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THE EFFECT OF FATIGUE ON SHOOTING PERFORMANCE IN YOUNG BASKETBALL PLAYERS

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ABSTRACT

The aim of this study was to investigate the effect of fatigue on the hit rate in 16-17 year old male basketball players. The study group consisted of 10 volunteer basketball players with an average age of 16.40 and an average length of 181.30. Yo-Yo Intermittent Recovery Test Level 1 (Yo-Yo ATT1) was used to cause acute fatigue in basketball players. In order to evaluate the hit rate, basketball players were given 5 shots 2 times, 5 shots 3 times and 5 turnstile shots after resting, moderate load and after exhaustion point. The scores obtained were evaluated. The difference between the smash test scores and frequency analyzes performed at three different fatigue levels were performed in the computer statistical package program. Basketball players Yo-Yo Intermittent Recovery Test In the first level test, a minimum of 16 shuttles and a maximum of 21 shuttles run. The distance they run was found to be a minimum of 640 meters and a maximum of 840 meters. Significant differences were found between smash test scores applied at three different fatigue levels ($p<0.05$). When the fatigue levels were gradually increased, the biggest difference was found between the shot success rates after the exhaustion point and the hit rate taken at rest. As a result, when the results of the study were taken into consideration, it was found that acute fatigue created had a significant effect on the hit rate of basketball players. As the fatigue level of basketball players increased, it was seen that the hit rate decreased. These results showed that it is necessary to determine the critical points of the individual fatigue levels of the athletes and to establish a training program in this direction.
Key Words: Basketball, Shooting, Fatigue, Shuttle Run.

1. INTRODUCTION

Sports such as basketball, football, handball, rugby and tennis are defined as intermittent sports due to the high intensity game segments interspersed with submaximal effort periods over a long period of time in which both aerobic and anaerobic systems are used (Eler, Yıldıran and Sevim, 1999). In basketball, the success of athletes depends on their ability to perform high-intensity activities. However, the ability to repeat such high-intensity activities on the same level throughout the game depends on how effective and fast the athletes can regenerate their PCr and glycogen energy stores. This is directly related to the level of aerobic capacity which affect the regeneration rate (Bishop and Spencer, 2004). The use of O2 is important to maintain physical efficiency as the muscles require more O2 during exercise. Physiological adaptation of the respiratory system which will provide sufficient oxygen for the exercises performed during the competition or training is a requirement of this mechanism (Astrand and Rodahl, 1986). During exercise, the increased breathing frequency causes the muscles that maintain breathing to also use more oxygen. The respiratory system which is developed through endurance exercises prepares the environment for decreasing the frequency of breathing and transferring oxygen to blood (Pancar, 2018; Tahhan, Özdal, Vural, Pancar, 2018). Thus, thanks to an increase in breathing volume and the

development of an economic environment for ventilation during overload, the efficiency for daily activities is increased and the person tires late and recovers more quickly in the face of effort (Jensen, Secher, Fiskestrand, Christensen and Lund, 1984).

An athlete needs to conserve his/her skills in the highest level for at least 40 minutes while doing sudden acceleration and deceleration, direction changing, side sweeps and jumps with or without the ball, in an area of 28x15 meters and to have an anaerobic stability, swiftness and agility of the highest level (Delextrat and Cohen, 2009). The aim of this study is to determine the level of fatigue of young basketball players and to investigate the relationship between shuttle run exercises, height, weight, body mass index, and shooting score.

2. METHOD

The study consists of ten well trained male basketball players. The age average of male basketball players is 16,40±0,52 years, their body weight average is 77,50±13,17 kg., and their height average is 181,30±5,35 cm. The athletes' mean body mass index is found to be 23.48±3.24. The necessary permissions were obtained for the athletes participating in the study and the research was conducted on the participants who volunteered.

Yoyo Intermittent Recovery Test Level 1 was used to inflict acute fatigue in basketball players. In the resting state, shooting tests were performed after moderate load and after exhaustion. In order to obtain the shooting test scores at these levels, running was interrupted and athletes' heart rates were measured before the shooting tests. Heart rates were used to determine the level of acute fatigue.

Yoyo Intermittent Recovery Test (Level I): The test consists of 2 segments, as in a 20m running segment and 5m active recovery segment. Basketball players have completed the first 20m segment on a loop, and then they have completed the 5m active recovery segment by jogging on a loop. The test was terminated when the athlete reached his exhaustion point or made three consecutive grunting sounds.

Moderate intensity load: The karvonen formula was used to determine the intensity of the moderate load program applied to basketball players. In line with this method, after measuring the resting pulse of basketball players, the intensity was determined as 50-60% and when the targeted heart rate was reached, the basketball players were subjected to a shooting test.

3 pointer test: A total of 5 shots were fired from a distance of 6.75m from the centre of the basketball hoop to the three pointer score-line. 1 point was given for each successful shot and no points for unsuccessful shots.

2 pointer test: A total of 5 shots were fired from a distance of 5.80m from the center of the basketball hoop to the free throw line. 1 point was given for each successful shot and no points for unsuccessful shots.

Layup test: The athlete dribbles the ball towards the basket and shoots when he feels ready. This is the technique that allows shooting from the shortest distance to the hoop. 1 point was given for each successful shot and no points for unsuccessful shots.

Analysis of the data: For descriptive statistics of basketball players, frequency analysis, resting state, moderate intensity load and exhaustion point comparative analyzes were performed using Paired-Samples T-Test.

3. FINDINGS

Table 1. Height, Weight, Age Range and Body Mass Index of Basketball Players

Data	N	Min.	Max.	x̄	s.s
Height (cm)	10	175	190	181,30	5,35
Weight (kg)	10	55	95	77,50	13,17
Age range (years)	10	16	17	16,40	,52
Body mass index	10	17,96	27,76	23,48	3,24

In Table 1, the following data about the participants have been presented: the number of basketball players participating in the research: 10, minimum height: 175 cm, maximum height: 190 cm, minimum

body weight: 55 kg, maximum bodyweight: 95 kg, youngest age: 16, oldest age: 27, minimum body mass index: 17.96, maximum body mass index: 27,76. Average age: 16,40±,516 years, mean body weight: 77,50±13,17 kg, the average height: 181,30±5,35 cm, mean body mass index: 23.48±3.24.

Table 2. Number of Shuttle Runs Performed by the Players and the Distances that They Ran

Data		N	Min.	Max.	x̄	s.s
Yo-Yo IRT 1	Total number of shuttle runs	10	16	21	18,70	1,63
Yo-Yo IRT 1	Distance total(m)	10	640	840	748	65,46

In the Yoyo Intermittent Recovery Level 1 test, it was found that the basketball players performed a minimum of 16 and maximum 21 shuttle runs and ran a minimum of 640 and maximum 849 meters.

Table3. Descriptive Statistics of the Heart Rates of Basketball Players

Data	N	Min.	Max.	x̄	s.s
Pulse during resting state	10	82	94	88,70	3,20
Pulse during moderate load	10	130	138	133,40	2,63
Pulse during exhaustion	10	172	180	175,90	2,92

The heart rate of basketball players before the shooting test while they were resting was measured to be between 82/min and 94/min. Their heart rate right after moderate intensity load was measured to be between 130 and 138; and at exhaustion level, their heart rate was measured between 172 and 180.

Table 4. Descriptive Statistics of Basketball Players' Successful Shots

Data		N	Min.	Max.	x̄	s.s
Resting	2 pointer	10	3	5	3,50	,71
	3 pointer	10	2	4	2,80	,63
	Layup	10	3	5	4,30	,67
Moderate intensity load	2 pointer	10	2	3	2,40	,52
	3 pointer	10	1	2	1,70	,48
	Layup	10	2	5	3,50	,97
Exhaustion	2 pointer	10	1	2	1,30	,48
	3 pointer	10	0	2	,80	,63
	Layup	10	1	3	2,30	,67

When the resting state shooting scores of basketball players were examined, the success rate was found to be between 3 and 5 for two pointer shots, between 2 and 4 for 3 pointer shots, between 3 and 5 for layups. The same tests after the moderate intensity load have resulted in the following success rates: Between 2 and 3 two pointer shots, between 1 and 2 three pointer shots and between 2 and 5 layups. And finally, after the exhaustion, between 1 and 2 two pointers, between 0 to 2 three pointers and between 1 and 3 layups were scored successfully.

Table 5. Comparative Analysis of 2 Pointer Shooting Test Scores of Basketball Players According to Different Fatigue Levels

Data	N	x̄	s.s.	t	p
Resting	10	3,50	,71		
Moderate intensity load	10	2,40	,52	11,00	,000
Resting	10	3,50	,71		
Exhaustion	10	1,30	,48	7,57	,000
Moderate intensity load	10	2,40	,52		
Exhaustion	10	1,30	,48	4,71	,001

Table 5 shows the results of the comparative analysis between the two pointer shooting test scores at different fatigue levels. Statistically a significant difference was found between resting and moderate intensity load, between resting and exhaustion point, and between moderate intensity load and exhaustion points ($p < 0.05$).

Table 6. Comparative Analysis of 3 Pointer Shooting Test Scores of Basketball Players According to Different Fatigue Levels

Data	N	x̄	s.s.	t	p
Resting	10	2,80	,63		
Moderate intensity load	10	1,70	,48	11,00	,000
Resting	10	2,80	,63		
Exhaustion	10	,80	,63	13,42	,000
Moderate intensity load	10	1,70	,48		
Exhaustion	10	,80	,63	9,00	,000

Table 6 shows the results of the comparative analysis between the three pointer shooting test scores at different fatigue levels. Statistically a significant difference was found between resting and moderate intensity load, between resting and exhaustion point, and between moderate intensity load and exhaustion points ($p<0,05$).

Table 7. Comparative Analysis of Layup Shooting Test Scores of Basketball Players According to Different Fatigue Levels

Data	N	x̄	s.s.	t	p
Resting	10	4,30	,67		
Moderate intensity load	10	3,50	,97	2,75	,022
Resting	10	4,30	,67		
Exhaustion	10	2,30	,67	7,75	,000
Moderate intensity load	10	3,50	,97		
Exhaustion	10	2,30	,67	6,00	,000

And Table 7 shows the results of the comparative analysis between the layup shooting test scores at different fatigue levels. Statistically a significant difference was found between resting and moderate intensity load, between resting and exhaustion point, and between moderate intensity load and exhaustion points ($p<0,05$).

4. CONCLUSIONS AND RESULTS

This study aimed to investigate the effect of acute fatigue on shooting accuracy of 16-17 year old male basketball players. The study group consisted of 10 volunteer basketball players with an average age of 16,40±0,52, the average height of 181,30±5,35 and an average body mass index of 23,48±3,24. As a result of Yoyo Intermittent Recovery Test Level 1, it was revealed that the athletes could perform crunches between 16 to 21, and run distances between 640 meters and 840 meters. The basketball players heart rate during the resting state before the shooting test was measured to be between 82 and 94 beats per minute. After the moderate intensity load, this number has risen to 130 to 138 range; and after the exhaustion, it was measured in a range between 172 to 180. Significant differences were also found between the shooting test scores applied at three different fatigue levels ($p <0.05$). As fatigue levels increased, the success rate of the shots has decreased. When the gradual increase of fatigue levels is taken into account, the biggest difference was found to be between the success rates of the resting state and the exhaustion point. Lyons, Al-Nakeeb and Nevill (2006), in their study which examined in what level the fatigue effected the passing technique of both elite and non-elite basketball players, reported a significant difference between the resting state passing scores and the high fatigue passing scores of both groups. The difference was higher in non-elite basketball players. A highly significant difference in passing scores was reported for both groups according to their fatigue levels (resting, 70% and 90%).

In his master's thesis titled "Investigation of various factors affecting the shooting percentage in basketball", Arıkan found that the shooting accuracy of subjects was found to be 29,183±5,842 after acute tiring. The accuracy for the resting state, however, was found to be 43.470±8,837. Arıkan reported a statistically significant difference between the averages (Arikan, 2010). In their study, Erculj et al. tested an elite NBA player for 20 shots from the three pointer line (7,24m) in 7 series. The player's heart rate and fatigue levels were examined during the making of these shots. As a result, heart rate increase adversely affected the percentage of fatigue levels and a statistically significant difference was found in the statistical analysis (Erculj and Supej, 2009). Mülazımoğlu examined the effect of fatigue on the shooting technique of young basketball players in his study. He reported in his study which consisted

13 basketball players with the mean age 15.08±0.76 years, mean height 182.00±9.49 cm and mean weight 68.54±7.08 kg, with an average 20-meter shuttle run count of 81,08±9,43 that they ran an average distance of 1621,54±188,58 meters. As his results suggest, the average points the players received is 13,92±2,78 in moderate fatigue levels and 10,0±04,20 in high fatigue levels. He also found a statistically significant difference for the average scoring rates between medium fatigue and high fatigue levels (Mülazimoglu, 2012). These scientific studies and the results of our study show in parallel that young athletes' ability to shoot, which is an important technique in basketball, is adversely affected by fatigue. When we examine the literature, it can be seen that fatigue has a decisive effect on both team success and athletes' skills. In this context, planning the training to reduce such adverse effects of fatigue on the skills of the athletes and finding solutions to reduce such effects will positively contribute to the success of the whole team.

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