13 (1) (2026) 305 - 310

Journal of Physical Education, Health and Sport

https://journal.unnes.ac.id/journals/jpehs

The Effect of Plyometric Upper Body Exercises on Long-Distance Throwing Ability in Football Matches

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History Article

Received March 2026
Approved April 2026
Published vol 13 no 1 2026

Keywords

UPBT; Explosive Power; Football; Throw in

Abstract

This study is motivated by a lack of attention to upper body strength training in football training programs, even though this strength plays an important role in improving the ability to throw inside. Football training programs generally emphasize more on foot technique so that the development of the strength of the shoulder, arm, and upper body muscles has not been carried out optimally. This study aims to determine the effect of upper body plyometric exercise (UBPT) on the improvement of throwing ability inward in football players. The research method used is a quantitative approach with a pre-experimental design using a pretest-posttest design of one group. The study participants amounted to 24 PS Ranc FC Football School players in the age group of 14 years who were selected through purposive sampling techniques. Data collection was carried out through throw-in tests at the pretest and posttest stages after the implementation of 12 UBBT training sessions. Data analysis used normality test, homogeneity test, and paired sample t-test. The results showed a significant increase in the ability to throw with a significance value of 0.001 ($p < 0.05$). Thus, UBPT exercises are effective in increasing the strength and explosiveness of the upper body muscles so that they can improve the ability to throw into football players.

How to Cite

Hidayattuloh, M. I., Rahman, A. A., & Supriyadi, T. (2026). The Effect of Plyometric Upper Body Exercises on Long-Distance Throwing Ability in Football Matches. Journal of Physical Education, Health and Sport, 13 (1), 305-310.

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p-ISSN 2354-7901
e-ISSN 2354-8231

INTRODUCTION

Football is one of the sports that has a high level of complexity because it involves technical skills, physical conditions, and tactical abilities that are integrated with each other. In the process of coaching football players, mastery of basic techniques is an important foundation that must be developed systematically from childhood to adolescence. According to Khansyah, (2017) Good basic technique will support the player's ability to effectively implement game strategy on the field. One of the basic techniques that has an important role in the game of football is the throw-in.Throw-in). This technique is used to restart the game when the ball comes out of the sideline. Although often considered a simple technique, throw-ins have strategic potential in the game because they can be utilized to maintain possession while creating attacking opportunities. Throws that have good distance and accuracy can provide a tactical advantage for the team, especially in game situations that require a quick distribution of the ball to the opponent's defensive area.

In the practice of football coaching, exercises related to throwing skills often do not receive optimal attention. Training programs at many football schools tend to place more emphasis on foot skills such as passing, dribbling, and shooting, while the development of upper body strength that plays a role in throwing ability has not been systematically trained. In fact, the strength of the upper body muscles has a significant contribution to throwing performance, body stability, and the efficiency of athletes' movements when throwing (Li & Chen, 2023). Lack of stimulation in upper body strength can have an impact on limited throwing distances, poor quality of movement coordination, and suboptimal biomotor skills required in the modern game of football (Chau, 2021; Issam et al., 2023). These conditions show that the development of a more comprehensive training program, including upper body strength training, is an important need in the development of football players.

The development of modern football demands that players have more comprehensive and balanced physical abilities. Players are not only required to master technical skills, but also have physical conditions that are able to support various demands of the game. In this context, upper body strength plays an important role not only in the ability to throw in, but also in maintaining body stability, balance during physical contact, and overall body movement coordination. Therefore, the integration of upper body strength training in football training programs is becoming increasingly important to improve the overall performance of players (Issam et al., 2023; Torregrosa-Domínguez et al., 2025). Training programs that are designed systematically and in accordance with the stages of athlete development are expected to be able to contribute to improving the technical skills and physical condition of young players.

One training method that can be used to increase muscle strength and explosiveness is plyometric exercises. Plyometric exercises are a training method that utilizes the mechanism of Stretch-shortening cycle (SSC), which is a series of muscle contractions involving an eccentric phase followed by rapid concentric contractions that produce greater explosive power (Fanhar et al., 2025). In the context of the upper body, this exercise is known as Upper Body Plyometric Training (UBPT) which focuses on developing the strength and explosiveness of the shoulder, arm, chest, and core muscles involved in throwing movements. Some forms of UBPT training such as Medicine Ball Chest Feed, Overhead Throw, and Plyometric push-ups This is believed to be able to improve the ability to produce strength and movement efficiency needed in throwing activities.

A number of previous studies have shown that upper body plyometric exercises are effective in improving physical performance and throwing ability in a variety of sports. Singla et al., (2018) through Systematic review reports that UBPT is able to improve muscle strength, explosiveness, and throwing performance in healthy individuals. These findings are reinforced by research Hang et al., (2025) Who did it Meta-analysis in handball athletes and found that plyometric exercises significantly improved throwing speed and distance. Research Aloui et al., (2021) also showed that plyometric exercises using Rubber Bracelet able to improve arm muscle strength, explosiveness, and throwing speed in handball athletes. In addition, the research Aloui et al., (2019) An eight-week plyometric training program was able to significantly improve upper and lower extremity performance in adolescent athletes.

These findings are also supported by research Garcia-Carrillo et al., (2023) which suggests that upper body plyometric exercises can improve strength, explosiveness, as well as the efficiency of movement mechanics in athletes. Other research by Sayers & Lorenzetti, (2020), Lu & Duan, (2024), and Cochrane & Hawke, (2007) It also shows that upper body plyometric exercises are capable of significantly increasing the production of strength and muscle strength. In general, the results of the study show that UBPT is an effective exercise method to improve the performance of explosive movements involving the upper extremities.

In the context of football, the ability to make an inward throw is influenced by several biomechanical factors such as the angle of release of the ball, the rotation of the torso, and the coordination between the lower and upper extremities. Researcher Radwan

et al., (2024) This suggests that an effective throw-in technique requires a synchronized sequence of movements from the legs, torso, to the arms resulting in a farther and more stable throw. In addition, the research Nuryastuti, Triana & Siolon, (2023) This suggests that arm muscle strength has a significant relationship with the ability to throw inside in football players.

In addition to the muscle strength factor, motor development also has an important role in learning throwing techniques in adolescent athletes. By about 14 years of age, the development of coordination, balance, and neuromuscular control has improved significantly. Research Groselj et al., (2019) suggests that balance is closely related to the development of motor skills in pre-adolescents. This is reinforced by research Mnejja et al., (2023) which states that postural control is an important factor that affects gross and fine motor abilities. In addition, the research Säisänen et al., (2021) This suggests that the development of motor representations in the brain continues to increase into adolescence, so this period is an important phase in the development of movement skills such as throwing.

Although various studies have proven the effectiveness of plyometric exercises in improving the performance of throwing movements in various sports, the application of upper body plyometric exercises in the context of football coaching is still relatively limited. Most of the research on UBPT has been done more on sports such as handball which emphasizes throwing activities. Therefore, there is still a research gap related to the application of UBPT in improving the ability to throw inside in football players, especially in the adolescent age group.

Based on this background, this study aims to determine the effect of upper body plyometric exercises on the improvement of throwing ability in 14-year-old football players. This research is expected to contribute to the development of more comprehensive training methods in youth football coaching and enrich scientific evidence-based coaching practices.

METHOD

This study uses a quantitative approach with a Pre-Experimental Design design, namely One-Group Pretest-Posttest Design. This design was used to determine the effect of Upper Body Plyometric Training (UBPT) on the improvement of throwing ability inwards in football players. In this design, one group of participants is given a pretest, then follows an exercise program as a treatment, and ends with a final test (posttest). Changes in throwing ability are known through a comparison of pretest and posttest results.

The subject of the study was a 14-year-old soccer player who actively participated in a training program. The selection of subjects is based on the stages of motor development of adolescents who are undergoing improved coordination, strength, and neuromuscular control making them suitable for the development of manipulative movement skills such as throwing.

Data collection is carried out through throwing tests (Throw-in test) and interviews. Throw test refers to the instrument ABDUL WAHAB, (2015) which has a validity of 0.78 and a reliability of 0.73. The test is carried out during the pretest and posttest by measuring the throwing distance using a meter from the point of the throw to the point of dropping the ball. Interviews were conducted to find out the athletes' perception of the exercises given with indicators including: the feeling of throwing further, increasing the strength of the arm and shoulder muscles, the positive impact of training on throwing performance, increasing confidence when throwing, not hesitating when throwing, increased motivation and confidence, difficulties during training, the contribution of training to team performance, and suggestions for continuous training.

Data analysis was carried out through normality tests and homogeneity tests as a prerequisite for statistical analysis. If the data meets the assumptions of normality and homogeneity, the Paired Sample t-test is used to determine the difference between the pretest and posttest values. If the data is not distributed normally, the Wilcoxon Marked Rating Test is used as an alternative to nonparametric analysis. This analysis aims to determine the effect of Upper Body Plyometric Training on the improvement of throwing ability.

RESULTS AND DISCUSSION

This study aims to determine the skills of long-range throwing ability in 14-year-old PS Ranc FC players. Data obtained from throw-in training, namely, Pre-test and Post-test from the research sample, can be used to determine the impact of upper body plyometric training on long-distance throwing ability in football. The effect has been tested according to the hypothesis.

Table 1. Descriptive statistics

	N	Minutes	Max	Red	Std. Deviations
Prates	24	1020	1490	1254,58	136,158
Post-tests	24	1210	1550	1390,00	103,125

Table 1. Descriptive statistics, it can be seen that the entire sample totals 24 people who take part in pre-test and post-test throws. With a minimum score of 1020 for the pre-test while for the post-test 1210. For the maximum score in the pre-test is 1490

while for the post-test it is 1550. Then the standard deviation for the pre-test is 136,158 and the post-test is 103,125.

Table 2. Normality Test

	Statistics	df	Sig.
Throw prates	.946	24	.219
Post-test throws	.959	24	.410

Table 2. The results of the Shapiro-Wilk normality test showed a significance value of 0.219 for the pretest and 0.410 for the posttest. Both values are greater than 0.05 so it is concluded that the data is distributed normally. Therefore the assumption of normality is met and the analysis can be continued with parametric tests.

Table 3. Homogeneity Test

Live Statistics	df1	DF2	Sig.
.884	1	46	.176

Table 3. Homogeneity test, it can be concluded that the significance data obtained is 0.176 it can be said that the data is homogeneous because the significance value exceeds 0.05. This shows that the assumption of homogeneity of variance is fulfilled so that the analysis can be continued using parametric tests.

Table 4. Paired Sample T-Test

	t	df	Sig. (2 tails)	
Couple 1	Prates - Pascates	-15.830	23	.001

Table 4. The results of the hypothesis test were carried out using the Paired Sample t-Test. The results of the analysis of 0.001 showed that there was a significant difference between the pretest and posttest values with a significance value of $p < 0.05$. Thus, the accepted research hypothesis is that upper body plyometric exercises have a significant influence on the improvement of throwing ability in football matches.

The results of the N-VIVO analysis of athletes' perception of the influence of upper body plyometric exercises in football games at the PS RANC FC Rancakalong club.

Figure 1. Word Cloud Results

Figure 1, the dominance of the words "throw", "training", "far", and "more" shows that the main focus of this study is the effectiveness of upper body plyometric exercises in improving the throwing distance and body strength of athletes.

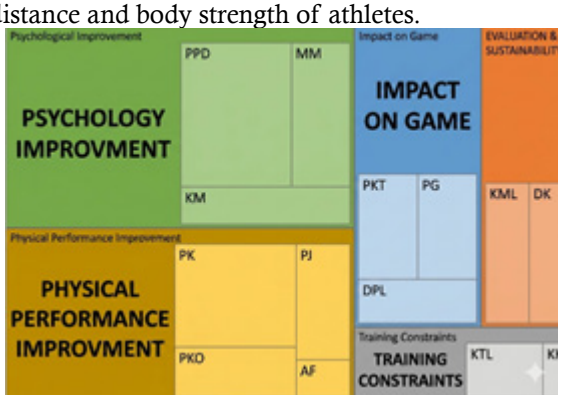

Figure 2. Hierarchical Results

Figure 2, data is grouped into five main dimensions, namely psychological improvement, game impact, program evaluation, physical performance, and training constraints which include aspects of experience, technique, and player motivation.

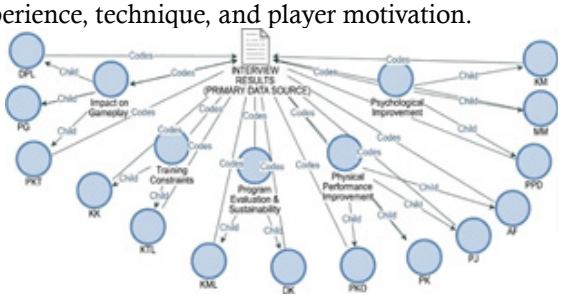

Figure 3. Concept Map

Figure 3, the radial structure links the central interview document with various indicator codes that represent the dimensions of the subject's experience, such as the impact of the game (DPL-PKT), constraints (KK-KTL), physical performance (AF-PKO), and psychological aspects (MM-PPD) are linked to integrate the field findings into the analytical framework.

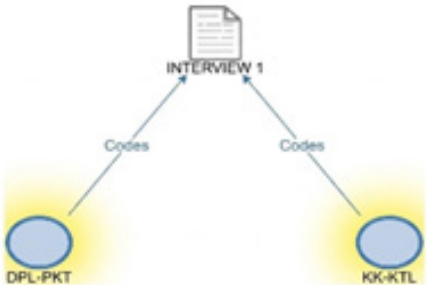

Figure 4. Comparison Results

Figure 4, data sourced from interviews is summarized into two main transformation points, namely the real impact on the results of throws during the match (DPL-PKT) and the increase in body muscle strength that supports the quality of the throws (KK-KTL).

This study aims to analyze the influence of sports programs Upper Body Plyometric Training (UBPT) for the improvement of throwing ability in

youth football players. The ability to throw inside is one of the basic techniques that has an important contribution to the game of football, especially in creating attack opportunities from set-piece situations. Therefore, the development of the strength and explosiveness of the upper body muscles is an important factor in improving the performance of throws to players (Garcia-Carrillo et al., 2023). The exercise program applied in this study focuses on increasing the explosiveness of the shoulder, arm, and core muscles through various forms of upper body plyometric exercises.

The results of the analysis showed an increase in the ability to throw after participants participated in the UBPT training program for 12 training sessions. The improvement showed that exercises that emphasized explosive muscle contractions were able to provide a neuromuscular adaptation stimulus that had an impact on improving the performance of manipulative movements such as throwing a ball. According to Hammami et al., (2025), plyometric exercises on the upper body are able to rapidly increase the ability to generate muscle strength quickly through mechanisms Stretch-shortening cycle, resulting in more powerful and explosive movements. This adaptation plays an important role in sports activities that require simultaneous strength and speed.

In addition, the improvement in throwing performance can also be explained through improved neuromuscular coordination between the shoulder, arm, and core muscles. UBPT exercises allow for increased muscle activation efficiency which plays a role in generating thrust when throwing in. Previous research has also shown that plyometric training is able to improve intramuscular and intermuscular coordination which contributes to the improvement of athletes' explosive abilities (Aloui et al., 2019). Thus, a structured and consistent training program can have a positive impact on the development of the physical abilities of football players.

The four-week training duration in this study is also in line with the findings of previous studies which stated that a plyometric training program in a span of 4-6 weeks was able to produce significant physical adaptations in athletes (Mnejja et al., 2023). Adaptation occurs as the body's response to repetitive and progressive exercise stimuli. In addition, regular exercise frequency allows for a process of supercompensation, which is a condition when the body adapts to the load of exercise and results in an increase in physical capacity (Randers et al., 2024).

The findings of this study are also supported by the results of interviews with athletes. Some participants revealed directly that the exercises given had a positive impact on the ability to throw in. One athlete stated;

"I feel like my throws have gone further after this exercise", while another athlete added "The strength of my arm and shoulder muscles feels better than before".

In addition, from the psychological aspect, participants also showed an increase in confidence. This is reflected in the statements;

"I became more confident when I threw into the game" and "Now I am less afraid and more prepared when I throw".

In terms of motivation, athletes also experienced an increase in enthusiasm in participating in training, as expressed;

"I became more enthusiastic because I wanted my throw to be even better" and "This exercise made me more enthusiastic because throwing can be a threat to the opponent".

However, some athletes also expressed obstacles in the training process, such as;

"I still have difficulty doing clap push-ups" and "I still have trouble adjusting the position of my feet and hands so that the throws can be far and straight".

The results of the interviews showed that UBPT training not only had an impact on increasing the strength and distance of the throw, but also increased the confidence and motivation of athletes, although there were still some technical obstacles during the training process. This shows that the training program has an impact not only on the physical aspect, but also on the psychological aspect of the athlete. According to Tangkung et al., (2021), confidence and motivation have an important role in improving motor skills performance in adolescent athletes.

The results of this study show that the Upper Body Plyometric Training program is an effective training method to improve the throwing ability of football players. This exercise is able to increase the strength and explosiveness of the upper body muscles which play a direct role in producing farther and stronger throws.

CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that the application of upper body plyometric exercises has a positive effect on improving throwing ability in 14-year-old soccer players. Exercise programs that focus on developing the strength and explosiveness of upper body muscles are able to increase the effectiveness of throwing movements through improved coordination, body stability, and power production abilities in the shoulder, arm, and core muscles. These findings suggest that upper body plyometric training can be one of the effective training methods in supporting the development of technical skills in football, especially in throwing ability. The study makes a scientific contribution to the development of plyometric training studies in the context of football, which has been studied more extensively in other sports that emphasize throwing activities. Thus, the results of this study can be the basis for the development of

more innovative and evidence-based training methods in the development of adolescent football athletes.

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