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The Effect Of Box Jump Training On The Heading Ability Of SSB Syamsul 08 Parangrea Football Players In Gowa Regency

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ABSTRACT

Football heading ability is a crucial technical skill that is influenced not only by technique but also by explosive lower-limb power and jumping ability. However, preliminary observations at SSB Syamsul 08 Parangrea, Gowa Regency, revealed that players' heading performance was still below expectations, particularly in terms of jumping height, timing, and ball contact accuracy. Therefore, this study aimed to examine the effect of box jump training on the heading ability of football players at SSB Syamsul 08 Parangrea, Gowa Regency. This study employed a quantitative experimental approach using a two-group pretest-posttest design. The population consisted of 30 football players, and 20 participants were selected through random sampling and divided equally into an experimental group and a control group. The experimental group received box jump training for 16 sessions, while the control group followed regular training activities. Data were collected using a heading test and analyzed through descriptive statistics, normality and homogeneity tests, paired-samples t-tests, and independent-samples t-tests using SPSS version 22. The results showed that the experimental group experienced a substantial increase in heading ability, with the mean score improving from 8.90 ± 2.51 to 23.40 ± 2.41, whereas the control group improved only from 9.00 ± 2.45 to 11.10 ± 1.73. The paired-samples t-test revealed a significant effect of box jump training ($t = 14.790$; $p = 0.000 < 0.05$). Furthermore, the independent-samples t-test indicated a significant difference between the experimental and control groups, with a mean difference of 12.30 points. In conclusion, box jump training is an effective and practical training method for improving the heading ability of youth football players by enhancing explosive power and jumping performance.

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A. Conception and design of the study;
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INTRODUCTION

Football is one of the most popular sports worldwide and is played across different age groups, ranging from children to adults. Its popularity continues to increase due to the dynamic nature of the game, which requires a combination of technical skills, physical fitness, tactical understanding, and psychological preparedness. In modern football, technical proficiency alone is insufficient; players must also possess excellent physical qualities to execute game actions effectively (Clemente et al., 2020). Among the fundamental techniques in football, heading remains an essential skill that

contributes to attacking and defensive performance, including scoring goals, passing, clearing the ball, and maintaining possession (Sarmento et al., 2020).

Heading performance is influenced by several factors, including technical execution, timing, coordination, and explosive leg power. The ability to jump high and generate force during aerial duels is critical for successful heading actions (Loturco et al., 2019). Recent studies have emphasized that lower-limb power is strongly associated with jump height and heading effectiveness in football players (Ramírez-Campillo et al., 2021). Therefore, training programs aimed at improving explosive power are expected to enhance heading ability. Various forms of strength and plyometric training have been developed to improve lower-limb power, such as squat jumps, countermovement jumps, drop jumps, speed hops, and box jumps. Among these methods, box jump training has attracted considerable attention because it combines explosive concentric muscle contractions with coordinated landing mechanics, thereby improving neuromuscular efficiency and lower-body power (Slimani et al., 2019). Box jump exercises involve repeatedly jumping onto and off a box using both legs within a predetermined duration, targeting the quadriceps, gluteal muscles, hamstrings, gastrocnemius, and soleus muscles, which are essential for explosive movements in football (Moran et al., 2018).

Preliminary observations conducted by researchers in collaboration with coaches at Syamsul 08 Soccer School, Gowa Regency, between March and June 2024 revealed that players' heading abilities remained below expectations during both friendly and official matches. Several players exhibited poor jumping height, inaccurate ball contact, and inadequate timing when competing for aerial balls. These deficiencies negatively affected offensive and defensive performance. If such conditions persist, players' competitive achievements may be difficult to improve. Consequently, identifying effective training interventions to enhance heading ability is highly relevant for football coaching and athlete development.

Recent developments in sports science have demonstrated that plyometric training is one of the most effective approaches to improving explosive power and sport-specific performance. Plyometric exercises stimulate the stretch-shortening cycle (SSC), which enhances the ability of muscles and tendons to produce maximal force in a short period (Markovic & Mikulic, 2020). In football, plyometric training has been associated with improvements in sprinting speed, vertical jump height, agility, and kicking performance (Ramírez-Campillo et al., 2022). Among various plyometric exercises, box jump training has emerged as an accessible and practical method for developing lower-limb power. Box jumps emphasize explosive upward movements followed by controlled landings, which stimulate neuromuscular adaptations and improve force production (Lloyd et al., 2019). Studies involving youth football players have shown that regular box jump exercises significantly improve vertical jump performance and muscular power (Asadi et al., 2018; Moran et al., 2018). Similarly, Slimani et al. (2019) reported that plyometric interventions lasting 6–8 weeks positively affected jumping performance and explosive strength in adolescent athletes.

Research conducted by Loturco et al. (2019) demonstrated that lower-limb power is strongly correlated with heading success because players who can generate greater jumping force are more capable of winning aerial duels. Likewise, Maulana et al. (2020) argued that heading ability is not solely dependent on technique but also on explosive power and jumping capacity. Improvements in vertical jump height resulting from plyometric training are therefore expected to translate into enhanced heading performance. The physiological basis of box jump training has also been widely explored. The exercise activates major lower-body muscle groups, including the rectus femoris, vastus lateralis, gluteus maximus, gastrocnemius, and soleus, all of which contribute to explosive jumping actions (Moran et al., 2018). Furthermore, box jump exercises improve motor unit recruitment and intermuscular coordination, which are essential components of explosive athletic performance (Suchomel et al., 2021). These adaptations are particularly relevant for football players, whose performance frequently depends on rapid force generation and explosive aerial movements.

Despite the growing body of evidence supporting plyometric training, several research gaps remain. First, most previous studies have focused on the effects of plyometric training on general physical performance indicators such as vertical jump, sprint speed, agility, and muscular power (Ramírez-Campillo et al., 2022; Slimani et al., 2019). Only a limited number of studies have specifically examined the influence of box jump exercises on football heading ability. Second, previous

investigations have predominantly involved elite athletes, university students, or professional players, whereas research on youth football academies and soccer schools remains scarce (Lloyd et al., 2019). Training characteristics, physical maturity, and technical proficiency differ substantially between youth and elite players, indicating that findings from elite populations cannot be generalized directly to youth athletes. Third, empirical evidence regarding the effectiveness of box jump training in Indonesian football contexts, particularly at the Soccer School (SSB) level, is still limited. Most domestic studies have focused on general physical conditioning rather than sport-specific skills such as heading. Consequently, there is a need for empirical studies that investigate how box jump training contributes directly to heading performance among youth football players in Indonesia. Addressing these gaps is important because heading remains a decisive skill in football matches. Understanding the effectiveness of box jump training can provide coaches with evidence-based training strategies that are practical, inexpensive, and applicable to youth football development programs.

Based on the aforementioned background, this study aims to examine the effect of box jump training on the heading ability of football players at Syamsul 08 Soccer School, Parangrea, Gowa Regency. Specifically, this research seeks to determine whether systematic box jump exercises can significantly improve players' heading performance. The novelty of this study lies in three aspects. First, unlike previous studies that focused primarily on general physical performance, this research investigates the direct effect of box jump training on a specific football skill, namely heading ability. Second, this study focuses on youth football players enrolled in a Soccer School program, a population that has received limited attention in previous research. Third, this research provides empirical evidence from the Indonesian context, particularly in Gowa Regency, thereby enriching the literature on football training and athlete development in developing countries. Therefore, the findings of this study are expected to contribute theoretically to the field of sports training science and practically to football coaching by providing an alternative training model that can be used to improve heading ability through the enhancement of lower-limb explosive power.

In conclusion, heading is a crucial football skill that depends not only on technical mastery but also on explosive lower-limb power and jumping ability. Box jump training, as a form of plyometric exercise, has demonstrated potential for improving neuromuscular performance and explosive strength, both of which are essential for effective heading. However, empirical studies examining its direct impact on heading performance among youth football players remain limited, particularly in Indonesia. Therefore, this study seeks to fill this gap by investigating the effect of box jump training on the heading ability of Syamsul 08 Soccer School players in Gowa Regency and providing evidence-based recommendations for football training practices.

METHODS

This study employed a quantitative approach using a two-group pretest–posttest experimental design to examine the effect of box jump training on the heading ability of football players at Syamsul 08 Soccer School (SSB Syamsul 08) in Parangrea, Gowa Regency. Experimental research is widely recognized as an effective approach for investigating causal relationships between training interventions and performance outcomes in sports science because it allows researchers to compare changes before and after treatment under controlled conditions (Thomas et al., 2022). The pretest–posttest design has been extensively applied in football training research to evaluate the effectiveness of plyometric interventions on sport-specific skills and physical performance (Ramírez-Campillo et al., 2021).

The population of this study consisted of 30 athletes registered at SSB Syamsul 08 Parangrea, Gowa Regency. A random sampling technique was employed to ensure that each athlete had an equal opportunity to be selected, thereby reducing selection bias and improving the representativeness of the sample (Creswell & Creswell, 2023). Based on this procedure, 20 athletes were selected as research participants and were randomly assigned into two groups: an experimental group receiving box jump training and a control group following the regular football training program.

The primary instrument used to collect data was the Heading Test, which measures players' ability to perform accurate and effective heading actions. Heading tests have been widely used in football research because they provide objective and reliable measures of heading performance, including aspects of timing,

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accuracy, and ball control (Sarmento et al., 2020). Objective testing is essential in sports science to ensure the validity and reliability of performance measurements (Hopkins et al., 2019).

Data collection was conducted in three stages. First, all participants completed a pretest to determine their baseline heading ability before the intervention. Second, the experimental group underwent a box jump training program for 16 training sessions, while the control group continued with their regular training activities. Box jump training is a plyometric exercise designed to improve lower-limb explosive power through repeated jumping movements that stimulate the stretch-shortening cycle (SSC), thereby enhancing neuromuscular adaptations and force production (Moran et al., 2018; Suchomel et al., 2021). Previous studies have demonstrated that plyometric exercises, including box jumps, effectively improve vertical jump performance, explosive strength, and football-related skills (Slimani et al., 2019; Lloyd et al., 2019; Asadi et al., 2018). Third, after completing the intervention program, all participants performed a posttest using the same heading test to assess changes in heading ability.

The collected data were analyzed using descriptive and inferential statistics with the assistance of IBM SPSS Statistics version 22. Before hypothesis testing, prerequisite analyses were conducted, including the normality test and homogeneity test, to ensure that the data met the assumptions required for parametric analysis (Field, 2022). Subsequently, a paired-samples t-test was employed to compare the mean scores of the pretest and posttest heading results. The t-test is commonly used in sports science research to evaluate the effectiveness of training interventions by determining whether significant differences exist between measurements taken before and after treatment (Cohen et al., 2018). Statistical significance was established at a probability level of $p < .05$.

RESULTS AND DISCUSSION

Result

Descriptive Statistics of Heading Ability

The descriptive analysis was conducted to provide an overview of the heading ability scores of football players from SSB Syamsul 08 Parangrea, Gowa Regency, before and after the intervention. Table 1 presents the descriptive statistics of both the experimental group, which received box jump training, and the control group.

Table 1.
Descriptive Statistics of Heading Ability Scores

Variable	N	Range	Minimum	Maximum	Sum	Mean	SD
Experimental Group Pretest	10	8.00	5.00	13.00	89.00	8.90	2.51
Experimental Group Posttest	10	7.00	20.00	27.00	234.00	23.40	2.41
Control Group Pretest	10	8.00	5.00	13.00	90.00	9.00	2.45
Control Group Posttest	10	6.00	8.00	14.00	111.00	11.10	1.73

Table 1 shows a substantial improvement in heading ability among players in the experimental group after participating in the box jump training program. The mean score increased from 8.90 ± 2.51 during the pretest to 23.40 ± 2.41 in the posttest. In contrast, the control group exhibited only a slight improvement, with the mean score increasing from 9.00 ± 2.45 to 11.10 ± 1.73. These findings indicate that the box jump training program contributed more effectively to improving heading performance than regular training alone.

Normality Test

Before hypothesis testing, the data were examined for normality using the Kolmogorov–Smirnov and Shapiro–Wilk tests. The results are presented in Table 2.

Table 2.
Normality Test Results

Variable	Kolmogorov-Smirnov Statistic	Sig.	Shapiro-Wilk Statistic	Sig.	α	Interpretation
Box Jump Group	0.141	0.200	0.142	0.624	0.05	Normal
Control Group	0.142	0.200	0.970	0.892	0.05	Normal

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As shown in Table 2, the significance values obtained from both normality tests were greater than 0.05. Specifically, the Shapiro–Wilk significance values were 0.624 for the box jump group and 0.892 for the control group. Therefore, all data were normally distributed and met the assumptions required for parametric statistical analysis.

Homogeneity Test

The homogeneity of variance between the experimental and control groups was assessed using Levene's Test. The results are summarized in Table 3.

Table 3.
Homogeneity Test Results

Variable	Levene Statistic	Sig.	α	Interpretation
Experimental and Control Groups	0.814	0.494	0.05	Homogeneous

The significance value of Levene's test was 0.494, which is greater than 0.05, indicating that the variances of the two groups were homogeneous. Therefore, the assumptions for conducting the independent and paired t-tests were satisfied.

Effect of Box Jump Training on Heading Ability

To determine the effect of box jump training on heading ability, a paired-samples t-test was conducted between the pretest and posttest scores of the experimental group.

Table 4.
Paired Samples t-Test of the Experimental Group

Variable	Mean Pretest	Mean Posttest	Mean Difference	t-value	df	Sig. (2-tailed)	t-table
Box Jump Training	8.90	23.40	14.50	14.790	9	0.000	1.833

The results indicated a significant improvement in heading ability after box jump training. The calculated t-value (14.790) was considerably higher than the critical t-value (1.833), with a significance level of $p = 0.000$ (< 0.05). Therefore, the null hypothesis was rejected, indicating that box jump training had a significant positive effect on the heading ability of SSB Syamsul 08 football players. The average increase in heading scores reached 14.50 points.

Effect of Regular Training on Heading Ability

A paired-samples t-test was also conducted for the control group.

Table 5.
Paired Samples t-Test of the Control Group

Variable	Mean Pretest	Mean Posttest	Mean Difference	t-value	df	Sig. (2-tailed)	t-table
Control Group	9.00	11.10	2.10	5.161	9	0.000	1.833

The control group also demonstrated a statistically significant increase in heading ability ($p < 0.05$). However, the improvement was relatively small, with a mean difference of only 2.10 points compared to 14.50 points in the experimental group.

Comparison Between Experimental and Control Groups

An independent samples t-test was performed to compare the posttest scores between the experimental and control groups.

Table 6.
Independent Samples t-Test of Posttest Scores

Variable	Mean	Mean Difference	t-value	df	Sig. (2-tailed)	t-table
Box Jump Group	23.40	12.30	13.104	18	0.000	1.734
Control Group	11.10	-	-	-	-	-

The independent t-test revealed a significant difference in posttest heading scores between the experimental and control groups ($t = 13.104$, $p = 0.000$). The mean posttest score of the box jump group (23.40) was substantially higher than that of the control group (11.10), resulting in a mean difference of

12.30 points. These findings confirm that box jump training was significantly more effective than regular training in improving the heading ability of SSB Syamsul 08 football players in Gowa Regency.

Discussion

The findings of this study demonstrate that box jump training had a significant effect on improving the heading ability of football players at SSB Syamsul 08 Parangrea in Gowa Regency. Based on the descriptive statistical analysis, the experimental group showed a substantial increase from a pretest mean score of 8.90 to a posttest mean score of 23.40. In contrast, the control group increased only from 9.00 to 11.10. Although both groups experienced improvement, the magnitude of improvement in the experimental group was considerably greater. This indicates that box jump training provided a more meaningful training stimulus than regular football training in developing heading performance. The improvement in the experimental group can be explained through the principle of plyometric adaptation. Box jump training is a plyometric exercise that emphasizes explosive upward movement, rapid force production, and coordinated landing mechanics. In football, heading ability does not depend solely on the movement of the head, but also on the player's ability to jump, maintain body balance, coordinate timing, and generate sufficient lower-limb power before contacting the ball. This finding is consistent with Asadi et al. (2018), who stated that plyometric training improves explosive power through repeated stretch-shortening cycle activity. Similarly, Moran et al. (2018) reported that plyometric training significantly improves jump performance in young soccer players. Therefore, the increase in heading ability in this study is strongly associated with the improvement of lower-limb explosive strength developed through box jump training.

The results also support the concept that heading performance is closely related to vertical jump ability. Players who can jump higher and faster have a greater opportunity to reach the ball earlier than opponents, especially in aerial duels. Loturco et al. (2019) emphasized that lower-limb power is a key determinant of explosive football actions, including jumping, sprinting, and heading. Ramírez-Campillo et al. (2021) also found that plyometric jump training improves neuromuscular performance and sport-specific actions in soccer players. In the present study, the experimental group's mean improvement of 14.50 points suggests that box jump training successfully transferred physical power development into technical heading performance. Before hypothesis testing, the data were examined through normality and homogeneity tests. The Kolmogorov–Smirnov and Shapiro–Wilk tests showed that the data were normally distributed, while Levene's Test indicated that the variances between groups were homogeneous. These results confirm that the data met the assumptions for parametric analysis. According to Field (2022), normality and homogeneity testing are essential procedures in experimental research because they ensure that inferential statistical conclusions are valid. Therefore, the use of paired-samples and independent-samples t-tests in this study was statistically appropriate.

The paired-samples t-test in the experimental group showed a t-value of 14.790, which was higher than the t-table value of 1.833, with a significance value of 0.000. This means that the difference between pretest and posttest scores was statistically significant. In practical terms, the training intervention was effective in improving heading ability. This finding aligns with Slimani et al. (2019), who reported that plyometric training improves explosive strength and athletic performance in team sports. It is also supported by Suchomel et al. (2021), who argued that muscular strength and power are essential foundations for high-level sport performance. In this context, box jump training helped players develop stronger and faster leg extension, which is required when performing heading movements.

Although the control group also showed a significant improvement, the increase was relatively small, with a mean difference of only 2.10 points. This improvement may have resulted from routine football practice, repeated exposure to heading activities, and natural learning effects. However, the independent-samples t-test showed that the posttest score of the experimental group was significantly higher than that of the control group, with a mean difference of 12.30 points. This confirms that box jump training was more effective than regular training alone. Lloyd et al. (2019) explained that structured plyometric training produces greater neuromuscular adaptation than unstructured or general sport practice. Therefore, the superior improvement in the experimental group reflects the importance of using specific, systematic, and progressive training methods.

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Conceptually, box jump training improves heading ability through several mechanisms. First, it strengthens the quadriceps, hamstrings, gluteus maximus, gastrocnemius, and soleus muscles, which are involved in take-off during jumping. Second, it enhances motor unit recruitment, allowing players to produce force more rapidly. Third, it improves body coordination and landing control, which are important for maintaining balance after aerial contact. Fourth, it develops confidence in performing explosive jumping movements during competitive play. These mechanisms are in line with Markovic and Mikulic (2020), who explained that plyometric training increases the efficiency of neuromuscular coordination and elastic energy utilization. Sarmento et al. (2020) also emphasized that football performance depends on the interaction between technical, physical, and tactical components.

Empirically, the findings of this study reinforce previous studies showing that plyometric training is effective for football players. Ramírez-Campillo et al. (2022) found that plyometric interventions improved vertical jump, sprint, agility, and explosive performance in soccer athletes. Hammami et al. (2020) demonstrated that jump-based training improved power and movement efficiency among young football players. Chaabene et al. (2020) also stated that explosive training is particularly important for youth athletes because it supports the development of sport-specific motor skills. In relation to heading, Maulana et al. (2020) argued that heading success is influenced by leg power, timing, and technical coordination. Thus, the present study provides additional evidence that box jump training can directly improve heading ability, not merely general physical fitness.

For coaches, these results have important practical implications. Box jump training can be used as an alternative exercise model to improve heading ability among youth football players. The exercise is relatively simple, does not require expensive equipment, and can be integrated into regular football training sessions. However, coaches must ensure that the training is performed progressively, with appropriate box height, correct landing technique, sufficient recovery, and supervision to reduce injury risk. As noted by Behm et al. (2017), youth strength and plyometric training must be adapted to athletes' maturity, ability, and training experience.

In conclusion, the results of this study prove that box jump training significantly improves the heading ability of SSB Syamsul 08 Parangrea football players in Gowa Regency. The improvement occurred because box jump training develops lower-limb explosive power, jumping ability, coordination, and neuromuscular efficiency, all of which are essential for effective heading performance. Compared with regular training, box jump training produced a substantially greater improvement, making it a relevant and evidence-based training method for youth football development.

CONCLUSION

This study concludes that box jump training has a significant positive effect on the heading ability of football players at SSB Syamsul 08 Parangrea, Gowa Regency. The findings demonstrate that systematic plyometric training through box jump exercises effectively enhances players' heading performance by improving lower-limb explosive power, jumping ability, neuromuscular coordination, and movement efficiency, all of which are essential components of successful heading in football. Empirically, the descriptive analysis showed a substantial improvement in the experimental group after participating in the box jump training program. The mean heading score increased from 8.90 ± 2.51 in the pretest to 23.40 ± 2.41 in the posttest, representing an average improvement of 14.50 points. In comparison, the control group showed only a modest increase from 9.00 ± 2.45 to 11.10 ± 1.73, with a mean improvement of 2.10 points. Furthermore, the independent-samples t-test revealed a significant difference between the posttest scores of the experimental and control groups, with a mean difference of 12.30 points. The inferential statistical analysis further confirmed the effectiveness of the intervention. The paired-samples t-test for the experimental group yielded a t-value of 14.790, which was substantially higher than the critical value (t-table = 1.833), with a significance level of $p = 0.000$ (< 0.05). Therefore, the null hypothesis was rejected, indicating that box jump training significantly improved the heading ability of the participants. Conceptually, these findings reinforce the theoretical framework that heading performance is not solely determined by technical skills but is also strongly influenced by explosive muscular power and jumping capacity. Consequently, box jump training can be recommended as an evidence-based, practical, and efficient training method for youth

football development programs. Coaches and sports practitioners are encouraged to incorporate this training model into regular football practice to optimize heading performance and enhance overall competitive achievement among young athletes.

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