Original Article

JER

https://doi.org/10.12965/jer.2346628.314

Journal of Exercise Rehabilitation 2024;20(1):34-41

The effects of proprioceptive exercise training on physical fitness and performance of soccer skills in young soccer players

U-Yeong Lee[1,2], Chang-Hwa Joo[1,2,*]

[1]Department of Sport Science, Kangwon National University, Chuncheon, Korea
[2]Interdisciplinary Program in Smart Health Science and Technology Convergence Department, Kangwon National University, Chuncheon, Korea

The purpose of this study is to analyze the effect of proprioceptive exercise training on soccer skills and physical fitness in young soccer players. Nineteen young soccer players participated in the study. Participants were divided into proprioceptive exercises training (PT) and control (Cont) groups. The physical fitness and soccer skill performance test assessed at pre- and posttraining. Balance ability and power significantly improved in both groups after 8 weeks of training ($P<0.05$). Dribble in the PT group was similar between pre- and posttraining, with a statistically significant difference in the Cont group ($P<0.05$). There were no significant differences within and between groups according to training in the left and right feet for juggling. The PT and Cont groups did not differ significantly regarding short passes posttraining. However, a significant improvement in long passes was observed in the PT group after training period ($P<0.05$). Shooting was no different between and within the groups. In conclusion, these inconsistent findings are thought to be due to the applied exercise method, training duration, and the specificity of the physical growth period of the young players. Therefore, it is necessary to increase the frequency and time of proprioceptive exercise training and apply factors for cognitive ability improvement to training programs for young soccer players in future studies. These studies could suggest appropriate training methods necessary to improve the performance of young soccer players.

Keywords: Soccer, Proprioceptive exercise, Physical fitness, Soccer skill performance

INTRODUCTION

Soccer is the most popular sport in the world; it requires players to perform for 45 min each in the first and second halves and demands the ability to maintain intense exercise during the matches. Players' movement during soccer matches combines aerobic and anaerobic exercise that repeats instantaneous movements with a short rest period of 15 min between the two halves. Due to tactical changes in modern soccer, the quantity and quality of movements affect performance and require more high-intensity movements. Players need to maintain short distances with constant movements for high performance during the match, so they must repeatedly perform instantaneous and intermittent exercises (Pettersen and Brenn, 2019). Although the form of movement varies depending on the playing positions, all positions frequently require movements such as tackles, sprints, change of direction, and pressure (Stølen et al., 2005). Therefore, explosive movements during matches are essential in all positions.

In modern society, lack of physical activity among elementary school students due to studies, computer games, etc., can cause various physical and psychological problems. Indeed, lack of physical activity during childhood increases the incidence of obesity and reduces self-efficiency (Ha et al., 2016). Fundamentally, these problems can be solved by increasing physical activity through methods that spur interest in participating in sports and exercises. Previous studies reported that elementary school students' physical activities were significantly related to academic achievements and physical fitness (Lambourne et al., 2013; Watson et al., 2017).

*Corresponding author: Chang-Hwa Joo https://orcid.org/0000-0002-7429-3104
Department of Sport Science, Kangwon National University, 1 Kangwondaehak-gil, Chuncheon 24341, Korea
Email: phd.football@gmail.com
Received: December 29, 2023 / Revised: January 11, 2024 / Accepted: January 14, 2024

Playing soccer can have positive psychological and physical effects, such as improving physical fitness for children and adolescents. Regular soccer playing can improve self-esteem, confidence (Quinn and Carr, 2006), and physical fitness (Zouhal et al., 2020). For these reasons, many young students enjoy playing soccer and other sports.

Although young soccer players are not fully developed physically, they perform similar forms of exercise, such as sprinting and changing direction during the match, as senior soccer players. Although the exercise forms are similar during the match, training for young soccer players should not be structured as that for senior players. The growth and development processes are essential to design desirable training for young soccer players. For example, training structured to improve muscle strength can cause injury in young soccer players as muscle growth has not been completed and training efficiency is low. Training for young soccer players should be organized as an effective way to improve their technique and skills. Regarding physical fitness, training for young players needs to mainly involve coordination and balance training to improve the dynamic postrural control ability (Cakir et al., 2020).

Proprioception is the sense of perception of the position and movement of skeletal muscles and joints. It contributes to joint stability during daily life or exercise by preventing muscles and tendons from being out of the normal range (Proske and Chen, 2021). Proprioception sense stimulation exercises positively affect injury prevention and exercise performance due to improved body balance and functional movement of the lower extremities (Han et al., 2015). Owing to these effects of the proprioceptive exercises, soccer players perform the exercise during general training and as postinjury rehabilitation training (Ambhore et al., 2021). Training to develop functional movements is essential, especially for childhood soccer players, compared to other periods of physical growth (Duncan et al., 2022). Improving the coordination ability between nerves and muscles could enhance functional movement.

Balance ability is essential for controlling the body's movement and significantly correlates with exercise performance (Hrysomallis, 2011). Various exercise methods, including proprioceptive exercise, improve balance ability when performed optimally. In particular, proprioceptive exercise in childhood soccer players, which focuses on technical development, can improve exercise performance due to the enhanced balance ability. However, few studies have investigated the relationship between proprioceptive exercise and young soccer players' performance. Therefore, this study aims to analyze the effect of proprioceptive exercise training on soccer skills and physical fitness in young soccer players.

MATERIALS AND METHODS

Participants

Soccer players in the 5th and 6th grades of elementary school who voluntarily expressed interest in participating in the study were recruited. Participants were divided into proprioceptive exercises training (PT) and control (Cont) groups; the purpose and methods of the study were explained to players, parents, and coaching staff through verbal description with an explanatory document to understand the purpose. Nineteen players (PT; n = 10, 11.4 ± 0.5 year, career 1.8 ± 0.9 year, Cont; n = 9, 11.1 ± 0.3 year, career 2.1 ± 1 year) participated in the study. The study recruited soccer players with no injuries (fractures, sprain, etc.) and no restrictions on performing 8 weeks of exercise training. The exclusion criteria were participants with limited exercise capacity because they were on medications and those considered inappropriate by a doctor due to injury. The Ethics Committee of Kangwon National University approved this study (KWNUIRB-2023-02-006-001), which was conducted in accordance with the Declaration of Helsinki.

Study procedures

The PT group performed 30 min of proprioceptive sensory exercise 2 times weekly for 8 weeks after approximately 3 hr of team training. The control group was instructed to only participate in general team training during the experiment. Body composition (Inbody 370, InBody Co. Ltd., Seoul, Korea), dynamic balance ability, agility, quickness, and soccer skills (juggling, dribbling, short and long passes, shooting) were assessed a day before and after the training sessions. The players performed a 20-min warm-up exercise before the test, and a soccer skill test was conducted after the exercise performance test. After each test, a 10-min break was provided for the players to recover fully. Finally, players performed a cool-down exercise for 10 min after completing all tests. All tests were conducted on artificial turf, and players were allowed to drink water freely during the test.

Proprioceptive exercise training program

A proprioceptive training program for 8 weeks was applied by modifying the exercise program according to a previous study to suit young soccer players (Gidu et al., 2022). Table 1 shows the exercise program. Exercise was carried out in groups of two for 30 sec using the Both Sides Utilized (BOSU) balance trainer (Bosu Fitness, LLC, SanDiego, CA, USA), and 30 sec of rest was given after each exercise type. Each exercise was performed 4 times. Squats,

lunges, swings, and jumps were performed without using the ball on the BOSU ball for the first 4 weeks and with the ball for the remaining 4 weeks. The exercise with the ball was performed by balancing on the BOSU ball and passing the ball thrown by the assistant.

Assessment of physical fitness

The physical fitness test assessed balance ability, agility, and power. Balance capacity was assessed using a balance measurement system (MFT challenge disc 2.0, TST-Trend Sport Trading, Großhöflein, Austria) consisting of a board with a diameter of 44 cm and a height of 7.5 cm. The method of moving to the center point of the target area on the computer screen while standing with a foot on the board was applied to evaluate the balance ability (Fig. 1). The arrowhead test was performed for agility. A measuring system (Speedlight, Swift performance, Brisbane, Australia) using a laser was applied, and the fastest time performed was recorded after measuring twice in each direction (Joo, 2016). Power was assessed with a standing long jump using the device (Trajković et al., 2020). The players performed jumping with recoil in the standing position, and the distance from the start line to the posterior part of the farthest point of landing was recorded. The longest distance was selected after jumping twice.

Table 1. A proprioceptive training program for 8 weeks

Week	Ball	Proprioceptive training
1	Without ball	Squat on both
2		Lunge on one leg
3		Swing (forward & back, lateral)
4		Single leg jump
		Lateral jump
		Jump lunge
5	With ball	Standing with both
6		Standing with one leg
7		Single leg dead
8		Jump holding (forward, lateral)
		Step back (back & forward)
		Standing one leg heading

Soccer skill tests

The soccer skill performance test followed the methods used in previous study (Rosch et al., 2000). The juggling test recorded how many times the ball was kicked without dropping it on the ground, starting with dropping it with hands from chest-level height; it was performed on the left and right feet. The dribble test used a timing system (Speedlight, Swift performance, Brisbane, Australia) to assess how quickly to dribble past a cone with a 2-m distance between cones for 10 m, with three cones between the first and the last, and return to the starting point similarly. If the players touch the cones with a ball during the dribbling test, 2 sec were added to the dribbling time (Fig. 2).

The short-pass test was conducted on the left and right feet five consecutive times. The players passed the ball towards the goalpost 11 m ahead after dribbling 4 m. One, two, and three points were recorded for hitting the goalpost, hitting the crossbar, and scoring the goal directly, respectively (Fig. 3).

In the long-pass test, the players kicked the ball from 31 m away from the center of a circle with a radius of 2 m in a 10×10 m square,

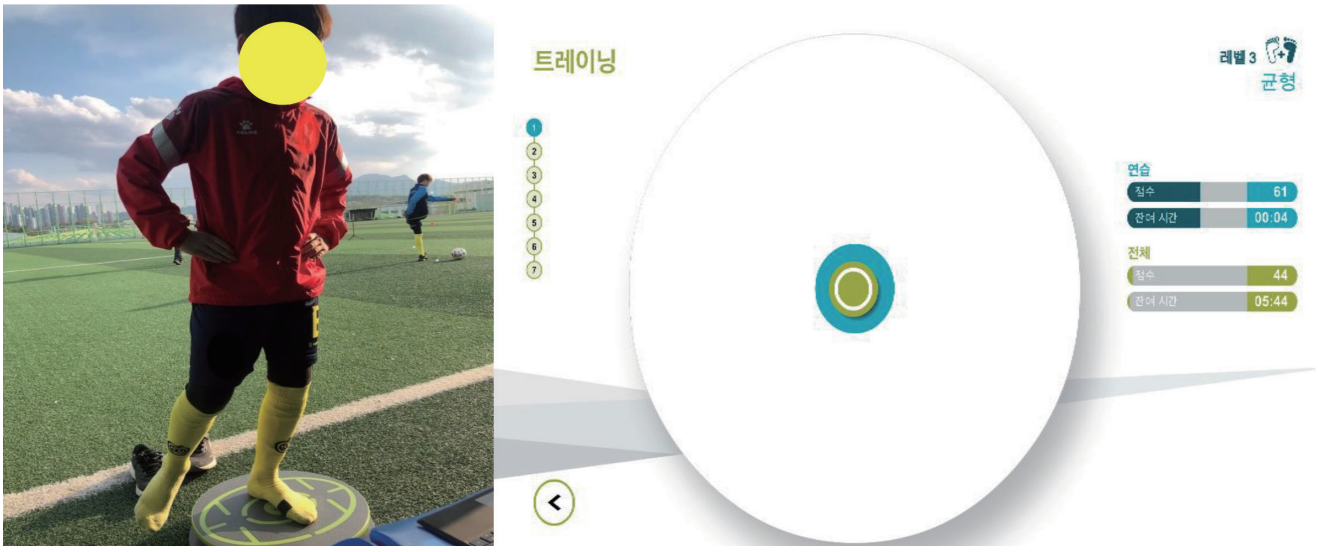

Fig. 1. Balance ability test on the board.

 https://doi.org/10.12965/jer.2346628.314

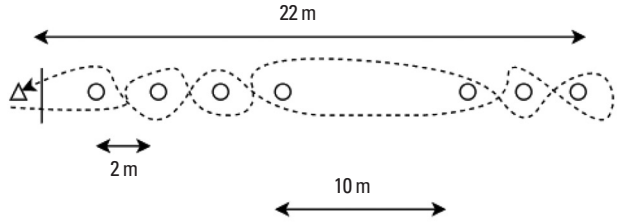

Fig. 2. Dribble test.

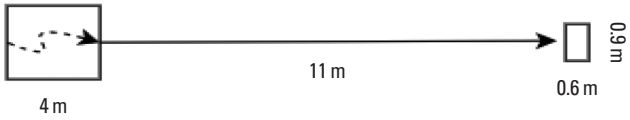

Fig. 3. Short-pass test.

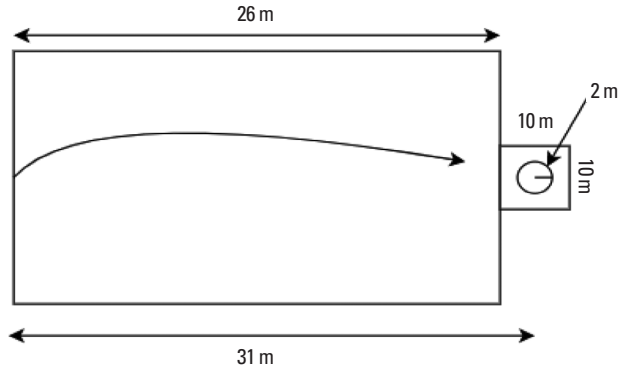

Fig. 4. Long-pass test.

assigning 3 and 1 points when the ball arrived directly into the circle and the square, respectively. The sum of the scores for the left and right foot was assessed for five consecutive trials (Fig. 4).

Shooting was assessed based on a set score per goal area (Fig. 5). The players shot the ball 15 m away from the goal, divided into nine spaces. The scores for the left and right feet each were summed up after shooting 5 times.

Statistical analyses

All statistical analyses were performed using IBM SPSS Statistics ver. 26.0 (IBM Co., Armonk, NY, USA). All values were expressed as mean values±standard deviation. A two-way repeated-measures analysis of variance (ANOVA) was used to analyze the differences between the groups and periods. A paired *t*-test was used to identify differences between the periods within the groups. Partial eta-square (repeated ANOVA) and Hedges'g (*t*-test) were calculated to estimate the effect size (ES). Statistical significance was set at $P<0.05$.

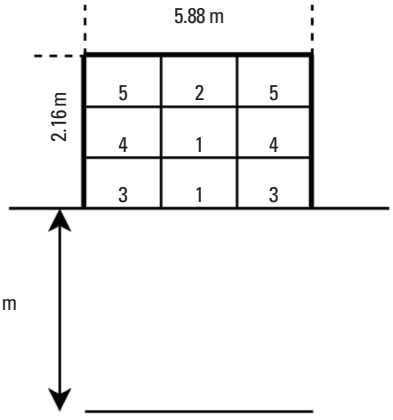

Fig. 5. Shooting test.

Table 2. Changes in body composition

Variable	Groups	Pre	Post
Height (cm)	PT	147.34±6.44	147.88±6.96
	Cont	147.94±7.45	149.04±8.09*
Weight (kg)	PT	39.77±4.43	39.86±4.51
	Cont	38.86±4.27	39.48±4.72
Musle mass (kg)	PT	17.06±2.03	17.31±2.20
	Cont	17.89±2.66	18.34±2.93*
Fat mass (kg)	PT	7.96±2.52	7.59±2.64
	Cont	5.61±3.17	5.31±3.05
Free fat mass (%)	PT	19.80±4.83	18.83±5.19
	Cont	14.31±7.44	13.38±7.27
BMI (kg/m^2)	PT	18.31±1.47	18.22±1.65
	Cont	17.77±1.82	17.77±1.72

Values are presented as mean±standard deviation.
PT, proprioceptive training; Cont, control; BMI, body mass index.
*$P<0.05$ from pretraining.

RESULTS

Changes in body composition

The changes in body composition after 8 weeks of proprioceptive exercise training are shown in Table 2. There was no change in body composition according to the training period in the PT group (ES range of 0.02–0.19); however, height (ES=0.14) and muscle mass (ES=0.16) increased after the study period in the Cont group ($P<0.05$).

Physical fitness

Balance ability (ES=0.59) and power (ES=0.59) significantly improved in both groups after 8 weeks of training ($P<0.05$); however, there was no difference between groups after training. As for agility, the main effect of time (ES=0.39) and group (ES=0.38) and the interaction effect between time x groups (ES<0.01) were

Table 3. Changes in physical fitness

Variable	Groups	Pre	Post
Balance (point)	PT	314.40±75.85	352.50±48.45*
	Cont	306.66±45.64	351.77±34.11*
Agility (sec)	PT	9.33±0.30	9.12±0.40
	Cont	8.98±0.51	8.77±0.25
Power (cm)	PT	174.00±15.95	178.22±14.51*
	Cont	185.44±15.96	192.22±15.90*

Values are presented as mean±standard deviation.
PT, proprioceptive training; Cont, control.
*$P<0.05$ from pretraining.

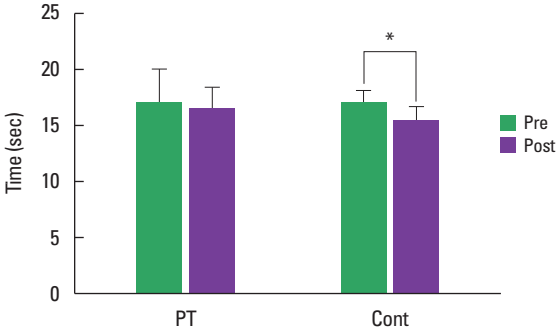

Fig. 6. Changes in dribbling performance. PT, proprioceptive training; Cont, control. *$P<0.05$ from pretraining.

not significant (Table 3).

Skills performance

Dribble in the PT group was similar between pre- (17.01±2.94 sec) and posttraining (16.53±1.79 sec) (ES=0.2), with a statistically significant difference in the Cont group (pre-; 16.96±1.17 sec, post-; 15.52±1.08 sec) (ES=1.28) ($P<0.05$) (Fig. 6).

There were no significant differences within and between groups according to training in the left and right feet for juggling (left foot juggling pre- [PT; 23.66±13.09, Cont; 17.11±10.63] and posttraining [PT; 21.44±12.86, Cont; 24.11±15.12] and right foot jugging pre- [PT; 28±14.72, Cont; 30.66±15.83] and posttraining [PT; 23.22±11.3, Cont; 30.55±15.12]) (ES range of 0.02–0.17) (Fig. 7).

Pretraining, short passes for the PT and Cont groups were 13.11±6.62 and 10.11±3.78, respectively. The PT and Cont groups did not differ significantly regarding short passes posttraining (9.88±4.45 vs. 10.44±2) (ES=0.16). However, a significant improvement in long passes was observed in the PT group from 1.77±2.27 at pretraining to 6±4 at posttraining (ES=1.3) ($P<0.05$); there was no significant change in the Cont group (pre-; 2.33±2.06, post-; 3.66±3.27) (ES=0.49) (Fig. 8).

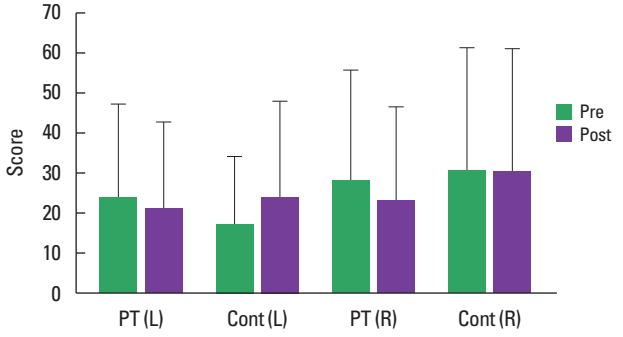

Fig. 7. Changes in dribbling performance. PT, proprioceptive training; Cont, control; L, left; R, right.

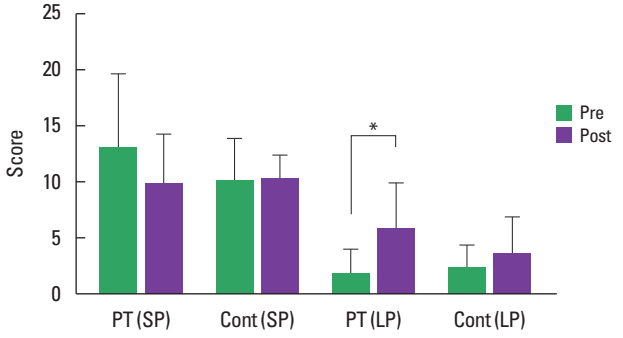

Fig. 8. Changes in passing performance. PT, proprioceptive training; Cont, control; SP, short pass; LP, long pass. *$P<0.05$ from pretraining.

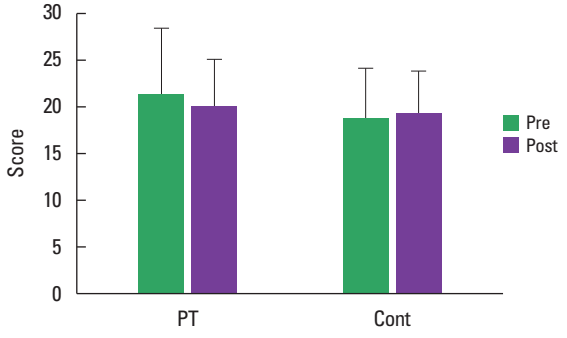

Fig. 9. Changes in shooting performance. PT, proprioceptive training; Cont, control.

Shooting was no different between and within the groups (ES range of 0.01–0.14). It was 21.44±6.87 and 18.66±5.4 at pretraining and 20.11±4.85 and 19.33±4.44 at posttraining in PT and Cont groups, respectively (Fig. 9).

DISCUSSION

This study analyzed the effect of 8 weeks of proprioceptive exercise training on young soccer players' physical fitness and skill

https://doi.org/10.12965/jer.2346628.314

performance. Principally, the study found that physical fitness tended to improve in both groups, and skill performance differed depending on the variable. Dribbling changed in the Cont group; however, long passes improved only in the PT group.

In this study, height and muscle mass significantly increased only in the Cont group, which could be related to the player's career. Considering that the Cont group started their career earlier than the PT group, it can be guessed that repeated and regular exposure to more stimulation for height growth at a relatively young age accounted for this difference. Previous study also reported that regular exercise at young ages causes growth (Alves and Alves, 2019). In addition, the growth of young athletes may be influenced by genetic factors; unfortunately, we did not analyze genetic factors in the current study. Changes in growth hormones due to exercise and genetic factors could have further improved the height of the Cont group compared to the PT group. Increased muscle mass in the Cont group resulted from height growth due to regular exercise at an earlier age than in the PT group.

Analyzing the change in physical strength according to the 8-week training period, balance ability and power significantly improved in both groups. Powerful actions are required during exercise training due to the specificity of soccer, and repetitive exercise training can change the ability to express power. Indeed, exercise training for young soccer players improves the powerful movements (Michailidis et al., 2019). Interestingly, however, there was no difference in balance ability between groups after training, despite additional proprioceptive exercise after general team training in the PT group. This result may have been due to this study's measurement method for balance ability. In other words, the balance ability was assessed by moving the center of the body along with a moving target on a computer monitor rather than by applying technical movements that can be performed during a soccer game. In the PT group, the exercise applied technical movements that should be performed in football game situations along with the ball; however, the balance ability during these movements could not be measured due to the limitations of equipment and measurement techniques the study employed. Therefore, in future studies, assessing the balance ability of soccer players more accurately and realistically will necessitate developing a method to measure the balance ability while performing soccer skills and apply it to analyze the effectiveness of proprioceptive training for elite soccer players.

Soccer skill evaluation can be an essential indicator to evaluate potentially talented players who can grow to a high level in the future. Dribbling is one of the critical skills in carrying and possessing a ball in soccer. The youth players with good dribbling ability had high stride frequency and reduced hip and knee flexion range of motion. Dribbling ability improved in both groups, but statistically significant differences were found only in the Cont group. It is thought that the change in body composition affects the improvement of dribbling records. The coordination ability, closely related to the balance ability, can affect the performance of the dribble skill (Daulay and Azmi, 2021). As mentioned earlier, even if the balance ability measurement method employed was inappropriate considering the characteristics of soccer skill performance, it improved in both groups. However, only the Cont group showed a statistically significant improvement, indicating that balance ability and other factors affected the young soccer players' dribbling ability. This improvement in dribbling ability may have been positively affected by the degree of body growth, such as height and muscle mass changes. In line with the result, a previous study reported that youth players' dribbling skills improved with age, especially among those aged 12–14 years (Huijgen et al., 2010).

Among soccer skills, passes can be influenced by various factors such as the balance of footsteps, the ability to touch the ball accurately, and the timing of impacting the ball. In particular, this ability can be more necessary in performing a long pass with a wider range of motion and requiring greater force than a short pass. In this study, long-pass performance improved with 8 weeks of proprioceptive exercise training. It is well-known that long-pass ability is generally strongly related to muscle strength (Cerrah et al., 2024). However, the training group showed a significantly lower increase in muscle mass than the Cont group in this study; improved long-pass performance results suggest that long-pass performance by young soccer players is more closely related to accurate movement performance, for example, by stability of the stepping up foot than muscle strength. This observation is supported by the lack of significant difference before and after training in both groups in short-pass ability that requires less force and sense of balance than long passes for accurate exercise performance.

There was no change in juggling and shooting in either group, primarily due to the short training period. In the case of juggling, it may be related to the level of cognitive function in addition to physical abilities such as ball touch and sense of balance. Indeed, cognitive functions, especially working memory capacity, were positively related to ball control and ball juggling in elite youth soccer players aged 11–13 years (Scharfen and Memmert, 2019). High-level players have higher shooting skills than low-level players and long-term strength and power training improve young

players' shooting skills (Keller et al., 2016; Wong et al., 2010). The 8-week proprioceptive exercise training conducted in this study is presumed to have resulted in no changes in juggling and shooting performance due to the lack of relevance to the composition of the exercise program to improve the cognitive function and muscle strength of young athletes and the short training period.

In conclusion, muscle mass and height were found to have grown in the Cont group than in the PT group, and balance and power ability had significant results in both groups. There was a significant difference in long passes only in the PT group and dribbles only in the Cont group. These inconsistent findings are thought to be due to the applied exercise method, training duration, and the specificity of the physical growth period of the young players. Therefore, it is necessary to increase the frequency and time of proprioceptive exercise training and apply factors for cognitive ability improvement to training programs for young soccer players in future studies. These studies could suggest appropriate training methods necessary to improve the performance of young soccer players.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENTS

The authors received no financial support for this article.

REFERENCES

Alves JGB, Alves GV. Effects of physical activity on children's growth. J Pediatr (Rio J) 2019;95 Suppl 1:72-78.

Ambhore S, Dass B, Hotwani R. Effectiveness of strengthening and proprioceptive training in preventing anterior cruciate ligament injury and rehabilitation: a case report. Ann Rom Soc Cell Biol 2021;25:11651-11654.

Cakir BA, Turkkan M, Ozer O. Effects of adding cognitive motor coordination exercise to soccer training vs. soccer training alone on physical fitness of prepubescent boys. Int J Appl Exer Physiol 2020;9:234-242.

Cerrah AO, Şimsek D, Soylu AR, Nunome H, Ertan H. Developmental differences of kinematic and muscular activation patterns in instep soccer kick. Sports Biomech 2024;23:28-43.

Daulay B, Azmi F. Coordination and agility: how is the correlation in improving soccer dribbling skills? J Sport Area 2021;6:147-161.

Duncan MJ, Eyre EL, Noon MR, Morris R, Thake CD, Clarke ND, Cunningham AJ. Actual and perceived motor competence mediate the relationship between physical fitness and technical skill performance in young soccer players. Eur J Sport Sci 2022;22:1196-1203.

Gidu DV, Badau D, Stoica M, Aron A, Focan G, Monea D, Stoica AM, Calota ND. The effects of proprioceptive training on balance, strength, agility and dribbling in adolescent male soccer players. Int J Environ Res Public Health 2022;19:2028.

Ha SA, Lee SY, Kim KA, Seo JS, Sohn CM, Park HR, Kim KW. Eating habits, physical activity, nutrition knowledge, and self-efficacy by obesity status in upper-grade elementary school students. Nutr Res Pract 2016;10:597-605.

Han J, Anson J, Waddington G, Adams R, Liu Y. The role of ankle proprioception for balance control in relation to sports performance and injury. Biomed Res Int 2015;2015:842804.

Hrysomallis C. Balance ability and athletic performance. Sports Med 2011;41:221-232.

Huijgen BC, Elferink-Gemser MT, Post W, Visscher C. Development of dribbling in talented youth soccer players aged 12–19 years: a longitudinal study. J Sports Sci 2010;28:689-698.

Joo CH. The effects of short-term detraining on exercise performance in soccer players. J Exerc Rehabil 2016;12:54-59.

Keller BS, Raynor AJ, Bruce L, Iredale F. Technical attributes of Australian youth soccer players: implications for talent identification. Int J Sports Sci Coach 2016;11:819-824.

Lambourne K, Hansen DM, Szabo AN, Lee J, Herrmann SD, Donnelly JE. Indirect and direct relations between aerobic fitness, physical activity, and academic achievement in elementary school students. Ment Health Phys Act 2013;6:165-171.

Michailidis Y, Tabouris A, Metaxas T. Effects of plyometric and directional training on physical fitness parameters in youth soccer players. Int J Sports Physiol Perform 2019;14:392-398.

Pettersen SA, Brenn T. Activity profiles by position in youth elite soccer players in official matches. Sports Med Int Open 2019;3:E19-E24.

Proske U, Chen B. Two senses of human limb position: methods of measurement and roles in proprioception. Exp Brain Res 2021;239:3157-3174.

Quinn R, Carr D. Developmentally appropriate soccer activities for elementary school children. J Phys Educ Recreat Dance 2006;77:13-17.

Rosch D, Hodgson R, Peterson L, Graf-Baumann T, Junge A, Chomiak J, Dvorak J. Assessment and evaluation of football performance. Am J Sports Med 2000;28:29-39.

Scharfen HE, Memmert D. The relationship between cognitive functions and sport-specific motor skills in elite youth soccer players. Front Psychol 2019;10:817.

 https://doi.org/10.12965/jer.2346628.314

Stølen T, Chamari K, Castagna C, Wisløff U. Physiology of soccer. Sports Med 2005;35:501-536.

Trajković N, Gušić M, Molnar S, Mačak D, Madić DM, Bogataj Š. Short-term FIFA 11+ improves agility and jump performance in young soccer players. Int J Environ Res Public Health 2020;17:2017.

Watson A, Timperio A, Brown H, Best K, Hesketh KD. Effect of classroom-based physical activity interventions on academic and physical activity outcomes: a systematic review and meta-analysis. Int J Behav Nutr Phys Act 2017;14:114.

Wong PL, Chamari K, Wisløff U. Effects of 12-week on-field combined strength and power training on physical performance among U-14 young soccer players. J Strength Cond Res 2010;24:644-652.

Zouhal H, Hammami A, Tijani JM, Jayavel A, De Sousa M, Krustrup P, Sghaeir Z, Granacher U, Ben Abderrahman A. Effects of small-sided soccer games on physical fitness, physiological responses, and health indices in untrained individuals and clinical populations: a systematic review. Sports Med 2020;50:987-1007.