observed reduced blood GSH and increased gluthatione difulfide/gluthatione (GSSG/GSH) values immediately after a single Wingate test and during the following 2 h.[26] Spanidis et al specifically, GSH levels in erythrocytes were significantly lower in end-of-season athletes than in pre-season.[2] He stated that acute aerobic exercise resulted in a decrease in GSH levels, partly due to the inhibition effect of FR for ascorbic acid and α-

tocopherol regeneration.[27] Remarkably, Zembron-Lacny et al. showed that GSH levels also decreased at the end of the playoff period in Polish Basketball Extra League professional players.[28] In this study, in contrast to GSH levels, the activity of CAT in erythrocytes did not differ in the neuromuscular fatigue test. However, a study reported that CAT activity increased after a basketball game.[29] Although studies show that CAT activity does not increase after exercise, in general, the mechanisms by which exercise affects CAT activity are not clear.[29,30] As a result of the neuromuscular fatigue test of our study, the SOD and GSH values of the athletes showed a statistically significant increase while the CAT value increased although this increase was not statistically significant (Figure 2, Figure 3, Figure 4). In the last measurement, it is thought that antioxidant enzyme activity increases for SR, which is caused by the effect of neuromuscular fatigue (Table 2). The conflicting results in the literature can be explained by the specificity of the training loads applied to the athletes and the physiological characteristics of the subjects studied.

The need for oxygen increases during exercise. During the transmission of oxygen to functioning muscles, polyunsaturated fatty acids in the membrane structure may be damaged. Lipid peroxidation of cell membranes ends in decreased membrane fluidity, the inability to maintain ionic gradients, cellular swelling and tissue inflammation. It has been determined in similar study that free radicals lead to lipid peroxidation.[31] In their study, El Abed et al. showed that MDA levels increased significantly at the end of the test as a result of mixed-intensity exercise applied to judo players and sedentary men.[32] In a different study, it was determined that the MDA level increased in the pre-post results of the core training applied to basketball players.[33] In addition, although some studies have similar results, there are different results.[34,35] In our study, it is observed that the values obtained in the neuromuscular fatigue test of MDA and lactate, which are markers of lipid peroxidation caused by oxidative stress, increased significantly (Figure 5, Figure 6). In the last measurement, MDA and lactate levels increased with the effect of neuromuscular fatigue, and it is thought that the antioxidant inhibition effect is not effective in a short time (Table 2).

There are limitations in our study that should be noted. Our participants were male basketball players with chronic training and sufficient exercise experience. Therefore, our results may not valid to female or recreational athletes. In addition, the athletes were in the preparatory period. Care should be taken when comparing the results of our study with other athletes who may have a different level of training and physical readiness. In addition, a cross-sectional design

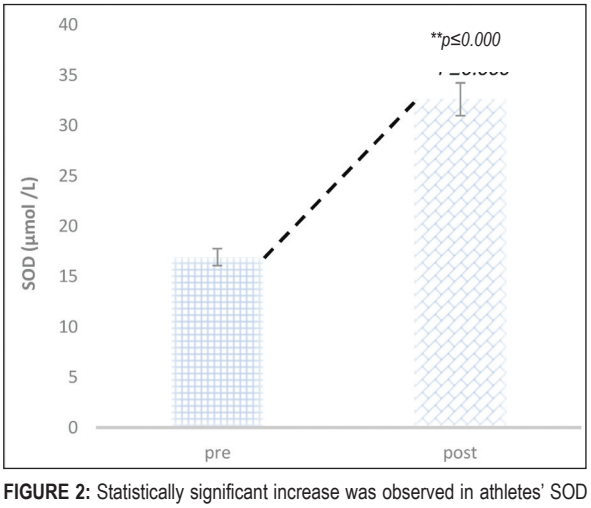

FIGURE 2: Statistically significant increase was observed in athletes' SOD pre-test value and post-test value) (**p≤0.000).
SOD: Superoxide dismutase.

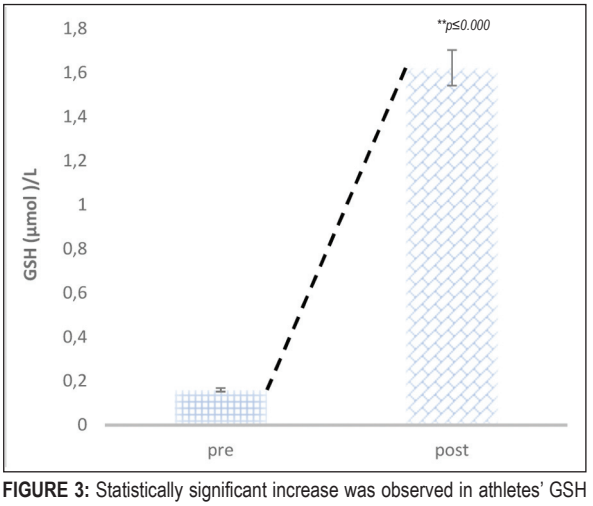

FIGURE 3: Statistically significant increase was observed in athletes' GSH pre-test value and post-test value (**p≤0.000).
GSH: Glutathione.

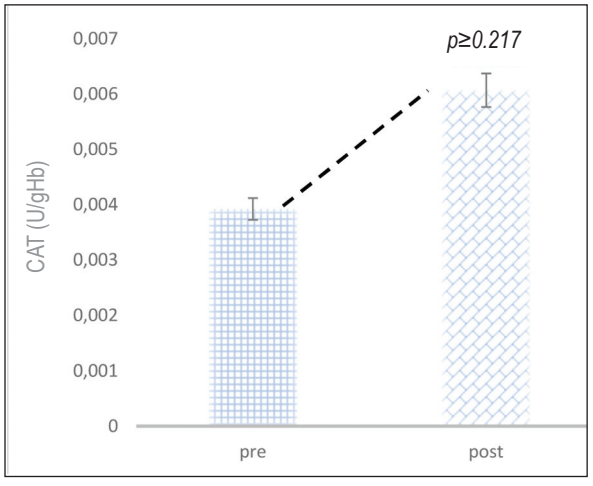

FIGURE 4: No statistically significant difference was detected between athletes' CAT pre-test value and post-test value (p≥0.05).
CAT: Catalase.

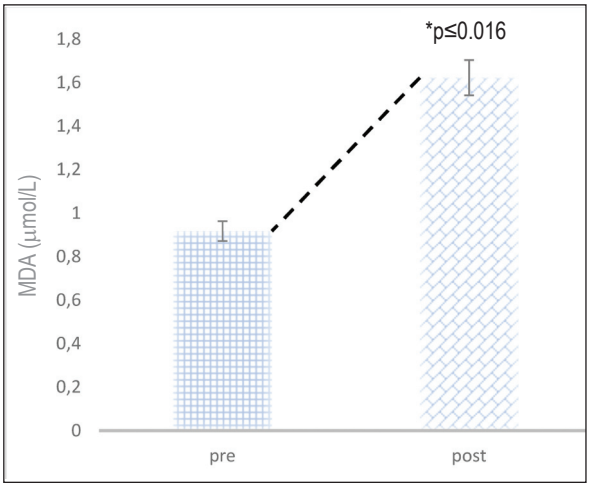

FIGURE 5: Statistically significant increase was observed in athletes' MDA pre-test value and post-test value (*p≤0.05).
MDA: Malondialdehyde.

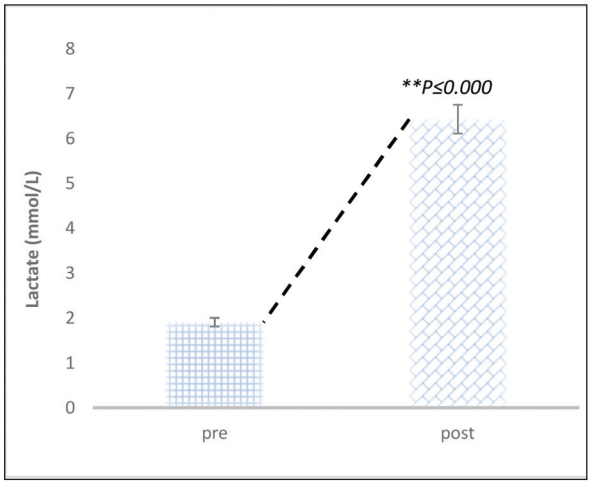

FIGURE 6: Statistically significant increase was observed in athletes' lactate pre-test value and post-test value (**p≤0.000).

was used in the study; longitudinal studies should be conducted to show whether such acute parameters can provide different training adaptations.

CONCLUSION

As a result of the obtained data, it can be said that the created neuromuscular fatigue and anaerobic power and capacity increase the antioxidant enzymes and this prevents the formation of FR by forming reaction chains. In line with this result, it can be said that as the anaerobic power and capacity of the basketball players increase, the antioxidant systems will positively affect the performance of the athletes and will enable them to recover faster.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Recep Soslu;* ***Design:*** *Recep Soslu;* ***Control/Supervision:*** *Recep Soslu;* ***Data Collection and/or Processing:*** *Abdullah Uysal, Kerem Gündüz;* ***Analysis and/or Interpretation:*** *Murat Taş;* ***Literature Review:*** *Ömer Özer;* ***Writing the Article:*** *Recep Soslu, Ömer Özer;* ***Critical Review:*** *Ömer Özer;* ***References and Fundings:*** *Abdullah Uysal;* ***Materials:*** *Abdullah Uysal, Kerem Gündüz.*

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