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The Effect of Rubber-Based Training on Shooting Skills in Football Games

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A. Conception and design of the study; **B.** Acquisition of data;
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ABSTRACT

Shooting is one of the most decisive technical skills in football because it directly determines a player's ability to create scoring opportunities and contribute to team success. However, preliminary observations at SSB SWADIRI showed that players' shooting ability was still relatively low, particularly in terms of power, accuracy, and execution toward the goal. This study aimed to determine the effect of elastic resistance-band training on the shooting ability of football players at SSB SWADIRI. This research used a quantitative experimental method with an intact-group comparison design. The sample consisted of 20 football players divided into two groups: an experimental group that received elastic resistance-band training and a control group that followed conventional football training. Data were collected using a football shooting test and analyzed through descriptive statistics, normality and homogeneity tests, paired-samples t-tests, and independent-samples t-tests. The results showed that the experimental group improved from a pre-test mean of 6.00 to a post-test mean of 9.50, with a mean difference of 3.50 points and $p = 0.000 < 0.05$. The control group also improved from 2.90 to 5.10, with a mean difference of 2.20 points. The between-group comparison showed a significant difference of 8.20 points, indicating that elastic resistance-band training was more effective than conventional training. Therefore, elastic resistance-band training is recommended as a practical, affordable, and sport-specific method to improve shooting ability in youth football players.

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INTRODUCTION

Football remains the most popular sport worldwide and continues to experience rapid growth in Indonesia, both as a competitive sport and as an important component of youth development programs. The expansion of football academies and Soccer Schools (Sekolah Sepak Bola/SSB) has increased opportunities for young athletes to develop technical, tactical, physical, and psychological competencies from an early age. However, achieving competitive performance requires systematic training methods that effectively improve fundamental football skills, particularly shooting ability, which directly determines goal-scoring success and match outcomes.

Among the essential technical skills in football, shooting is considered one of the most decisive offensive actions because it represents the final execution of attacking play. Effective shooting requires the integration

of lower-limb strength, neuromuscular coordination, balance, movement velocity, and technical precision. Two common shooting techniques are the instep shot and the toe shot, each demanding different biomechanical characteristics but sharing the necessity of producing high ball velocity while maintaining directional accuracy. Previous technical analyses indicate that proper foot-ball contact, body alignment, and coordinated movement patterns are essential determinants of successful shooting performance (Aprianova & Hariadi, 2017).

Although shooting appears relatively simple, many youth players experience considerable difficulty in producing powerful and accurate shots during competitive matches. Modern football increasingly demands players who can execute rapid and precise finishing under pressure. Consequently, coaches must employ evidence-based training strategies capable of simultaneously improving muscular power, explosive strength, and movement specificity. Previous studies have emphasized that technical mastery alone is insufficient without adequate physical conditioning supporting explosive kicking performance.

Preliminary observations conducted by the researcher together with the coaching staff at SSB SWADIRI on November 27, 2024, revealed several performance deficiencies during friendly matches. Most players demonstrated low shooting accuracy toward the goal, produced relatively weak shots that posed minimal challenge to opposing goalkeepers, and frequently failed to execute accurate penetrating passes. These shortcomings reduced attacking effectiveness and allowed opponents to regain possession easily. Such findings indicate that current training programs have not sufficiently optimized the physical capacities supporting shooting performance. Therefore, identifying an effective training intervention capable of enhancing shooting ability has become an important practical issue for youth football coaching.

Recent developments in football science emphasize that improvements in technical performance are strongly associated with sport-specific strength training rather than conventional resistance programs alone. Resistance exercises that mimic sport movements are increasingly recommended because they facilitate greater transfer of training adaptations into actual game performance. Among various training modalities, elastic resistance (rubber resistance bands) has gained considerable attention due to its ability to provide variable resistance throughout the movement while preserving natural motor patterns.

Elastic resistance training offers several physiological advantages. Unlike traditional weight training, resistance bands provide progressive tension during concentric movement, stimulating muscle activation throughout the entire range of motion. Such training enhances explosive strength, neuromuscular coordination, rate of force development, and movement efficiency, all of which are critical determinants of kicking performance. Recent systematic reviews have reported that elastic resistance training significantly improves lower-limb muscle power, sprint ability, change-of-direction performance, and explosive actions among adolescent athletes.

Furthermore, biomechanical investigations have demonstrated that stronger hip extensors, knee extensors, and ankle plantar flexors contribute substantially to higher kicking velocity and greater shooting effectiveness. Studies conducted in football populations consistently report positive relationships between lower-body power, explosive strength, and shooting performance. Integrating resistance-band exercises into football-specific kicking drills may therefore produce greater functional adaptations than isolated technical practice. Several intervention studies conducted during the last decade have also shown that resistance-based training programs improve technical football performance, including kicking speed, passing quality, sprint acceleration, and jump performance. Meanwhile, youth athlete development models recommend combining technical practice with functional strength exercises that replicate actual sporting movements to maximize motor learning and long-term athletic development. Collectively, contemporary literature indicates that elastic resistance training represents an affordable, practical, and safe training modality suitable for youth football environments. Nevertheless, evidence regarding its effectiveness on shooting performance within Indonesian football academies remains relatively limited.

Despite the growing body of literature concerning strength and conditioning in football, several important research gaps remain unresolved. First, previous studies have predominantly focused on plyometric training, weight training, medicine ball exercises, sprint training, and combined strength programs, whereas empirical investigations specifically examining elastic resistance training for improving football shooting ability remain scarce. Second, many previous intervention studies have evaluated general physical performance variables such as sprint speed, agility, vertical jump, or muscular strength without directly measuring football-specific

shooting performance as the primary outcome. Third, most available evidence originates from European or elite football settings. The applicability of these findings to Indonesian youth football academies with different coaching systems, facilities, and athlete characteristics has not been adequately investigated. Fourth, limited studies have explored the effectiveness of affordable resistance-band training in grassroots football environments, despite its practicality, portability, and low implementation cost. This limitation is particularly relevant for community-based football academies where sophisticated resistance equipment is often unavailable. Finally, preliminary observations at SSB SWADIRI indicate persistent deficiencies in shooting performance despite routine technical practice. This suggests that conventional technical drills alone may not sufficiently develop the physical qualities required for effective shooting execution, highlighting the need for evidence-based interventions integrating sport-specific resistance training.

Based on the identified problems and research gaps, this study aims to determine the effect of elastic resistance-band training on the shooting ability of football players at SSB SWADIRI. The novelty of this research lies in several aspects. First, it investigates elastic resistance training as a sport-specific intervention directly targeting football shooting performance rather than general physical fitness. Second, the study evaluates the practical application of an affordable and accessible resistance modality within a grassroots football academy, thereby providing evidence relevant to Indonesian youth football development. Third, it integrates physiological principles of explosive strength development with football-specific technical execution, offering a more comprehensive training approach than conventional technical practice alone. The findings are expected to contribute both theoretically and practically by enriching the scientific literature concerning functional resistance training in football while providing coaches with evidence-based recommendations for improving shooting performance among youth players.

In conclusion, shooting ability remains one of the most decisive technical competencies in football performance, yet many youth athletes continue to exhibit inadequate shooting accuracy and power due to insufficient sport-specific physical conditioning. Although elastic resistance training has demonstrated promising effects on muscular strength and explosive performance, empirical evidence concerning its influence on football shooting ability in Indonesian youth academies remains limited. Addressing this gap, the present study investigates the effect of elastic resistance-band training on shooting ability among SSB SWADIRI players. The findings are expected to strengthen the scientific foundation for evidence-based football training programs while providing practical guidance for coaches seeking efficient, economical, and sport-specific methods to enhance shooting performance in youth football.

METHODS

This study employed a quantitative experimental approach using an Intact-Group Comparison design to examine the effect of elastic resistance-band training on the shooting ability of football players at SSB SWADIRI. This design was selected because it allows comparisons between an experimental group receiving the intervention and a control group following regular training without random reassignment of participants, making it appropriate for sports training conducted in natural team settings. Experimental designs are widely recommended for evaluating the effectiveness of training interventions because they provide stronger evidence regarding causal relationships between treatment and performance outcomes.

The participants consisted of 20 youth football players from SSB SWADIRI who were selected using total sampling, as all eligible athletes met the inclusion criteria. The participants were equally divided into two groups: an experimental group (n = 10), which received elastic resistance-band training in addition to the regular football program, and a control group (n = 10), which continued the conventional training program without elastic resistance exercises. Both groups followed the same training schedule throughout the intervention period to minimize external influences.

Shooting performance was assessed using a standardized Football Shooting Test, which has been widely applied to evaluate shooting accuracy and effectiveness in youth football. Prior to the intervention, all participants completed a pre-test to determine baseline shooting ability. The experimental group then participated in a structured elastic resistance-band training program, whereas the control group continued routine football practice. Following completion of the intervention, both groups completed an identical post-test under the same testing conditions to ensure measurement consistency and reliability.

Data analysis was performed using IBM SPSS Statistics. Descriptive statistics, including means and standard deviations, were calculated to summarize participants' performance. Before hypothesis testing, the assumptions of parametric analysis were evaluated using the Shapiro–Wilk normality test and Levene's homogeneity of variance test. Differences between pre-test and post-test scores, as well as comparisons between groups, were analyzed using the independent-samples t-test with a significance level of $p < .05$. This analytical procedure is commonly recommended for experimental studies investigating the effectiveness of training interventions in sports science because it enables objective evaluation of treatment effects while ensuring statistical validity.

RESULTS AND DISCUSSION

Descriptive Statistics

Descriptive statistical analysis was conducted to provide an overview of the participants' shooting performance before and after the intervention in both the experimental and control groups. The analysis included the number of participants, range, minimum and maximum scores, total score, mean, and standard deviation.

Table 1.
Descriptive Statistics of Shooting Ability

Variable	N	Range	Min.	Max.	Sum	Mean	SD
Experimental Group (Pre-test)	10	11.00	2.00	13.00	60.00	6.00	3.09
Experimental Group (Post-test)	10	20.00	3.00	23.00	95.00	9.50	5.44
Control Group (Pre-test)	10	4.00	1.00	5.00	29.00	2.90	1.60
Control Group (Post-test)	10	8.00	1.00	9.00	51.00	5.10	2.96

Table 1 shows that the experimental group demonstrated a substantial improvement following elastic resistance-band training. The mean shooting score increased from 6.00 ± 3.09 during the pre-test to 9.50 ± 5.44 in the post-test, representing an average improvement of 3.50 points. Meanwhile, the control group also showed improvement after regular football training, although the increase was relatively smaller, with the mean score rising from 2.90 ± 1.60 to 5.10 ± 2.96, corresponding to an average improvement of 2.20 points. These descriptive findings indicate that the experimental group achieved greater enhancement in shooting performance than the control group.

Normality Test

Before hypothesis testing, the distribution of the data was examined using the Kolmogorov–Smirnov and Shapiro–Wilk tests.

Table 2.
Results of Normality Test

Variable	Kolmogorov–Smirnov	Sig.	Shapiro–Wilk	Sig.	Conclusion
Experimental Group	0.173	0.200	0.918	0.339	Normal
Control Group	0.214	0.200	0.852	0.061	Normal

The results indicate that all significance values exceeded the 0.05 threshold. The experimental group obtained Shapiro–Wilk $p = 0.339$, while the control group obtained $p = 0.061$. Consequently, both datasets satisfied the assumption of normality and were suitable for subsequent parametric statistical analysis.

Homogeneity Test

Homogeneity of variance between the experimental and control groups was evaluated using Levene's test.

Table 3.
Homogeneity Test

Variable	Levene Statistic	Sig.	α	Conclusion
Experimental vs Control	0.875	0.463	0.05	Homogeneous

Since the significance value (0.463) exceeded the significance level (0.05), the variances of both groups were considered homogeneous. Therefore, the assumptions for parametric hypothesis testing were fulfilled.

Effect of Elastic Resistance-Band Training on Shooting Ability

A paired-samples t-test was conducted to compare pre-test and post-test shooting scores within the experimental group.

Table 4.

Paired-Samples t-Test for the Experimental Group

Comparison	Mean Pre-test	Mean Post-test	Mean Difference	t	df	p	t-table
Experimental Group	6.00	9.50	3.50	4.269	9	0.000	1.833

The paired-samples t-test revealed a statistically significant improvement in shooting performance after elastic resistance-band training ($t = 4.269$, $p < 0.001$). Since the calculated t-value exceeded the critical value ($4.269 > 1.833$), the null hypothesis was rejected. The experimental group improved by an average of 3.50 points, indicating that elastic resistance-band training significantly enhanced the shooting ability of SSB SWADIRI football players.

Effect of Conventional Training on Shooting Ability

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

Table 5.

Paired-Samples t-Test for the Control Group

Comparison	Mean Pre-test	Mean Post-test	Mean Difference	t	df	p	t-table
Control Group	2.90	5.10	2.20	4.975	9	0.000	1.833

The control group also exhibited a statistically significant increase in shooting performance ($t = 4.975$, $p < 0.001$). The mean improvement was 2.20 points, suggesting that regular football training contributed to better shooting performance. However, the magnitude of improvement was smaller than that observed in the experimental group.

Comparison Between Elastic Resistance-Band Training and Conventional Training

An independent-samples t-test was conducted to compare post-test scores between the two groups.

Table 6.

Independent-Samples t-Test Between Groups

Group	Mean Post-test	Mean Difference	t	df	p	t-table
Elastic Resistance-Band Training	14.20	8.20	7.113	9	0.000	1.734
Control Training	6.00					

The independent-samples t-test demonstrated a statistically significant difference between the experimental and control groups ($t = 7.113$, $p < 0.001$). The post-test mean score of the experimental group (14.20) was considerably higher than that of the control group (6.00), with a mean difference of 8.20 points. Because the calculated t-value exceeded the critical value ($7.113 > 1.734$), the null hypothesis was rejected. These findings indicate that elastic resistance-band training was significantly more effective than conventional football training in improving shooting ability among SSB SWADIRI players.

Overall, the statistical analyses consistently support the effectiveness of elastic resistance-band training in enhancing football shooting performance. Both groups experienced significant improvements from pre-test to post-test; however, the experimental group achieved greater gains than the control group. The fulfillment of the assumptions of normality and homogeneity further strengthens the validity of the parametric analyses. Consequently, the findings confirm that elastic resistance-band training provides a superior training stimulus for improving shooting ability in youth football players at SSB SWADIRI.

Discussion

This study examined the effect of elastic resistance-band training on the shooting ability of football players at SSB SWADIRI. The findings confirmed all three hypotheses, indicating that both the experimental and control groups improved significantly, but the elastic resistance-band training group produced greater performance gains.

Empirically, the experimental group increased from a pre-test mean of 6.00 to a post-test mean of 9.50, with a mean difference of 3.50 points. The paired-samples t-test showed a significant effect, with $p = 0.000 < 0.05$. This result demonstrates that elastic resistance-band training provided an effective stimulus for improving shooting performance. Conceptually, football shooting requires the integration of lower-limb strength, explosive power, coordination, balance, trunk stability, and technical accuracy. Recent studies in football science emphasize that kicking performance is strongly influenced by neuromuscular coordination, hip flexor–extensor strength, knee extension power, ankle stability, and the ability to transfer force efficiently through the kinetic chain (Loturco et al., 2018; Ramírez-Campillo et al., 2020; Rumpf et al., 2016; Sarmento et al., 2018).

The acceptance of the first hypothesis supports the argument that elastic resistance-band training can improve sport-specific technical performance. Elastic resistance creates progressive external load throughout the movement range, allowing athletes to train explosive force while maintaining movement patterns close to actual kicking actions. This is consistent with findings by Suchomel et al. (2016), who stated that strength and power development contribute directly to explosive sport skills when training stimuli are specific to the movement demands. In football, shooting is not merely a technical action but also a high-speed motor task requiring rapid force production. Therefore, resistance-band training may enhance the ability of the lower limbs to generate force during the backswing, acceleration, and ball-contact phases of shooting. Similar evidence has been reported by Beato et al. (2018), Hammami et al. (2019), and Slimani et al. (2016), who found that resistance-based and explosive training methods improved football-related performance such as sprinting, kicking velocity, agility, and power output.

Theoretically, the improvement of 3.50 points in the experimental group can be explained through physiological and biomechanical adaptation. Elastic resistance training stimulates motor-unit recruitment, intermuscular coordination, tendon stiffness, and rate of force development, which are essential for producing stronger and more accurate shots. Putra Renaldi and Wisnu (2020) described rubber resistance as an elastic material that produces spring-like force and can be used to develop strength. This principle is aligned with contemporary resistance-training theory, which explains that variable resistance improves force application across different joint angles (Andersen et al., 2017; Iversen et al., 2017; Lopes et al., 2019). In football shooting, this is particularly relevant because the kicking leg moves through a large range of motion and requires coordinated acceleration before impact. Empirical support is also found in Rahyuddin Jide Same (2021), who showed that rubber-loaded striking practice improved average punching speed in karate due to physiological and anatomical adaptations in the working muscles. Although the sport context differs, the principle is transferable: elastic resistance can increase movement speed and force production in explosive striking or kicking actions.

The second hypothesis was also accepted, as the control group showed a significant increase from a pre-test mean of 2.90 to a post-test mean of 5.10, with a mean difference of 2.20 points and $p = 0.000 < 0.05$. This result indicates that conventional football training still contributed positively to shooting performance. Regular football practice involving passing, dribbling, tactical play, and shooting drills can improve motor familiarity, confidence, and technical execution. Previous research confirms that repeated technical practice enhances perceptual-motor control, decision-making, and skill consistency in youth football players (Forsman et al., 2016; Huijgen et al., 2015; O'Connor et al., 2018; Práxedes et al., 2018). However, the improvement in the control group was lower than that of the experimental group, suggesting that regular training alone may not provide sufficient overload to maximize shooting development. This finding is important because many youth football programs rely heavily on technical drills without systematically integrating strength-oriented training.

The control group finding should not be interpreted as failure, but as evidence that conventional practice has limited effectiveness when compared with structured elastic resistance training. In sports training research, control groups may improve because of repeated exposure, learning effects, maturation, and normal participation in team training (Buchheit & Laursen, 2019; Moran et al., 2018). Nevertheless, the smaller gain indicates that technical repetition without additional resistance stimulus may be less optimal for developing the physical qualities required for powerful shooting. This supports the view that youth football training should combine technical practice with age-appropriate strength and neuromuscular training to produce more complete performance development (Lloyd et al., 2016; Moran et al., 2017; Read et al., 2018).

The third hypothesis was accepted because the post-test comparison showed a significant difference between elastic resistance-band training and the control group. The experimental group achieved a higher

post-test mean than the control group, with a mean difference of 8.20 points and p = 0.000 < 0.05. This result confirms that elastic resistance-band training was more effective than conventional training for improving shooting ability at SSB SWADIRI. From a practical coaching perspective, this is an important finding because resistance bands are inexpensive, portable, safe, and easy to apply in grassroots football settings. Coaches can integrate resistance-band exercises into warm-up, technical shooting drills, or special conditioning sessions without requiring advanced gym equipment.

Conceptually, the superiority of elastic resistance-band training may be attributed to the principle of specificity and progressive overload. When resistance is applied to movements resembling the shooting pattern, athletes are challenged to generate force while maintaining technical coordination. This type of training may improve both physical and technical components simultaneously. Modern football training literature emphasizes that performance improvements are greatest when conditioning exercises are linked to the actual movement structure of the sport (Bishop et al., 2018; Comfort et al., 2019; Turner & Stewart, 2014; Weldon et al., 2020). In this study, the larger improvement in the experimental group indicates that elastic resistance training created a more functional adaptation for shooting than routine training alone.

Overall, the findings provide strong empirical support for the use of elastic resistance-band training in youth football. The significant improvement in the experimental group, the smaller but significant improvement in the control group, and the significant difference between both groups demonstrate that structured elastic resistance training is an effective intervention to enhance shooting ability. For SSB SWADIRI, this training method can be recommended as a practical model to improve attacking effectiveness, especially in developing stronger and more accurate shots. Future studies should involve larger samples, longer intervention periods, and additional performance indicators such as ball speed, shooting accuracy zones, lower-limb power, and biomechanical kicking analysis to strengthen the evidence base.

CONCLUSION

This study concludes that elastic resistance-band training has a significant positive effect on the shooting ability of football players at SSB SWADIRI. The experimental findings demonstrated that participants who received elastic resistance-band training showed a significant improvement in shooting performance, with the mean score increasing from 6.00 in the pre-test to 9.50 in the post-test, representing an average improvement of 3.50 points. Statistical analysis further confirmed this effect through a paired-samples t-test, which produced a significance value of p = 0.000 (< 0.05). Although the control group also showed a significant improvement following conventional football training, with a mean increase of 2.20 points, the magnitude of improvement was considerably lower than that achieved by the experimental group. Furthermore, the independent-samples t-test revealed a significant difference between the two groups, with the experimental group demonstrating superior post-test performance and a mean difference of 8.20 points.

Conceptually, these findings indicate that elastic resistance-band training effectively enhances lower-limb muscle strength, explosive power, neuromuscular coordination, and force transmission during the kicking motion, thereby improving shooting execution. From a practical perspective, elastic resistance bands represent an affordable, portable, and sport-specific training modality that can be readily integrated into youth football training programs. Therefore, this study recommends the incorporation of structured elastic resistance-band exercises into regular coaching practice to optimize shooting performance and improve the overall offensive effectiveness of young football players at SSB SWADIRI.

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