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THE EFFECT OF PLYOMETRIC TRAINING ON THE ANAEROBIC POWER OF BASKETBALL PLAYERS TRAINING IN PRIVATE COLLEGE

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ABSTRACT
This study was conducted in 2019 to examine the effect of 12-week plyometric training on some physical and physiological values and anaerobic power performance of basketball players aged 18-23 studying at a private college. This study aimed and conducted in 2019 to examine the effects of 12-week plyometric training on some physical and physiological values and anaerobic power performance of 18-23 year old basketball players. Divided into two groups, the control and experimental groups, a total of 34 athletes who were interested in the basketball branch for not less than 4 years participated in the study voluntarily. Internationally valid laboratory standard proven tests were applied. While the control group did technical-tactical training for 3 days in a week, the experimental group did plyometric training only before technical-tactical training. At the end of 12 weeks, the results of the groups divided into two were evaluated statistically with dependent and independent sample t-test. As a result of the study, the improvement in height values of both groups was found to be significant ($P < 0.01$). It was observed that the horizontal and vertical jump values of the experimental group increased significantly compared to the control group ($P < 0.01$). When we evaluated it in terms of anaerobic power, the values of the experimental group were significant compared to the pre-training ($P<0.01$), while there was no significant difference compared to the control group ($P<0.01$).

Key Words: Basketball, Plyometric Training, Performance

INTRODUCTION

Nerve-muscle coordination and reactions, fiber types, biological structure of the muscle, and various trainings for muscle development are of great importance in terms of the use of scientific principles in improving performance, which is the main task of coaches. Studies on these issues shed light on coaches to better develop an athlete (Rodríguez-Rosell, et al., 2018). As in every branch, some branch-specific characteristics must be good in team sports (Hostler, et al., 2001). Characteristics such as attention, agility, jumping and quickness are characteristics that exist in the genetics of these sports and are key to success. At this point, trainers aim to find new approaches to develop the hamstring, quadriceps and calf strain muscles (Davies, et al., 2015; Koyama, et al., 2014; Slater, et al., 2019).

One of the most important exercises that improve the muscle working principle and also the jumping ability is lyometric training (Perez-Gomez, & Calbet, 2013; Slater, et al., 2019). Many coaches have noted positive changes as a result of plyometric training exercises (Beato, 2018, Rahimi, & Behpur, 2005; Gjinovci, et. al, 2017).

The aim of this review is to examine the effects of plyometric exercises performed for 12 weeks on some physiological and physical values and vertical jump performances of private university athletes aged 18-23.

METHOD

Data collectıon methods; Our study to obtain the data was conducted in 2019, and the methods of obtaining the data are given below. Before the tests, the subjects were informed by giving a motivational speech. They were instructed to enter the protocols using all their power. During the study, it was determined whether the subjects had any health problems. Subjects entered the study on a voluntary basis. Before the test, necessary stretching exercises were carried out to ensure that the subjects could perform each movement in the best way and to avoid any injuries. Thirty-four male team athletes playing basketball at a private university, aged 19.47±0.48, participated in the research, with 17 athletes each in the experimental and control groups (n=17). While only technical exercises were carried out in the control group, the experimental group athletes were given plyometric training three days a week for 12 weeks.

Research Design

The experimental design of this study consists of pre-test and post-test application of Anaerobic Power Measurement, Measurement of Pushing Force, Standing Long Jump Test, Measurement of Throwing Force measurements to the research and control groups of Basketball Players. The training period was determined as 12 weeks and the experimental group was motivated in terms of willingness before the studies. The control group had technical-tactical training for 3 days for 12 weeks. The experimental group had plyometric work before technical-tactical training for 12 weeks. Subjects of both groups participated in the pre-test and post-test on the announced dates.

Study Plan

The experimental group received plyometric training 3 days for 12 weeks to improve some physical and physiological values and anaerobic power performance.

The control group had only technical-tactical training for 3 days for 12 weeks.

Experimental group was programmed to develop the effect of 12-week plyometric training on some physical and physiological values and anaerobic power performance of basketball players aged 18-23 studying at a private college for 12 weeks, 3 days. The control had technical-tactical training for 3 days for 12 weeks.

Personal Information

Personal information was noted acording to their specialities the researchers (age, Weight, Height). In addition, during the face-to-face interview, subjects was selected to experimental or control groups and those were informend in which groups at once.

Subjects

A total sample of 34 subjects were taken in this study. And both groups consisted of 17 participants were formed as the experimental and control groups. The main characteristics of this sample of 34 participants are that they are new to scientific researches took education at private university. The physical parameters of the basketballers are given in table below

Data Collectıon Methods

The main purpose of experimental data collection methods is to test the validity of a certain hypothesis and to reveal cause-effect relationships. These methods are carried out by manipulating variables under controlled conditions, thus examining the effects of independent variables on dependent variables.

Experimental methods are usually applied in laboratory environments or in the form of controlled field studies, thus keeping external factors to a minimum. These methods provide high internal validity in scientific research, increase the reliability of the results obtained, and ensure repeatability.

Data collection methods are techniques and procedures used to collect data for research purposes. These methods can range from simple, feedback-providing measurements to more complex experiments. Our data acquisition study was conducted in 2019, and the data acquisition methods are given below.

Anaerobic Power Measurement

This measurement was carried out with the jump test. First, the last point the subject could reach while standing was determined, and then the point he touched when he jumped vertically was determined and the

difference was taken. Afterwards, body weights were determined and anaerobic power was calculated (Rahimi & Behpur, 2005).

Height and Weight Measurement: The weights of the people participating in the experiment were determined by wearing only their shorts and their bare feet. Using this, anaerobic power was calculated using the method mentioned below (Stojanović, et. al, 2017).

P = ...J4.9 XWX D"
-J4.9 = Standard (sec)
D" = Jump Distance (m)
W = Body Weight (kg)
P = Anaerobic Power

Measurement of Pushing Force

The person throws the weight ball maximally forward, taking the ball from a distance that has not changed its location, with the feet at the same level, and the distance between the point where it remains stationary and the distance the ball falls after being released is calculated (Sevim, (1992).

Standing Long Jump Test

The person tries to throw a long distance from behind the place where the position has not changed, using the right and left feet simultaneously and using maximal power. The distance between the previously determined place and the shorter distance left by the subject is calculated in meters (Sevim, 2002).

Measurement of Throwing Force

It measures the quick strength of the muscles that allow the shoulder area and abdomen to bend inwards. The person gains strength by holding the weight ball from an unchanged distance, with the right and left feet at the same distance, with the arms back, and then throws the weight ball maximally forward, using the right and left hands simultaneously. Results are in meters (Sevim, 1997).

Statistical Analysis

Data regarding the applied scales were analyzed in the SPSS 18 program. The the above mentioned test values of the groups before and after training were examined. In terms of the training independent variable and the results were evaluated statistically. In this evaluation, statistical t test was used. The obtained findings were analyzed by performing normality test. Spss Paired-T test was utilized to examine if there was a statistical differences between pre-test and post-test of performance tests. The significance value is based on $p<.05$.

DRILL-1 Experimental Group Study

One-Leg Descending from the Vault: The athlete jumps up with the starting foot on the vault, taking power from the arms, comes to the starting position with the other foot during the fall, and performs the same movement repeatedly, one after the other.

Jump with a Half Turn Around Himself: The athlete jumps from the obstacle to the ground, then jumps again without waiting and makes a half turn around himself in the air.

Jumping by Pulling the Right and Left Knees to the Abdomen at the Same Time: People jump upwards from the position by pulling the right and left knees to the abdomen at the same time.

Jumping with Right and Left Foot at the Same Time Using the Arms: Athletes jump with their right and left feet straight, taking power from their arms, while standing on a fixed place.

Single Foot Jump: Jumps forward a certain number of times. If the athlete starts with the right foot, the athlete moves with the left foot on the return.

Jumping on the Hoop by Changing Arms: Athletes jump on the basketball hoop with both feet, changing their right and left hands.

Double Forward Jump: Jumps forward with the right and left feet moving simultaneously.

Double Leg Jump: Athletes jump upwards from a fixed place, without using their arms, without bending their knees.

Jumping from the Box to the Floor: The athlete jumps on the ground with both feet and then climbs back onto the vault.

Double Leg Jump over Obstacles: Athletes jump with double legs over obstacles placed at certain intervals.

Jumping from the Ground to the Obstacle with Right and Left Feet at the Same Time: The person jumps to the vault with his right and left feet, then goes down again normally.

Jumping up and down the vault: The athlete waits on the vault, jumps with two feet at the starting sound, jumps backwards and jumps again with two feet onto the vault.

Jumping from the Obstacle to the Floor and from the Floor to the Basketball Hoop: The athlete jumps from the obstacle to the ground and then jumps, aiming to touch the basketball hoop.

Jumping to the Right and Left on the Rope, but not on one leg: The other athlete jumps on the rope held by two people, but not on one leg.

Jumping Rope: Athletes jump with two legs or one leg in response to commands.

Experimental Group Study Drill-2

Jumping by Turning Around Oneself: A full circle is made around oneself, after turning, one jumps and climbs onto the obstacle again.

Jumping quickly over obstacles without waiting: Jumping over obstacles arranged at specified distances.

Additive Movements from Obstacles of Different Heights: They jump over obstacles of different heights. Again, obstacles of different heights are lined up in different ways and jumped over.

Shuttles with Weight Ball: The person is lying on his back on the ground in the sit-up position with his feet bent and fixed on the ground. There is a person at the foot who will hold and throw the medicine ball. The movement begins with the athlete doing sit-ups in an upward position with the medicine ball on his head. He throws the ball towards the person standing at his feet and picks up the medicine ball while descending to the ground again towards the first movement.

Lifting and Lowering the Weight Ball from the Chest: In a position where the athlete is on his back with his arms up, the assistant waits on the bench with the weight ball, pulls the weight ball downwards, catches the ball lying on his back below and throws the weight ball up again.

Catch the Weight Ball and Jump: After the athlete lands on the ground over the obstacle, he catches the weight ball directed towards the athlete while jumping up and jumps with the ball again.

Jumping to the Hoop from the Ground to the Obstacle with the Weight Ball: The athlete jumps down from the vault with the weight ball, jumps again and throws the weight ball into the hoop.

Climbing the Obstacle with a Weight Ball, with One of the Right and Left Foot, Without Double Legs: With the weight ball, the movement is made by standing on the platform with one toe and the other foot is in a position pulled towards the abdomen, keeping the ball at chest level.

Low Post Drill: In this movement performed in pairs, one of the partners throws the ball to the other athlete, the athlete holding the ball jumps up with two feet with a pivot movement and makes a pivot movement again and throws it back to his partner.

FINDINGS

Table 1. Pre-Test And Post-Test Results Of The Experimental And Control Groups

	Experımental Group				Control Group			
Parameters	Pre-Workout X1	Post-Workout X2	x2-x1	t Test	Pre-Workout X1	Post-Workout X2	x2-x1	t Test
Height (cm)	170.79±7.82	172.79±7.82	2.01	-7.70**	165.14±7.10	168.22±6.74	1.04	-4.89**
Body Weight (Kg)	55.90±10.20	56.00±9.80	1.02	-2.42*	58.70±8.30	58.54±7.90	-0.19	0.394
Vertical Jump(cm)	37.90±5.70	46.25±5.98	8.29	-13.15**	34.17±5.40	34.70±4.90	0.50	1.780
Anaerobic Power (kgm/sec)	75.70±1.56	85.17±1.68	9.40	-12.05**	76.15±1.50	76.50±1.40	0.35	0.39
Horizontal Jump(m)	2.01±0.10	2.09±0.10	0.06	-4.50**	1.94±0.08	1.96±0.06	0.01	-1.58
Shooting Force(m)	5.68±0.85	6.30±0.74	0.60	-8.91**	5.72±0.50	5.71±0.52	-0.01	0.11
Thrust Force (m) (Right Arm)	6.10±0.92	6.93±1.02	0.80	-2.74*	5.90±0.46	5.92±0.48	0.02	1.24
Thrust Force (m) (Left Arm)	5.31±0.68	5.80±0.90	0.50	-3.20**	5.20±0.29	5.33±0.28	0.03	1.82

**p<0.01 *p<0.05

As a result of the study conducted for 12 weeks to private college basketball players in 2019, a significant increase in the values of the experimental group was detected in the vertical jump results.

The arithmetic mean of the pre-test vertical jump result of the experimental group is 37.90±5.70 cm. last test: 46.25±5.98 cm. It was determined as. In the results of the experimental group, an increase of 8.29 cm was observed (P<0.01).

The average of the pre-test vertical jump results of the control group is 34.17±5.40 cm. final test 34.70±4.90 cm. has happened. Although there was no statistically significant difference in the pre-test values of the vertical jump of both groups, a significant difference was observed in the post-test values (P < 0.01).

CONCLUSION and DISCUSSION

As it can be seen, in our research, the effect of 12-week plyometric training on the physical and physiological parameters of the anaerobic power of 18-23 age group basketball players studying at a private university was investigated with the values of the control group, which did only technical training three days a week in the 12-week program. Similarities were observed with the plyometric training principles in the experimental group's selection of the training plan prepared before the research. Plyometric training was referred to as drills by coaches. These resurrections were combined and applied to increase speed, strength and power. Plyometric exercises have recently been applied in many sports branches that require quick strength (Andrews, et., al, 1998; Chu, 1992; de Villarreal, et. al., 2009; Heiderscheit et. al, 1992; Wilk, et. al., 1992; Yurdakul, 1998).

It is an effective method in improving vertical jumping ability in healthy young individuals by expanding the results of research on the effects of plyometric training methods on jumping ability (Gabbett, 2008; Markovic, 2007) and regarding the effects of assisted and resisted plyometric exercises on jumping ability (Yingling, 2018).

When the force formation of the lower and upper extremities is compared as a result of eight-week plyometric studies; It was observed that there was an increase in strength in the lower extremity muscles, but not in the upper extremity muscles. They stated that the lower extremity muscles could be overloaded compared to the upper extremity muscles (Wilson, et. al., 1993).

When the 8-week plyometric study applied to the handball training during the competition period was compared with the handball training without the plyometric study, positive effects were observed on the physical and technical results of the male players (Gabbett, et. al., 2008).

As a result of the research, plyometric training significantly increased the back strength and pushing and throwing results ($P < 0.01$). A significant difference was observed according to the post-test results of both groups ($P < 0.01$).

As a result, a planned plyometric training resulted in a proportional increase in the athlete's quick strength and maximal strength. This study, especially in branches where jumping strength is important, can lead to positive success.

SUGGESTIONS

Research Design

Long-Term Studies: Studies of 6 months or longer duration may be planned to examine the long-term effects of plyometric training.

Training Protocols

Various Plyometric Exercises: Studies comparing the effects of different plyometric exercises (e.g., box jumps, deep jumps) on anaerobic power.

Different Types of Training: Studies comparing the effects of plyometric training with other types of training (e.g., resistance training, interval training).

Training Intensity and Frequency: Studies examining the effects of plyometric training performed at different intensities and frequencies.

Measurement and Assessment

Advanced Measurement Techniques: Use of more sensitive and advanced technologies (e.g., isokinetic dynamometers) to measure anaerobic power.

Performance Tests: Use of various performance tests (e.g., sprint tests, Wingate test) to assess anaerobic power.

Future Research Recommendations

Molecular and Cellular Level Studies: Studies examining the effects of plyometric training on muscle cells at the molecular level

ETHICAL TEXT

Participants' confidentiality and protection of personal data were taken into consideration in the study. The study was conducted in accordance with scientific ethical rules. In this article, the journal's writing rules, publication principles, research and publication ethics rules and journal ethics rules were followed. The responsibility for any violations that may occur regarding the article belongs to the authors.

Data for this study were collected in 2019

The contribution rate of the first author to this study is 60% and the contribution rate of the second author is 40%.

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