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ORIGINAL ARTICLE

Investigation of the Effects of 8-Week Selected Pliometric Training Program on Vertical Jump and Agility in Female Volleyball Players

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ABSTRACT

Purpose: The aim of this study was to investigate the effects of pliometric training on vertical jump and agility in young female volleyball players.

Methods: Normal training was applied to the groups and pliometric study protocol was applied to the training program of the training group for 8 weeks. Pre-test and post-test were applied before and after the program. SPSS 25.0 program was used in the analyzes. Descriptive statistics were expressed as frequency (n), average (Mean), standard deviation (SS), minimum (Min) and maximum (Max) values. Independent samples t test was used for comparison of two groups and paired sample t test was used for intragroup comparisons. Statistical significance was evaluated at p <0.05.

Results: In the analyzes, A total of 50 female athletes, 25 of whom were in experimental and 25 of which were in the control group, participated in the study. The mean age of the training group was 14,56 ± 1,45 years, body weight was 55,79 ± 7,93 kg and height was 165,6 ± 7,26 cm. The mean age of the control group was 14,88 ± 1,86 years, body weight was 54,4 ± 9,82 kg and height was 164,56 ± 6,59 cm. Pliometric training applications have significant contributions to BF percentage, anaerobic capacity, (p<0,05), vertical jump, leg strength, long jump, hegzagonal test, 505 agility test, Illinois agility test, and back strength (p<0,001) level of significance.

Conclusions: It was concluded that it will contribute to strength development by decreasing the intensity in sports branches and middle school Physical Education classes which require strength and agility, especially in volleyball and in many branches in training programs and through game training and pliometric exercises.

Keywords: Development, Pliometric Training, Training, Volleyball.

INTRODUCTION

Volleyball, which is the main theme of this study, is a team sport that has a history of more than a century and that includes complex movements due to its dynamic and constantly changing position feature, and needs to have very different sports skills. For this reason, when the characteristics that volleyball athletes should have are examined, it is seen that important biomotor features that can be counted as general and special endurance, reaction speed, explosive force, special quick force, continuity in quick force are at the forefront[1].

Vertical jumping is seen as one of the notable motor skills that have significant effects on offensive and defensive performance in volleyball. Block and dunks technics and net movements, which are among the basic techniques of volleyball, need sudden explosive power and agility[2]. In terms of the volleyball branch, the most imperative indicators of the athlete's being at a high level are biomotor features such as jumping and quick force exercising. Since volleyball sport has a complex system based on speed, agility and technique, the advanced biomotor characteristics of volleyball athletes will add a plus to them and enable them to get ahead of other athletes[3]. In this study, the effect of pliometric training programs, which are one of the different training methods to be applied for volleyball athletes, on the vertical jump and agility characteristics of volleyball players was examined. In this day and age, the positive effects of complex training practices on athlete performance are known. In this sense, the effect of pliometric training on volleyball players' agility and vertical jumps was also evaluated within this scope.

Plyometric training has a significant place in the training of athletes. High-quality pliometric training increases the sporting performance of each athlete and contributes to sports success. As a consequence, almost every coach has certain levels of pliometric training in their holistic training program. In this way, coaches strive to bring their athletes to a better level and especially try to increase the competition success of the contestants[4].

Plyometric training is defined as “a special training method that includes exercises and exercises consisting of a mixture of speed and strength that increase the athlete's power or reactive explosive movements” [5]. According to another definition, pliometric trainings; exercises consisting of a combination of strength and speed that increase the explosive power activities of athletes [6,20,21].

Each of the plyometric trainings reveals different physiological effects on the muscles. Therefore, it should be said that the effect on the muscles is different according to the type of pliometric training. When examined physiologically, it is seen that pliometric training contains four main contractions in itself. The first of these is concentric or in other words, isotonic contractions. In such contractions, shortening occurs in the muscles and the muscles regain a short state from their initial state. The second type of contraction is isometric or static contractions. In isometric contractions, there is no change in the length of the muscle where the contraction occurs, and the muscle length remains the same throughout the movement. The third type of contraction is the eccentric contraction. Along with, at the moment of contraction, the joint angle widens and the muscle lengthens. The last type of contraction is isokinetic contraction. In isokinetic contractions, the muscles contract simultaneously with the movements performed in succession and the contractions continue in a series [7].

MATERIAL AND METHOD

This research was carried out with women with a mean age of 14,56±1,45 years, 25 of whom were used as the experimental group and 25 as the control group, who played in the stars category in their provinces. While the normal training program was applied to the control group for 8 weeks, the selected plyometric study protocol, seen in Table-1, was applied to the experimental group for 8 weeks, as well as the normal training program for 2 days/week.

Table 1: Plyometric Training Program Applied to the Experimental Group.

Weeks	Number of sets	Repetition
1st-2nd WEEK		
Ankle Jump Using Levers	2	6
Vertical Jump by Switching Arms	2	6
Double Foot Jump Over Obstacle	2	8
Jumping Left and Right Over the Obstacle	2	8
One Foot Crawl Bounce (Will Change Feet)	2	8
3rd-4th WEEK		
Jumping With Strength	3	6
Double Feet Knees Abdominal Jump	3	6
Vertical Jump by Switching Arms (Rim-Jump)	3	8
Cross Jump	3	8
Double Feet Jump from Ground to Chassis	3	8
5th-6th WEEK		
Alternate Single Leg Jump	3	8

Single Leg Jump	3	8
Squat (Crouching) Leap	3	10
Jump Over Obstacle	3	10
Jumping Right-Left Over Obstacle	3	10
Bounce from Crate to Ground Floor to Crate	3	10
7th–8th WEEK		
Alternate Single Leg Jump	4	12
One Foot Jump	4	12
Squat (Crouching) Leap	4	12
Jump Over Obstacle	4	12
Jumping Left and Right Over the Obstacle	4	12
Jumping Right-Left over an Obstacle	4	12

A pre-test was applied before the program and a post-test was applied after. SPSS 25,0 program was used in the analysis. Descriptive statistics in the analyzes were given as frequency (n), mean (Avg.), standard deviation (SD), minimum (Min) and maximum (Max) values. While independent sample t-test was used for two-group comparisons, paired-sample t-test was used for in-group comparisons. Statistical significance was evaluated at the p<0,05 level.

RESULTS

In the analyses made, the descriptive data of both groups of plyometric training practices in female volleyball players are shown in Table-2.

Table 2: Descriptive Data of Participants

Experimental Group				Control Group	
Variant	n	Mean	sd	Mean	sd
Age	25	14.56	1.45	14.88	1.86
Pre-Test Length	25	165.16	7.24	164.24	6.51
Final Test Length	25	165.6	7.26	164.56	6.59
Pre-Test Weight	25	55.68	8.23	54.00	9.53
Post-Test Weight	25	55.79	7.93	54.40	9.82

The mean age of the experimental group was 14,56±1,45 years, body weight was 55,79±7,93 kg, and height was 165,6±7,26 cm. The mean age of the control group was 14,88±1,86 years, body weight was 54,4±9,82 kg, and height was 164,56±6,59 cm.

Table 3: Variables that were Significant in the Pre-Post-Tests of the Experimental Group

Test	n	Pre-Test	Post-Test	t	p
BFP	25	14,29±2,19	13,73±1,87	2,992	.006*
Vertical Jump cm	25	29,38±4,75	33,46±4,68	-18,57	.000*
Long Jump Forward cm	25	159,08±17,53	168,52±20,00	-6,031	.000*
Hexagonal Test sec	25	9,58±1,31	8,31±.89	7,881	.000*
505 Agility Test sec.	25	3.13±.36	2.79±.27	11,328	.000*
Illinois Speed Test sec.	25	20.60±1,98	19,38±1,60	6,626	.000*
Anaerobic Capacity kgm/sec	25	669,04±131,71	684,30±123,42	-2,615	.015*
Sit and Reach Test cm	25	21,14±3,68	23,20±3,15	-6,300	.000*
Hand Grip Force kg	25	19,62±5,00	22,23±5,36	-7,011	.000*
Leg Strength kg	25	45,58±14,49	53,20±13,59	-5,625	.000*
Back Force kg	25	52,08±15,51	57,26±14,53	-4,915	.000*

In Table-3, the variables that showed a significant increase at the end of the 8-week study of the experimental group are tabulated. As can be seen from this table; After the study, significant improvements were observed in the VYY and anaerobic capacities of the subjects in favor of the post-test (p<0,05). Again, significant improvements were observed in favor of the post-test in vertical jump, standing long jump, hexagonal agility test, 505 agility test, Illinois sprint test, reach-reach test, claw strength, leg and back strength values (p<0,01). However, there was no improvement in airtime in vertical jump.

In Table-4, in the evaluations made between the experimental and control groups after the 28-week study, there was a significant difference in favour of the experimental group only in the hexagonal test(p<0,05).

Table 4: Variables that were Significant in the Experimental and Control Group Post-Test

Test	n	Experimental Group	Control Group	t	p
Hexagonal Test sec	25	8,31±1,31	9,37±1,25	-3,458	.005*

Although there were no statistical differences in the evaluations made between the experimental and control groups after the 8-week study, as can be seen in Table-5, there were mathematical differences in favor of the experimental group.

Table 5: Mathematical Differences in Experimental and Control Group Post-Tests

Test	n	Experimental Group	Control Group	t	p
BMI	25	20,51±2,47	19,83±3,03	.857	.622
Vertical Jump cm	25	33,46±4,68	29,66± 4,96	2,781	.454
Long Jump Forward cm	25	168,52±20,00	152,84±14,40	3,181	.188
505 Agility Test sec	25	2,79±.27	3,12±.35	-3,733	.419
Illinois Speed Test sec.	25	19,38±1,60	20,51±1,33	-2,729	.256
Anaerobic Capacity kgm/sec	25	684,30±123,42	655,12±141,65	.777	.513
Sit and Reach Test cm	25	23,20±3,15	21,36±2,94	-5,625	.593
Hand Grip Force kg	25	22,23±5,36	19,76±6,42	1,477	.266
Back Force kg	25	57,26±14,53	46,86±11,43	2,812	.320
Leg Strength kg	25	53,20±13,59	48,74±12,57	1,206	.468

DISCUSSION

At the stage of discussing the effects of plyometric training on volleyball players, it will be useful to examine the results of academic studies conducted in the past. Concordantly, the following studies are very important in terms of showing the level and direction of the effect of plyometric training on athletes.

Atacan, in his study conducted in 2010, examined the effects of plyometric training applied to 14-year-old young football players on the agility of the athletes. In the Illinois agility test, significant differences were found in favour of the posttest in the pre-posttest values of the experimental group, and in favour of the experimental group in the post-test values of the experimental and control groups. There is a parallelism between this study and Atacan's work[8].

Ulucay, in his research in 2009, investigated the effect of plyometric training on vertical jump in basketball players aged 12-14 years. In addition to their normal training, the experimental group was subjected to plyometric training two days a week. The control group, on the other hand, studied technical tactics training at the same time. As a consequence, there was a significant difference in the vertical jump between the experimental group and the control group. There is a parallelism between this study and Uluçay's study[9].

Cicioglu et al., in their study in 1995, investigated the effects of 8-week plyometric training applied to 14-15 age group basketball players on vertical jump performances and some physiological and physical parameters. As a result of the research, it was seen that the vertical and horizontal jump characteristics of the experimental group increased significantly compared to the control group, and this study shows parallelism with the literature[10].

Topuz, in his 2008 research, investigated the effect of plyometric exercises on the leg strength development of young volleyball players. The first group of three separate groups participated in technical tactical training together with plyometric training, the second group only participated in technical tactical training and the third the group did not engage in any sport. As a result of the investigation, in the first group of the experiment; vertical jump, horizontal jump anaerobic power, BMI findings reveal a significant difference compared to the other two groups[11]. In our research, a significant result was obtained in favour of the posttest in the anaerobic capacity pre-post test values of the experimental group. It seems to overlap with other scientific studies.

Demirci, in his study conducted in 2016, investigated the effects of 8-week plyometric exercises on physical parameters in female volleyball players aged 14-16. The experimental group was subjected to plyometric training two days a week in addition to normal training for 8 weeks, while the control group continued their normal training. Before and after the application of the 8-week training program prepared for the research, height, body weight, horizontal jump, vertical jump, back strength, hand grip strength, 30-sec shuttle test, and bioimpedance measurements were made. According to the data obtained as a result of the research, in the comparison of the pre-test and post-test results of the experimental group athletes, it was seen that there was a statistically significant difference in the hand grip strength, back strength, horizontal jump, vertical jump, 30-sec shuttle test and weight values. As a result of the evaluations between the groups, a statistically significant difference was found in the experimental and control group post-test values in the vertical jump and 30-second shuttle test values. Studies in the literature support this research[12].

Additionally, similar studies have also obtained results that support this study[13-19].

CONCLUSIONS

Both in this study and according to the findings and studies in the relevant literature, well-planned plyometric exercise significantly improves motor performance if continued one to three times a week for at least eight weeks. It is obvious that increases in vertical jump and agility values where the lower extremities are more active in motor performance will increase the beauty of both volleyball and the branches in which these features are used. Hereby, it can be recommended to use plyometric training drills in a normal training program.

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