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The Impact of Leg Press Training and Squat Training on the Weapon Attack Ability of Fencing Athletes in South Sulawesi

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ABSTRACT

This research aims to determine the effect of leg press training and squat training on the ability of degen weapon attacks in South Sulawesi athletes' fencing. The study employed a quasi-experimental research method, utilizing a two-group pre- and post-test design on a sample of 20 individuals. The matched ordinal pairing technique ranked the attack ability based on the pre-test results, resulting in the formation of two treatment groups. Each group consisted of 10 people using leg press exercises, and one group used squat exercises. We carried out the treatment for 16 meetings, training three times a week, performing 3–4 sets and 10–14 repetitions, and loading each sample according to their individual abilities. Based on the results of the data analysis, it was found that leg press training had a significant effect of -3,959 > α. 0.05 on the attack ability of degen weapons in South Sulawesi athletes' fencing. Squat training has a significant effect of -8,200 > α 0.05 on the ability of degen weapon attacks in South Sulawesi athletes' fencing. The effect of squat training is more effective when compared to leg press training in increasing the ability of degen weapon attacks in South Sulawesi athletes' fencing. Squat training is more effective because the movement characteristics of squat training are closer to the characteristics of attack movements in fencing. The results of this study recommend that coaches and athletes, to improve their dominant physical components to increase their ability to attack weapons in fencing, should choose leg press and squat exercises.

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1. INTRODUCTION

Fencing is a sport that uses a set of tools when practicing or competing. Fencing is a martial arts sport using weapons that emphasizes skill techniques such as slashing, stabbing, or parrying (Monstery, 2015; Barth & Barth, 2017). In fencing, there are three types of weapons: floret (foil), degen (epee), and sabre. Each weapon has differences in shape, target area, and unique characteristics of blocking techniques and grip. Fencing has attack techniques that require excellent physical abilities, including strength, explosive leg power, and accuracy (Turner et al., 2014; Chen et al., 2017). Only regular, systematic, and continuous physical training can achieve good leg strength and

explosive power. Forms of training to obtain good leg strength and explosive power through weight training include leg press and squat exercises. The leg press and squat exercises are two forms of weight training to improve physical condition, especially the strength and explosive power of the leg muscles, with different movement processes, but the training targets the leg muscles (Wirth et al., 2016). These two forms of training focus on increasing the strength and explosive power components of the leg muscles. Only hard training can achieve high physical condition, and the training method requires specific preparation for each sport one participates in. Therefore, we expect the leg press and squat training forms to enhance the weapon attack abilities of fencers.

Fencing requires excellent physical condition to support the achievement of playing techniques; therefore, a fencer must have the required physical components, among others, strength, speed, power, coordination, accuracy, and flexibility, especially in the leg and arm muscles (Turner et al., 2014; Salfield & Norris, 2020; Villiere et al., 2021). Various forms of regular, systematic, and continuous training can enhance this physical component, with weight training being one effective training method. As explained by experts, weight training is an effective way to increase muscle strength and explosive power (Caserotti et al., 2008; Zatsiorsky et al., 2020). The most effective training program for enhancing muscle strength is using a weighted training ramp. You can perform weight training to increase leg muscle strength by providing "an initial load of around 50–60% of a person's body weight with a number of repetitions of 10–12, a number of sets of 3–5, and a rest interval of 2–4 minutes with a moderate rhythm".

When implementing a good training program, it must be founded on training principles and components that enhance the physical quality of athletes, while also taking into account the physiological abilities of each individual athlete involved. Training is defined as a physical training program that aims to prepare an athlete for important competitive events (Smith, 2003). Training is a deliberate process that aims to enhance an athlete's performance by subjecting them to physical and mental challenges on a regular, directed, gradual, increasing, and repeated basis over time. In addition, "training is a systematic sporting activity over a long period of time, increasing gradually and individually, that aims to form human beings who have physiological and psychological functions in meeting task demands (Kovacs, 2007; Gamble, 2013; Jeffries et al., 2021)." Several principles guide the execution of a weight training program to enhance physical fitness, including increased load (overload principles), specialization principle, the principle of individualization, the principle of exercise variation, the principle of original recovery, and the principle of modeling.

Leg press training is a type of weight training that aims to increase or develop strength and explosive power, especially helping to strengthen the strength of the hips, leg muscles, knee tendons, and lower abdominal area (Liu et al., 2013; Smith et al., 2019). The leg press exercise involves overloading the body's organs, particularly the leg muscles, with iron weights under a pressing machine. The intensity, sets, frequency, and duration of the exercise can lead to a training effect that enhances strength, power, and muscular endurance (Sarto et al., 2020; Martín-Fuentes et al., 2020). We hope that

this loading will enhance fencers' leg muscle strength and explosive power, thereby enhancing their attack ability.

"Compound exercises" include leg press-type weight training. The main goal is to train the leg and thigh muscles. When doing leg press exercises, the muscles trained are the quadriceps (thigh extensors and knee extensors), rectus femoris, hip flexors, gastrocnemius (calf), soleus, achilies tendon, and ankle muscles. The leg press exercise involves pushing a specific weight with the legs (Martín-Fuentes et al., 2020). Weight training is a systematic exercise that uses weights as a tool to enhance muscle performance and achieve specific goals.

"Furthermore, we set the knee-leg press exercise in a flexed (bent) position until it extends, while maintaining a stable back." The leg press is an exercise to help strengthen the strength of the hips and legs, knee tendons, and lower abdominal area (Akima et al., 2000; Harden et al., 2018). The analysis of movements in leg press exercises, as proposed by Liu et al. (2013); Smith et al. (2019); Sarto et al. (2020), is as follows:

(1) Movement aimed at straightening the leg position (a) Hip; the movements are extension, hamstring, gluteus maximus, and adductor magnus; (b) Knee; the movements are extension and guadriceps (c) Foot and ankle; no movement but static. (2) Returning to the initial position involves (a) hip flexion and hip extensors (eccentric contraction). In (b), the knee flexes and the knee extensors contract; in (c), the foot and ankle do not move. Several expert opinions conclude that leg press training, a type of weight training, aims to increase and develop leg muscle strength, leg muscle explosive power, and even leg muscle endurance. It specifically strengthens the hip muscles, thighs, leg muscles, knee tendons, and the lower abdominal area, with weights serving as the main basis for training. For more details on the form of the leg press exercise, see the following figure 1:

Figure 1. Leg Press

Squat training, with its movement characteristics, if done with certain repetitions, sets, and also the frequency of training, can certainly improve the components needed in fencing (Tsolakis et al., 2010). The squat movement with isotonic contractions, when done repeatedly with a certain load, can increase the strength, explosive power, and endurance of the leg muscles, which in itself has an impact on increasing the fencer's Squats are a type of strength training that involves wearing weights on the shoulders (Turner et al., 2014). the shoulders." The movement when doing squat exercises is with your feet shoulder-width apart and your body upright, carrying a barbell during the up and down squat movement. Squat exercises can develop the muscles of the lower back

(erector spinae), the back (gluteal muscle), the front of the upper leg (quadricep), and the chest. To perform squats, place the bar (iron bar) on the rack, slightly below the shoulders. The athlete positions the bar on the rack, just beneath the shoulders. The athlete places the bar on the back, slightly below the shoulder blades. In the squat, the athlete maintains a straight back by keeping their chest out and head up at all times, both during the lifting of the weight and during the movement itself. The athlete must maintain a straight back both when lifting the iron from the rack and during the actual movement. The analysis of movements in squat exercises, as stated by Turner et al. (2014); Chen et al. (2017), is as follows: (1) An upward movement straightens the position of the legs. The movements include extension and guadriceps. and (b) In the knee, the movement involves flexion and extensor contraction. s (eccentric contraction) (b) The knee moves in flexion and extensor (eccentric contraction). contraction). (c) Feet and ankles: The movements are dorsal flexion and plantar flexors (eccentric contraction). Squat exercises allow you to strengthen the glutes, quadriceps, hamstrings, hips, and calves, which are responsible for every movement you perform.

The muscles trained in squat exercises are the lower body, as well as the muscles above the waist, as well as the gluteus maximus, minimus, and medius muscles, quadriceps, hamstrings, adductors, hip flexors, and calves (Turner et al., 2018; Chtara et al., 2020). Apart from the lower body muscles, squat exercises will also target the core muscles, including the rectus abdominis, obliques, transverse abdominis, and erector spinae. Core muscles help improve mobility and balance. Squat exercises not only increase leg strength; they also stabilize muscles and maintain balance while improving communication between the brain and muscle groups in the body. For more details on the form of squat training, see Figure 2 below:

Figure 2. Squat Exercise

Attacks are a commonly used technique in fencing matches, as they bring the player closer to the opponent and increase the likelihood of scoring points (Hagemann et al., 2010; Sunal et al., 2021). Therefore, a player carrying out an attack must reach or hit the target in order to score points and win the match. Only a strong physical condition, specifically leg muscle strength and endurance, can support an attack effectively, enabling a player to carry out the attack with maximum effectiveness. A fencer initiates an attack by straightening the arm holding the weapon and directing the weapon's tip towards the target area on the opponent's body (Roi & Bianchedi, 2008; Allerdissen et

al., 2017). "You can initiate a change from a defensive to an attacking stance by taking a step forward and aiming towards your opponent."

During an attack, one should swiftly and smoothly straighten the hand holding the weapon, maintain an upright body position with the chest outstretched, and keep the soles of the front and back feet firmly planted on the floor (Sunal et al., 2021). Holding the weapon gently yet firmly, one swiftly straightens it towards the intended target, then reverts back to its initial position to support subsequent attacks. Only systematic training and continuous development of leg muscle speed and strength can carry out effective attacks, ensuring they are on target (Hagemann et al., 2010; Allerdissen et al., 2017). If the weapon's tip strikes the opponent's target with enough force, as indicated by the weapon apparatus's flashing light, the attack is considered valid and earns a point; hence, it necessitates constant and diligent practice. Based on the description of the attack movement that has been stated, it can be concluded that what is meant by attack in this research is a movement process carried out by the fencer to stab the opponent at the right target, which begins by straightening the arm first, then stepping forward. The fencer points the tip of the weapon at the target area with the hind leg, stabs precisely, and scores.

The degen weapon (epee) as "a type of fencing weapon specifically for stabbing." The area of contact applies to all parts of the body, namely from toe to head (Yanto, 2013; Nugroho, 2019). So fencers don't need to wear metallic jackets. For degenerate weapons, it is enough to wear standard white fencing clothing. The degen weapon is relatively large, V-shaped, and trenched with a hand guard (kom). The roundabout of this weapon is much larger than that of the floret weapon. According to Ihsan (2006), degen is "the largest weapon with a minimum weight of 770 grams, a minimum length of 110 cm, a triangular shape with parts: a pointe d'arret, a sword tip that can be pressed with a spring resistance (veer) of at least 500 grams, with a movement distance of 1 mm, an iron sword with a length to the pointe d'arret of 90 cm, and a round hand guard (kom) that can be passed through a cylindrical tool with a height of 15 cm and a diameter of 13.5 cm. The weapon features a curved part that ranges in depth from 3 to 5.5 cm. It includes a finger protection layer, a weapon handle (grip), an iron pommel (nut), a contact-stop bodywire connection, and a sword cable.

2. METHOD

This type of research is semi-experimental, with a two-group pre-test and post-test design (Abbuhl et al., 2013; Creswell & Creswell, 2017). The independent variables of this research are leg press training and squat training. The Degen weapon's fencing attack capability is the dependent variable. The study included 20 South Sulawesi fencing athletes as sample members, dividing them into two groups using the matched ordinal pairing technique based on the ranking of their degen weapon fencing attack results. The leg press group consists of 10 people, and the squat group consists of 10 people.

3. RESULTS AND DISCUSSION

Results

The research data obtained were initial test data (pretest) and final test data (posttest) on the weapon fencing attack abilities of the leg press training group and the squat training group of South Sulawesi fencing athletes.

The initial test (pretest)

1. The first test of the leg press training group's ability to use a weapon for attack had 10 samples and an average score of 69.30 points, with a standard deviation of 9.33 points and a median score of 67.50 points. The variance was 87.12 points. The range value resulted in 31 total scores, with a minimum data difference of 56 and a maximum of 87.
2. For the first test of weapon fencing attack skills, a squat training group with 10 samples was used. The average score was 69.20, with a standard deviation of 8.90 and a median score of 67.00. The range of scores was 79.28. The range value yields 27 total scores, with a minimum difference of 57 total scores and a maximum difference of 84 total scores.

Final test (posttest)

1. Ten people in the leg press training group took the final test of their ability to attack with a sword. The average score was 76.50, with a standard deviation of 5.87 and a median score of 77.00. The variance was 34.50. The range value yielded 18 total scores, with a minimum data difference of 69 total scores and a maximum of 87 total scores.
2. Ten people from the squat training group took the final test of their ability to attack with a sword. The average score was 80.30, with a standard deviation of 7.00 and a median score of 79.50. The scoring range was 49.12 points. For range values, we obtain 20 total scores, with data differences ranging from a minimum of 70 to a maximum of 90.

The pre-test and final-test data on the degen weapon fencing attack ability in the leg press training group of South Sulawesi fencing athletes yield the following t-test results: The t-observation value is -3.959 with a significant value of 0.003, which is smaller than the α value of 0.05. So, Ho is rejected. The acceptance of H1 indicates that the leg press training group treatment has a significant impact on enhancing Degen's weapon fencing attack ability. Furthermore, the degen weapon fencing attack ability increased in the leg press training group before and after treatment, where the average score before treatment was 69.30 total, while after treatment the average score was 76.50 total. So, the effect of the leg press training group treatment, if seen from the range of average values, experienced an increase in the effect of a 7.20 total score.

The t-test data from the initial and final tests of the squat training group of South Sulawesi fencing athletes provides the following results: The t-observation value is -8.200 with a significant value of 0.000, which is smaller than the α value of 0.05. So, Ho is rejected. The acceptance of H1 indicates that the squat training group treatment has a significant impact on enhancing the degen weapon fencing attack ability.

Furthermore, the degen weapon fencing attack ability increased in the squat training group before and after treatment. The average score before treatment was 69.20, and after treatment, it increased to 80.30. Therefore, the squat training group treatment resulted in an increase of 11.10 total score, as indicated by the range of average values. Based on the t-test results of the final test data from the leg press and squat training groups, South Sulawesi fencers could obtain a t-observation value of -1.314 with a significant value of 0.005, which is smaller than the α value of 0.05. So, Ho is rejected. The acceptance of H1 indicates a difference in the impact of the leg press and squat training groups on the enhancement of degen weapon fencing attacks.

Discussion

The treatment group underwent leg press training with loading for 15 meetings, with training loads based on everyone's body weight, repetitions, sets, rhythm, and rest, all by the training schedule. Attacks in degenerate weapon fencing are one of the movement processes carried out by players to obtain points. A player earns points by hitting the target area or making a legitimate impact on the opponent with a degen weapon, and part of their effort involves advancing closer to the impact point on the opponent's body. A degenerate fencer initiates an attack by straightening their arm, directing the weapon's tip towards the target area on their opponent's body. An attack is a follow-up movement from the fencing position, where the change from this position to an attacking stance begins with stepping the front foot to approach the target, straightening the arm holding the weapon while maintaining a stable body position where the front foot is in a stance, the back foot is straight, and the soles of your feet must still be tightly attached to the floor (Hagemann et al., 2010; Sunal et al., 2021).

The best equipment for leg press training is the press machine, which lifts and lowers the weight (iron) in a specific position with a support to maintain the initial position (Smith et al., 2019; Sarto et al., 2020). This enables the testee to lie on his back beneath the machine and place his feet on it while under load. Then the testee pushes up until the legs are straight, returning to the starting position with certain repetitions. This is certain to increase leg muscle strength effectively. Leg press exercises can regulate the movement of the legs and knees in a flexed (bent) position until they are completely straight and then return to their original position while the back remains in a stable condition. The leg press exercise is an exercise to help improve and strengthen the movement of the hips, thighs, feet, and muscles in the legs and lower abdominal area. A fencer requires these components to enhance the effectiveness of their attacks in hitting targets on opponents during a match. The results of this study are in line with the opinion of Harden et al. (2018), who said that leg press exercises, either using machines or with barbells (iron bars) alone, can help increase the strength of the hips, thigh muscles, leg muscles, and lower abdominal area.

The process of a series of attack movements on a degen weapon begins with straightening the arm holding the weapon, followed by taking a step forward and lifting it to a height of approximately 10 cm from the floor (lover) with the help of pushing the hind leg until it is straight; the arm that is not holding the weapon is thrown backwards

with the aim of helping to push the body forward; and the tip of the weapon is directed at the opponent's target area. Next, return to your original position by bending your back leg. This attack movement requires strength and endurance from both leg muscles so that the player can maintain a stable body position to anticipate a counterattack from the opponent. Experiments on sample groups have produced this component through leg press training. Nugroho et al. (2021) researched volleyball athletes and found that leg press and squat trust training could increase leg power by 25,248, surpassing the p-value of 0.05.

This research has found that there is an influence of leg press training on the ability of degen weapon attacks in fencing, which is carried out with loading according to individual ability, repetitions, sets, and rhythm of movements carried out regularly, repeatedly, and systematically. The results of this study are in line with the opinion of Sarto et al. (2020), who said that the movement in the leg press exercise when straightening the legs will stimulate and build strength in the hips due to extension movements, hamstring movements, gluteus maximus, and adductor magnus. Meanwhile, in the knee there is extension and guadriceps movement, while in the foot and ankle there is no static movement. The movement back to the original position in the leg press exercise influences hip strength because flexion, hip extensors, or eccentric contraction movements occur; likewise, on the knees, flexion, knee extensors, or eccentric contraction movements occur, and the foot and ankle movements remain stable.

Physiologically, performing leg press exercises with a specific load, both periodically and repeatedly, significantly enhances the energy capacity or power in the lower leg muscles, extending from the hip muscles to the feet (Harden et al., 2018). Enhancing the lower leg muscles of fencers significantly enhances their ability to carry out weapon attack movements effectively. The increase in degen weapon attack ability found in this experimental research was because the fencers in the leg press training experimental group experienced an increase in energy due to an increase in leg muscles and functional stability of the back muscles.

Squat training is a simple exercise that is effective for strengthening body muscles and burning calories. It has benefits for the body, and its various types effectively train muscle strength and make the body healthy in a practical way. Squat training is a dynamic exercise that requires the cooperation of several lower and upper body muscles, but the focus is on the strength of the lower body muscles, such as the quadriceps, hamstrings, and buttocks (Turner et al., 2014). Fencers regularly, systematically, and repeatedly perform squat training, a training model that applies an internal load based on their body weight with predetermined repetitions and sets. This exercise has the potential to enhance leg muscle strength, a crucial requirement for fencers during game attacks to score points.

There are two ways to perform squat exercises. One technique involves placing an iron bar on a rack slightly below the shoulders. The testee places the bar on the back, slightly below the shoulder blades on the trapezius muscle, and then lifts it from the rack. The testee maintains a straight back in the squat, always keeping the chest out and

the head up while lifting the weight, both when moving the iron from the rack and during the movement itself (Chen et al., 2017). Everyone can perform the squat movement using their own body weight, eliminating the need for an external load like a bar or iron bar. These two forms of squat training can increase the strength of the leg muscles, thigh muscles, and stability of the back muscles if done regularly and systematically over a certain period.

The eight weeks of squat training led to an increase in leg muscle strength, which positively impacted the fencer's ability to use degen weapon fencing. This increase in energy in the leg muscles increased the range of the player's attack, allowing for proper target reach (Turner et al., 2014). The results of this study are in line with research findings that state that squat training significantly increases leg muscle strength after training for a period of 8 weeks, with an increase during the pre-test found on average of 91.88 and 91.88 and increasing to 128.84 during the post-test (Ihsan, 2006). You can perform the squat movement in three different ways: a quarter squat, a half squat, a squat, and a deep squat. In this study, the athletes performed the half-squat as their squat exercise. To get maximum results from squat training, athletes must be sure to perform squat movements with half-squats. Chen et al. (2017) states that you should perform the half squat exercise with your feet shoulder-width apart, your back flat, bending your knees, and pushing your body down until your thighs are parallel to the floor, while keeping your heels attached to the floor. Supriyoko & Mahardika (2018) found that strength, particularly leg muscle strength, plays a crucial role in fencing. Leg muscle strength is very necessary because the support (legs) in fencing must remain actively moving to support attacking and defensive movements.

Analysing the movements during squat training: Physiologically, analysing the movement to straighten the legs results in movement in the hips, hamstrings, and gluteus maximus. In the knees, there are extension movements (guadriceps), while in the feet and ankles, there are plantar flexion, gastrocnemius, peroneus, and soleus movements. The process of moving back to the position of bending the knees at the hips occurs with hip extensors (eccentric contraction); in the knees there is flexion; in the knees there is a knee extensor (eccentric contraction); while in the feet and ankles dorsal flexion and plantar flexors (eccentric contraction) occur.

Through this research, fencers receive leg press training and squat training with specific loads, sets, repetitions, and durations. The duration of training have an influence on the fencing weapon attack abilities of South Sulawesi fencers. Leg press training is a type of exercise that uses external weights with the aim of increasing and developing leg muscle strength, especially by helping to strengthen the strength of the hips, leg muscles, knee tendons, knee joints, and lower abdominal area. Leg press training involves applying an iron weight under a pressing machine to the body organs, particularly the leg muscles. The intensity, sets, repetitions, frequency, and duration of the exercise can cause a training effect, namely leg muscle strength, power, and endurance. The purpose of the leg press exercise is to enhance the strength of the leg muscles, which in turn enhances the weapon fencer's attack ability. This is because

attacks in fencing necessitate leg muscle strength to propel the player forward and push their back leg closer to the opponent's target.

Based on the results of the data analysis in this study, the two forms of leg press and squat training have a positive influence on the weapon attack abilities of South Sulawesi fencers. On average, leg press training influences fencing attacks of 76.50, while squat training has an effect of 80.30. Therefore, we can conclude that both leg press training and squat training positively impact the fencer's weapon attack ability. We achieved this increase by providing leg press and squat training for 5 weeks, with a frequency of 3 meetings per week, 10–14 repetitions, 3–4 sets, and loading based on everyone's body weight. Do this with a training frequency of 3–4 times a week, with repetitions between 8 and 12 times and 3–4 sets. This research also found that squat training was more effective than leg press training in improving the weapon attack ability of South Sulawesi fencers, these results are in line with those found by Weiss et al. (2000); Rossi et al. (2018).

The treatment of leg press training and squat training has increased the strength of the leg muscles, thigh muscles, calf muscles, ankles, and feet in fencers, thus having an impact on increasing the ability of degen weapon attacks in fencing. Muscle strength increases through nervous system adaptations that allow the player to move an increasing number of motor units at a time. Adaptations of the nervous system to strength training are at least as important as adaptations of muscle-based hypertrophy. Regular, systematic, and continuous training of muscles by the principles of weight training leads to physiological changes, which include changes in muscle biochemistry and muscle hypertrophy. As explained by D'Antona et al. (2006); Van Wessel et al. (2010), hypertrophy that occurs in muscle fibres is characterised by the presence of one or more of the following changes: (1) an increase in the number or size of myofibrils in each muscle fibre; (2) an increase in the total amount of contractile protein, especially myosin filaments; and (3) an increased density of each muscle fiber. (4) increased size and strength of connective tissue, tendons, and ligaments Researchers even found an increase in the number of muscle fibres.

4. CONCLUSION

The research's conclusions, derived from data analysis and discussion, are as follows: (1) There is a significant influence of leg press training on increasing the ability of degen weapon fencing attacks in South Sulawesi athletes' fencing games. (2) There is a significant influence of squat training on increasing the ability of degen weapon fencing attacks in fencing athletes from South Sulawesi. (3) There is a significant difference in the influence between leg press training and squat training on increasing the ability of degen weapon fencing attacks. Squat training is more effective in improving the fencing attack ability of degen weapons when compared to leg press training in the fencing game of South Sulawesi athletes.

Fencing coaches recommend weight training to enhance the attacking abilities of fencers and to improve the physical condition of athletes. The recommended weight training is a form of leg press exercise and a form of squat exercise.

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