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Is there any Effect of Core Exercises on Anaerobic Capacity in Female Basketball Players?

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Abstract

This study was planned in order to determine the effect of core exercises on anaerobic capacity of female basketball players. Twelve female athletes who play basketball participated in the study voluntarily. The athletes had 3 sets of repetitive core exercise program performed 4 days a week for 8 weeks at the end of their basketball trainings. The height of the athletes was 165 ± 6.57 cm, body weight was 58.73 ± 7.42 kg, age was 19.75 ± 1.05, and athletic age was 6.11 ± 2.11. According to the analysis of the results, peak power, average power, right and left hand grip strengths and right and left arm fat percentages of post-tests were found to have a statistically significant difference than the pre-tests ($p < 0.05$). To sum up, there are very few studies on the anaerobic capacity of female basketball players, especially on the upper extremities. It is observed that basketball players have a stronger anaerobic capacity in attack and defense and that core exercises have a positive effect on certain basketball-specific technical skills such as passing, shooting, dribbling and defensive movements, and in this sense, they will also increase the performance of the athletes.

Keywords: core, Wingate, anaerobic, force, basketball

1. Introductıon

The work capacity of the skeletal muscles generated using anaerobic energy transfer systems during maximal and supra-maximal physical activity is defined as "anaerobic capacity" and the value of this work in unit time is expressed as "anaerobic power" (kgm/sc, kgm/min, watt), (Yıldız, 2012). Anaerobic performance is a term that is of great importance for sports branches that are completed in a short time or that require explosive force (Erkılıç, 2015). In other words, this increase in anaerobic performance is the increase resulted in the efficiency of the ATP-PC storage and the lactic acid system. The athlete's ability to use energy resources is an important factor for sportive performance (Özkan et al. 2011). Anaerobic performance, gender and muscle mass are all related to each other and an important factor in determining the anaerobic performance (Thomas et al. 2009). Anaerobic capacity in women reaches maximum level between the ages of 20 and 25, but decreases due to environmental (living habits, activity level) factors and hereditary factors (Jordan et al. 1997). Since the anaerobic requirements are predominant and repetitive during a match, it is stated that basketball is often more dependent on anaerobic capacity than aerobic capacity and that anaerobic glycolysis as a source of energy is significantly involved in the performance of various high intensity activities (Halder et al. 2016).

The main objective of basketball is to achieve the highest sportive performance. In addition to individual talents and technical skills, athletes with a high level of physical and physiological competence are needed to achieve superior performance (Aksen-Cengizhan et al. 2017). It is stated that the physical structure, technical, tactical and mental abilities that are important for the basketball branch are prominent and it is important to improve the physical fitness for optimal performance (Bakırcı & Kılınç, 2014).This is a process that demands more strain. A good core workout will enable athletes to be more strained and also the technical movements are more efficiently and better exhibited (Egesoy et al. 2018). The core is defined as the whole muscle system causing the spine to get its most effective state and its protection supported by the abdominal and spinal muscles during a movement that has functions in the body's active movements (Gür & Ersöz, 2017). Increasing muscle strength and reducing the percentage of body fat lay an important role in the fulfillment of many functions such as the connection between the upper and lower parts of the body during a movement, transfer of energy, supporting the weight reflected on the body, the spine and the protection of nerve roots etc. (Shirey et al 2012). Although there are many studies in the literature, there are not many studies investigating the

effects of core exercises on anaerobic capacity of upper extremity. Therefore, it was planned to determine the effect of core exercises applied to women basketball players on anaerobic capacity.

2. Materials and Methods

Study group consisted of 12 female athletes who play basketball actively and participated in the study voluntarily. The athletes were informed about the duration of the study. The height of the athletes was 165 ±6.57 cm, body weight was 58.73 ±7.42 kg, age was 19.75 ±1.05, and athletic age was 6.11 ±2.11.

2.1 Anthropometric Measurements

The height of the athletes participating in the study was measured by a stadiometer (Holtain, UK) with a precision of ± 0.01 mm, and body weight was measured with an electronic scale (Tanita BC 418 A, Japan) with a precision of ±0.1 kg. Body analysis was performed with the device called Tanita BC 418 A. Bio Impedance Analysis 50 kHz electrical current was sent to 5 separate zones. The fat percentage of the arms, legs and the body was analyzed as fat-free mass and muscle weight (Soslu et al. 2017)

2.2 Study Design

The athletes participated in the study were provided 3 sets of repetitive core exercise programs (Table 1) to be performed 4 days a week for 8 weeks at the end of their basketball trainings(Dilber at al. 2016).

Table 1. Core training program (Dilber at al. 2016)

Core exercises	Set 1	Set 2	Set 3
Side Bend	30 sec	30 sec	30 sec
Power Shiver	30 sec	30 sec	30 sec
Alternate Legs Jump	30 sec	30 sec	30 sec
Side Bridge	30 sec	30 sec	30 sec
Abdominal Plank	30 sec	30 sec	30 sec
Alternate Plank	30 sec	30 sec	30 sec
Squat	20	20	20
V-Up	20	20	20
Crunch	20	20	20
Lying Twist Trunk	20	20	20
Alternate Superman	20	20	20

Taking into account the mobilization and stabilization of the core exercises, 1-week adaptation training was provided for the athletes before the application for accurate performance of the exercises and to correct the errors. At the end of the adaptation training, the body analysis, anaerobic capacity and arm strength of the athletes were recorded according to the test protocol and they were analyzed once more at the end of the 8th week (Figure 1).

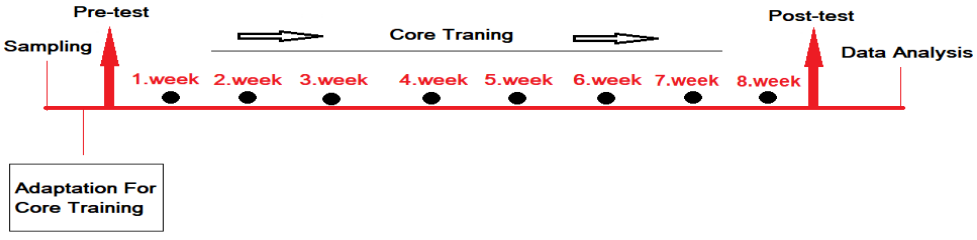

Figure 1. Study design

2.3 Wingate Anaerobic Power Test

The Wingate anaerobic power test (WAnT) was performed on Monark 891 E (Sweden) arm ergometer, which was connected to a computer modified for the arm and operating with a compatible software. Athletes are provided detailed information about the test prior to the test and then a 4-5 minutes of warming protocol is carried out on a cycle ergometer with 60-70 W workload, 60-70 RPM pedal speed, including 2 or 3 sprints of 4-8 seconds. After warming, 3-5 minutes of passive rest was given. Seat and handlebar settings were done for each subject after warm-up and rest. For

each athlete, 30 g load per kg was applied as external resistance during the test and the test was started after the arm was placed on the scale of the ergometer. The athletes were asked to reach the highest pedal speed as soon as possible without resistance. Subjects pedaled to the highest speed with their arms for 30 seconds against external resistance. Athletes were encouraged verbally throughout the test. Information on the power parameters during the test was recorded at 1000 Hz and transferred to the software program (Özkan et al. 2011).

2.4 Handgrip Strength

Handgrip strength of the athletes was measured with Takei Grip-D brand hand dynamometer. After five minutes of warm-up, the subject was asked to squeeze the dynamometer while standing in an upright position, without bending the arm and touching the body with the arm at an angle of 45 º. The foregoing was repeated three times for the right and left hands and the highest value was recorded (Özer & Kılınç 2012).

2.5 Analysis of the Data

Mean ± standard deviation of the data was calculated. Normal distribution and homogeneity of the parameters were checked with Shapiro–Wilk, and Levene's test. The differences between after and before results in both Pre and post-test groups were analysed by factorial ANOVA with repeated measures. The probability level for significance was set at $p<0.05$. An analysis was performed using SPSS version 23.0(Chicago, IL, USA).

3. Findings

Table 2. Basketball Players' Right-Left Arm Fat Percentage values from Pre and Post-Tests

Variables	Groups	N	Mean	P
Right Arm Fat Percentage	Pre-Test	12	28.57±2.74	0,011
(%)	Post-Test		19.31±1.73$^{\pi}$	
Left Arm Fat Percentage	Pre-Test		28.83±2.75	0,015
(%)	Post-Test		19.63±2.01$^{\pi}$	
Right Arm Muscle	Pre-Test		1.95±.90	0,124
(kg)	Post-Test		2.22±.14	
Left Arm Muscle	Pre-Test		1.94±.09	0,181
(kg)	Post-Test		2.17±.13	

$^{\pi}$*: p<0,05*

According to Table 2, the average fat percentage of the right arm was determined in the pre-test (28.57±2.74), and the average fat in the right arm was determined as (19.31±1.73) in the post-test. There is a statistically significant difference in right arm percentage fat pre-test and post-test results. The average fat percentage of the left arm was determined in the pre-test (28.83±2.75), and the average fat in the left arm was determined as (19.63±2.01) in the post-test. There is a statistically significant difference in left arm percentage fat pre-test and post-test results. The average of the right arm muscle was determined in the pre-test (1.95±.90), and the average of right arm muscle was determined as (2.22±.14) in the post-test. The average of the left arm muscle was determined in the pre-test (1.94±.09), and the average of left arm muscle was determined as (2.17±.13) in the post-test.

Table 3. Basketball Players' Right-Left Handgrip Strength values from Pre and Post-Tests

Variables	Groups	N	Mean	P
Strength Right Handgrip	Pre-Test	12	26.90±1.58	.041
(kg)	Post-Test		29.15±1.70$^{\pi}$	
Strength Left Handgrip	Pre-Test		25.95±1.60	.043
(kg)	Post-Test		28.18±1.18$^{\pi}$	

$^{\pi}$*: p<0,05*

According to Table 3, the average of the strength right handgrip was determined in the pre-test (26.90±1.58), and the average strength right handgrip was determined as (29.15±1.70) in the post-test. There is a statistically significant difference in strength right handgrip pre-test and post-test results. The average of the strength left handgrip was determined in the pre-test (25.95±1.60), and the average strength left handgrip was determined as (28.18±1.18) in the post-test. There is a statistically significant difference in strength left handgrip pre-test and post-test results.

Table 4. Basketball Players' Anaerobic Power Capacity values from Pre and Post-Tests

Variables	Groups	N	Mean	P
P (W)	Pre-Test	12	185.11±20.39	.033
	Post-Test		241.46±18.08 $^{\pi}$	
T (W)	Pre-Test		203.93±.87	.786
	Post-Test		195.53±14.59	
A (W)	Pre-Test		113.55±8.02	.046
	Post-Test		134.73±5.79$^{\pi}$	

$^{\pi}$*: p<0,05 P (Peak Power),T (Time At Peak Power), A (Average Power),W(Watt).*

According to Table 4, the average of the peak power was determined in the pre-test (185.11±20.39), and the average of peak power was determined as (241.46±18.08) in the post-test. There is a statistically significant difference in peak power pre-test and post-test results. The average of the time at peak power was determined in the pre-test (203.93±.87), and the average of time at peak power was determined as (241.46±18.08) in the post-test. The average of average power was determined in the pre-test (113.55±8.02), and the average of average power was determined as (134.73±5.79) in the post-test. There is a statistically significant difference in average power pre-test and post-test results.

3. Conclusion

There are limited studies on upper extremity of the core training and they have conflicting and overlapping aspects when compared to our results. Exercise models with high threshold values, such as core training, are used as an effective tool for improving performance and fixing the balance of energy. During high intensity trainings with high threshold values, fats hydrolyze and provide energy and as a result, a decrease in body fat and an increase in muscle density will be expected. Differences in performance with the body's lean mass are somewhat affected by the proportion of body fat.

In our study, when the pre- and post-test arm fat percentages of the basketball players were examined, it is seen that the post-test arm fat percentages of the athletes decreased compared to the pre-test arm fat percentages. It is stated that core training did not affect body mass index (Dilber at al. 2016), lean body mass, other body composition parameters and body weight (Dilber at al. 2016; Segal et al. 2004; Dedecan, 2016; Barak et al. 2016) but the percentage of body fat was effected positively (Dedecan, 2016; Prabhakaran et al. 1999; Arslan et al. 2009). It is indicated that the increase in body fat weight affects the ability to maintain the core stability and increase the weight load in the core muscles, and that this will have a more negative effect on the core muscle function than body weight (King et al. 2012). Body weight is very important in basketball, especially because it is linked to strength. Body weight is an important factor affecting the energy expenditure in the exercises. The increase in body weight with regards to basketball players will have a negative effect on their pass and shoot performances and their energy consumption will become higher as well. Therefore, the difference between the oxygen utilization capacities of the athletes with higher body weight will be significant. In our study, it is thought that core exercises have a positive effect on body weight.

When the arm strengths of the basketball players were examined, it was determined that the average of the post-test grip strength was higher than the pre-test grip strength average. In basketball, the muscles of the arms and legs are expected to be strong, and the workout of the abdominal muscles is also important. Technical movements such as a good handling of the ball, passing, dribbling, and shooting, largely depends on the strength of the arms, wrists and, in particular, the fingers. In the shootings of male and female athletes; when the kinematics of the shoot is examined, it is noted that men use their elbows to increase the speed of the ball while women use both their shoulders and elbows. In the studies carried out, it is stated that the core exercises have effects on the strengths of lower extremity (Marshall& Murphy, 2005; Cosio-Lima et al. 2003; Drinkwater et al. 2007; Myer et al. 2006), and the body and back muscles (Carpes et al. 2008; Granacher et al. 2013; Sukalinggam et al. 2012; Cowley et al. 2007). In basketball, basketball-specific technical skills such as pass, shoot, dribbling and defensive movements and motor characteristics are important facts for performance. There was a significant increase in maximum throw speed (Saeterbakken et al. 2011), in health ball throw strength from the chest (Sharrock et al. 2011) and in lumbar cervical spine upper extremity functions (Özer, 2009), and in right-left handgrip strength (Dilber at al. 2016), and also in 1 min. push-ups and shuttle measurements (Dedecan, 2016). Core exercises lead to positive structural change in muscles, while strengthening neural adaptation at the same time (Iacono et al. 2014). This positive effect is thought to be related to the increasing intensity of the movements based on the upper extremity in basketball.

In our study, pre-post test anaerobic power capacities of basketball players were examined; the following results were

found out: the post-test peak power averages increased compared to the pre-test average. Time at peak power post-test averages were decreased compared to pre-test time at peak power averages. Average power post-test averages increased compared to pre-test averages. Due to the intensive flow and continuity of the basketball game, it is very important to develop both aerobic and anaerobic endurance. Because energy production in both offense and defense systems in basketball has an important role (Kılınç et al. 2011). Fatigue can adversely affect the attack and defense performance in a certain part of the game in basketball (Soslu et al. 2017). Minimizing the negative effects of fatigue occurring in athletes is very important in terms of performance. When the studies carried out were examined, it was observed that the strength workouts increase the upper extremity anaerobic capacity (Soslu et al. 2017; Özdil, 2016; Colado et al. 2010; Ivoilov et al. 1981). It is stated that high anaerobic capacity affects the level of success positively in terms of shooting, pass and dribbling techniques in basketball (Uygur et al. 2010).

To sum up, there are very few studies on the anaerobic capacity of female basketball players, especially on the upper extremities. It is observed that basketball players have a stronger anaerobic capacity in attack and defense and that core exercises have a positive effect on certain basketball-specific technical skills such as passing, shooting, dribbling and defensive movements, and in this sense, they will also increase the performance of the athletes.

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