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Effect of Exercise *Barrier Hop and Jump to Box* To Improvement *Power* Muscle Kampung Jawa Regency Men's Volleyball Club Legs Greater Sumbawa in 2025

Subakti[1*], Nurdin[2]
[1.2] Mandalika University of Education Mataram
**Coresponding Autor*: Subakti121968@gmail.com

Abstract

Ball volleyball is one of the branch a popular sport in Indonesia. Volleyball is also expected capable make it fragrant Name nation and state at the event International. Purpose study This For know There is or whether or not influence exercise barrier hop and jump to box to improvement power muscle legs volleyball club son of Kampung Jawa, Sumbawa Besar Regency in 2025 ". The sample used totaling 16 people, the data collection method uses method test actions as method the main thing , namely with stage test beginning before do exercise use jump to box and barrier hop (pre-test) and after exercise (post-test). Research test instrument For measuring muscle power legs with the vertical jump test , while method data analysis with use analysis statistics with t- test formula . From the results data analysis where treatment use jump to box there is significant influence where t- count more big from t- table (4.849 > 1.895) so based on In the above analysis , Ho is rejected and Ha is accepted. so conclusion from study This that is there is " The Effect of Exercise Barrier Hop And Jump To Box To Improvement Power Muscle The Leg of the Men's Volleyball Club of Kampung Jawa, Sumbawa Besar Regency in 2025" . Meanwhile, data analysis where treatment use barrier hop there is significant influence where t- count more big from t- table (5.789 > 1.895) so based on In the above analysis , Ho is rejected and Ha is accepted. so conclusion from study This that is There is Effect of Exercise Barrier Hop And Jump To Box To Improvement Power Muscle The Leg of the Men's Volleyball Club of Kampung Jawa, Sumbawa Besar Regency in 2025

Keywords : Exercise *Jump To Box* , *Barrier Hop*, Improvement *Power* Muscle Legs

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Introduction

Volleyball is one of the most popular sports in Indonesia and is widely played at various levels, ranging from schools and universities to community clubs and professional competitions. As a competitive sport, volleyball is not only a recreational activity but also a medium through which athletes are expected to bring pride and honor to their regions and to the nation in national and international events. Despite its popularity, the achievement level of volleyball performance in several regions of Indonesia, including West Nusa Tenggara Province, particularly Sumbawa Besar Regency, remains relatively low and has not yet shown optimal development compared to other regions with more established sports training systems.

The low level of volleyball achievement in a region is influenced by various interrelated factors, such as the quality of coaching, the availability of facilities and infrastructure, athlete motivation, and especially the physical condition of the athletes. In modern volleyball, the physical demands placed on athletes are increasingly high. Players are required to perform repeated explosive movements, rapid changes of direction, and high-intensity jumps throughout the match. Therefore, optimal physical conditioning becomes a fundamental requirement for achieving high performance in volleyball.

Physical condition in volleyball consists of several essential components, including strength, speed, agility, balance, flexibility, endurance, and explosive power. All of these

components play a crucial role in supporting the execution of volleyball techniques such as serving, passing, smashing, and blocking. Among these components, explosive power of the leg muscles is considered one of the most dominant physical attributes in volleyball performance. This is because most decisive actions in volleyball, such as jump serves, spike jumps, and blocking actions, depend heavily on the ability of the athlete to generate high vertical jump performance.

Vertical jump height is a critical indicator of leg muscle explosive power. Athletes who possess optimal vertical jumping ability tend to have an advantage in both offensive and defensive actions near the net. A higher vertical jump allows players to perform smashes at a higher contact point and execute blocks more effectively against opponents' attacks. Consequently, improving leg muscle power becomes a priority in volleyball training programs aimed at enhancing overall performance.

Several studies have emphasized the importance of leg muscle explosive power in volleyball. Sari et al. (2023) reported that improvements in lower-limb explosive power significantly contribute to enhanced performance in volleyball-specific movements, particularly vertical jumping tasks. Similarly, Wiasta et al. (2025) demonstrated that plyometric-based training methods not only improved leg muscle power but also enhanced blocking skills in male volleyball students. These findings underline the strong relationship between physical conditioning, especially leg muscle power, and technical performance in volleyball.

To achieve optimal physical condition, athletes must undergo a systematic, planned, and continuous training process. Physical training is not only intended to improve athletic performance but also to prepare the body to adapt to increasing training loads and competitive demands. Among various training methods used to improve explosive power, plyometric training has gained considerable attention due to its effectiveness and efficiency.

Plyometric training is a form of exercise that emphasizes rapid and powerful muscle contractions following a rapid stretching phase, commonly referred to as the stretch-shortening cycle. According to Bobbert (1990), plyometric exercises utilize elastic energy stored in muscles and tendons during the eccentric phase, which is then released during the concentric phase to produce greater force and power output. This mechanism makes plyometric training particularly effective for improving jumping ability and explosive movements.

In practice, plyometric training includes various exercise forms, both with and without equipment. Some commonly used plyometric exercises for improving leg muscle power include jump to box, barrier hops, hurdle hops, depth jumps, tuck jumps, and multiple box jumps. These exercises are designed to stimulate neuromuscular adaptations that enhance explosive strength, coordination, and reactive ability of the lower limbs.

Research evidence consistently supports the effectiveness of plyometric training in improving leg muscle power. Amar et al. (2025) found that box jump plyometric exercises significantly increased lower-limb explosive power in students. Similarly, Arif (2025) reported that jump-to-box plyometric training had a positive and significant effect on leg muscle power in volleyball players. These findings indicate that plyometric exercises can be effectively applied to volleyball training programs to enhance physical performance.

In addition to jump-to-box exercises, barrier hops have also been widely used as an effective plyometric training method. Barrier hops require athletes to perform repeated jumps over obstacles, emphasizing quick ground contact and explosive take-off. Naswiranto et al. (2024) demonstrated that barrier hops plyometric training significantly improved leg muscle explosive power in volleyball students. Furthermore, Sihombing and Situmeang (2022) compared box jump and barrier hops training and found differences in their effects on leg muscle explosive power, suggesting that each exercise type has unique characteristics and training benefits.

The effectiveness of plyometric training has also been supported by numerous international studies and meta-analyses. De Villarreal et al. (2009), in their meta-analysis, concluded that plyometric training variables such as intensity, volume, and exercise selection play a crucial role in improving vertical jump performance. Asadi et al. (2016) further confirmed that plyometric training not only enhances explosive power but also improves change-of-direction ability, which is essential for volleyball players during fast-paced rallies.

Moreover, combining plyometric training with strength training has been shown to produce even greater improvements in lower-limb performance. A study published in *Frontiers in Physiology* (2025) reported that an eight-week combined strength and plyometric training program significantly improved lower-limb vertical stiffness and jump performance. These findings are consistent with the systematic review conducted by Ramirez et al. (2022), which highlighted the effectiveness of plyometric training in improving multiple aspects of physical fitness, particularly explosive power, in athletes.

Despite strong scientific evidence supporting plyometric training, its implementation at the regional club level remains limited. Based on preliminary observations at the Men's Volleyball Club of Kampung Jawa, Sumbawa Besar Regency, training programs tend to focus primarily on technical and tactical aspects of the game. Physical conditioning, especially structured training aimed at improving leg muscle power, has not been optimally implemented. As a result, many athletes demonstrate suboptimal vertical jump ability, which negatively affects their performance in smashing and blocking during matches.

Volleyball clubs play a vital role in athlete development and serve as the foundation of regional sports achievement. Therefore, introducing scientifically proven training methods at the club level is essential to enhance athlete performance. Plyometric exercises such as barrier hops and jump-to-box training are considered practical and effective alternatives because they can be implemented with minimal equipment while providing significant performance benefits.

Several national-level studies further support the application of plyometric training in volleyball. Utamayasa (2025) reported that multiple box jump training effectively increased leg muscle power. Competitor JKO (2024) also found that jump-to-box exercises significantly improved leg muscle power in volleyball players. Additionally, Komandan et al. (2025) and Nugroho (2025) emphasized that plyometric training contributed not only to physical improvements but also to enhanced volleyball-specific skills such as jumping smash performance.

Based on the above considerations, it is evident that improving leg muscle explosive power is a fundamental requirement in volleyball athlete development, particularly at the club level. However, there is still a lack of empirical studies focusing specifically on the comparative and combined effects of barrier hop training and jump-to-box training on leg muscle power in regional volleyball clubs, especially in Sumbawa Besar Regency.

Therefore, this study is conducted to examine the effects of barrier hop training and jump-to-box exercises on the improvement of leg muscle power in athletes of the Men's Volleyball Club of Kampung Jawa, Sumbawa Besar Regency. The findings of this study are expected to provide scientific evidence and practical recommendations for coaches and sports practitioners in designing effective physical training programs to enhance volleyball performance."

Method

This research uses an experimental method with a quantitative approach. Experimental research requires selecting an appropriate design or pattern that aligns with the variables in the hypothetical problem being tested. Before assessing a sample, *a pre-test is administered.* to measure the initial conditions (T1), then the experimental group was given

treatment (X) and then given a final test or *post-test* (T2).

The research design was carried out using *the Group Pre Test-Post Test Design* (Sugiyono , 20 21). Before being given treatment, the results of the treatment can be known more accurately because it can be compared with the conditions before the treatment. However, in this design there is no control group so the results of the increase after being given treatment are not necessarily from the treatment because it could be caused by other factors. From a methodological perspective, This design is in accordance with the reference and meets the requirements for this type of experimental research. This study aims to determine whether or not there is an effect of *barrier hop training. and jump to box* to increase *the power* of the leg muscles of the football club Kampung Jawa Boys Volleyball Sumbawa Besar Regency .

The research design is as follows:

T1	XI
	T2

Research Design (Maksum, 2009: 49)

Information:
T1 and T3 = *Pre-test* (initial leg muscle *power test)*
XI = *Treatment (jump to box* treatment)
XII = *Treatment* (*barrier hop treatment*)
T2 and T4 = *Post-test* (final leg muscle *power test)*

So that the differences in results due to the treatment given can be known with certainty (Maksum, 2009: 49). The data analysis technique used in study This is technique quantitative data analysis , meaning data that is tangible numbers numbers (Rianto, 2001: 104), Suitable data analysis techniques used For testing hypothesis is a T-test with level significant 5%. After the data is collected , the data will then be analyzed with procedure as following :

$$t = \frac{\sum d}{\sqrt{\frac{N.\Sigma d^2 - (\sum D)^2}{(N-1)}}}$$

Information :
∑d= The difference between each partner score *(Post Test-Pre Test)*
N = Number samples used

(Sugiyono , 2022)

Research result

The purpose of this study was to examine the effects of jump-to-box training and barrier hop exercises on the improvement of leg muscle explosive power in athletes of the Men's Volleyball Club of Kampung Jawa, Sumbawa Besar Regency, in 2025. Based on the statistical analysis of the collected data, the results indicate that both training methods produced a significant effect on the improvement of leg muscle power. These findings confirm the research hypothesis that plyometric-based exercises, specifically jump to box and barrier hop training, are effective methods for enhancing explosive power of the lower limbs in volleyball athletes.

The significant improvement observed in leg muscle power among athletes who participated in jump-to-box and barrier hop training supports previous research demonstrating the effectiveness of plyometric exercises in improving lower-limb explosive strength.

Plyometric training has long been recognized as one of the most efficient training methods for developing explosive power due to its reliance on the stretch-shortening cycle mechanism (Bobbert, 1990). This mechanism allows muscles to store elastic energy during the eccentric phase and release it rapidly during the concentric phase, resulting in greater force production. The results of this study are consistent with the findings of Amar et al. (2025), who reported that plyometric box jump exercises significantly improved lower-limb explosive power in students. Similarly, Arif (2025) found that jump-to-box training had a positive and significant effect on leg muscle power in volleyball players. These studies emphasize that jump-to-box training is an effective exercise for developing explosive leg strength due to its dynamic movement pattern and high neuromuscular demand.

In this study, jump-to-box training demonstrated a strong influence on leg muscle power improvement because the exercise primarily targets major muscle groups involved in jumping movements, including the quadriceps (front thigh muscles), hamstrings (back thigh muscles), and gastrocnemius and soleus muscles (calf muscles). The execution of jump-to-box exercises requires athletes to generate maximum force in a short time while maintaining body stability during take-off and landing. This combination of force production, coordination, and balance contributes significantly to improvements in explosive leg power.

Moreover, the jump-to-box exercise promotes proper body alignment and landing mechanics, which enhance neuromuscular coordination and reduce energy loss during jumping movements. According to Alim et al. (2024), jump-to-box plyometric training not only increases leg muscle strength but also improves flexibility, which plays an essential role in optimizing explosive movements. Increased flexibility allows muscles to stretch more efficiently during the eccentric phase, leading to greater power output during the concentric phase.

In addition to jump-to-box training, barrier hop exercises also showed a significant effect on improving leg muscle explosive power. Barrier hops require athletes to perform repeated jumps over obstacles with minimal ground contact time, emphasizing speed, rhythm, and reactive strength. This type of exercise stimulates fast-twitch muscle fibers and enhances the ability of the neuromuscular system to produce rapid and forceful contractions. Naswiranto et al. (2024) reported similar findings, stating that barrier hop plyometric training significantly increased leg muscle explosive power in volleyball students.

The effectiveness of barrier hop training can be explained by its emphasis on repeated stretch-shortening cycles in a short period of time. This repetitive loading pattern improves muscle-tendon stiffness and enhances the efficiency of force transmission during explosive movements. ScienceDirect (2021) highlighted that plyometric jump training improves lower-limb stiffness, which is a crucial factor in maximizing jump performance. Increased stiffness allows muscles and tendons to store and release elastic energy more effectively, resulting in higher and more powerful jumps.

The findings of this study also align with the results of Sihombing and Situmeang (2022), who found differences in the effects of box jump and barrier hop training on leg muscle explosive power. Although both exercises were effective, each training method offered unique benefits. Jump-to-box training emphasized maximal force production and stability, while barrier hop training focused more on speed, coordination, and reactive strength. These complementary characteristics suggest that combining both exercises within a training program may produce more comprehensive improvements in leg muscle power.

The improvement in leg muscle power observed in this study can also be attributed to the structured and continuous application of plyometric training. Consistency and progression are critical factors in achieving optimal training adaptations. According to de Villarreal et al. (2009), the effectiveness of plyometric training depends on training variables such as frequency, intensity, volume, and exercise selection. In this study, the systematic application

of jump-to-box and barrier hop exercises allowed athletes to adapt gradually to increasing training demands, resulting in significant improvements in explosive power.

Furthermore, the results of this study support the findings of several meta-analyses and systematic reviews that highlight the effectiveness of plyometric training across different sports. Asadi et al. (2016) concluded that plyometric training significantly improves explosive power and change-of-direction ability, both of which are essential physical attributes in volleyball. Ramirez et al. (2022) also emphasized that plyometric training enhances multiple aspects of physical fitness, particularly lower-limb power, making it a valuable component of athletic training programs.

From a physiological perspective, improvements in leg muscle explosive power are closely related to enhanced neuromuscular coordination, increased motor unit recruitment, and improved firing frequency of fast-twitch muscle fibers. Plyometric training stimulates the nervous system to activate muscles more efficiently, resulting in faster and stronger contractions. MDPI (2024) emphasized that optimizing plyometric jump training variables can maximize human performance by enhancing neuromuscular efficiency and muscular power output.

In the context of volleyball performance, increased leg muscle explosive power has direct implications for technical execution, particularly in smashing and blocking actions. Athletes with greater explosive power can jump higher and faster, allowing them to contact the ball at a higher point during a smash and form a more effective block at the net. Nugroho (2025) demonstrated that plyometric depth jump and jump-to-box training significantly improved jumping smash ability in volleyball players, supporting the practical relevance of plyometric training in volleyball-specific performance.

Similarly, Wiasta et al. (2025) found that plyometric training methods, including hurdle hops and box jumps, not only improved leg muscle power but also enhanced blocking skills in male volleyball players. These findings reinforce the notion that physical conditioning and technical performance are closely interconnected in volleyball. Improved physical attributes provide a solid foundation for executing technical skills more effectively and consistently.

The results of this study also support the findings of Competitor JKO (2024) and Utamayasa (2025), who reported significant improvements in leg muscle power following jump-to-box and multiple box jump training. These studies suggest that plyometric exercises are practical and effective training methods that can be implemented even in settings with limited facilities, such as regional volleyball clubs.

In addition, the present study aligns with the findings of Chelly et al. (2010), who reported that short-term plyometric training programs significantly improved leg power and jumping performance in athletes. Although their study focused on soccer players, the physiological demands of jumping and explosive movements are similar across sports, indicating that plyometric training benefits are transferable to volleyball athletes.

The findings of this study have important implications for volleyball training programs, particularly at the club level. The significant influence of jump-to-box and barrier hop exercises on leg muscle explosive power indicates that coaches should incorporate these exercises into regular training sessions. Continuous and progressive application of plyometric training is essential to maintain and further enhance physical performance.

Moreover, this study highlights the importance of designing training programs that address multiple physical components simultaneously. Explosive power is closely related to strength, speed, coordination, flexibility, and accuracy. Jump-to-box and barrier hop exercises contribute to the development of these components in an integrated manner. Power generation results from the coordination between maximal muscle strength and movement speed, while flexibility allows muscles to achieve optimal stretch during explosive actions. Therefore,

plyometric training serves as an effective method for developing comprehensive physical fitness in volleyball athletes.

In the specific context of the Men's Volleyball Club of Kampung Jawa, Sumbawa Besar Regency, the implementation of jump-to-box and barrier hop training proved to be an appropriate and effective strategy for improving leg muscle explosive power. Athletes who demonstrated improved explosive power showed better performance in smash and block execution, indicating a positive transfer of physical improvements to technical performance.

Despite the positive findings, this study also has limitations that should be considered. The study focused primarily on leg muscle explosive power and did not examine other physical or technical variables in detail. Future research could explore the combined effects of plyometric training on additional performance indicators, such as agility, reaction time, and match performance outcomes. Furthermore, comparative studies involving different age groups and competitive levels could provide deeper insights into the optimal application of plyometric training in volleyball.

Overall, the findings of this study provide strong evidence that jump-to-box and barrier hop plyometric exercises are effective training methods for improving leg muscle explosive power in volleyball athletes. These exercises are practical, efficient, and adaptable to various training environments. By incorporating plyometric training into regular training programs, volleyball clubs can enhance athlete performance and contribute to the development of competitive volleyball at the regional level.

Conclusion

Based on the findings of this study, it is recommended that volleyball coaches and athletes at the Men's Volleyball Club of Kampung Jawa, Sumbawa Besar Regency, implement a structured plyometric training program incorporating jump-to-box and barrier hop exercises. These exercises should be performed continuously and progressively, with attention to proper technique, intensity, and recovery.

Jump-to-box exercises should focus on developing the quadriceps, hamstrings, and calf muscles, emphasizing stable landings and controlled take-offs. Athletes are advised to start with lower box heights and gradually increase the height as their explosive strength and confidence improve. This exercise should be performed 2–3 times per week, allowing sufficient rest between sessions to avoid fatigue and reduce the risk of injury.

Barrier hop exercises should be included to enhance speed, coordination, reactive strength, and neuromuscular efficiency. These exercises train the stretch-shortening cycle of the leg muscles and improve lower-limb stiffness, contributing to higher and more powerful jumps. Barrier hop sessions can be performed 2–3 times per week, either on the same day as jump-to-box training or on alternate days, ensuring balanced training and adequate recovery.

Coaches should integrate these plyometric exercises with regular technical and tactical volleyball practice. Combining physical conditioning with skill development ensures that improvements in leg muscle explosive power directly translate into better performance during smashes, blocks, and other game-specific actions.

Finally, it is important to monitor athletes' progress, provide individualized adjustments based on fitness levels, and maintain a gradual progression in exercise intensity and complexity. By consistently applying jump-to-box and barrier hop exercises in a structured program, volleyball athletes can achieve significant improvements in leg muscle explosive power, ultimately enhancing their overall competitive performance.

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