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The Effect of Plyometric Training on Some Motoric and Technical Parameters in 13-15 Age Soccer Players

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Abstract

The aim of this study was to examine the effect of regular plyometric training on some motoric and technical parameters of young soccer players in addition to regular soccer training. A total of 25 male volunteers (13 training group, 12 control group) aged between 13-15 studying at Konyaspor Infrastructure Soccer School participated in the study. The training group followed an 8-weeks, 2 days a week and 30 minutes plyometric training program in addition to the regular soccer training. The control group players continued their normal soccer training. In order to determine some motoric and technical characteristics of the players body weight of all participants were recorded before and after the study. Also vertical jump, standing long jump, T agility test, 20 meter sprint, speed dripling test, and Mor-Christian shot ability test measurements were taken. SPSS 22.0 IBM statistical package program was used to evaluate the data obtained within the scope of the research. In order to determine the difference between the groups, t test was used in independent groups and paired sample t test was used to compare the pre-test and post-test values. According to the research findings when the pre-test and post-test values of the training and control groups were compared, only a significant difference was observed in the dribbling values at the beginning of the study, but at the end of 8 weeks there was a statistically significant difference in agility, shot and dribbling values in favor of the training group ($p < 0.05$). In addition, it was found that there was a statistically significant difference between the pre-test and post-test values of all the parameters of the players who participated in the training group ($p < 0.05$), but there was no statistically significant difference in the control group ($p > 0.05$). As a result, it can be said that plyometric exercise applied in addition to regular soccer training has positive effect on some motoric and technical characteristics of 13-15 age soccer players.

Keywords: Soccer, Strength, Plyometric Training,

13-15 Yaş Futbolcularda Pliometrik Antrenmanların Bazı Motorik ve Teknik Parametreler Üzerine Etkisi

Özet

Bu çalışmanın amacı düzenli olarak uygulanan futbol antrenmanlarına ek olarak sekiz hafta süreyle yapılan pliometrik antrenmanların genç futbolcuların bazı motorik ve teknik parametreleri üzerine etkisinin incelenmesidir. Araştırmaya, Konyaspor Altyapı Futbol Okulu'nda eğitim gören, yaşları 13-15 arasında değişen toplam 25 gönüllü erkek (13 antrenman, 12 kontrol) futbolcu katılmıştır. Antrenman grubunu oluşturan sporculara düzenli olarak uygulanan futbol antrenmanlarının yanı sıra 8 hafta, haftada 2 gün ve 30 dakika pliometrik antrenman programı uygulanmıştır. Kontrol grubunu oluşturan sporcular ise normal futbol antrenmanlarına devam etmişlerdir. Sporcuların performansla ilgili bazı motorik ve teknik özelliklerini belirlemek amacıyla tüm katılımcıların çalışma öncesi ve sonrası vücut ağırlığı belirlenmiş ayrıca dikey sıçrama, durarak uzun atlama, T çeviklik testi, 20 metre sürat, sürat dripling testi ve Mor- Christian şut yetenek test ölçümleri alınmıştır. Araştırma kapsamında elde edilen verilerin değerlendirilmesinde, SPSS 22.0 IBM istatistik paket programı kullanılmıştır. Gruplar arasındaki farklılığı belirlemek için bağımsız gruplarda t testi, ön test ve son test değerlerinin karşılaştırılmasında ise bağımlı gruplarda t testi kullanılmıştır. Verilerin ortalama ve standart sapmaları verilmiş ve araştırmada anlamlılık düzeyi $p < 0,05$ olarak kabul edilmiştir. Araştırma bulgularına göre antrenman ve kontrol grupları ön test-son test değerleri karşılaştırıldığında, çalışma başlangıcında sadece dripling değerlerinde anlamlı bir fark görülürken, 8 hafta sonunda çeviklik, şut ve dripling değerlerinde antrenman grubunun lehine istatistiksel olarak anlamlı bir farklılık olduğu tespit edilmiştir ($p<0,05$). Ayrıca antrenman grubuna katılan sporcuların tüm parametrelerinin ön test-son test değerleri arasında istatistiksel olarak anlamlı bir farklılık olduğu tespit edilirken ($p<0,05$), kontrol grubunda istatistiksel olarak anlamlı bir farklılık olmadığı belirlenmiştir ($p>0,05$). Sonuç olarak düzenli futbol antrenmanlarına ek olarak uygulanan pliometrik antrenmanların futbolcuların bazı motorik ve teknik özelliklerine olumlu etkisinin olduğu söylenebilir.

Anahtar Kelimeler: Futbol, Kuvvet, Pliometrik Antrenman.

INTRODUCTION

Today, one of the most important phenomena is sports activities. Soccer, with the largest number of supporters and participants, is the most popular one of the sports events. (1,12). In order for athletes to achieve a successful performance in all branches, their physiological and physical characteristics must be suitable for the sports branch they do. Therefore, the main goal of every player and coach is to increase performance (76). Physical structure is positively affected when speed, strength, flexibility, resistance and power are combined with performance variables (1, 6).

The achievement of high levels of sportive performance in soccer and the best display of technical skills specific to soccer depend on the bio-motor characteristics of soccer players. (32). In order to increase the performance of athletes to the next level, it is recommended that motoric features should be developed with appropriate training programs (18). Soccer is handled with an intermittent activity profile with metabolic contributions from both aerobic and anaerobic systems (52). In the soccer, improving performance has an important place since athletes must perform activities such as slowing down, acceleration and change direction very rapidly by using short recovery times while cover distances of 10-13 km during the match (17, 40, 59, 75).

Some training models are applied to improve performance (15, 67). The plyometric training model is one of them (57). When it comes to plyometric model, it comes to mind as a tool that enables the nerve-muscular system to start generating power as soon as possible and to create a tight bridge between speed and power by improving this ability (37). In this method, in which jumping and throwing methods are used to improve sportive performance, it is aimed to increase the explosive power at the end of fast eccentric contraction. The plyometric training method consists of a series of explosive movements to bring the muscles to the highest level in the shortest time (12).

It has been reported that plyometric studies will be beneficial especially in sports branches such as soccer, volleyball, handball, and basketball, where explosive force is a priority (41). This training model, which has an important place among the training programs of young soccer players, is seen as a training model that allows the gradual use of effective, fun, and resistant loads that are important for the development of some motoric properties required for the soccer. Moreover, plyometric training is a method in which many different movements are performed without the need for expensive equipment and a large field. (9,10, 14, 23, 73). It is known that using plyometric training to improve sprint performance and strength is important for development (13, 24, 72). Plyometric training is reported to improve and enhance people's neuromuscular functions, as well as increase strength to perform the next movement by using their natural elastic components to stretch and reflex (37, 38). Plyometric training is also seen as a method that allows soccer players to improve in technically (60, 63, 71). In this context, it is important to provide training for the physical structure, technical and tactical skills of the athlete, starting with the children in the infrastructure teams. In the literature, there are studies reporting that plyometric studies applied in soccer, where explosive force is a priority, positively affect the performances of athletes both technically and motorically (20, 39, 50, 51). However, contrary to these studies, there are studies showing that plyometric training does not affect the performance of soccer players (33, 35).

The aim of this study is to determine the effect of plyometric training applied together with soccer training for eight weeks on some motoric and technical parameters of young soccer players and to provide guidance to trainers and athletes for training planning.

MATERIAL AND METHOD

A total of 25 male soccer players, aged 13-15, being trained at Konyaspor Youth Soccer School voluntarily participated in the study. Athletes are composed of participants who have been continuing their football training for 1 year. Participants were divided into 2 groups; training group (n:13) and control group (n:12). Groups were randomly designed. In addition to the regular soccer trainings applied to the athletes who make up the training group. A 30-minute plyometric training program was applied for 8 weeks, 2 days a week. The athletes in the control group continued their normal soccer training.

Ethical and Legal Format of Research: Before the study, the purpose of the study and the tests to be applied were explained in detail to all participants, and the necessary permission was obtained from the Konyaspor Soccer School Coordinatorship before the study. Moreover, participants related to the study were asked to fill in a written voluntary participation form. Necessary permission was obtained from the

families of the participants. For this study, the approval of Selcuk University Faculty of Sport Sciences Non-Interventional Clinical Research Ethics Committee was obtained. (Date-14/01/2019, Number of Decisions-08).

Applied Measurements and Tests: In calculating the age of the athletes, the birth dates were taken as years. The height (m) and body weight (kg) of the participants were determined using a scale with height measure. In order to determine some motor and technical characteristics related to performance, vertical jump test was applied to all participants before and after the study to determine the vertical jump strength, and their anaerobic power was determined by calculating in kg-m/sec using the Lewis formula (21). The standing long jump test (27) to determine jump distances, the 20-meter running test (3) to determine the sprint speed, and the agility T test to measure their agility were applied (47, 53). Moreover, a speed dribbling test station was prepared to determine the athletes' ability to coordination with the ball against time and their durations were recorded with a stopwatch (8). In addition, the Mor-Christian shooting test was applied to measure the shoot-through rate of soccer players and the successful ones were recorded by scoring according to the shots hit (69). The obtained values are presented in tables and compared. The trainings and measurements in our study were carried out at the Konyaspor Youth Soccer School field. The soccer players were informed about the tests and they were allowed to practice. Each test was administered to all participants twice with full rest, and the best time was recorded.

Plyometric Training Program: Along with the regular soccer training sessions applied to the participants in the training group, a plyometric training program consisting of the following movements, 2 days and 30 minutes a week, was applied for 8 weeks (Table 1). The training program was applied with a 1-2 minute rest interval and a single set. The control group continued their normal soccer trainings.

Table.1: 8-week plyometric training program applied to the training group

Weeks	Exercise Type	Repeatition
1. Week	Double Foot Jump (Jumping without using the arms)	10
	Double Foot Jump (Jump using arms)	10
	One Leg Side Jump	10
	Side Jump Over Obstacle	10
	Box Drill With Hoop	10
2. Week	Side Jump Over Obstacle	15
	Box Drill With Hoop	15
	Cross The Hoop With The Right Leg	10
	Cross The Hoop With The Left Leg	10
	Horizontal Jump With Right Leg	10
3. Week	Cross The Hoop With The Right Leg	15
	Cross The Hoop With The Left Leg	15
	Horizontal Jumping with Right Leg	15
	Horizontal Jumping with Left Leg	10
	Side Jump With Hoop	10
4. Week	Horizontal Jumping with Left Leg	15
	Side Jump With Hoop	15
	Change of direction with long jump	10
	Jumping Over the Cone Changing Direction with Sprint	10
	Cone Jumping with 180° Rotation	10
5. Week	Change of direction with long jump	15
	Jumping Over the Cone Changing Direction with Sprint	15
	Cone Jumping with 180° Rotation	15
	Hexagon Exercise	10
	Pushing the Body Up by Switching Feet	10
6. Week	Hexagon Exercise	15
	Pushing the Body Up by Switching Feet	15
	Barrier jump	10
	Depth Jump with One Leg	10
	Speed Jumping	10
7. Week	Jump Over The Barrier	15
	Depth Jump with One Leg	15
	Speed Jumping	15
	Depth Jump Between Barriers (Right foot)	10
	Depth Jump Between Barriers (Left foot)	10
8. Week	Depth Jump Between Barriers (Right foot)	15
	Depth Jump Between Barriers (Left foot)	15
	Depth Jump Between Barriers (Double Foot)	10
	Double Foot Jump (Jumping without using the arms)	15
	Double Foot Jump (Jump using arms)	15

Statistical Analysis

SPSS 22.0 IBM statistical package program was used to evaluate the collected data. T test was used in independent groups to detect the difference between groups and Paired Simple T test was used to compare pre-test and post-test values. The data were summarized by giving mean and standard deviations, and the level of significance in the study $p < 0.05$ was accepted.

RESULTS

The average age of the athletes in the training group was determined as 13.69 ± 0.85 years, the average height was 1.57 ± 0.08 m, the average age of the control group was 13.25 ± 0.45 years, the average height was 1.59 ± 0,07 m.

Table 2. Comparison of training and control groups pretest values for dependent variables

Variables	Groups	x̄± SD	t	95% CI	p	ES
Body weight (kg)	Training Group	49,01 ± 12,54	0,32	-0.91 - 0.65	0,75	0,12
	Control Group	47,75 ± 5,84				
Vertical Jump (cm)	Training Group	29,15 ± 5,22	0,01	-0.31 - 1.27	0,99	0.47
	Control Group	29,16 ± 7,96				
Anaerobic Power (kgm/ sec)	Training Group	592,54 ± 165,3	-0,21	-0.69 - 0.87	0,83	0.08
	Control Group	604,64 ± 109,5				
Horizontal Jump (cm)	Training Group	170,38 ± 22,03	0,77	-0.48 - 1.09	0,45	0.30
	Control Group	177,00 ± 21,03				
20 meters speed (sec)	Training Group	3,87 ± 0,26	0,88	-1.17 - 0.41	0,39	0.37
	Control Group	3,78 ± 0,21				
Agility (sec)	Training Group	11,99 ± 0,70	0,42	-0.63 - 0.94	0,68	0.15
	Control Group	12,10 ± 0,71				
Shoot (point)	Training Group	30,76 ± 20,06	0,64	-1.06 - 0.51	0,53	0.27
	Control Group	26,33 ± 13,80				
Dribbling (sec)	Training Group	30,48 ± 3,16	3,21	-2.14 - -0.42	0,00*	1.28
	Control Group	27,10 ± 1,89				

*: p<0,05, x̄: Mean, SD: Standard Deviation, CI: Confidence Interval, ES: Effect Size

In the comparison of training and control group pre-test values for the variables of body weight, vertical jump, anaerobic power, standing long jump, 20-meter speed, agility, and shooting of the athletes participating in the study, it was found that there was no statistically significant difference between the two groups (p > 0.05). On the other hand, only the dribbling variable of the training group was found to be statistically significantly higher than the control group (p <0.05) (Table 2)

Table 3. Comparison of the post-test values of the training and control groups regarding the dependent variables.

Variables	Groups	x̄± SD	t	95% CI	p	ES
Body weight (kg)	Training Group	49,06 ± 11,52	0,38	-0.93 - 0.63	0,71	0.15
	Control Group	47,67 ± 5,49				
Vertical Jump (cm)	Training Group	34,07 ± 7,73	0,14	-0.86 - 0.70	0,89	0.07
	Control Group	33,66 ± 6,67				
Anaerobic Power (kgm/sn)	Training Group	636,25 ± 189,23	0,35	-0.92 - 0.64	0,73	0.14
	Control Group	613,94 ± 119,33				
Horizontal Jump (cm)	Training Group	170,38 ± 22,03	0,05	-0.76 - 0.80	0,96	0.02
	Control Group	178,17 ± 21,54				
20 meters speed (sec)	Training Group	3,75 ± 0,26	0,20	-0.69 - 0.87	0,84	0.08
	Control Group	3,77 ± 0,20				
Agility (sec)	Training Group	11,41 ± 0,65	2,53	0.17 - 1.84	0,02*	1.00
	Control Group	12,11 ± 0,73				
Shoot (point)	Training Group	49,23 ± 16,74	3,54	-2.29 - -0.54	0,00*	1.41
	Control Group	28,00 ± 12,79				
Dribbling (sec)	Training Group	30,09 ± 3,22	2,85	-1.99 - -0.29	0,01*	1.14
	Control Group	27,07 ± 1,82				

*: p<0,05, x̄: Mean, SD: Standard Deviation, CI: Confidence Interval, ES: Effect Size

It was found that there was no statistically significant difference in the comparison of the training and control groups in the post-test values of the variables of body weight, anaerobic power, vertical jump, and

long jump with standing and 20 meters speed of the athletes participating in the study (p> 0.05). On the other hand, it was found that there was a statistically significant decrease in agility and dribbling post-test values in the training and control groups and a significant increase in the shooting test (p <0.05) (Table 3).

Table 4. Comparison of the pretest-posttest values of the dependent variables of the training group.

Variables	Training Group	$\bar{x}$ ± SD	t	95% CI	p	ES
Body weight (kg)	Pretest	49,01 ± 12,54	-0,13	-1,09-0,96	0,90	0,03
	Posttest	49,07 ± 11,52				
Vertical Jump (cm)	Pretest	29,15 ± 5,22	5,46	-6,15-2,15	0,00*	1,25
	Posttest	34,07 ± 7,73				
Anaerobic Power (kgm/sn)	Pretest	592,54 ± 165,29	-4,41	-65,3- -22,0	0,00*	1,22
	Posttest	636,25 ± 189,23				
Horizontal Jump (cm)	Pretest	170,38 ± 22,03	2,61	-13,4-1,20	0,02*	0,72
	Posttest	177,69 ± 22,03				
20 meters speed (sec)	Pretest	3,87 ± 0,26	2,73	0,02-0,22	0,02*	0,75
	Posttest	3,75 ± 0,26				
Agility (sec)	Pretest	11,99 ± 0,70	5,08	0,33-0,82	0,00*	1,40
	Posttest	11,41 ± 0,65				
Shoot (point)	Pretest	30,77 ± 20,05	3,47	29,4- -5,97	0,01*	0,91
	Posttest	49,23 ± 16,74				
Dribbling (sec)	Pretest	30,48 ± 3,16	2,55	0,02-0,70	0,03*	0,64
	Posttest	30,09 ± 3,23				

*: p<0,05, $\bar{x}$: Mean, SD: Standard Deviation, CI: Confidence Interval, ES: Effect Size

A statistically significant difference was found between the pre-test values and the post-test values in all parameters studied, except weight (p <0.05) (Table 4).

Table 5. Comparison of the pretest-posttest values of the dependent variables of the control group.

Variables	Control Group	$\bar{x}$± SD	t	95% CI	p	ES
Body weight (kg)	Pretest	47,75 ± 5,84	0,42	-031-046	0,68	0,12
	Posttest	47,67 ± 5,49				
Vertical Jump (cm)	Pretest	29,16 ± 7,96	2,03	-2,60- 0,43	0,07	0,45
	Posttest	33,66 ± 6,66				
Anaerobic Power (kgm/ sec)	Pretest	604,64 ± 109,51	-1,91	-0,20- 1,42	0,08	0,55
	Posttest	613,94 ± 119,33				
Horizontal Jump (cm)	Pretest	177,00 ± 21,03	2,02	-2,27- -0,05	0,07	0,66
	Posttest	178,16 ± 21,53				
20 meters speed (sec)	Pretest	3,78 ± 0,21	2,02	-0,00- 0,04	0,07	0,63
	Posttest	3,76 ± 0,20				
Agility (sec)	Pretest	12,11 ± 0,71	0,08	-0,02- -0,02	0,94	0,02
	Posttest	12,11 ± 0,73				
Shoot (point)	Pretest	26,33 ± 13,80	1,45	-3,67- 2,00	0,18	0,18
	Posttest	28,00 ± 12,79				
Dribbling (sec)	Pretest	27,11 ± 1,89	0,36	-1,42 0,19	0,72	0,10
	Posttest	27,08 ± 1,82				

* p<0,05, $\bar{x}$: Mean, SD: Standard Deviation, CI: Confidence Interval, ES: Effect Size

When the pre-test and post-test values of the control group participating in the study were compared, it was determined that there was no statistically significant difference in all parameters studied (P> 0.05) (Table 5).

DISCUSSION AND CONCLUSION

In the study that we conducted, the effect of the regular eight-week plyometric training program applied on some motoric and technical parameters of 13-15 year old soccer players was examined and in all parameters of the training group (vertical jump, standing long jump, anaerobic power, 20

meters speed, agility, shooting and dribbling) It was observed that there was a statistically significant difference in the post-test values compared to the pre-test values ($p < 0.05$) (Table 4), while there was no significant difference in the control group ($p > 0.05$) (Table 5).

When the results of the study were evaluated, there was no statistically significant difference in the body weight of the training and control groups. The reason for this can be said that the training method we use is not a training aimed to change body weight. Literature research conducted support our study (36, 48, 63).

With regular training, increases occur in the physical and physiological parameters of athletes (28, 70). It has been reported that in the soccer branch where explosive force is a priority, plyometric studies have been reported to positively affect the performances of athletes by improving their motoric characteristics such as jumping and explosive force (39, 40, 50, 51, 59).

Determining the vertical jump distance is extremely important in improving the explosive performance of athletes (5). In our study, when the pre-test and post-test values of the training group were compared, it was observed that the vertical jump score post-test values increased compared to the pre-test values ($p < 0.05$). Although there was an increase in the control group, no statistically significant difference was found ($p > 0.05$). As a result of these results, it can be concluded that the plyometric training program performed in addition to the soccer training applied regularly at vertical jump distances is more effective than the soccer training applied alone. The vertical jump measurement results we obtained in our study support the studies presented in the literature. Kobal et al. (34) found a significant increase in the vertical jump performance of the subjects in their study titled "The effects of different strength and plyometric training combinations on the physical performance of elite young soccer players." In their study, Asadi et al. (4) examined the effects of maturation on jumping ability and sprint adaptation to plyometric training in young soccer players and observed that there was a significant change in the vertical jump performance of the subjects. Similar to the results of the above studies, it was reported in studies conducted in different age groups that a significant increase was found in the vertical jump value as a result of the plyometric training applied to soccer players (22, 44, 46, 54, 61, 62). Contrary to these studies, there are studies reporting that there is no significant change between the vertical jump distances before and after the applied training and do not show parallelism with our results (11, 19, 25, 56). Another finding of our study, a statistically positive increase was shown in the values of long jump by standing, thanks to the plyometric training applied in accordance with the results of the studies in the literature. In the studies conducted, positive results were obtained in the long jump performances of the athletes with the plyometric training applied to young soccer players for different durations (13, 66). Ramirez et al. (49) conducted a single-blind randomized controlled study in young soccer players to compare the effects of 7-week plyometric jump training on components, and in this study conducted in 3 groups of 38 people, they found significant improvements in their long jump performance.

Soccer is characterized by an intermittent activity profile with metabolic contributions from both aerobic and anaerobic systems. (52). Although the energy system used in soccer matches is generally aerobic energy system, it is known that the attacks made during the match take place in the anaerobic energy system and these movements are the determining element of the match. Many methods are used to determine the dominant anaerobic performance in high intensity muscle activities lasting between a few seconds or minutes, and vertical jump distance is used to determine short-term anaerobic power among these methods. (68). In this study, the anaerobic power of the athletes were calculated by using vertical jump distances. Brown et al. (16) stated that the average anaerobic power values of young people aged 15 years were between 49.4 and 60.4 kgm / sec. Ferley et al. (20) found that the anaerobic power values of the athletes showed a positive improvement in their study where they combined sprint interval, plyometric and strength training on 46 soccer players between the ages of 13-18 for 8 weeks. In another study, after plyometric training applied 3 days a week for eight weeks,

significant results were obtained in anaerobic power values in favor of the experimental group when the experimental and control groups were compared (26). In our study, it is observed that the anaerobic power values of young soccer players are compatible with the above literature data. While the arithmetic mean of anaerobic power values of the training group before training was 592.54 ± 165.3 kgm/sec, this value increased by 636.25 ± 189.23 kgm/sec after training and was found to be statistically significant ($p < 0.05$). While the pre-training value of the control group was 604.64 ± 109.52 kgm/s, this value was determined as 613.94 ± 119.33 kgm/s after training, and no statistically significant difference was observed ($p > 0.05$). Considering that anaerobic performance is an important feature in many sports, our results show that it is beneficial to include plyometric training in the training periodization of trainers who are interested in the strength and conditioning of young athletes (2).

Soccer players tend to run and change direction during the game. Speed performance is also necessary for this and has an important place for performance in soccer in terms of physical and technical skills (29). As a result of the study of the training group that participated in the plyometric training program we applied in this study, a positive improvement was observed in the 20-meter speed values compared to the pre-study ($p < 0.05$), while no significant difference was found in the control group ($p > 0.05$). Ronnestad et al (58) divided the players into three groups and applied only sprint training to the first group, and plyometric training to the second group with sprint training. The third group continued only with soccer training as the control group. As a result of the study, significant differences were determined in the speed values in both training groups compared to the control group, but no significant difference was found between training groups. Beato et al. (13) found significant improvements in sprint performances after 6 weeks of training in their research, in which they examined the effects of plyometric and directional training on speed and jumping performance in elite young soccer players. Contrary to these studies, there are studies reporting that 10 m and 20 m sprint distances do not create a significant change between the groups after plyometric study (33, 65). Considering the results of this study and the literature, it is concluded that in most of the studies, significant results were obtained in the sprint performance of the athletes in the plyometric training group, and that the plyometric trainings were better than classical training.

While the athletes are performing movements with or without the ball during the match, the athlete should be trained in agility and reaction time in order to do and develop it in the best way (7, 31). In this study, T agility test was applied before and after the exercise to determine the agility of the athletes. At the beginning of the study, it was determined that the agility values of all participants were similar to each other, but at the end of the study, there was a statistically significant difference in the agility post-test values between the training and control groups. As a result of the study, a positive improvement was observed in the agility scores in the pre-test and post-test comparison of the training group, while no significant difference was found in the control group. Renfro (55) In his study, which examined the effect of plyometric training on the agility performance of athletes, he found that after 8 weeks of training, there was an improvement in agility values compared to before training. Negra et al. (42) reported positive increases in the agility performances of athletes between groups in their study, in which they examined the effects of plyometric training on the physical fitness components of young male soccer players. Similarly, Sheikh and Hassan (64) evaluated the agility performance of the athletes, who were divided into 3 groups, aged between 18-22, consisting of 45 male volleyball players, and found that they showed positive increases among the groups.

The soccer has an important popularity for young people and children. In order for these children to be good athletes, it is recommended that their skills such as dribbling, passing and shooting should be developed within the trainer in accordance with a certain program (30, 45). In this study we conducted, dribbling, and shooting skills of all participants were measured. While a positive improvement was observed in the dribbling scores of the training group of our study, as in the other variables, in the comparison of pre-test and post-test, there was no statistically significant difference in the control group. Winarko (74), in a study he conducted on 40 soccer players, found that the plyometric training applied significantly increased the dribbling speed of the participants. In another study, Nurudin (43) states that in young soccer players aged 16-18 years, plyometric training increases the dribbling speed of the players and recommends that coaches use exercises such as box jumps to improve this

technical skill. In another study examining the effect of plyometric training on the technical actions of 26 pubertal soccer players during the season, a significant improvement was found in shooting performance (60). These studies presented in the literature indicate that plyometric applications have a positive effect on dribbling and shooting skills and are in parallel with the findings of the present study

The results we obtained in our study are generally compatible with the literature, although there are contrary opinions. The reason for the studies that are not in line with our results can be shown as the method of application, duration, intensity of the training, anthropometric characteristics and gender factors of the individuals who were trained. In line with all these results, it was determined that plyometric training applied in addition to soccer training positively affected some motoric and technical parameters of soccer players aged 13-15. In this context, it can be said that if plyometric studies are included in soccer training, it will be beneficial in the development of some performance values of the athletes.

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