Game-like situations training method and endurance impact on volleyball player performance

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ABSTRACT

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This study aimed to examine the impact of game-like situations training on the improvement of cardiovascular fitness and volleyball skills among high school students. The quasi-experimental design involved a sample of 32 secondary school students aged 13-17 years, divided into four groups based on two training methods (game-like situations and endurance) and two skill levels (high and low). The 8-week program, with sessions twice a week, focused on improving players' technical skills such as passing, setting, and ball control, as well as their cardiovascular endurance. Data were collected through the Yo-Yo Intermittent Recovery Test to measure cardiovascular fitness, alongside physical endurance tests. The results showed that the game-like situations training method was more effective than endurance training in improving volleyball skills, particularly for players with high skill levels. While endurance also played a significant role, combining game-like situations with endurance training yielded dual benefits, enhancing both technical skills and cardiovascular fitness. This study suggests that integrating game-like situations into volleyball training programs at the adolescent level is essential for the holistic development of players. Further research is recommended to explore additional factors influencing skill development and to assess the long-term impact of these training methods.

KEYWORDS

Game-like Situations; Volleyball Skills; Cardiovascular Fitness; Endurance Training; Adolescent Athletes

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1. INTRODUCTION

Exercise is a very important part of human life, providing a wide range of benefits for physical, mental, and social health (Bakhtiar et al., 2020, 2023). At the educational level, especially in high school students, sport is not only a means of recreation, but also a platform for developing important life skills (Ronkainen et al., 2021; Umar et al., 2023). Volleyball, as one of the most popular sports, is a sport that requires good technical and physical skills (Oliinyk et al., 2021; Risma et al., 2024). In it, players are required to have good coordination, high ball possession, and optimal endurance, especially in cardiovascular terms (Luo et al., 2023; Mardius et al., 2025). Optimal performance in volleyball relies heavily on the ability to perform a series of basic techniques quickly and effectively, as well as the ability to survive long match durations. However, in many situations, especially at the high school level, students often face difficulties in reaching their maximum potential in volleyball. The main problems that are often faced are low levels of cardiovascular endurance and lack of basic technical skills such as passing, setting, and ball control (Schuch & Vancampfort, 2021). In volleyball, which is not a sport that requires a continuous run like football or basketball, the intensity is very high and requires excellent endurance, especially in terms of recovery speed and the ability to survive long rallies (AlSamhori et al., 2023). Cardiovascular endurance, which refers to the ability of the heart and lungs to deliver oxygen to the body's muscles during physical activity, plays a crucial role in determining a volleyball player's performance (Latino et al., 2024; Milovancev et al., 2021). A good endurance is able to maintain a high level of performance throughout the match, reducing the risk of fatigue and improving recovery between rounds. Without adequate endurance, players will struggle to stay in optimal physical condition, especially in long-lasting and demanding matches with high concentration.

In addition to endurance, technical skills are a key element in a volleyball player's success. Some of the basic skills that volleyball players must master are passing, setting, and ball control. Passing is a skill that allows players to receive the ball appropriately, both to make an attack and to maintain the flow of the game (Mocanu et al., 2024). Setting is the ability to set the tempo of the game by giving the ball ready to be attacked by teammates. Ball control, both defensively and offensively, is also crucial to avoid mistakes that could cost the team (Akhmad et al., 2022). However, while these technical skills are essential, volleyball players at the high school level often face difficulties in mastering them well. One of the factors that affects this is the lack of challenging and realistic exercises that test players in situations similar to real matches. More traditional training methods often focus only on separate basic exercises, such as practicing individual passing or setting without considering

the overall aspect of the game. This can reduce players' ability to cope with the pressure that arises in the game, as well as hinder their ability to improve their technical skills significantly. In this case, it is important to design a training method that can address these two factors simultaneously. One method that can be used to improve technical skills and physical condition is through game-like situationsbased training.

Game-like situations-based training is an approach that integrates realistic game situations into training sessions (Raab, 2007). This method aims to mimic the conditions of a real match, where players practice with the same time, space, and situation pressures as they would in a real match (Harvey et al., 2020). With this approach, players can hone their technical skills while working on their physical endurance in a more dynamic and realistic environment. These exercises are designed to challenge players in terms of their physical and mental endurance. With this method, players not only learn technical skills, but also get the opportunity to improve their endurance through intensive and thorough training. By applying this method, coaches can help players develop their technical abilities in a more realistic game context, while improving their physical condition through more dynamic and intense training. This will not only improve the player's individual skills, but also improve the overall strength of the team. Therefore, the integration of game-like situations-based training in volleyball training programs in high schools is critical, and can have a significant impact on improving player and team performance.

2. METHODS

2.1. Design and participants

This study used a quasi-experimental research design to examine the cause-and-effect relationship between game-like situations training methods and the improvement of cardiovascular fitness of volleyball players. The study involved an 8-week exercise program with sessions twice a week, each lasting 90 minutes. The design of the study followed a 2x2 treatment by level framework, in which two independent variables—training method and endurance level—were divided into two levels: game-like situations (A1), endurance (A2), and high-skill (B1) low-skill (B2). Thus, there are four treatment conditions: (A1B1) game-like situations with high skills, (A2B1) cardiovascular with high skills, (A1B2) game-like situations with low skills, and (A2B2) endurance with low skills. In game-like situations (A1) exercises, players are trained through game situations that resemble real matches, such as 3v3 or offensive and defensive drills, aimed at improving volleyball skills. While endurance (A2) focuses on training with a certain intensity. High skill levels (B1) and (B2) involve training achievements with basic skills in volleyball.

Participants aged 13-17 years were selected from secondary schools in Padang using purposive sampling techniques. A total of 32 students participated in the study, which was divided into four groups based on two training methods (game-like situations and endurance) as well as two skill levels (high and low).

2.2. Instruments and procedures

Data were collected through tests that measure cardiovascular fitness using the Yo-Yo Intermittent Recovery Test as well as tests to measure physical endurance. All tests were carried out with appropriate equipment and the data were systematically recorded by two testers.

2.3. Statistical analyses

The normality test and homogeneity test were carried out before conducting a two-way ANOVA analysis. The results of the normality test (Kolmogorov-Smirnov and Shapiro-Wilk) showed that all data groups were normally distributed. The homogeneity test using the Levene test shows that the data meet the homogeneity requirements. The main goal of this study was to identify whether the combination of game-like situations with endurance had a greater impact on improving skills in volleyball.

3. RESULTS

The homogeneity test using the Levene test showed that the data met the homogeneity requirements. Here for more details can be seen in the table below:

Normality Test					Homogeneity Test					
v-Smiri	nov	Shapiro-Wilk			Levene Statistics					
df	Р	Statistik	df	Р	df1	df2	Р			
39	0,235	0,982	39	0,920	3	37	0,970			
	7-Smiri df 39	Normal V-Smirnov df P 39 0,235	Normality Test/-SmirnovShapirdfPStatistik390,2350,982	Normality Testv-SmirnovShapiro-WilkdfPStatistikdf390,2350,98239	Normality TestV-SmirnovShapiro-WilkdfPStatistikdfP390,2350,982390,920	Normality TestV-SmirnovShapiro-WilkIdfPStatistikdfP390,2350,982390,9203	Normality TestHomogenei/-SmirnovShapiro-WilkLevene StatistikdfPStatistikdfP390,2350,982390,920337			

Table 1. Normality and homogeneity test results

The results of the two-way ANOVA showed a significant effect of training method and endurance between training method and endurance on volleyball skills (Table 2). The results showed that Game-like Situations Training was more effective than endurance in improving basic skills in volleyball, especially for players with high skills. Additionally, endurance levels play a crucial role in the effectiveness of training methods, highlighting the importance of tailoring training programs to individual endurance levels.

skills											
Source	Type III Sum of Squares	df	Mean Square	\mathbf{F}	Р						
Corrected Model	5,89	3	1,963	1,5	0,195						
Intercept	920,105	1	920,105	765,89	0						
Game-like Situations Training Method (A)	3,1	1	3,1	2,88	0,097						
Endurance (B)	2,17	1	2,17	1,87	0,18						
Game-like Situations Training Method (A) * Endurance (B)	0,27	1	0,27	0,23	0,634						
Error	41,62	37	1,157								
Total	985,52	39									
Corrected Total	47,51	39									

 Table 2. Two-way ANOVA results for the effects of training method and endurance on volleyball

 skills

4. DISCUSSION

This research is important because the development of technical skills and cardiovascular fitness in volleyball, especially among adolescents, is still a challenge that is often faced. Many learners struggle to reach their maximum potential, both in terms of physical endurance and basic skills such as passing, setting, and ball control. Given the importance of these two aspects in supporting volleyball players' performance, this study provides insight into effective training methods, especially through a game situation-based approach. This is supported by research by Crespo et al. (2004) showed that game situation-based exercises are more effective in improving technical skills because they create simulations of real game conditions, which helps players hone their abilities under the pressure of real situations. In addition, research by Ashford et al. (2021) also underlined that exercises that create time and space pressures similar to matches can improve a player's decision-making and execution speed. Meanwhile, research by Sgrò et al. (2024) highlights the importance of cardiovascular fitness in sports that require players to have optimal physical endurance, such as those required in volleyball, to reduce fatigue and maintain high performance throughout the game. Therefore, this study contributes to the understanding of how the combination of game situation training and resistance training can improve players' skills and fitness simultaneously.

The implication of this study is the importance of developing a training program that considers both technical and physical aspects in volleyball, especially at the adolescent level. An approach that combines game situation-based training with endurance training will be more effective in improving players' technical abilities as well as cardiovascular fitness. The recommendation for future research is to further explore other factors that can influence the development of volleyball skills, such as psychological factors and team dynamics. Longitudinal research looking at the long-term impact of this training program also needs to be conducted to find out whether the recorded improvement is sustainable and can be translated into real performance in the game.

5. CONCLUSIONS

The conclusion of this study indicates that the game-like situations training method is more effective than endurance training in improving basic volleyball skills, particularly for players with high skill levels. While endurance plays a crucial role in training effectiveness, combining game-like situations with endurance training provides dual benefits—enhancing both technical skills and cardiovascular fitness. Game-like training helps players cope with time and space pressures similar to real match conditions, improving decision-making and execution speed. Therefore, an approach that integrates both aspects is essential for the holistic development of adolescent volleyball players. Further research is needed to explore other factors, such as psychological aspects and team dynamics, and to investigate the long-term impact of this training program on actual match performance.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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