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Squat thrust motivation exercise: improved shooting of female handball athletes

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ABSTRACT

This study focuses on the low shooting ability of female handball athletes, resulting from a lack of proper training and motivation. The purpose of this study was to determine the effect of squat thrust training and motivation on improving shooting in handball athletes. The method used in this study was a quasi-experimental design with a pre-test and post-test design. Twenty female handball athletes were involved, divided into experimental and control groups. The experimental group received squat thrust training, while the control group received conventional treatment. Data analysis used a t-test using IBM SPSS V24. The results showed a significant improvement in shooting ability in the experimental group compared to the control group, as evidenced by a p-value <0.05 in the t-test, indicating that the treatment significantly impacted shooting ability. This is in line with research findings that specific training can improve technical performance, and motivation plays a crucial role in consistent training. Squat thrust training, coupled with motivation, had a positive and significant effect on improving shooting skills. Trainers recommend combining physical training with a psychological approach to achieve optimal results.

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Introduction

The development of handball in Indonesia has been a diverse process, starting in the early 1980s and evolving through various stages of institutional support and educational integration. Handball has been integrated into the physical education curriculum in Indonesian schools, promoting sports from a young age and contributing to the development of technical and tactical skills (Nicolaevici and Leuciuc 2022). With quite rapid development, handball has become a popular sport among Indonesians, one of whom is female athletes from Riau. The key to winning in this sport is getting the ball into the opponent's goal as many times as possible (Bilous and Kononenko 2023). To achieve this, various components must be possessed, one of which is shooting ability. Shooting ability is the ability to use the swing of the arm with power and balance, but also on coordination, muscle strength, and other factors (Asan 2023). Achieving victory involves a complex interaction of various factors beyond just scoring goals (Font et al. 2022). While shooting effectiveness, defensive strategy, and physical and

tactical preparation all contribute significantly to team success Camrano, González-Ramírez, and Trejo-Silva (2024), many female handball players struggle with shooting accuracy and power throughout matches. A lack of specific physical training modifications and decreased motivation during training are significant factors that can contribute to poor shooting skills, especially in sports that require lower-body muscle building and explosive strength training (Abood, Al Abdullah, and Midhatee 2022; Hamza, Alwawi, and Dasit 2023). This lack of training modifications leads to athletes being less motivated to practice.

Athlete development in handball should prioritize shooting skills training, as this skill is crucial for scoring points and achieving success in the game (El Cintami Lanos and Lestari 2021). Shooting is a fundamental aspect of handball, and its effectiveness can significantly influence match outcomes (Nopianto et al. 2021). In particular, female athletes require training strategies that encourage them to train regularly to improve their strength and endurance. The squat thrust is a simple exercise that has a significant impact on muscle strength and endurance (Mufti, Hermawani, and Arifin 2024). However, little research has explicitly examined how the squat thrust affects the shooting ability of female handball players, particularly in relation to training motivation.

Motivational training plays a crucial role in motivating athletes to engage in physical activity, as motivation is a key driver of athletic performance and exercise adherence (Holovchenko 2025; Leunda-Goni, Jauregui, and Figueras 2023), and purposeful training promotes athlete engagement and satisfaction (Holovchenko 2025). It is important to emphasize that structured training provides opportunities and enjoyment in activities. To achieve this, solutions must be implemented, one of which is the Squat Thrust training method. Squat thrust training provides opportunities and motivates children to participate actively (Nugroho et al. 2021). One example is already being implemented in high schools to improve coordination, strength, agility, and endurance (Widaningsih et al. 2022). However, there is no research in the literature that discusses handball shooting skills. Therefore, initial steps are needed to provide an understanding of shooting skills using squat thrust training.

Squat thrust is an exercise that involves explosive movements requiring simultaneous activation of major muscle groups such as the quadriceps, hamstrings, gluteus maximus, and core muscles responsible for maintaining body stability. Physiologically, this movement enhances lower-body strength and explosive power through the stretch shortening cycle (SSC), in which elastic energy generated during the eccentric phase is immediately utilized during a rapid concentric contraction. Improvements in SSC capacity contribute to more efficient force and speed production. In handball, these components are essential because an effective shooting motion relies heavily on the initial drive from the lower limbs as the primary source of energy transfer from the ground to the upper body (Osborne et al., 2025; Rodríguez et al., 2025; Staiano et al., 2025). Therefore, strengthening the legs and improving explosive power through squat thrust training can theoretically enhance stability, balance, and the foundational force needed to support shooting performance (Bugten et al., 2025; Mendicino et al., 2025; Sjølie et al., 2025).

In addition, squat thrust exercises increase core stability through repeated contractions of the abdominal and lumbar muscles, which play a crucial role in maintaining posture during trunk rotation and arm extension while shooting. Biomechanically, a handball shot does not rely solely on arm and shoulder muscles; rather, it is a kinetic chain movement that begins with the legs, continues through the hips and torso, and ends at the arm. When core muscles are stronger, the transfer of energy from the lower limbs to the torso and then to the arm becomes more efficient, resulting in improved shot accuracy and power (Luteberget et al., 2025; Pereira et al., 2025). Squat thrust training also enhances cardiovascular capacity and anaerobic endurance, which help athletes maintain high quality shooting performance during intense matches that require repeated explosive actions. These combined physiological effects make squat thrust a theoretically sound and relevant exercise for improving shooting ability in handball athletes (Garcia, 2025; Møller et al., 2025; Takegami et al., 2025).

An experimental strategy using organized and quantitative squat thrust training, along with motivational techniques, is needed to address these issues. In addition to strengthening the legs and core, this training also builds discipline and endurance, both of which can influence shot quality. The effectiveness of this training can be scientifically tested and controlled thanks to the use of a quasi-experimental approach (Ageberg et al., 2025; Bencke & Kreutzfeldt Zebis, 2025; Kociuba et al., 2025).

The purpose of this study was to determine how the shooting skills of female handball athletes are affected by squat thrust training combined with high training motivation. The specific objective of this study was to demonstrate that the strength, explosive power, and shooting accuracy of athletes can be significantly improved by combining squat thrust-based physical training with training motivation.

Method

Study Design. This study used a quasi-experimental pretest-posttest design with unequal groups and quantitative methodology. Subjects were divided into two groups: the control group received traditional training, while the experimental group received an intervention in the form of squat thrust exercises. To determine the impact of the intervention, shooting skills tests were administered to both groups before and after the intervention.

Subjects. Twenty female handball athletes competing and training at the high school or sports club level were the subjects of this study. The following criteria were used to determine participant eligibility: (1) athletes must be female and between 15 and 18 years of age; (2) in good physical health and able to follow a regular training program; (3) free from injuries that could interfere with training or shooting skills tests; and (4) willing to participate in the entire study, from the pre-test through the training program to the post-test. Purposive sampling, which involves deliberately selecting a sample based on characteristics that align with the research objectives, was used to select subjects.

Research Instruments. Several measuring instruments were used in this study to facilitate the collection of objective data. First, a handball shooting test was used to measure shooting skills. This test involved shooting at a designated target and scoring based on shot accuracy and power using common handball tactics. Second, a Likert-scale observation sheet covering cognitive (understanding the training objective), affective (interest and feelings during training), and conative (willingness to actively participate in training) elements was used to measure training motivation. Third, to ensure uniformity of treatment across the experimental groups, a squat thrust training recording form was used, which recorded the athletes' frequency, intensity, and adherence throughout the training program. Data Analysis. The results of this study were analyzed using t-test techniques to identify differences. Pre-test and post-test data were processed using IBM SPSS V24.

Results and Discussions

The results of research that has been conducted on female handball athletes in Riau found several significant differences between the experimental group and the control group can be conveyed in table 1 of the normality test.

Table 1. Normality Test

	Sig	p-value	Information
Experiment	0,221		Normal
Control	0,181	0,05	

If the value (Sig) > 0.05, then the data are normally distributed. If the value (Sig) < 0.05, then the data are not normally distributed.

With 18 degrees of freedom (df) and an average difference of 4,400 points, the t-test result is 2,262. This shows that the average skill score of the first group was 4.4 points higher than that of the second group. The evidence that the difference is truly significant and not the result of chance is reinforced by the 95% Confidence Interval of the Difference, which ranges from 0.314 to 8.486, excluding zero.

Basically, these findings indicate that skill development was positively affected by the treatment or conditions that differentiated the two groups-the experimental group (Motivational Squat Thrust Training) and the control group (Conventional). Therefore, compared to the groups that did not receive the same therapy, it can be said that the treatment in the first group successfully improved the skill level of the participants.

Previous research has shown that regular squat thrust training, supported by motivation, significantly improves shooting skills in handball athletes. Squat thrust training is a form of plyometric exercise that involves leg muscle strength, core strength, and cardiovascular endurance, which is highly suited to the physical needs of handball athletes.

Table 2. Uji Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Shooting Skills	Equal variances assumed	2.256	.150	2.262	18	.036	4.400	1.945	.314	8.486
	Equal variances not assumed			2.262	15.659	.038	4.400	1.945	.270	8.530

Table 3. Average Comparison

	Grup	N	Mean	Std. Deviation	Std. Error Mean
Shooting skills	Exsperiment	10	44.00	5.121	1.619
	Control	10	39.60	3.406	1.077

Both groups were treated with squat thrust training and motivation in the experimental group, while the control group used a conventional approach. Squat thrust training combined with motivation significantly improved shooting accuracy. This is in line with the theory of transfer of physical training to sport-specific skills, which states that increasing muscle strength and endurance through targeted training can improve performance in specific sport techniques Issurin (2013); Young (2006), and motivation provides the impetus to reinforce training gains. Motivation plays a crucial role in athlete success, influencing their commitment, discipline, and focus during training sessions (Holovchenko 2025). Both intrinsic and extrinsic motivation are important in improving athlete performance because they encourage athletes to engage with and persist with their training (Vallerand 2012).

In line with research findings that implementing squat thrust training and motivation can help improve skills, especially shooting, a study involving U12-15 soccer players showed a significant increase in shooting precision after a squat jump regimen, as evidenced by a significant p-value in a statistical test (Basri et al. 2023). Similarly, another study with U17-U18 athletes showed that squat jumps increased the power of soccer shots, with a t-test confirming the significance of this improvement (Arwandi et al. 2020). Furthermore, motivation plays a crucial role in increasing athletes' focus and commitment, further enhancing their shooting skills (Lu and Li 2022; Simamora 2023). This provides coaches with the understanding that squat thrust training and motivation have a significant impact on athletes. Therefore, coaches need to design training programs that can motivate athletes to participate.

Researchers should emphasize that improving shooting performance does not solely depend on muscle strength; coaches also need to consider other factors such as coordination, technique, and concentration. Therefore, squat thrust training should be combined with shooting technique training and match simulations for optimal results. The limitations of this study include the fact that it used a specific group, so it cannot be categorized as a whole, and the sample size was not very broad. Going forward, the researchers recommend that future research use this information as a resource and guideline for conducting research, including involving specific groups.

Conclusions

According to the study's findings, regular, motivated squat thrust training significantly improves handball players' shooting abilities. This plyometric exercise is ideal for the physical demands of handball because it builds cardiovascular endurance, leg muscle strength, and core strength. Compared with a control group using traditional training methods, the experimental group receiving squat thrust training plus incentives showed greater improvements in shooting accuracy. The principle of transfer of training and previous research showing that increased muscle strength can influence the development of sport-specific technical abilities complement these findings. Furthermore, both internal and external motivation are crucial for increasing athletes' dedication, attention, and discipline during training. Coaches should understand that synchronization, technique, and focus are as important as physical strength for better shooting performance. Therefore, it is recommended to combine squat thrust training with match simulations and shooting skills training. The limitations of this study include the limited sample size and scope, and further research is recommended with a larger population.

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