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Effectiveness of rope jump and single leg jump training towards the leg power and the length of the kick (long pass) of the football players from ssb pesat tempel sleman in the age group of 14-15 years old

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Abstract
This research aims to determine the effectiveness of rope jump training and single leg jump training towards the increasing leg power and long pass skills of football players from SSB Pesat (Pesat Football School) Tempel, Sleman Regency in the age group of 14-15 years old. This study used a quasi-experimental type for 16 training sessions with a two-group pretest- posttest design research method. The selection of subjects used a purposive sampling technique totaling 20 student samples with group division using the matched subject ordinal pairing technique. The research instrument used a skipping rope for rope jump training and a hurdle for single leg jump training. The data collection technique used a long pass test by Frank M. Verducci with a validity value of 0.94 and a reliability value of 0.99, and a vertical jump test by Bafirman and Wahyuni with a validity value of 0.95 and a reliability value of 0.96. The data analysis technique used prerequisite tests, called normality tests and homogeneity tests, and used a t-test to determine the research hypothesis with a significance level of 5%.
The research findings show that 1) rope jump training increase leg power ability, with t count at 6.000 > t table 2.262, significance 0.000 < 0.05, percentage increase at 5.053%, and increasing long pass skills, with t count at 5.288 > t table 2.262, significance 0.001 < 0.05, percentage increase at 2.626%. 2) Single leg jump training increases leg power ability, with t count at 7.571 > t table 2.262, significance 0.000 < 0.05, percentage increases 4.536%, and increasing long pass skills, with t count at 6.181 > t table 2.262, significance 0.000 < 0.05, percentage increases at 2.426%. 3) Rope jump training provides greater improvement compared to single leg jump training on leg power ability and long pass skills of football players from SSB Pesat Tempel Sleman in the age group of 14-15 years old.
Kata kunci: long pass, leg power, rope jump, single-leg jump

INTRODUCTION

Soccer is a sport that requires players to have good physical condition, especially in lower-limb strength and explosive power. Lower-limb power plays an important role in several soccer skills, such as sprinting, jumping, changing direction, and performing long-distance passes. In adolescent players, especially those aged 14-15 years, the development of lower-limb power is crucial because this age group is in a rapid phase of physical growth and in an optimal period for improving biomotor abilities (Bompa & Buzzichelli, 2019). Youth physical development research also emphasizes that training should match the athlete's growth, maturation, and long-term development needs (Lloyd & Oliver, 2012).

The long pass is one of the basic techniques in modern soccer. It helps players switch play, create attacking opportunities, and accelerate the transition from defense to attack. The distance and accuracy of a long pass are strongly influenced by leg muscle strength, movement coordination, and the player's explosive ability during the kicking action (Lees et al., 2010). Recent systematic evidence also shows that plyometric training can improve soccer kicking performance, including kicking distance and kicking speed (Zhang et al., 2023). Therefore, improving lower-limb power is expected to contribute positively to long-pass distance in young soccer players.

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Plyometric training is an effective method for improving lower-limb power. This training emphasizes the muscle stretch-shortening cycle, which can significantly increase explosive muscle ability (Chu & Myer, 2013). Meta-analytic evidence also reports that plyometric training improves strength and power performance through neuromuscular adaptation (de Villarreal, Requena, & Newton, 2010). Rope jump and single leg jump are simple plyometric exercises that are easy to apply and suitable for adolescent players. Rope jump focuses on coordination, rhythm, and bilateral lower-limb explosive power, while single leg jump emphasizes unilateral leg strength, power, and balance (Miller, 2012).

In a tactical context, the long pass changes the tempo and direction of play quickly, especially when a team faces high pressure from the opponent. Effective long passing allows a team to bypass the opposing midfield line more efficiently and exploit free space in the opponent's defensive area (Sarmento et al., 2014). Tactical performance analysis in team sports also shows that technical actions must be understood as part of collective decision-making, not merely as isolated individual skills (Garganta, 2009). This means that the long pass is not only an individual technical skill, but also an integral part of team strategy in modern soccer.

From a technical and biomechanical perspective, successful long passing is affected by several factors, including lower-limb strength and power, movement coordination, kicking angle, and foot swing speed during ball contact. Lees et al. (2010) stated that increased foot speed and impulse force during kicking contribute significantly to ball distance and ball velocity. For this reason, the quality of long passing is closely related to the player's physical condition and technical ability.

Rope jump is a plyometric exercise that involves repeated jumps at moderate to high intensity. This exercise improves lower-limb power and also trains coordination, balance, and movement rhythm, which are highly needed in soccer (Chu & Myer, 2013). Systematic review findings indicate that plyometric training supports improvements in jumping, sprinting, and agility performance in team-sport athletes (Slimani et al., 2016). Rope jump is relatively easy to apply in youth soccer training because it does not require complex equipment and has a low injury risk when performed with proper technique.

Single leg jump is a plyometric variation that emphasizes the use of one leg alternately. This exercise aims to improve unilateral lower-limb power, balance, and body stability. In soccer, unilateral ability is very important because many game actions, such as kicking and landing after jumping, rely more on one leg (Miller, 2012). Research shows that unilateral plyometric training can produce neuromuscular adaptations that are specific to movement demands in soccer (Ramírez-Campillo et al., 2016). Several studies report that programmed rope jump and single leg jump training can significantly contribute to physical performance in soccer players, especially lower-limb power and explosive movement performance (Markovic & Mikulic, 2010). Evidence from youth soccer also shows that plyometric training improves athletic performance when programs use appropriate exercise type, volume, and progression (Bedoya, Miltenberger, & Lopez, 2015).

Similar findings indicate that plyometric training can improve power and kicking distance in adolescent soccer players (Rubley et al., 2011). However, selecting the appropriate plyometric exercise according to player characteristics remains essential so that training goals can be achieved effectively. Therefore, studies on rope jump and single leg jump training in youth soccer development need to continue as a scientific basis for designing effective training programs.

Soccer requires players to develop physical, technical, tactical, and mental abilities in a balanced way. Youth soccer development needs a systematic and continuous framework so that players can develop optimally according to their stage of growth and maturation. One widely used approach in long-term athlete development is Long-Term Athlete Development (LTAD), which emphasizes the alignment of training programs with age stages and athletes' biological maturity (Balyi, Way, & Higgs, 2013). In the LTAD framework, players aged 14-15 years are in the Train to Train phase. This advanced stage focuses on structured development of physical capacity and soccer skills. The phase is important because players experience rapid growth, increased muscle mass, and significant nervous system development. These conditions make ages 14-15 a strategic period for improving key biomotor components, such as strength, power, speed, and endurance, which become the foundation for future soccer performance (Lloyd & Oliver, 2012).

In soccer, the application of LTAD at ages 14-15 does not only emphasize physical conditioning. It also strengthens basic technical mastery and tactical understanding. Players begin to receive training that is more specific to soccer demands, such as sprinting, changing direction, jumping, and kicking the

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ball effectively. Ford et al. (2011) stated that integrating physical and technical development during adolescence is important for shaping adaptive players who are ready for higher competitive demands. LTAD in soccer for ages 14-15 also emphasizes training-load management and injury prevention. A training program that does not match the player's developmental stage can negatively affect health and performance. Therefore, the LTAD approach guides coaches in designing programs that are progressive, safe, and oriented toward long-term development rather than short-term achievement only (Balyi et al., 2013).

Previous studies show that plyometric training can improve lower-limb power and soccer skill performance, including long-distance kicking ability (Markovic & Mikulic, 2010). However, comparative evidence on the effectiveness of different plyometric exercises, especially rope jump and single leg jump, for improving lower-limb power and long-pass distance among soccer-school players aged 14-15 years remains limited, particularly in the Indonesian youth soccer development context.

Based on this background, this study is important for determining the effectiveness of rope jump and single leg jump training on lower-limb power and long-pass distance in SSB Pesat Tempel Sleman players aged 14-15 years. The findings are expected to guide coaches in designing training programs that are effective, efficient, and appropriate to the developmental characteristics of young players.

METHOD

This study aimed to determine the effectiveness of rope jump training and single leg jump training on the improvement of lower-limb power and long-pass distance among SSB Pesat Tempel Sleman players aged 14-15 years. This study used a quasi-experimental design conducted over 16 training sessions with a two-group pretest-posttest design.

The subjects were selected using purposive sampling and consisted of 20 student players. The groups were formed using the matched subject ordinal pairing technique. The research instruments were a skipping rope for rope jump training and hurdles for single leg jump training. Data were collected using Frank M. Verducci's long-pass test, with a validity value of 0.94 and a reliability value of 0.99, and the vertical jump test by Bafirman and Wahyuni, with a validity value of 0.95 and a reliability value of 0.96. Data were analyzed using prerequisite tests, namely the normality test and homogeneity test, followed by the t-test to test the research hypotheses at a significance level of 5%.

RESULTS AND DISCUSSION

The sample in this study consisted of 20 students from a total of 25 students in the 14-15 age group. Three students did not take the pretest from the beginning and had a low attendance percentage. Two other students also had low attendance and did not take the posttest. Complete data on student attendance percentages are presented in Appendix 9. After the students were divided into two groups, each group received its respective treatment for 16 meetings according to the training program attached in Appendix 18. The program was conducted from February 4 to March 10, 2024. The students then took a final test or posttest to determine the effectiveness of the training program. The following section presents the pretest and posttest results for each group in this study.

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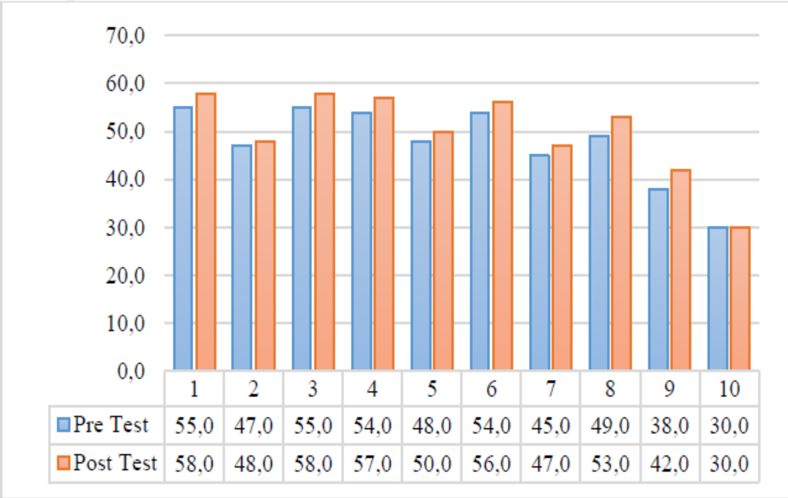

Figure 1. Pretest and Posttest Results of the Rope Jump Group: Lower-Limb Power

Based on the chart above, descriptive statistical analysis of the pretest and posttest lower-limb power data in the rope jump group, which consisted of 10 students, showed that the pretest mean was 47.5 cm and the posttest mean was 49.9 cm. The posttest mean was 2.4 cm higher than the pretest mean. This result indicates that the rope jump group experienced an increase in lower-limb power after receiving the treatment.

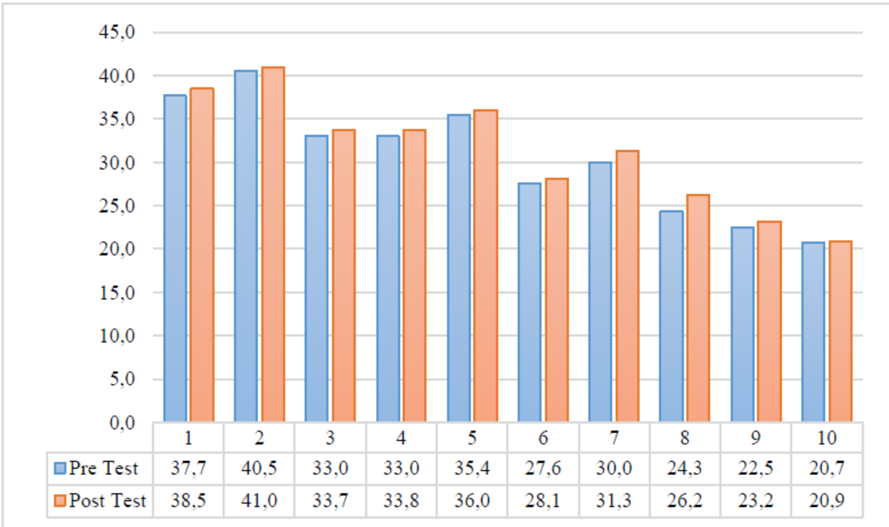

Figure 2. Long-Pass Distance

Berdasarkan Based on the chart above, descriptive statistical analysis of the pretest and posttest long-pass data in the rope jump group, which consisted of 10 students, showed that the pretest mean was 30.47 m and the posttest mean was 31.27 m. The posttest mean was 0.8 m, or 80 cm, higher than the pretest mean. This result indicates that the rope jump group experienced an increase in long-pass skill after receiving the treatment.

The normality test was conducted to determine whether the distribution of data in each group or variable was normal. The normality test using SPSS produced probability values. These probability values were then compared with the significance level. This study used a 95% confidence level or a significance level of 5%, equal to 0.05. The data were considered normally distributed when the

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probability value was greater than or equal to 0.05. Conversely, the data were considered not normally distributed when the probability value was lower than 0.05.

The probability values for the pretest and posttest lower-limb power data in the rope jump group were 0.076 and 0.085, respectively. These values were greater than or equal to the significance level of 0.05, so the data were normally distributed. The probability values for the pretest and posttest lower-limb power data in the single leg jump group were 0.540 and 0.686, respectively. These values were also greater than or equal to 0.05, so the data were normally distributed. The probability values for the pretest and posttest long-pass data in the rope jump group were 0.827 and 0.901, respectively. These values were greater than or equal to 0.05, so the data were normally distributed. The probability values for the pretest and posttest long-pass data in the single leg jump group were 0.649 and 0.671, respectively. These values were greater than or equal to 0.05, so the data were normally distributed. Based on these results, all data were normally distributed.

The homogeneity test in this study was performed using SPSS 23 with variance analysis through the Levene method. In the homogeneity test, data are considered homogeneous when the probability value is greater than or equal to the significance level of 0.05. Conversely, data are considered not homogeneous when the probability value is lower than 0.05. The probability value for the pretest and posttest lower-limb power data in the rope jump group was 0.831, which was greater than or equal to 0.05, so the two datasets were homogeneous. The probability value for the pretest and posttest lower-limb power data in the single leg jump group was 0.901, which was greater than or equal to 0.05, so the two datasets were homogeneous. The probability value for the pretest and posttest long-pass data in the rope jump group was 0.940, which was greater than or equal to 0.05, so the two datasets were homogeneous. The probability value for the pretest and posttest long-pass data in the single leg jump group was 0.979, which was greater than or equal to 0.05, so the two datasets were homogeneous. Based on these results, all data were homogeneous.

The paired t-test results for the pretest and posttest lower-limb power data in the rope jump training group showed a sig. (2-tailed) value of 0.000, which was lower than the significance level of 0.05, and a calculated t-value of 6.000, which was higher than the t-table value of 2.262. Therefore, Ha was accepted and Ho was rejected. The paired t-test results for the pretest and posttest long-pass data in the rope jump training group showed a sig. (2-tailed) value of 0.001, which was lower than 0.05, and a calculated t-value of 5.288, which was higher than the t-table value of 2.262. Therefore, Ha was accepted and Ho was rejected. These results indicate that rope jump training had a significant effect on lower-limb power and long-pass distance among SSB Pesat Tempel Sleman players aged 14-15 years.

The results show that rope jump and single leg jump training had a significant effect on increasing lower-limb power and long-pass distance among SSB Pesat Tempel Sleman players aged 14-15 years. This finding supports the view that plyometric training is an effective method for improving explosive lower-limb ability, which is highly needed in soccer (Markovic & Mikulic, 2010). The increase in lower-limb power after rope jump training can be explained by the characteristics of the exercise, which involves repeated jumps at a fast tempo. These movements optimize muscle work through the stretch-shortening cycle, allowing the muscles to produce maximal force in a short time. Chu and Myer (2013) explain that rope jump can improve neuromuscular coordination and lower-limb muscle elasticity, which directly contributes to increased explosive power.

Single leg jump training also produced a more specific effect on unilateral lower-limb power development. In soccer, actions such as kicking, landing after jumping, and changing direction are often performed with one dominant leg. Therefore, single leg jump training provides neuromuscular adaptation that is more consistent with soccer-specific movement demands (Miller, 2012). Ramírez-Campillo et al. (2016) also stated that plyometric training can significantly improve maximal-intensity performance in soccer players.

The increase in lower-limb power produced by both forms of training directly affected long-pass distance. Biomechanically, kicking distance is influenced by foot swing speed and the impulse force generated during ball contact. Lees et al. (2010) emphasized that greater lower-limb power increases foot velocity during kicking, allowing the ball to travel farther. Zhang et al. (2023) also concluded that plyometric training is generally effective for improving kicking performance in soccer players. Thus,

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the increase in long-pass distance among SSB Pesat Tempel Sleman players can be explained as the result of physical adaptations produced by rope jump and single leg jump training. Comparatively, rope jump tends to be more effective for improving general lower-limb power and movement rhythm, while single leg jump tends to be more specific for improving the strength and explosive ability of the dominant leg used in kicking. This aligns with Bompa and Buzzichelli (2019), who state that training variation is needed to obtain optimal physical adaptation, especially among adolescent athletes in a rapid biomotor development phase. In the 14-15 age group, plyometric training must follow the principles of progression and safety. Rope jump and single leg jump are safe and appropriate for this age group when given with controlled intensity and volume. Ford et al. (2011) stated that jump-based training is recommended during early adolescence to improve basic physical ability without interfering with growth. In the Long-Term Athlete Development (LTAD) framework, players aged 14-15 years are in the Train to Train phase. This phase is important because athlete development focuses on the systematic improvement of physical capacity as a foundation for more specific sport performance. During this phase, athletes experience rapid biological development, marked by increased muscle mass, strength, and central nervous system maturity. These conditions make ages 14-15 a strategic period for improving key biomotor components, especially strength and power (Balyi, Way, & Higgs, 2013).

Plyometric training is highly relevant to the goals of the Train to Train phase because it emphasizes explosive muscle ability through the stretch-shortening cycle. The neuromuscular adaptations produced by plyometric training allow athletes to generate maximal force in a short time, which is needed in several sports, including soccer, volleyball, and athletics (Markovic & Mikulic, 2010). Thus, integrating plyometric training into the program for athletes aged 14-15 years is consistent with LTAD principles that prioritize long-term physical development.

Research findings show that plyometric training in adolescent athletes can significantly improve lower-limb power, speed, and movement coordination when the program is designed with progressive loading and proper technique supervision (Bedoya et al., 2015). Evidence in adolescent soccer players also indicates that plyometric training can improve both power and kicking distance (Rubley et al., 2011). These findings support the LTAD view that training quality is more important than training quantity, especially for athletes who are still in a growth phase.

Plyometric training at ages 14-15 also helps transfer physical capacity to sport-specific technical skills. In soccer, increased lower-limb power through plyometric training directly affects jumping ability, acceleration, changes of direction, and kicking strength. This shows that plyometric training improves not only physical aspects, but also the effectiveness of technical and tactical performance (Sarmento et al., 2014).

From a long-term development perspective, the application of plyometric training in the Train to Train phase serves as a transition from basic strength training toward more specific and competitive training in the next stage, namely Train to Compete. Balyi et al. (2013) explained that athletes who receive appropriate explosive training stimuli during adolescence tend to have better physical readiness for higher training loads in the future. Therefore, plyometric training has a strategic role in supporting LTAD implementation at ages 14-15 years. A training program that integrates plyometrics in a planned, safe, and developmentally appropriate manner can optimize athlete potential and minimize injury risk, allowing long-term athlete development goals to be achieved sustainably.

CONCLUSION

Based on the study conducted by the researcher, the following conclusions can be drawn.

a. Rope jump training was effective in improving lower-limb power and long-pass distance among SSB Pesat Tempel Sleman players aged 14-15 years. Rope jump training increased lower-limb power by 5.053% and increased long-pass distance by 2.626%.
b. Single leg jump training was effective in improving lower-limb power and long-pass distance among SSB Pesat Tempel Sleman players aged 14-15 years. Single leg jump training increased lower-limb power by 4.536% and increased long-pass distance by 2.426%.
c. There was a difference in the effectiveness of rope jump and single leg jump training on lower-limb power and long-pass distance among SSB Pesat Tempel Sleman players aged 14-15

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years. Based on the percentage increase in the results, rope jump training produced a higher effect than single leg jump training on both long-pass distance and lower-limb power.

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