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Effects of Plyometric Training on General Motor Skills of Football Players

THE EFFECTS OF LOWER BODY PLYOMETRIC TRAINING ON GENERAL MOTOR SKILLS OF MEN FOOTBALL PLAYERS AGED 12-14 YEARS OLD

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Authors' Contribution: A: Study design, B: Data collection, C: Data analysis, D: Manuscript preparation, E: Discussion and conclusion

ABSTRACT

Study aim(s): The study aim was to determine the effects of plyometric training on general motor skills such as endurance, agility (maneuverability), high-speed strength (jump), and active flexibility in hips and hamstrings muscles of men football players aged 12-14 years old.
Methods: A study sample consists of 24 football players who were 12 of whom belonged to an experimental group and 12 of them belong to the control group. Effects of the 8-week plyometric training program applied once per week besides the football training have been tested by using performance tests such as free arms countermovement jump, 1200 meters jogging test, Illinois agility test, and sit and reach test. The tests have been applied pre and post-training in both experimental and control groups, where differences between groups and changes in time (pre-post tests) have been analyzed by using the paired sample t-test when the significance level was $p<0.05$.
Results: The result of the 8-week training program has statistically significant differences ($p<0.05$) between the pre and post-tests of jumping performance, endurance, agility, and flexibility in the experimental group. The same analyses resulted in not being significant in the control group ($p>0.05$).
Conclusions: Besides the jump performance where improvements were expected because of the experience and clear data in current literature, the improvements in endurance, maneuverability as a factor of agility, and active flexibility which is expressed as a range of motion in football have been improved significantly.

Keywords: High-Speed Strength, Active Flexibility, Endurance, Agility

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INTRODUCTION

Football, like other sports, emphasizes physical active training, or training for the development of motoric features. Good training should meet the physical and physiological needs of the sport by employing physical methods that are appropriate for the athlete's structure [1- 4]. The goal of football players' research is to improve their physical and physiological development [5,6]. The athlete's development is a direct result of the research conducted during training [7].

The goal of plyometric training, also known as intense exercise requiring high-intensity strength, is to provide the physiological change required for high-level performance; Its purpose is to reduce the amount of time spent in contact with the ground while running or jumping. The quadriceps muscle group is lengthened and stretched when it comes into contact with the ground. Tendons and connective tissues also stretch. Potential elastic energy emerges as a result of this situation. In addition, potential elastic energy occurs in cross bridges. This energy is collected during the eccentric contraction, and significant power is released by making use of gravity while transitioning to the concentric contraction. In plyometric studies, the reflexive strengthening of contraction also increases during muscle stretch [8].

Plyometric exercises are defined as exercises and drills that are used to develop power [9], increase relative explosive movements, and combine speed and strength [8]. In plyometric exercises; It is believed that sports efficiency increases as a result of keeping the time between eccentric and concentric contractions very short, so that elastic energy is quickly converted into mechanical energy and the loss of conversion to heat is reduced [10-12].

So, in order to increase the general performance of football players plyometric training is considered a key factor of training.

Besides these, it's obvious that football players' performance key factors can be considered endurance, agility, high-speed strength such as jumping performance, and general flexibility of the body. When lack of performance occurs in mentioned factors of football performance, drastically decreases (Source). In order to increase performance, there are many training types used and one of them is plyometric training. These training are applied to the athletes twice or more times per week, effects which are inevitable (source). But what if the plyometric training is applied just once per week? Is there any positive impact of this training on athletes' performance if it's applied less than twice per week? There is no clear data about this. So, this study has been carried out in order to carry out results about the effect of plyometric training applied once per week on general motor skills such as endurance, agility (maneuverability), high-speed strength (jump), and active flexibility in hips and hamstrings muscles of men football players aged 12-14 years old.

METHODS

Research design

This paper consists of an experimental study that includes a control group (12 players) and an experimental group (12 players) of participants who voluntarily participated in the study. An 8-week plyometric training program was applied to the athletes. The applied training program has been explained in the below sections. The study was conducted in a manner that respected the principles established by the Declaration of Helsinki.

Subjects

Iğdır Kafkas sports club and Iğdır İnönü secondary school players, who are licensed athletes in Iğdır province, participated in the study. Our subjects, who belong to active athletes, have an age of 13.63±1.92 (years), an average body weight of 50.74 ± 4.67 (kg), and an average height of 1.62±0.70 (m),

and a total of 24 athletes playing in different positions has been included in the study.

Data collections tools

1200m Shuttle Test

The 1.2SRT consist of continuous 20m, 40m, and 60m, strait shuttle runs, completed 5 times at a maximal intensity. Each participant was required to touch the line with their entire foot and was closely monitored throughout each shuttle, failure to do so caused the cessation of the test. The primary outcome measure was participant performance, recorded at the time of task completion (minutes). This time was then converted into m.s-1 to determine a score of maximum speed [13].

Illinois Agility Test (Maneuverability)

The test was used in order to measure the maneuverability ability as the agility component. The athlete lies prone to the ground at the starting point

With the command of the tester, the athlete stands up and runs around the parkour lines to finish the distance. The total time recorded is used.

Free arms Countermovement Jump

The vertical jump free arms test was used in order to measure the high-speed strength of the lower extremities (high jump performance). The height of the stack of movable color-coded horizontal plastic vanes was adjusted to be within the athlete's standing reach height. The highest vane that could be reached and pushed forward with the dominant hand while the athlete stands flat-footed determines the standing touch height [13].

Sit and Reach Test

Measurement of the active flexibility of the lower back and hamstrings muscles was made by using sit and reach test. The athlete slowly reaches forward with both hands as far as possible on the measuring stick, holding this position momentarily. To get the best stretch, the athlete should exhale and drop the head between the arms when reaching. The athlete keeps the hands adjacent to each other and does not lead with one hand. The fingertips should remain in contact with the measuring stick. The tester may hold the athlete's knees down, if necessary, to keep them straight. The best of three trials was recorded to the nearest 1 cm.

Applied Plyometric Training Program

The warm-up phase consists of 10 min low-tempo aerobic jogging, 6 minutes of stretching movements, and 2 minutes of low-height double and single leg jumps. The plyometric training includes 8 stations such as jump in place, standing jumps, multiple hops and jumps, bounds, box drills, and depth jumps.

The plyometric training program was prepared according to the National Strength and Conditioning Association [14]. In the program, as a movement used for performance development of the athlete's lower body plyometrics such as jumps in place, standing jumps, multi hops and jumps, bounds (a leaping movement upward), and box drills were applied.

Recovery for depth jumps consisted of 5 to 10 seconds of rest between repetitions and 2 to 3 minutes between sets. The time between sets was determined by a proper work-to-rest ratio (i.e., 1:5 to 1:10) and was specific to the volume and type of drill being performed [15].

Data analysis

The SPSS 26 packet was used in the data analysis. A description of the sample was made by using descriptive statistics. Differences between pre and post-test, control, and experimental groups were made by using Paired-Samples T-Test.

FINDINGS

Table 1. Some Physical Characteristics of the Control and Experimental Groups

Features / **Groups**	N	Age X̄±SD	Height X̄±SD	Weight X̄±SD
Experimental group	12	13,50± 0,52	162± 4,65	50,74± 6,71
Control Group	12	13,58± 0,51	160,42± 3,80	52,08± 5,54
t Value		-0,39	0,91	-0,53
p Value		0,69	0,37	0,60

In table 1, descriptive statistics of the experimental and control group of football players have been given. As can be seen, the groups have no significant difference in age, height, or body weight at the beginning of the study, which means the pre-tests were similar for each group.

Table 2. Experimental and Control Groups Before and After Training

Groups	**Experimental group**				**Control Group**			
Tests	Pretest	Posttest	T	p	Pretest	Posttest	t	P
W	50.7± 6.7	51.7± 6.6	-4.3	0,00*	52.0± 5.5	52.9± 1.7	-4.2	0.00*
IAT	18.3± 0.9	16.6± 0.4	9.3	0,00*	18.6± 1.1	18.0± 1.0	1.6	0.10
SRT	17.5± 1.8	23.5± 2.1	-18.4	0,00*	18.4± 1.6	19.0± 1.5	-2.1	0.54
1.2SRT	5.8± 0.4	4.7± 0.4	8.4	0,00*	5.8± 0.4	5.9± 0.3	2.0	0.60
FA-CMJ	17.8± 4.8	27.7± 5.9	-12.6	0,00*	18.1 ± 3.4	20.9± 4.2	-5.5	0.00*

W: Body Weight (kg), IAT: Illinois Agility Tests (s), SRT: Sit and Reach Test (cm), 1.2SRT: 1200 Meters Jogging Test (m. s^-2), FA-CMJ: Free Arms Countermovement Jump.

Based on the results of table 2, when we analyzed the differences between the groups, it was observed that these variables: W (T=-4.3; p=.00), IAT (T=9.3; p=.00), SRT (T=-18.4; p=.00), 1200JT (T=8.4; p=.00), FA-CMJ (T=-12.6; p.00) of the experimental group (with training program), after the application of the plyometric program, had a significant percentage of development, compared to those of the control group: W (T=-4.2; p=.00), IAT (T=1.6; p=.10), SRT (T=-2.1; p=0.54), 1200JT (T=2.0; p=0.60), FA-CMJ (T=-5.5; p=0.00) which results have shown that no statistically improvement has been detected.

DISCUSSION

Based on the results of the study maneuverability as one of the most important factors of agility seem to be significantly improved by the applied plyometric training program once per week besides the football training. The maneuverability has physiologically based on speed, acceleration, and deceleration. So, the plyometric training programs'

effects are significant on the speed and speed factors also [16-18]. Increases in agility seem to have parallelism with literature.

Similarly, the active flexibility of the players who applied the training seems to be developed, even though the developments are not too high. But, these developments were valuable when it's known that applied training was not specific to active flexibility. Improvements may be caused by the increase in the tonus of muscles.

There are studies that show similar development in active flexibility in collective sports [19]. It has been observed that plyometric training with their own body weights and additional weights improves the flexibility of the athletes. In addition, in the study of Öztin et al., it was observed that quick strength and plyometric training applied to 15-16 age group basketball players improved the flexibility of the athletes [20].

The endurance ability also has shown valuable developments where the training program resulted to be significant. The training program applied to the experimental group showed that the football players increased their endurance after 8 weeks of training, even though it was once per week. However, these improvements may have occurred because of the football classic training also. A similar study made on physical education and sport science students resulted in significant developments [8]. In addition, Gökdemir et al. [21] have found statistically significant differences in the 20 m running speed values before and after the training in the experimental group of athletes.

As it is expected, the improvements in the hump performance measured by free arms countermovement jump resulted to be higher compared to other abilities analyzed in the study such as agility, endurance, and flexibility. An applied 8 weeks plyometric training program resulted in around 10 centimeters of development in jump performance which is very significant in a football player.

In the study conducted by Günay et al., which investigated the effects of plyometric training on the jumping abilities of athletes, significant improvements were observed in the experimental groups [6]. In a study that looked at the effects of plyometric training on handball and football players' vertical jump and shooting strength, a statistically significant difference was found in the experimental group's vertical jump values before and after training [9]. While the average of the vertical jump values of the athletes in the experimental group was 49.56 ± 7.57 cm before the training, this value increased to 55.93 ± 7.74 cm after the training. In the study conducted by Cicioğlu et al., in which they investigated the effects of 8-week plyometric studies on the vertical jump capacities and some physical and physiological parameters of the 14-15 age group male basketball players, an improvement was observed in the vertical jump values of the experimental group and the arithmetic average of the vertical jump results of the experimental group before the training was 37.94 This value, which was ± 5.78 cm, became 46.25 ± 6.01 cm after the training [21].

The results of the study seem to be in line with the literature. However, the study marks the developments in the abilities which are not supposed to be developed at a high level.

CONCLUSIONS

In conclusion, besides the jump performance where improvements were expected because of the experience and clear data in current literature, the improvements in endurance, maneuverability as a factor of agility, and active flexibility which is expressed as a range of motion in football have been improved significantly. It can be concluded that plyometric training has a cross effect on all motor abilities or it reflects the developments in all motor abilities.

CONFLICT OF INTERESTS

No potential conflict of interest was reported by the authors.

REFERENCES

1. Karatosun, H. Futbol, Çocuk ve Gençlerin Eğitimi, Isparta: Altintug Offset.1991; 2nd Edition.p.3.
2. Wilson, G., et all. "The Optimal Training LoadForThe Development Of Dynamic Athletic Performance", Med. Sci. Sports Exerc. 1993; 25:1279-1286.
3. Kaya, Y. Sezon Arasında Yapılan Hazırlık Antrenmanlarının Futbolcuların Performanslarına Etkisi, Master Thesis. Sakarya University Institute of Social Sciences. Sakarya, 1999; p. 3.8.
4. Koç, H., Gökdemir, K. and Kılınç, F. Sezon Arasında Yapılan Antrenmanların Kütahyaspor Futbolcularının Bazı Fiziksel ve Fizyolojik Parametrelerine Etkisi, Gazi University. Body Instructor and Sports Sciences 1st Congress. 2000; p.122-128, Ankara.
5. Gençay, Ö.A. and Çoksevim, B. Hazırlık Dönemlerinde Profesyonel Futbolcuların Atletik Performanslarının Değerlendirilmesi, Gazi University Physical Education and Sports Sciences 1st Congress. 2000; s. 87-93.
6. Günay, M. and Özder, A. "Futbolcuların Bazı Fizyolojik Parametrelerinin Oynadıkları Mevkilere Göre Karşılaştırılması", H. U. Journal of Sport Sciences, 1994;5(1);21-25.
7. Müniroğlu, S., Koz, M., Atıl, M., Erongun, D., Bulca, Y.S. Türkiye Profesyonel Birinci Liginde Mücadele Eden Bir Futbol Takımının Sezon Öncesi ve Sonrası Fiziksel ve Fizyolojik Özelliklerinin İncelenmesi. Gazi University. Phyc. ed. and Sports Sciences 1st Congress, congress book. 2000; p. 103-106, Ankara.
8. Churley, D. A. Jumping Into Plyometries. Leisure Press, Champing. Ilinois. 1992; s.1-18, 25-75, California.
9. Ağaoğlu, S.A., Kaldırımcı, M., Taşımektepligil, Y. "Ağırlık Topuyla Yapılan Plyometrik Antrenmanın Hentbolcuların Dikey Sıçraması ve Atış Kuvvetine Etkisi" Gazi University. Bed.Ed. and Sports Sciences 1st Congress, 2000; p. 58-66, May.
10. Kin, A. Plyometrik Antrenman. Football Science and Technology Magazine. Ankara: 2000;7(2).27.
11. Konter, E. Futbolda Süratin Teori ve Pratiği. Bağırgan Publishing House. Ankara. 1997; s.87-103.
12. Kutlu, M., Gür, E., Karahüseyinoğlu, M.F. and Kamanlı, A. "Pliometrik Antrenmanın Genç Futbolcuların Anaerobik İşlerine Etkisi" Gazi Phys. and Sports Science Journal, 2001; 6(4):37-43.
13. Kelly V, Jackson E, Wood A. Typical scores from the 1.2 km shuttle run test to determine maximal aerobic speed. Journal of Australian Strength and Conditioning. 2014;22(5):183-5.
14. Fatouros I, Jamurtas Z, Leontsini D, Taxildaris K, AggelousisN, Kostopoulos N, et al. Evaluation of plyometric exercises training, weight training and their combination on vertical jump performance and leg strength. The Journal of Strength and Conditioning Research, 2000; (14): 470–476.https://doi.org/10.1519/00124278-200011000-00016.
15. Thaqi A, Berisha M, Asllani I. The effect of plyometric training on performance levels of the shot put technique and its related motor abilities. Pedagogy of Physical Culture and Sports. 2021 Jun 30;25(3):144-51.
16. Kızılet A, Atılan O, and Erdemir İ. 12-14 Yaş Grubu Basketbol Oyuncularının Çabukluk Ve Sıçrama Yetilerine Farklı Kuvvet Antrenmanlarının

Etkisi. Ataturk University Journal of Physical Education and Sport Sciences. 2010.
17. Hazır, T., Mahir, Ö.F. and Açıkada, C. Genç futbolcularda çeviklik ile vücut kompozisyonu ve anaerobik güç arasındaki ilişki. Journal of Sport Sciences. 2010.
18. Anıl, F. Pliometrik Çalışmaların 14-16 Yaş Grubu Bayan Basketbolcuların Bazı Fiziksel ve Fizyolojik Parametreleri Üzerine Etkisi, Ankara: Master Thesis, Gazi University Institute of Health Sciences, Department of Physical Education and Sports. 1997.
19. Ateşoğlu, U. Kendi Vücut Ağırlığı ve Ek Ağırlıkta Yapılan PliometrikAntremanın Bazı Fiziksel ve Fizyolojik Parametreler Üzerine Etkisi. Doctoral Thesis. Gazi University Institute of Health Sciences, Department of Physical Education and Sports, Ankara, 2001.
20. Gökdemir, K., Çeker, B., Cicioğlu, İ. Çabuk KuvverAntremanlarının 16-17 Yaş Grubu Güreşçilerinin Bazı Fiziksel ve Fizyolojik Parametreleri Üzerine Etkisi, Selcuk University Journal of Physical Education and Sport Sciences, 1999.
21. Cicioğlu İ. Pliometrik Antrenmanın 14-15 Yaş Grubu Basketbolcuların Dikey Sıçraması İle Bazı Fiziksel Ve Fizyolojik Parametreler Üzerine Etkisi. Master Thesis, Ankara: Gazi University, Institute of Health Sciences, Department of Physical Education and Sports. 1995.

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