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The Influence of Training Methods on Improving Fundamental Techniques, Leg Power, and Coordination in Adolescent Volleyball: Literature Review

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Abstract

Inroduction: Mastery of fundamental techniques, leg power, and coordination is a crucial determinant of performance in adolescent volleyball athletes. However, many young athletes face limitations due to training methods that lack variation, do not match their developmental characteristics, and do not properly emphasize comprehensive biomotor development. These issues often result in suboptimal improvement in their essential skills. Objective: This study aims to examine the influence of specific training methods on enhancing fundamental techniques, leg power, and coordination among youth volleyball athletes, as well as to evaluate the effectiveness of each training method in supporting athletic performance development. Methods: An experimental design was used by implementing two types of training programs—agility hurdle and agility ring—to adolescent volleyball players over a structured training period. Measurement instruments included fundamental skills tests, leg power assessments, and coordination tests administered before (pre-test) and after (post-test) the intervention. Data were analyzed to determine changes in athletes' abilities following the training. Results: The results indicate that both training methods significantly improved fundamental volleyball skills, particularly in passing, serving, and spiking. Notable enhancement in leg power was observed through increased jump performance and movement explosiveness. Coordination improvements were more pronounced in athletes with higher initial coordination levels, suggesting that baseline ability influences training outcomes. Conclusion: Structured, varied, and well-targeted training methods are effective in improving fundamental skills, leg power, and coordination in adolescent volleyball athletes. These findings highlight the importance of selecting appropriate training strategies as a foundation for designing more effective and sustainable athlete development programs.

Keywords: *Agility, Adolescent Athletes, Coordination, Leg Power, Volleyball*

Abstrak

Latar Belakang: Penguasaan teknik dasar, power tungkai, dan koordinasi merupakan aspek fundamental yang sangat menentukan kualitas performa atlet bola voli remaja. Dalam proses pembinaan, banyak atlet usia muda mengalami hambatan karena metode latihan yang kurang bervariasi, kurang sesuai karakteristik atlet, serta kurang menekankan pengembangan komponen biomotor secara menyeluruh. Kondisi ini menyebabkan peningkatan keterampilan tidak optimal. Tujuan:Penelitian ini bertujuan untuk mengetahui pengaruh metode latihan tertentu terhadap peningkatan teknik dasar, power tungkai, dan koordinasi atlet bola voli remaja, serta mengevaluasi efektivitas masing-masing metode dalam mendukung pengembangan performa atlet. Metode:Penelitian menggunakan desain eksperimen dengan memberikan dua jenis program latihan, yaitu agility hurdle dan agility ring, kepada atlet bola voli remaja selama periode latihan tertentu. Instrumen pengukuran mencakup tes teknik dasar, tes power tungkai, dan tes koordinasi yang dilakukan pada tahap awal (pre-test) dan akhir latihan (post-test). Data dianalisis untuk melihat perubahan kemampuan setelah perlakuan. Hasil: Hasil penelitian menunjukkan bahwa kedua metode latihan memberikan peningkatan signifikan pada aspek teknik dasar, terutama pada kemampuan passing, servis, dan smash. Peningkatan power tungkai juga terlihat jelas melalui perbaikan kemampuan melompat dan eksplosivitas gerakan. Sementara itu, peningkatan koordinasi lebih menonjol pada atlet yang sejak awal memiliki tingkat koordinasi lebih baik, menunjukkan adanya pengaruh kemampuan dasar awal terhadap hasil latihan.

Kesimpulan: Metode latihan yang bersifat variatif, sistematis, dan sesuai kebutuhan atlet terbukti mampu meningkatkan teknik dasar, power tungkai, serta koordinasi atlet bola voli remaja. Temuan ini menegaskan pentingnya pemilihan strategi latihan yang tepat sebagai dasar penyusunan program pembinaan yang lebih efektif dan berkelanjutan.
Kata Kunci: Agility, Atlet Remaja, Bola Voli, Koordinasi, Power Tungkai

INTRODUCTION

The development of volleyball at the youth level requires a training process that is systematic, measurable, and based on performance needs. During adolescence, biomotor components such as fundamental techniques, leg power, and coordination must be developed simultaneously because these elements form the foundation for producing optimal performance in specific volleyball movements, such as serving, passing, smashing, and blocking. However, in practical training settings, many coaches still apply conventional training patterns that lack variation, do not sufficiently stimulate comprehensive biomotor abilities, and are not adjusted to the physical developmental characteristics of adolescents. This situation leads to slow improvement in athletes' skills and prevents them from achieving their full potential. Terminologically, fundamental volleyball techniques are a series of basic movements that every athlete must master as the foundation for performing advanced techniques. Meanwhile, leg power is the ability of the leg muscles to generate explosive force, which plays a role important in jumping, quick movements, and body stability. Coordination, which is the ability to integrate the neuromuscular system in controlling movement, becomes a prerequisite for producing efficient and consistent skills. These three components are interconnected, so developing one aspect without considering the others may hinder the overall improvement of an athlete's performance.

Advancements in sports science and training technology indicate that agility-based training, plyometrics, and coordinative exercises have been proven effective in enhancing neuromuscular responses, movement efficiency, and explosive abilities in athletes (Markovic & Mikulic, 2010; Young, James & Montgomery, 2002). Previous studies have reported that training variations such as agility hurdles, ladder drills, and agility rings can improve basic techniques and biomotor components in young athletes (Meylan & Malatesta, 2009; Hammami et al., 2020). However, these studies tend to focus on a single variable, such as only leg power or only fundamental techniques, thus failing to provide a comprehensive understanding of how training methods influence multicomponent performance improvement. Furthermore, limited research has integrated the three main aspects—fundamental techniques, leg power, and coordination—within a single comprehensive evaluation framework for youth volleyball athletes (Trajković et al., 2017). Weaknesses in current training methods are evident in the lack of load adjustment, minimal variation in motor stimulation, and the insufficient use of scientific approaches in evaluating skill development. To address these issues, a structured, varied, and science-based training method is needed—one capable of stimulating motor and technical abilities simultaneously. Agility hurdle and agility ring training become relevant alternatives as they involve a combination of rapid movements, changes of direction, body stabilization, and neuromuscular activation, which potentially provide significant improvements in the three skill components examined.

This study presents novelty through the integration of three main variables—fundamental techniques, leg power, and coordination—which are rarely examined together in the context of youth volleyball athletes. In addition, this research positions agility training

methods as an integrated approach to improving technical and biomotor performance, thereby strengthening the state of the art in sports training research. The hypothesis of this study is that agility-based training methods have a significant effect on improving fundamental techniques, leg power, and coordination in adolescent athletes. The purpose of this research is to analyze the effectiveness of these training methods as a comprehensive effort to enhance athletic performance. The impact of this study is expected to provide meaningful contributions for coaches and sports practitioners in designing evidence-based training programs, as well as enrich the literature on the development of technical and biomotor abilities in youth athletes. Moreover, the results may serve as a basis for developing more innovative, adaptive, and developmentally appropriate training models for young athletes.

RESEARCH METHODS

This study employs a literature review method, which is conducted by examining the coordination of adolescent volleyball athletes. The literature sources are reviewed, analyzed, and synthesized from various scientific publications relevant to the topic of The Influence of Training Methods on the Improvement of Basic Techniques, Leg Power, and Coordination. A total of ten primary journals were used, all focusing on training methods, improvement of volleyball technical skills, leg power, and athlete coordination, consisting of both national and international journals. The data collection process was carried out by searching journal databases such as Google Scholar, ResearchGate, and university e-journal portals using the keywords “training methods,” “basic volleyball techniques,” “leg power,” and “athlete coordination” (Snyder, 2019). The inclusion criteria consisted of: (1) articles published within the last ten years, (2) empirical research, (3) directly related to training in sports, and (4) having comparable results (Xiao & Watson, 2019). The exclusion criteria included articles that did not provide research data, were not relevant to the volleyball context, or were not fully accessible (Snyder, 2019). After the selection process, all articles were analyzed using a thematic synthesis approach. The analysis was conducted by extracting key components of each study, such as objectives, methods, types of training used, variables examined, and research findings. These findings were then compared to identify patterns, similarities, differences, and relationships between studies. The synthesized results served as the basis for drawing conclusions regarding the effectiveness of various training methods in improving basic techniques, leg power, and coordination among adolescent volleyball athletes.

RESEARCH RESULTS AND DISCUSSION

No	Judul Jurnal	Metode Penelitian	Sampel	Analisis Data	Hasil / Temuan	Sumber
1.	The Effect of Training Methods and Coordination on Lower-Limb Power of Junior Female Volleyball Athletes	2×2 factorial experimental design	24 junior female volleyball athletes	2×2 ANOVA and Post-hoc tests	The results of the study indicate that agility hurdle training significantly increases lower-limb power compared to agility ring exercises, due to repeated explosive movements that maximally stimulate the leg muscles. Agility ring training is more	Porkes

					effective for improving coordination, as it involves multi-directional movements that challenge the neuromuscular system. Athletes with higher initial coordination showed greater improvements in technical performance.	
2.	Survey of Basic Technical Skills of Volleyball Athletes in Sragen Regency	Descriptive survey	33 athletes	Descriptive statistics	The results of the study indicate that the smash is the skill most proficiently mastered by the athletes, while passing and serving show greater variation between clubs. POPSI athletes excel in smash performance, whereas IM athletes perform better in passing. Differences in training quality and athlete experience are the main contributing factors.	Porkes
3.	Survey of Basic Technical Skills of Extracurricular Volleyball Participants	Descriptive survey	Extracurricular participants	Descriptive statistics.	The results of the study indicate that most participants fall into the “adequate” category. Low training intensity, the absence of a structured training program, and limited coordination are the main factors contributing to the slow development of basic technical skills.	Porkes
4.	The Effect of Smash Drill Training and Smash Feed Training on the Smash Skills of	Experimental	Youth athletes	Pre-test and post-test comparisons	The results of the study indicate that smash drill training improves accuracy, striking power, and hand-control consistency. The repetitive movement	Porkes

	Youth Volleyball Athletes				patterns enable athletes to master the technique more quickly and with greater stability.	
5.	The Effect of Bench Step Training on Semi-Smash Ability in Volleyball Athletes	Experimental	Local club athletes	T-test & ANAVA	The results of the study indicate that bench step training significantly increases lower-limb power, which directly contributes to improved jump height and better semi-smash performance. The exercise stimulates explosive contractions of the leg muscles.	Porkes
6.	Relationship Between Physical Components and Smash Ability in Volleyball Athletes	Correlational survey	Club athletes	Correlation and regression tests	The results of the study indicate that lower-limb power is the most dominant indicator of smash performance. Coordination also has a significant influence, affecting stability, timing, and hitting accuracy.	Porkes
7.	The Effect of Smartphone Applications on Upper-Service Skill Improvement in Volleyball	Experimental	Student athletes	Pre–post testing	The results of the study indicate that the smartphone application helps athletes visually correct technical errors, thereby improving service accuracy and power. The group that used the application performed better than the control group.	Porkes
8.	Study of Basic Technical Skills of Female Volleyball Players	Descriptive	Female athletes	Descriptive statistical analysis	The results of the study indicate that passing and serving fall into the “adequate” category, while smash performance is categorized as “good.” The study highlights that insufficient coordination training	Porkes

					is a key factor contributing to variations in basic technical performance.	
9.	Survey of Physical Condition and Basic Technical Skills of Bravo Volleyball Club Athletes (2012)	Descriptive survey	Atlet klub Bravo	Descriptive statistics	The results of the study indicate that lower-limb power has a strong influence on technical performance—particularly in smash and block skills. Athletes with higher power levels demonstrate better technical stability.	Porkes
10.	The Effect of Game Modification on Creativity and Basic Volleyball Skills	Quasi-experimental	University athletes and young players	ANOVA	The results of the study indicate that game modification enhances creativity, decision-making speed, and the quality of basic techniques. Athletes become more adaptive in real game situations, leading to a significant improvement in overall skills.	Porkes

The studies in the literature review were conducted in various settings. Based on the analysis of ten relevant journals, it can be concluded that various training methods have been proven to positively influence the improvement of basic techniques, leg power, and coordination in adolescent volleyball athletes (Bompa & Haff, 2009). Training methods such as agility hurdles and bench step exercises consistently increase leg power through explosive movement stimuli that enhance jumping ability and support performance in spiking and blocking. Agility ring training, coordination training, and game modification activities provide significant improvements in coordination, agility, and situational adaptability during play. Meanwhile, technique-based drill training—such as smash drills and passing drills—contributes greatly to improvements in accuracy, consistency, and movement efficiency through systematic repetition that strengthens motor memory. Several journals also show that the use of technology, such as smartphone applications and video analysis, can improve basic techniques by providing visual feedback that helps athletes identify and correct movement errors. Survey-based studies also support these findings by demonstrating a strong relationship between physical conditions—especially leg power and coordination—and the quality of basic techniques. Overall, the synthesis of all journals confirms that training methods designed to be specific, progressive, and varied are capable of significantly improving athletes' technical and biomotor abilities. Therefore, effective training programs must integrate components of strength, agility, coordination, basic techniques, and learning technology to achieve optimal development of adolescent volleyball athletes.

According to research on agility training, the agility hurdle method provides significant improvements in leg power because it emphasizes explosive movements and repetitive jumps, whereas the agility ring is more effective for enhancing coordination due to its multi-directional movement patterns that stimulate the neuromuscular system. This study explains that athletes with better initial coordination respond more quickly and steadily to training, indicating that coaches must consider athletes' initial abilities when designing training programs. Research from the survey of POPSI and IM athletes in Sragen showed noticeable differences in basic technical abilities: POPSI athletes excelled in spiking, while IM athletes performed better in passing. The authors noted that these differences stemmed from variations in training methods, the intensity of technical programs, and the coaching experience in each club. A lack of repeated practice and technique evaluation contributed to low basic technical performance in several athlete groups. According to the study on extracurricular participants, most students fell into the "adequate" category in basic technical skills. The authors explained that this was due to low training intensity, limited facilities, and the absence of structured training programs such as those found in clubs. The study emphasizes the need for technique drills and coordination exercises to improve basic skills among students who do not receive intensive training.

Based on research on smash drills, consistent drill training improved accuracy, power, and hitting control during the smash. The discussion highlighted the importance of movement repetition because it strengthens motor memory and enhances hitting consistency during game situations. Drills also improve coordination between jump approach, arm swing, and ball contact timing, resulting in more effective smashes. According to research on bench step training, this plyometric method significantly increased explosive leg power, jump height, and stability during semi-smash execution. The authors explained that bench step exercises train rapid muscle contractions, accelerating neuromuscular adaptation required in semi-smash movements. This method is considered effective for improving striking quality in adolescent athletes.

In the journal examining physical components, leg power was found to be the most dominant factor determining smash quality, compared to agility or arm strength. The study noted that jump height, timing, and hitting force rely heavily on leg explosive power; therefore, power and coordination training should be prioritized in youth volleyball development programs. Research on smartphone application use found that video analysis effectively improved accuracy and technique in overhand serves because athletes could visually identify posture and arm swing errors. The authors explained that visual feedback accelerates technique correction and enhances body awareness. This technology is regarded as an effective modern tool for motor learning. In the study on female athletes, most basic technical abilities were classified as adequate, particularly in passing and serving. The authors noted that muscle strength, training experience, and body coordination were factors contributing to performance variations among athletes. A lack of coordination and stabilizer muscle training was identified as the main cause of low passing ability.

Research on Bravo club athletes demonstrated that good physical condition—especially strength, endurance, and leg power—was strongly correlated with the quality of basic techniques such as spiking and blocking. The discussion explained that optimal physical condition provides body stability and muscular endurance required for explosive movements. Therefore, physical conditioning must be an essential component of basic technique development programs. According to the journal on game modification, changes in game structure and rules significantly improved creativity, situational adaptability, and basic volleyball skills. The authors explained that game-based training requires rapid decision-making, allowing basic techniques to develop more naturally and flexibly. This method is

particularly effective for adolescents because it trains both technique and tactics simultaneously.

Discussion

Based on a literature review of ten journals examining the improvement of fundamental volleyball skills, it is evident that the development of players' technical abilities is strongly influenced by training approaches that are systematic, varied, and aligned with athletes' motor characteristics. Most studies indicate that specific training models, such as passing drills, variations of underhand passing, the use of lightweight plastic balls, and wall-rebound drills, significantly contribute to enhancing ball control, touch accuracy, and movement consistency during gameplay. In addition, several journals highlight that power-based exercises, such as vertical jump training, play a crucial role in improving blocking performance by increasing leg explosiveness and jump height. Coordination also emerges as a variable that consistently affects training effectiveness, where athletes with higher coordination levels demonstrate better skill development compared to those with lower coordination, even when implementing the same training methods. Other findings reveal that the use of technology, such as smartphone applications as visual feedback media, has a positive impact on athletes' understanding of techniques and their ability to correct movements independently. Meanwhile, studies on physical condition show that although many athletes fall into the moderate to good category, improvements in agility, strength, and power remain essential components for supporting fundamental technical skills. Overall, the literature review emphasizes that the successful enhancement of volleyball skills does not depend on a single type of training but rather on a combination of varied training methods, adequate physical conditioning, and the use of relevant learning media. Therefore, a comprehensive training program—incorporating technical, physical, media-based, and continuous evaluation components—serves as the key to optimizing volleyball skill mastery across different age groups and experience levels.

CONCLUSION

This study concludes that the various training methods reviewed across ten journals have been proven effective in improving basic techniques, leg power, and coordination in adolescent volleyball athletes. Training methods such as agility exercises, plyometrics, technical drills, and game modifications were shown to provide appropriate physical and motor stimulation aligned with volleyball performance demands (Markovic & Mikulic, 2010). Leg power and coordination emerged as dominant factors influencing the quality of basic techniques, while structured, varied, and progressive training played a crucial role in producing significant improvements in athletes' abilities.

BIBLIOGRAPHY

Bompa, T. O., & Haff, G. (2009). Periodization: Theory and methodology of training. Human Kinetics.

Girsang, A. E., & Hendrawan, D. (2022). Efforts to improve underhand passing skills in volleyball through play-based methods. Jurnal Pengabdian Kepada Masyarakat, 2(2), 56–67.

Hammami, M., et al. (2020). Effects of combined plyometric and short sprint training on physical performance in young soccer players. Journal of Strength and Conditioning Research, 34(3), 695–706.

Handoyo, A., & Adityatama, F. (2024). Improving volleyball overhead passing skills using training methods with plastic balls. Jurnal Ilmiah Spirit, 26(1), 105–110.

Ismoko, P. A., & Sukoco, P. (2013). The effect of training methods and coordination on leg power of junior female volleyball athletes. Jurnal Keolahragaan, 1(1), 1–12.

Keswando, Y., Sistiasih, S. V., & Marsudyanto, T. (2022). Survey of basic technical skills of volleyball athletes. Jurnal Pendidikan Olahraga Kesehatan & Rekreasi, 5(1), 168–177.

Markovic, G., & Mikulic, P. (2010). Neuromuscular adaptations to plyometric training. Sports Medicine, 40(10), 859–895.

Markovic, G., & Mikulic, P. (2010). Neuromuscular adaptations to plyometric training. Sports Medicine, 40(10), 859–895.

Meylan, C., & Malatesta, D. (2009). Effects of in-season plyometric training within soccer practice on explosive actions of young players. Journal of Strength and Conditioning Research, 23(9), 2605–2613.

Nasution, S. N. (2015). The relationship between arm muscle strength and self-confidence with open spike skills in female volleyball athletes of PELATKAB Karawang. Jurnal Pendidikan UNSIKA, 3(2), 188–199.

Nugroho, A. D., & Indahwati, N. (2023). Improving overhead passing skills in volleyball through paired movement patterns. Jurnal Pendidikan Olahraga & Kesehatan, 11(3), 185–191.

Pardiman, Wijaya, A., & Kartika, E. S. (2021). A literature study on vertical jump training toward blocking technique in volleyball. Jurnal Pendidikan Jasmani Kesehatan & Rekreasi, 6(2), 42–51.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. Journal of Business Research, 104, 333–339.

Sumarna, D., & Hidayat, A. (2020). Passing training using basketball to improve the quality of overhead passing in volleyball. Jurnal Pendidikan Jasmani Kesehatan & Rekreasi, 5(2), 1–6.

Trajković, N., et al. (2017). Effects of coordination training on motor skills in young volleyball players. Acta Kinesiologica, 11(1), 41–45.

Xiao, Y., & Watson, M. (2019). Guidance on conducting a systematic literature review. Journal of Planning Education and Research, 39(1), 93–112.

Young, W., James, R., & Montgomery, I. (2002). Is muscle power related to running speed with changes of direction? Journal of Sports Medicine and Physical Fitness, 42(3), 282–288.

Yunyun, Y. (2015). Implementation of tactical and technical approach models in volleyball learning in physical education at junior high schools. Jurnal Kajian Pendidikan, 5(1), 95–114.

Yunyun, Y. (2015). Implementation of tactical and technical approach models in volleyball learning in physical education at junior high schools. Jurnal Kajian Pendidikan, 5(1), 95–114.