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Short-term Plyometric and Jump Rope Training Effect on Body Profile and Athletic Performance in Adolescent Basketball Players

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Abstract

Background: Recent research has focused on the effects of different types of strength training on the performance and body profile of adolescent athletes. However, the effects of short-term plyometric and jump rope training on body profile and athletic performance in adolescent basketball players are a matter of curiosity.
Objectives: The aim of this study was to examine the effects of short-term plyometric and jump rope training on body profile and athletic performance in adolescent basketball players.
Methods: Twenty-two basketball players aged 13 - 15 were randomly divided into two groups as plyometric (n = 11) and jump rope training group (n = 11). All participants regularly completed to plyometric or jump rope training as 10 units for 4-weeks in addition to basketball training. Somatotype, body composition, push-up & sit-up test, sprint, agility (Illinois & hexagon), jump (vertical, squat, horizontal, plyometric) tests were measured before and end of the study.
Results: The push-up (P = 0.049 vs < 0.001), sit-up (P = 0.20 vs < 0.001), squat jump (P = 0.010 vs 0.003) and horizontal jump (P = 0.028 vs 0.014) of the players were significantly increased after 4-weeks plyometric and jump rope training. In addition, plyometric jump (P = 0.007) and hexagon performance (P = 0.001) were significantly increased in jump rope training group. At the end of 4-weeks, body mass, endomorphy and ectomorphy scores of the lower limb plyometric training group, and body mass index, endomorphy & mesomorphy scores and quadriceps circumference of the jump rope training group were significantly increased.
Conclusions: Short-term plyometric and jump rope training affect the body profile and athletic performance of the adolescent basketball players, but jump rope training has a more significant effect on athletic performance than plyometric training. Therefore, jump rope training is recommended for coaches who want to gain more athletic performance in a short-term.

Keywords: Basketball, Plyometric, Jump Rope, Athletic Performance, Adolescent

1. Background

Basketball is a sport in which players must have a high level of physical condition in order to use their technical and tactical skills throughout the competition (1). The most fundamentals specific to basketball are jump strength, speed, speed endurance and agility. Including these parameters, testing anthropometry and body composition will facilitate (a) evaluation of the effects of training (2); (b) the effects of training on body profile (3, 4); and (c) selection of position-specific athletes in basketball.

Studies show that strength and neuromuscular power training have a positive effect on sprint, jumping, changing directions and activities that require sport-specific skills (5, 6). In addition, it is known that 15% of the basketball game is spent with high-intensity activity and success depends on the development of anaerobic power (7, 8). It is also possible to find some studies in the literature showing that short-term training increases the maximum strength (9). Sale (10) revealed that there is strength gain in short-term training, although there is no measurable muscle hypertrophy in the early stages of strength training (first 2 - 4 weeks).

Today, basketball is a sport discipline that requires more athletic features and short-term muscle strength becomes important in many game situations. With the intensive match schedule and the increase in special tournaments, short-term strength training has started to attract more attention by the coaches and athletic performance trainers. Chelly et al. (11) reported that short-term muscle strength became so important in the competition that they added a short-term plyometric training program to their technical and tactical training in order to increase the performance of the players.

Different strength and conditioning trainings are used to increase athletic performance. In this study, plyometric and jump rope training were preferred. Plyometric training is a type of training that includes exercises in which active muscles are stretched before shortening, and can be performed with or without weights, as well as increased strength, jump height and sprint performance (12-15). In basketball, it is known that plyometric training improves strength and agility (16) and short-term plyometric training improves neuromuscular features (17). With the popularization of short-term training, jump rope training has also become more valuable. While this training method is an important training tool for many sports disciplines such as boxing, wrestling, tennis and martial arts (18), it is known that jump rope training applied to basketball players is effective on heart rate and anaerobic properties (8, 19).

2. Objectives

In the literature, it is seen that plyometric and jump rope training in adolescent basketball players were handled separately in the studies, and to the best of our knowledge no study has been found that two different training methods are compared, and their effects on both body profile and athletic performance are examined together. The difference in the number of repetitions and sets applied in each study is also remarkable. Therefore, the aim of this study was to examine the effects of short-term plyometric and jump rope training on body profile and athletic performance in adolescent basketball players. We hypothesized that short-term plyometric training would have a more significant effect on body profile and athletic performance compared to jump rope training.

3. Methods

3.1. Participants

Twenty-two male adolescent basketball players aged 13 - 15 participated in the study voluntarily. Although thirty players started to the trainings, eight basketball players who did not meet the inclusion criteria during the training period were excluded from the study. All players were on the same team and attended to the same basketball trainings. Participants were randomly divided into two groups as plyometric (n = 11, mean age and training experience: 13.6 ± 0.9 y, 5.1 ± 2.7 y, respectively) and jump rope training group (n = 11, mean age and training experience: 13.8 ± 0.9 y, 6.0 ± 1.7 y, respectively). The inclusion criteria for the study were (a) having been training on the basketball team at least 3 times a week for the last 2 years; (b) regularly participating in basketball training during the research period; (c) being at least 2 years of training experience; (d) regularly participate in plyometric and jump rope training programs. Exclusion criteria from the study were (a) having any musculoskeletal injury or surgery in the last six months; (b) not participating in basketball training more than once; (c) not participating in plyometric and jump rope training more than once. The participants were instructed before the research and written informed consent was taken from their parents. The study was performed according to the World Medical Association Declaration of Helsinki and approved by the Ethics Commission of Gazi University (with the ethical approval number 317225).

3.2. Study Design

Players regularly participated in 90 minutes of basketball technical training three days a week. In addition to basketball training, the participants were regularly recruited to plyometric and jump rope training in 10 units (2 units in the first 2-weeks, 3 units in the last 2-weeks) for 4-weeks (Table 1). Plyometric and jump rope training were applied after the warm-up (including 10 minutes self-selected warm-up protocol following by 10 minutes dynamic & static stretching), and then the athletes continued their routine basketball technical training.

3.3. Data Collection

Measurements were divided into two categories as body profile and athletic performance. Somatotype measurements were taken according to the Heath & Carter method (20). Body composition data were obtained with the bioimpedance analyzer (Tanita BS-418, Tanita

Corp., Tokyo, Japan). 30 sec push-up & sit-up test, 20 meter sprint test, Illinois agility test, hexagon agility test, vertical jump, squat jump, horizontal jump, and plyometric jump were applied for athletic performance measurements. Players participated in four measurement days with one day apart. The order and contents of the measurement sessions were as follows: Body profile measurements on the first day, push-up, sit-up, sprint tests on the second day, agility test, horizontal and vertical jumps on the third day, squat & plyometric jumps and hexagon test on the last day. Full rest was given between test protocols during each session. All measurements were taken at the evening training sessions (between 17:00 - 19:00). Before each test, the participants were given familiarization, which included one trial repetition.

Table 1. Training Program

	Rep			Set
	R	L	Both	
Plyometric				
Single leg forward jump	10	10	-	1
Double leg forward jump	-	-	10	2
Single leg side jump	10	10	-	1
Double leg side jump	10	10	-	1
Single leg hurdle jump	6	6	-	1
Double leg hurdle jump	-	-	10 [a]	1
Total	36	36	30	
Jump rope				
Basic bounce step	-	-	100	1
Double basic step	-	-	100	1
Alternate foot step	-	-	100	1
Scissors step	-	-	100	1
Side straddle	-	-	100	1
Single leg step	50	50	-	1
Total	50	50	500	

Abbreviations: R, right; L, left.
[a] In this drill, 6 jumps were performed over 6 obstacles with 30 cm height and 60 cm distance between obstacles, and the number of repetitions of the athlete who completed the 6 obstacles was counted as 1.

3.4. Body Profile

The body height was measured standing up with a stadiometer (SECA 217, Seca Ltd, Vogel & Halke, Hamburg, Germany) which has a scale that displays measurements in millimetres. The body mass, body mass index (BMI), body fat (%), and fat mass were measured via a bioimpedance analyzer (Tanita BS-418, Tanita Corp., Tokyo, Japan) with a sensitivity of 0.1 kg which is a valid instrument ($r = 0.81$, $P < 0.05$) (21) to determine the body composition. Somatotype (endomorphy, mesomorphy and ectomorphy) was determined using the procedures described by Heath & Carter (20) and ten required measurements were used: Body mass, height, four skinfold measurements (triceps, subscapular, suprailiac, and medial calf), two girths measurements (flexed arm and calf), and biepicondylar breadths of humerus and femur.

3.5. Athletic Performance Test

30 second push-up test: Participants were positioned in the prone position with their hands shoulder-width apart and their entire lower body weight on their toes. Test started in the downward position to achieve correct hand placement and then the starting position was taken with the head, shoulders, back, hip, knees and feet in a straight line without flexing the elbows. Maximum push-up performance within 30 seconds was requested from the participants. The test was applied once. The number of repetitions after the test was recorded. The number of repetitions where the elbows were not 90 degrees in the downward position and the elbows were not straight in the upward position was not recorded.

30 seconds sit-up test: Participants lie on their backs with their shoulders and head straight. The starting position was taken with the knees bent at 45 degrees and the hips at 90 degrees, with the soles of the feet on the floor and arms crossed at chest. The participants were asked to perform as many sit-up repetitions as possible within 30 seconds and the number of repetitions was recorded. The test was applied once. The number of repetitions after the test was recorded. During the test, repetitions were not recorded as proper repetition when the athlete (a) raised his feet, (b) did not raise his trunk completely during the pull, and (c) did not return to the starting position each time.

20 m sprint test: Before the test, the start and finish lines were determined and photocell device were placed (Newtest Power Timer, 2000, Finland). The athletes were asked to complete the 20 m distance at their maximum

running speed. Participants were informed before the test that they should start the run by standing at the starting line and not slow down until they cross the finish line. Three attempts were given and the best scores were recorded in seconds.

Illinois Agility Test: Illinois agility test was used via photocell (Newtest Power Timer, 2000, Finland) to measure agility. Two cones at start and finish, photocell placed at start and end, and two other cones at turning point. The remaining 4 cones were placed in the middle at 3.3 m intervals in a 10 m long and 5 m wide area. Before the test, the test directions were introduced to the participants both verbally and visually. The participant started the test lying face down on the ground behind the starting line and completed the test at maximum speed with the start command. Three trials were performed and the best scores were recorded in seconds.

Hexagon agility test: A hexagon with side lengths of 60 cm and interior angles of 120° was drawn using tape on the floor, and the middle of the hexagon was marked to determine the starting position. Each side of the hexagon is numbered from 1 to 6 in a clockwise direction. At the start of the test, the participant stood barefoot on the middle strip of tape. With the "go" command, they jumped across the 1st side of the hexagon and then returned from the same line to the middle of the hexagon. While maintaining a forward-facing position with both feet landing on the ground, the participant jumped to the numbered sides one after the other and jumped back in. Each participant was asked to complete 3 full laps clockwise. The total time was recorded in seconds using a stopwatch. The test was performed twice and the best score was noted.

Vertical jump test: The participants started to vertical jump test from an upright standing position, performing preliminary downward movement with flexed knees and hips, then immediately extending knees and hips again to jump vertically up off the ground. Each participant performed three vertical jump with the instruction to jump as high as possible. The measurements completed via Optojump system (Optojump, Microgate, Bolzano, Italy). Three minutes passive rest were given between the trials. The best scores were recorded in centimetres.

Squat jump test: In the squat jump test, participants were asked to stand, bending their knees approximately 90 degrees for three seconds without using a preliminary countermovement. Each participant performed three squat jump with the instruction to jump as high as possible. The measurements completed via Optojump system (Optojump, Microgate, Bolzano, Italy). Three minutes passive rest were given between the trials. The best scores were recorded in centimetres.

Standing long jump test: Participants were asked to stand still in a designated area behind the starting line. However, for measurement, free arms and double feet were asked to jump forward. Before the test, they were informed about standing still without losing their balance after jumping. The distance between the starting line and the heel of the athletes standing still after jumping was determined in centimetres, to the nearest 1 cm, using a tape measure. Players were given three attempts and best score was recorded.

Plyometric jump test: Participants were asked to perform 3 jumps from one leg to the other while standing in the starting position on a hard surface. After the final jump was completed, both feet were asked to land on the ground at the same time. The jump length was measured from the line to the point where the heel closest to the starting line landed and recorded in centimetres, to the nearest 1 cm, using a tape measure. Each participant performed three plyometric jump and best score was recorded. The steps of this test are almost the same as those used in the triple jump in athletics. The only difference is that the athlete starts jumping in a standing position instead of a speed-up run.

3.6. Data Analysis

Data analysis was performed by using the Sigma Plot version 11.0 (from Systat Software, Inc., San Jose, California, USA) software. Descriptive statistics were reported in body profile and athletic performance categories for each training groups. Data were presented as mean (standard deviation), mean difference, confidence intervals of mean difference ($95\%CI_{diff}$). Shapiro Wilk test was used to determine normality of the data distribution. Mann-Whitney U test for intergroup comparison and paired-sample *t*-test was used for intragroup comparison. $95\%CI_{diff}$ were calculated and presented in findings with significant difference. The effect sizes (ES) were classified using the Cohen's d (22) according to following scale: As trivial < 0.2, small 0.2 - 0.5, moderate 0.5 - 0.8, and large > 0.8. Significance level was set at 5%.

4. Results

The body mass and endomorphy score were found significantly increased (P = 0.001, "moderate" ES = 0.06; P = 0.010, "small" ES = 0.31, respectively), while ectomorphy score was significantly decreased (P = 0.041, "large" ES = 0.79) in the plyometric training group at the end of four-weeks in this study. The body mass index, quadriceps circumference, endomorphy score showed significantly increase (P = 0.032, "small" ES = 0.46, P = 0.049, "small" ES = 0.33, P = 0.005, "moderate" ES = 0.67, respectively) while mesomorphy score was significantly decrease (P = 0.010, "small" ES = 0.24) in the jump rope training group after four-weeks training intervention (Table 2). In addition, pre-tests between groups and post-tests between groups (intergroup comparison) were not significantly different in body profile parameters.

The percentage change of the data with a significant difference between the pre-test and post-tests (intragroup comparison) in the body profile was as follows: 1.4% in body mass, 15.3% in endomorphy score, 3.4% in ectomorphy score for plyometric training group; 11.5% in BMI, 28.2% in endomorphy score, 5.3% in mesomorphy score, 3.5% in quadriceps circumference for jump rope training group (Figure 1).

Short-term plyometric and jump rope training significantly increased the push-up (P = 0.049, "moderate" ES = 0.59 vs P < 0.001, "large" ES = 1.33, respectively), sit-up (P = 0.020, "large" ES = 1.52 vs. P < 0.001, "large" ES = 1.83), squat jump (P = 0.010, "small" ES = 0.32 vs. P = 0.003, "moderate" ES =0.68) and horizontal jump (P = 0.028, "small" ES = 0.38 vs. P = 0.014, "small" ES = 0.34) of the participants. In addition, it was determined that jump rope training significantly increased plyometric jump (P = 0.007, "small" ES = 0.47) and hexagon agility performance (P = 0.001, "large" ES = 1.32) (Table 3). In addition, pre-tests between groups and post-tests between groups (intergroup comparison) were not significantly different in athletic performance parameters.

The percentage change of the data with a significant difference between the pre-test and post-tests (intragroup comparison) in the athletic performance was as follows: 28.3% in push-up, 27.7% in sit-up, 7.4% in squat jump, 5.2% in standing long jump for plyometric group; 46.4% in push-up, 20.9% in sit-up, 13.4% in squat jump, 2.7% in standing long jump, 4.6% in plyometric jump, 13.7% in hexagon agility for jump rope training group (Figure 2).

5. Discussion

In this study, we aimed to examine the effects of short-term plyometric and jump rope training on body profile and athletic performance in adolescent basketball players. The research problem was to determine which of these two training programs had a larger effect size on body profile and athletic performance. The study results indicate that short-term plyometric and jump rope training significantly affected of the body profile and athletic performance in adolescent basketball players. However, as a result of short-term training intervention, jump rope training was found to have a larger effect size and greater athletic performance gain compared to plyometric training in this study.

The body composition and athletic performance are undoubtedly important characteristics in addition to technical-tactical skills in basketball. The previous studies have contradiction about the effects of plyometric and jump rope training on body profile. In a study, it was reported that although there was a decrease in body mass and body fat between the pre-test and post-test as a result of plyometric training performed on two different surfaces (sand vs wooden), this was not a significant difference (23). The findings of a significant decrease in body fat after twelve-weeks jump rope training in obese adolescent girls (24), a significant decrease in BMI after eight-weeks jump rope training in 12 - 16 years school children (25), a significant increase in body height with an insignificant decrease in body mass after eight-weeks jump rope training in young basketball players (26) do not coincide with our research results. On the other hand, in a study supporting our findings (27), an increase was observed in body mass, body height, and fat mass in pubertal basketball players after nine-weeks plyometric training. However, in this study, only the effect of plyometric training was examined and a comparison was not conducted with another training method. Another similar finding was the significant increase in the body height and body mass in adolescent basketball players after four-months basketball training (28). In our study, after four-weeks short-term training, there was an increase in body height, body mass, BMI, body fat and fat mass in both groups, but the increase in body mass in the plyometric training group and BMI in the jump rope training group were found to be significant. Whether this quantitative increase is due to the fact that our research performed in a special growth and development period, such as adolescence, or whether it was due to a short-term intervention is another situation that should be investigated.

In our study, a significant increase in endomorphy and a significant decrease in ectomorphy score in the plyometric training group, a significant increase in endomorphy score and a significant decrease in mesomorphy score in the jump rope training group were determined at the end of four weeks training. Although the plyometric training group was balanced mesomorph and the jump rope group had ectomorphic mesomorphy somatotype, the above-mentioned significant differences did not change the total somatotype score of the groups after four weeks training. To the best of authors' knowledge, no study has been found that investigated the effects of plyometric or jump rope training on somatotype in basketball players. As descriptive data, the somatotype of adolescent basketball players was found to be endomorphy-mesomorphy (somototype score = 5-5-2) (29) in a study and mesomorphy-ectomorphy (somatotype score = 3-4-4) (30)

Table 2. Short-term Plyometric and Jump Rope Training Effect on Body Profile in Adolescent Basketball Players [a, b]

	Plyometric					Jump Rope				
	Pre	Post	Mean Diff	$95\%CI_{diff}$	P	Pre	Post	Mean Diff	$95\%CI_{diff}$	P
Body height (cm)	175.3 ± 10.2	175.7 ± 10.2	0.4	-8.7, 9.5	0.118	177.8 ± 8.5	178.0 ± 8.7	0.2	-7.5, 7.9	0.374
Body mass (kg)	67.4 ± 16.3	68.4 ± 15.9	1.0	-13.3, 15,3	0.001	67.0 ± 12.3	67.8 ± 12.4	0.8	-10.2, 11.8	0.061
BMI (kg/m^2)	21.8 ± 3.7	21.9 ± 3.5	0.1	-3.1, 3.3	0.060	19.1 ± 6.1	21.3 ± 2.8	2.2	-2.6, 6.4	0.032
Body fat (%)	18.1 ± 5.3	18.6 ± 4.7	0.5	-3.9, 4.9	0.300	16.8 ± 4.2	17.3 ± 3.8	0.5	-3.1, 4.1	0.267
Fat mass (kg)	12.7 ± 6.9	13.2 ± 6.7	0.5	-5.5, 6.5	0.150	11.7 ± 5.0	12.1 ± 4.7	0.4	-3.9, 4.7	0.264
Endomorphy (a.u.)	2.94 ± 1.55	3.39 ± 1.35	0.45	-0.84, 1.74	0.010	2.59 ± 0.89	3.32 ± 1.26	0.73	-0.24, 1.70	0.005
Mesomorphy (a.u.)	5.52 ± 1.22	5.55 ± 1.32	0.03	-1.10, 1.16	0.792	5.24 ± 1.15	4.96 ± 1.15	0.28	-0.75, 1.30	0.010
Ectomorphy (a.u.)	3.22 ± 1.43	3.11 ± 1.37	0.11	-1.14, 1.36	0.041	3.62 ± 1.27	3.53 ± 1.26	0.09	-1.04, 1.22	0.158
Calf C. (cm)	35.8 ± 3.0	35.4 ± 2.8	0.4	-1.7, 2.5	0.102	36.1 ± 3.0	35.9 ± 3.0	0.2	-2.5, 2.9	0.355
Quadriceps C. (cm)	50.1 ± 5.5	50.9 ± 3.9	0.8	-3.4, 5.0	0.102	49.1 ± 4.9	50.8 ± 5.4	1.7	-2.9, 6.3	0.049

Abbreviations: Mean diff, difference between means; $95\%CI_{diff}$, 95% confidence interval of mean diff; BMI, body mass index; a. u., arbitrary unit; C., circumference.

[a] Values are expressed as mean ± SD.

[b] $P < 0.05$.

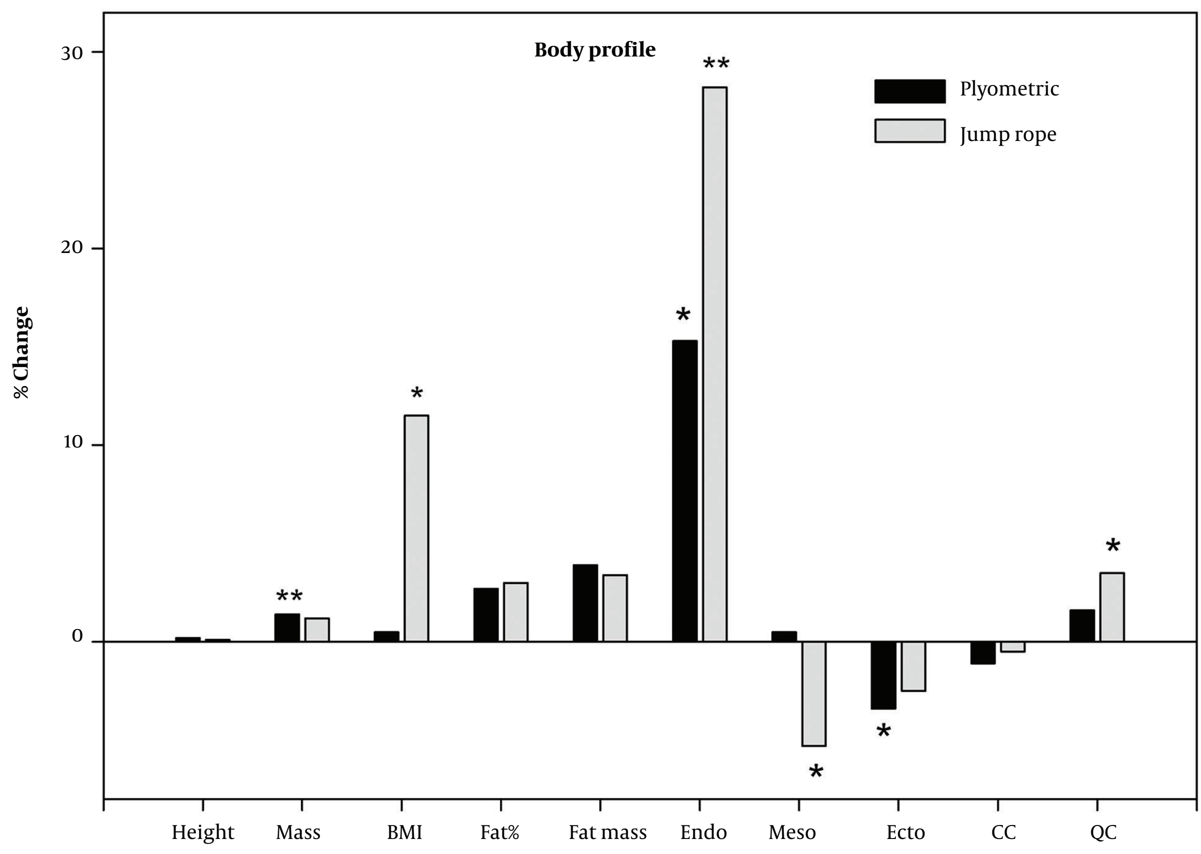

Figure 1. Change percentage of the short-term plyometric and jump rope training effect on body profile in adolescent basketball players. BMI, body mass index; endo, endomorphy score; meso, mesomorphy score; ecto, ectomorphy score; CC, calf circumference; QC, quadriceps circumference. *: $P < 0.05$ and **: $P < 0.01$ for intragroup comparison (pre vs post-test).

Table 3. Short-term Plyometric and Jump Rope Training Effect on Athletic Performance in Adolescent Basketball Players [a, b]

	Plyometric					Jump Rope				
	Pre	**Post**	**MD**	**$95\%CI_{diff}$**	**P**	**Pre**	**Post**	**MD**	**$95\%CI_{diff}$**	**P**
Push-up test (rep)	18.4 ± 8.7	23.6 ± 9.0	5.2	-2.7, 13.1	0.049	19.6 ± 6.7	28.7 ± 6.9	9.1	3.1, 15.2	< 0.001
Sit-up test (rep)	15.9 ± 2.0	20.3 ± 3.6	4.4	1.81, 6.99	0.020	17.2 ± 1.7	20.8 ± 2.2	3.6	1.9, 5.3	< 0.001
20 m sprint (sec)	3.54 ± 0.20	3.59 ± 0.27	0.05	-0.16, 0.26	0.323	3.42 ± 0.21	3.49 ± 0.22	0.07	-0.12, 0.26	0.083
Agility (sec)	17.77 ± 1.25	17.74 ± 1.50	-0.03	-1.19, 1,26	0.852	17.15 ± 0.69	17.24 ± 0.88	0.09	-0.61, 0.79	0.999
Hexagon agility (sec)	12.91 ± 1.35	12.35 ± 1.77	-0.56	-0.84, 1.96	0.256	13.13 ± 1.25	11.33 ± 1.46	-1.8	0.59, 3.01	0.001
Vertical jump (cm)	41.9 ± 8.0	42.5 ± 8.8	0.6	-6.88, 8.08	0.543	42.6 ± 8.1	42.8 ± 5.0	0.2	-5.8, 6.2	0.926
Squat jump (cm)	35.9 ± 8.4	38.6 ± 8.2	2.69	-4.7, 10.1	0.010	35.2 ± 7.7	39.9 ± 6.1	4.7	-1.5, 10.9	0.003
SLJ (cm)	196.0 ± 24.7	206.3 ± 29.9	10.3	-14.1, 34.7	0.028	202.6 ± 18.1	208.0 ± 13.5	5.4	-8.8, 19.6	0.014
Plyometric jump (cm)	561.3 ± 53.4	561.9 ± 51.6	0.6	-46.1, 47.3	0.928	561.8 ± 55.4	587.5 ± 52.8	25.7	-22.4, 73.8	0.007

Abbreviations: MD, difference between means; $95\%CI_{diff}$, 95% confidence interval of mean diff; SLJ, standing long jump.
[a] Values are expressed as mean ± SD.
[b] $P < 0.05$.

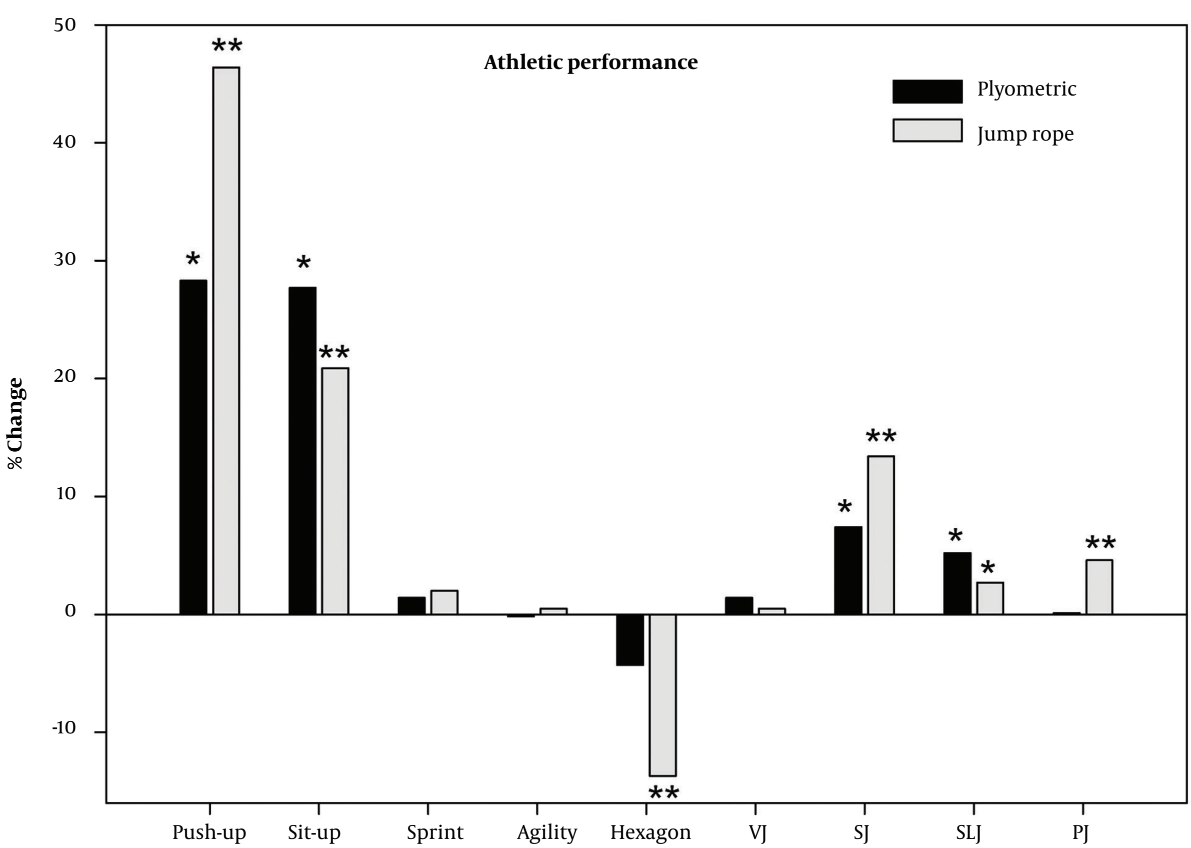

Figure 2. Change percentage of the short-term plyometric and jump rope training effect on athletic performance in adolescent basketball players. VJ, vertical jump; SJ, squat jump; SLJ, standing long jump; PJ, plyometric jump. *: $P < 0.05$ and **: $P < 0.01$ for intragroup comparison (pre vs post-test).

in another study. In our research, we predict that a short-term training application such as four-weeks is the reason why it does not make a difference in somatotype. Although it has been reported that trunk and leg muscle mass increased and body fat decreased significantly after plyometric training (31), in our study, an insignificant decrease in calf circumference and an increase in quadriceps circumference were obtained in both training groups. This increase in quadriceps circumference was significant only in the jump rope training group. This significant difference achieved in a short time is a remarkable and important finding.

In the literature, no study has been found that the effect of plyometric and jump rope training on the push-up or sit-up test in adolescent basketball players was examined. However, in our study, it was determined that four-weeks plyometric and jump rope training significantly increased the push-up and sit-up performance of the basketball players. The reason for this significant increase is thought to be the effect of arm swings and technical training applied during the training drills.

Previous research has shown that plyometric or jump rope training significantly improves athletic performance. Four to nine-weeks plyometric training in adolescent and young basketball players have been reported to significantly increase in jump (23, 27, 32), sprint and agility performance (19, 23, 32). In addition, jump rope training combined with plyometric for twelve-weeks has been found to significantly increase jump and sprint performance in adolescent volleyball players (33). While it was determined that eight-weeks jump rope training increased hexagon agility performance by 5% in young basketball players (26), the performance increase in the jump rope group in our study was 13.7% and this increase was found to be significant. In our study, while there was no significant difference in both groups in the Illinois agility test, it is thought that the significant difference in hexagon agility in the jump rope group was due to the difference in test contents. The hexagon test requires quick movements in a narrow space - one step distance - and this may have led to a statistical difference. This difference, which occurs only in the agility of the jump rope group, is also remarkable. In addition to these findings, the sprint performance of short-term plyometric and jump rope training in adolescent basketball players was not statistically significant between pre & post-tests in our study. Our four-weeks intervention did not create a significant difference in sprint performance. This can be explained by the fact that it has improved over the years even in elite athletes (34).

In this current study, it was determined that four-weeks plyometric and jump rope training significantly increased the squat and horizontal jumps of the players, and in addition, jump rope training significantly increased the plyometric jumps. After six-weeks plyometric training, a significant increase of 11.3% in vertical jump and 15.4% in squat jump was found in basketball players (35). In another study, although there was a significant increase (4.8 - 5.6 cm) in vertical jump (36), the authors stated that a short-term in-season plyometric training program added to regular basketball training was effective in improving muscle strength measurements. In addition, no remarkable finding was found regarding the effect of jumping rope training on jump height. At the end of our study, it is possible to say that short-term jump rope training in addition to basketball training also improves jumping performance. The number of participants (sample size) is the limitation of our research. However, since we applied training intervention in addition to basketball training for four weeks, we aimed to create a sample group from the players in the same team in order not to differentiate the possible effects of basketball training.

5.1. Conclusions

In conclusion, it has been determined that short-term plyometric and jump rope training affect the body profile and athletic performance of the adolescent basketball players, but it has been determined that jump rope training is more effective on athletic performance than plyometric training. It can be recommended that coaches or athletic performance trainers who want to gain more performance in a short-term, especially during adolescence, should prefer jump rope training.

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Footnotes

Authors' Contribution: Study concept and design: C.O. C., E. O. and E. C.; acquisition of data: C.O. C. and E. C.; analysis and interpretation of data: E. O. and E. C.; drafting of the manuscript: C.O. C., E. O. and E. C.; critical revision of the manuscript for important intellectual content: C.O. C., E. O. and E. C.; statistical analysis: C.O. C., E. O. and E. C.; administrative, technical, and material support: C.O. C., E. O. and E. C.; study supervision: C.O. C., E. O. and E. C.

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