

## Dumbbell Training and Its Influence on Power Among Handball Athletes

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**Abstract:** The background of this research highlights the lack of proficiency in shooting skills among senior male handball athletes in Tegal district. This deficiency is attributed to inadequate strength in the athletes' arm muscles (power), leading to poor shooting accuracy. One effective method to enhance power is through dumbbell exercises. This study employs an experimental design with a one-group pretest-posttest approach. The participants include all 12 senior male athletes from the Tegal Regency handball club, using a saturated sampling technique. In this research, the independent variable is dumbbell exercises, while the dependent variable is arm muscle strength. The results indicate a significant impact of dumbbell training on the power of senior male handball athletes in Tegal Regency in 2023. This conclusion is supported by hypothesis testing using the t-test, processed with SPSS version 25, at a significance level of 5% (0.05). The t-value calculated was 7.918, which is greater than the t-table value of 2.201, and the significance value was 0.000, which is less than 0.05.

**Keywords:** dumbbell training, shooting technique, power, handball

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### INTRODUCTION

Handball is a sport that combines elements of basketball and soccer, where the fundamental techniques involve bouncing and passing the ball, culminating in shooting at the goal to score, similar to scoring in soccer and basketball (Hermansah & Mahendra, 2019). It is a team sport played with a ball made of leather or synthetic materials, available in sizes 1, 2, and 3. The game is played using the hands on a rectangular field, aiming to score goals in the opponent's net, which is known as handball. Handball is played by two teams, each consisting of six players and one goalkeeper. Like other team sports, handball requires teamwork and individual skills from each player (Mustaqim, 2018). According to (Fadli, 2021), it is essential for players to master the basic techniques of handball, such as passing, catching, dribbling, and shooting. These techniques form the foundation of handball and require regular practice to achieve proficiency and develop effective playing patterns. In Indonesia, the sport of handball was first introduced in 2007, initially played outdoors on beaches. In 2015, handball began to be introduced as an indoor

sport. In 2018, when Indonesia hosted the Asian Games, a major event at the continental level, handball was officially included in the competition. Although the Indonesian team did not achieve optimal results at that time, their efforts deserve appreciation for showcasing their skills and introducing the sport of handball to the Indonesian public through the Asian Games.

In handball, not only are good technique and skill required, but also excellent physical condition and fitness (Pratama et al., 2022). This is because handball is a fast-paced game during a match. The game duration is also relatively long, with 2 x 30 minutes for the men's team and 2 x 25 minutes for the women's team (Susanto, 2017). Handball also relies on speed, strength, endurance, accuracy, and good focus, similar to other sports, and players must maintain physical consistency and stability throughout the game to support their performance on the court. The basic techniques that must be mastered in handball include passing, catching, dribbling, and shooting (*The Journal of Universitas Negeri Surabaya*, n.d.). In other words, handball athletes must possess all the essential physical components, including endurance (aerobic and anaerobic), strength, flexibility, speed, power, agility, coordination, and reaction (Windy Safiraputri & Achmad Widodo, 2021).

In handball, there are four techniques that every player must master: (1) passing, which involves throwing the ball with one or both hands to pass it in any direction and situation on the court, (2) catching, which involves gripping the ball with the fingers and palm, (3) dribbling, which is similar to basketball but differs in that the ball is bounced off the floor with the fingers and without changing hand positions, and (4) shooting, which is done to score points by throwing the ball accurately towards the goal (Aulia and Heri et al., 2020).

Among these four techniques, one must be mastered well as it is crucial for scoring goals: the basic shooting technique. According to Anggi Anggara & Pendidikan (2020), the shooting technique involves shooting with a powerful and directed throw towards the opponent's goal. In handball, there are several shooting techniques, including side shoot, standing shoot, and flying shoot (Susanto, 2017). According to Hermansah (2016), shooting is an action that accelerates the movement between the legs, hips, shoulders, elbows, wrists, and fingers. The shooting technique is the most vital technique for scoring goals. A handball athlete must master the basic shooting technique well to be able to shoot effectively in any situation on the court. To support good shooting movement, excellent physical condition is also required. As shooting is a common and frequently practiced technique during training and matches, it is easy to imitate but not necessarily performed perfectly by every individual. Therefore, the researcher aims to study it further.

One of the key components for achieving good shooting technique is having arm muscle power. According to Mustaqim (2018), power is essential for producing accurate shooting results, as it requires explosive power to propel the ball towards

the goal and score. All sports require power, whether they are individual or team sports, and regardless of whether they involve open skills or not. The physical condition of each player must be carefully monitored, and every handball athlete must have excellent physical fitness, especially concerning strength and explosive power, specifically arm muscle power (Yulianto Dwi Putro, 2019). In another definition, Afif and Nasrulloh (2016) describe power as the capability of the neuromuscular system to generate maximum strength in a short period, or the body's ability to exert maximum contraction speed in the shortest possible time.

An athlete must possess physical components such as coordination, reaction speed, flexibility, reaction speed, and power (Saman, 2017). To create an effective shooting technique, training is necessary to achieve optimal results. In handball, to support arm muscle power in executing shooting techniques, specific training that enhances arm muscle strength is required. Therefore, training is essential to produce accurate and optimal shooting results. Athletes must train regularly to vary their movements on the field. According to Saman (2017), training is a physical activity that is programmed, structured, and repeated over a long period to improve the individual athlete's ability to reach specified targets.

Several specific training forms can enhance the power of arm muscles for shooting techniques, such as dumbbell exercises, where the training uses dumbbells (weights) as the equipment for the athletes (Saman, 2017). Dumbbells or weights are a form of resistance training to increase strength, according to Pemberian et al. (2022). Dumbbell exercises are a variation of weight training aimed at improving the strength of arm and shoulder muscles, particularly the biceps and triceps. Since handball requires significant strength from an athlete's arms and hands, this aspect of training is crucial for athletes to achieve optimal shooting techniques (Saman, 2017). These exercises can increase arm muscle power, significantly influencing the ball's speed during shooting. If arm muscle power is not trained, the shooting technique will not be optimal. Therefore, this training is vital for athletes as it not only enhances power but also reduces the risk of injury when performing shooting techniques.

There are supporting components for achieving optimal shooting results, such as arm muscle power (Afif & Nasrulloh, 2016). Therefore, having good arm muscle power quality will result in good shooting technique as well. In other words, according to Aulia and Heri et al. (2020), the shooting technique has its own advantages over other shooting techniques; this technique is often used by players with a tall stature because, during shooting, it is difficult for the opposing player to block the ball's trajectory.

Based on observations conducted at the Tegal Regency Handball Club and interviews with the club's coach, it has been noted that senior male athletes still face certain deficiencies. Specifically, many senior male athletes struggle during practice sessions leading up to competitions, particularly with shooting accuracy. The shots

taken often lack power, making it easy for opponents to block them. This issue stems from inadequate arm muscle strength, which needs improvement to ensure the ball's trajectory is harder for opponents to intercept.

During competitions, such as the PRA PORPROV 2022, the players were still not performing effectively, with many senior male athletes failing in the flying shoot technique. According to the Tegal Regency coach, this is due to insufficient arm muscle strength training during practice sessions. If the training for arm muscle strength is not adequately addressed, it could significantly impact the team's performance and match outcomes. Proper arm muscle strength contributes to powerful shots that are difficult for opponents to block. Therefore, incorporating arm muscle strengthening exercises into training sessions is crucial for the athletes. Implementing dumbbell exercises is necessary to enhance arm muscle strength, which in turn can improve shooting accuracy. Given these issues, this study aims to investigate the impact of dumbbell exercises on the arm muscle strength of senior male handball athletes in Tegal Regency.

## **METHOD**

The method used in this research is the experimental method. According to Hardani (2020), experimental research is a quantitative research method used to determine the effect of an independent variable on a dependent variable. This study employs an experimental research design known as the One Group Pretest-Posttest Design. In essence, experimental research involves studying variables for which data is not yet available and requires the process of treatment or intervention on the research subjects to observe the outcomes. Thus, the experimental research method can be defined as a research method used to investigate the effect of a specific treatment on other variables under controlled conditions. The population and sample size for this research are both 12 individuals, as the study employs saturated sampling due to the relatively small population of 12 male handball athletes from Tegal Regency. Thus, the sample consists of all 12 male athletes from the Tegal Regency handball club.

The research instrument is a measurement tool used to assess an object or obtain quantitative information for a study conducted by the researcher (Hasyim & Saharullah, 2019). The test instrument in this study employs techniques for testing and measuring power using Two Hand Medicine Ball Put.

The data analysis in this research includes a normality test and a homogeneity test, followed by hypothesis testing using a paired sample t-test. In this study, data were analyzed with a significance level of 5% (0.05).

## RESULTS

In this study, hypothesis testing was conducted based on t-test data analysis with the criterion that if the calculated t-value > t-table value or if the significance value < 0.05, then H<sub>0</sub> is rejected and H<sub>a</sub> is accepted. Conversely, if the calculated t-value < 0.05, then H<sub>0</sub> is accepted and H<sub>a</sub> is rejected. The hypothesis test results are shown in the following table.

**Table 1.** Results obtained

<b>Data</b>	<b>Sig.</b>	<b>T Value</b>	<b>Significance Level</b>
<b>Power results</b>	0,000	7,918	0,05

Based on the above t-test hypothesis results, it can be seen that the calculated t-value > t-table value, which is  $7.918 > 2.201$ , indicating that there is an effect of dumbbell training on the arm muscle power of senior male handball athletes in Tegal Regency in 2023. This means that the research hypothesis stating that there is an effect of dumbbell training on the arm muscle power of senior male handball athletes in Tegal Regency in 2023 has been proven or accepted.

## DISCUSSION

The physical condition of arm muscle power is closely related to handball performance. Arm muscle power functions as the force in the arms, which is essential for measuring the explosive strength needed to shoot the ball with power, speed, and precision. Therefore, possessing strong and well-developed arm muscle power will enhance the techniques of passing, shooting, and catching, making them more powerful and accurate.

Based on the hypothesis test, it is evident that there is a significant effect of seated dumbbell triceps extension training on arm muscle power. This is indicated by the t-value > t-table value, or  $7.918 > 2.201$ , with a significance value of  $0.000 < 0.05$ , resulting in the rejection of H<sub>0</sub> and acceptance of H<sub>a</sub>. This means that the independent variable influences the dependent variable, or in other words, seated dumbbell triceps extension training can increase the arm muscle power of handball athletes. Consequently, good arm muscle power quality will result in better shooting technique.

Several studies have shown that power significantly impacts shooting performance. In handball, arm muscle power is crucial for both offense and defense. During offense, athletes with good arm muscle power can improve their passing, catching, shooting, and dribbling techniques. According to Afif & Nasrulloh (2016), power is the ability of the neuromuscular system to generate maximum strength in

a short period, or the body's ability to withstand maximum contraction speed in the shortest possible time.

In handball, basic techniques rely heavily on arm muscle power. For instance, the shooting technique not only requires accuracy to aim at the goal but also necessitates high power to deliver powerful shots. Effective shooting technique also demands specialized training to achieve perfection and precise timing when throwing the ball. Power is also essential not just in offense but also in defense. In handball, besides agility and speed, good endurance and power are necessary to stop opponents from scoring. Defensive techniques, such as grabbing the opponent's arms when they hold the ball, are legitimate strategies in handball defense. Additionally, blocking shots using both hands requires good arm muscle power to effectively stop the ball and halt the opponent's attack.

Athletes must possess physical components such as coordination, reaction speed, flexibility, reaction speed, and power (Saman, 2017). To create effective shooting, athletes need to train regularly to achieve optimal results. In handball, supporting arm muscle power for shooting techniques involves exercises that enhance arm muscle strength. Therefore, training is essential for achieving accurate and powerful shooting, and athletes must train regularly to vary their movements on the field. According to Saman (2017), training is a physical activity conducted in a programmed, structured, and repetitive manner over a long period to improve the individual abilities of athletes to meet specified targets.

Many training methods can enhance arm muscle power. With technological advancements, gym-based weight training has become increasingly supportive of improving athletes' performance. Various exercises, such as dumbbell training, treadmill, and leg press, can be performed at the gym. Dumbbell training is one effective method for enhancing arm muscle power. Experts have stated that dumbbell training can improve strength and increase the size of the biceps and triceps. Dumbbell exercises are practical weight training methods with significant effects on biceps muscle development. According to Taufiq Hidayat & Rizky Aris Munandar (2022), dumbbell exercises can be performed in different positions—standing, seated, or lying down—to enhance biceps and triceps muscles. One specific exercise to increase arm muscle power is the seated dumbbell triceps extension. This exercise strengthens the shoulders and arm muscles and is suitable for all individuals, from athletes to the general population, with minimal risk when performed with proper guidance and instructions. Therefore, handball athletes can use dumbbell exercises to increase arm muscle power, varying the movements according to their needs to enhance their performance.

For the senior male handball team in Tegal Regency, consisting of athletes aged 17-22 years, exercises to improve arm muscle power are necessary to enhance individual abilities. Young athletes need additional training to perfect their handball techniques. Many young athletes with ideal physiques still lack power in their basic

techniques, such as passing and shooting. To address this deficiency, gym exercises like seated dumbbell triceps extensions are essential to improve arm muscle power. Coaches should develop specific training programs for seated dumbbell triceps extensions to enhance arm muscle power, as having strong arm muscles will enable athletes to perform as expected. Observations at the Tegal Regency Handball Club indicate that coaches have not focused sufficiently on enhancing arm muscle power, particularly in the senior male team. Therefore, this research can serve as a reference for training programs aimed at improving arm muscle power for shooting skills, with minor modifications to meet the needs of the team or individual athletes across different age groups.

## CONCLUSION

Based on the narrative provided, the conclusion can be drawn as follows: The strength of power significantly influences handball performance, serving as the primary force for executing powerful, precise shots and enhancing techniques such as passing and catching. The results of the hypothesis test indicate a substantial impact of seated dumbbell triceps extension training on arm muscle power, evidenced by a t-value of 7.918 surpassing the critical t-table value of 2.201, with a significance level of  $0.000 < 0.05$ , leading to the rejection of  $H_0$  and acceptance of  $H_a$ . This underscores that the independent variable, seated dumbbell triceps extension training, positively affects arm muscle power among handball athletes. Enhanced arm muscle power translates directly to improved shooting technique, crucial for effective performance in both offensive and defensive plays in handball. Numerous studies affirm that power plays a pivotal role in handball, enabling athletes to execute techniques like shooting with accuracy and strength. Arm muscle power not only facilitates offensive maneuvers such as shooting and dribbling but also contributes to defensive strategies like blocking and intercepting opponents' shots. Athletes must cultivate physical attributes like coordination, reaction speed, flexibility, and especially power to excel in handball. Regular training, including specific exercises like seated dumbbell triceps extensions, is essential for enhancing arm muscle power and refining shooting skills, ensuring athletes perform optimally during competitive play.

In conclusion, integrating targeted exercises such as dumbbell training into training regimens can effectively enhance arm muscle power among handball athletes, thereby improving overall performance and competitiveness in the sport. Coaches and trainers should prioritize developing tailored training programs that include seated dumbbell triceps extensions to maximize the potential of athletes, particularly in senior male handball teams like those in Tegal Regency. This research serves as a valuable resource for optimizing training strategies aimed at bolstering arm muscle power and refining shooting abilities across different age groups within the sport of handball.

## Conflict of Interest

The author(s) declare that they have no conflict of interest.

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