

## The impact of specific anaerobic exercises on the development of kinetic performance speed and skill level for the backcourt smash in volleyball

El impacto de ejercicios anaeróbicos específicos en el desarrollo de la velocidad de rendimiento cinético y el nivel de habilidad para el smash de fondo en voleibol

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**Abstract.** This study examined the impact of specific anaerobic exercises on the development of kinetic performance speed ("movement speed") and the skill level of volleyball players in executing the backcourt smash (from position 6). The researchers employed an experimental methodology using a single experimental group with pre- and post-tests. The sample included 12 players from the Abu Risha Volleyball Club participating in the premier league. Over eight weeks, the players underwent three training sessions per week, with three training sessions per week. The practical part of the training sessions began with the main section, each lasting 15 minutes dedicated to anaerobic exercises. The post-test results were statistically analyzed and discussed scientifically, supported by relevant academic sources. The researchers concluded that the specific anaerobic exercises significantly enhanced both the straight and diagonal kinetic performance speeds and skill levels of the backcourt smash from position 6, particularly towards positions 1 and 5. The researchers recommend adopting these exercises when aiming to develop the kinetic performance speed or skill level of volleyball players, to achieve high-level performance in the game.

**Palabras clave:** entrenamiento anaeróbico, rendimiento en voleibol, velocidad de rendimiento cinético, desarrollo del nivel

**Resumen.** Este estudio examinó el impacto de ejercicios anaeróbicos específicos en el desarrollo de la velocidad de rendimiento cinético ("velocidad de movimiento") y el nivel de habilidad de los jugadores de voleibol al ejecutar el remate desde el fondo de la cancha (desde la posición 6). Los investigadores emplearon una metodología experimental utilizando un grupo experimental único con pruebas antes y después. La muestra incluyó a 12 jugadores del Club de Voleibol Abu Risha participando en la liga premier. Durante ocho semanas, los jugadores realizaron tres sesiones de entrenamiento por semana. La parte práctica de las sesiones de entrenamiento comenzó con la sección principal, cada una de 15 minutos dedicada a ejercicios anaeróbicos. Los resultados de las pruebas posteriores fueron analizados estadísticamente y discutidos de manera científica, respaldados por fuentes académicas relevantes. Los investigadores concluyeron que los ejercicios anaeróbicos específicos mejoraron significativamente tanto las velocidades de rendimiento cinético directas como diagonales y los niveles de habilidad del remate desde el fondo de la cancha desde la posición 6, especialmente hacia las posiciones 1 y 5. Los investigadores recomiendan adoptar estos ejercicios al buscar desarrollar la velocidad de rendimiento cinético o el nivel de habilidad de los jugadores de voleibol, para alcanzar un rendimiento de alto nivel en el juego.

**Keywords:** anaerobic training, volleyball performance, kinetic performance speed, skill level development, backcourt smash

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### Introduction

Volleyball distinguishes itself among team sports not only due to its popularity and competitive achievements but also because of the unique demands it places on athletes. Unlike other sports, volleyball prohibits players from retaining the ball, permitting no more than three touches before it must be sent to the opposing team's court (OTC). This rule highlights the necessity for players to possess exceptional physical, kinetic, and functional capabilities, especially in terms of speed and motor responses. Observers and enthusiasts recognize the clear advantages provided by rapid offensive and defensive skills, including the backcourt smash. These maneuvers, characterized by swift jumping and striking, along with precise ball direction, crucially impact the opponent's court strategy.

Excelling in these demanding aspects of volleyball requires reliance on modern, advanced sports training methods (Astuti et al., 2024; Martins et al., 2022; Vilela et al., 2021). These methods promote the incorporation of diverse and targeted physical and skill-based exercises, specifically tailored to the

needs of volleyball. Executing these exercises, grounded in standardized scientific principles, is aimed at boosting players' skill performance by enhancing the functionality of the body's systems to meet the sport's performance demands. The study by Gabbett et al. (2006) indicates that skill-based volleyball training significantly improves spiking, setting, and passing accuracy, as well as speed and agility, underscoring the value of skill-focused exercises (GABBETT et al., 2006).

Given the intense, rapid, and powerful movements essential in volleyball, focusing training on the anaerobic energy system (AES) is crucial. This system, known for supporting rapid performance without oxygen over brief periods, is vital for developing kinetic performance speed and skill levels (Gjinovci et al., 2017; Yue & Hong, 2023). Comparative studies on different training methods, such as plyometrics and weight training or their combination, have shown that mixed training methods notably enhance vertical jump performance, 50-yard dash times, and leg strength, thereby supporting the efficacy of integrated training approaches (Attia, 2013; FATOUROS et al., 2000; Rashwan Attia, 2013). Specialized

anaerobic exercises, particularly those designed to improve the backcourt smash, are crucial for preparing players to meet and exceed the rigorous physical demands of competitive volleyball. For instance, core strength training has been demonstrated to significantly enhance anaerobic power, speed, and static balance in volleyball players (Bora & Dağlıoğlu, 2022). Furthermore, interval training combined with hydration strategies like drinking vital water positively impacts anaerobic capacity, functional indicators, and various volleyball skills, highlighting the benefits of comprehensive training strategies (Issa, 2022).

Lastly, the utilization of free weights and lifting machines has proven effective in improving speed, strength, and anaerobic endurance in volleyball players, emphasizing the effectiveness of these training modalities (Kitamura et al., 2020). These advanced training methods are indispensable for developing the necessary physical attributes demanded by volleyball, particularly in enhancing the speed and power required for high-level performance

### **Research Problem**

In the realm of competitive volleyball, the ability to perform with high speed, precision, and power distinguishes top-tier athletes from the rest. International and high-level league matches witness exhilarating displays of athleticism, particularly in the execution of complex offensive and defensive maneuvers (Ouergui et al., 2013). These performances showcase not just skill, but a high degree of physical conditioning that supports rapid and powerful movements, essential for executing techniques such as the backcourt smash.

Despite the apparent advancements in training methodologies and their application in international settings, there is a noticeable discrepancy in performance levels when comparing elite athletes to those competing in regional and national circuits, especially in countries with less developed sports training infrastructures. This gap is particularly evident in Iraqi volleyball, where players often exhibit delays in reaching the kinetic performance speeds and skill levels demonstrated by their counterparts in more competitive leagues. The challenge lies in the inadequate application or absence of modern, scientifically based training regimens that are standard in more advanced volleyball programs (Ma & Li, 2014; Wang et al., 2022).

This discrepancy raises significant questions about the effectiveness of current training practices employed at the club and national levels in Iraq. Are existing training methods adequately enhancing the players' physical capabilities and skill execution, specifically in terms of speed, agility, and precision? How can these training methods be adapted or improved to close the performance gap with top-tier volleyball nations?

The research aims to address these issues by exploring the effectiveness of specific anaerobic training exercises tailored to enhance the performance attributes critical for volleyball,

particularly the speed and power of backcourt smashes. This investigation will contribute to a deeper understanding of how targeted training interventions can elevate the performance levels of volleyball players in Iraq, aligning them more closely with international standards

### **Research Hypothesis**

This study hypothesizes that:

- Players who undergo specific anaerobic training exercises designed for volleyball, particularly those aimed at enhancing backcourt smashes, will exhibit statistically significant improvements in kinetic performance speed and skill levels compared to their baseline measurements.
- These improvements will be evident not only in controlled testing environments but also in competitive settings, indicating a transfer of training gains to actual game performance.

### **Research Scope**

#### *Human Scope*

This paper will consider the Volleyball players from the Abu Risha Volleyball Club and their performance in the 2023/2024 season. These athletes will undergo systematic training aimed at improving their physical and technical abilities in volleyball, with a particular emphasis on enhancing speed and the effectiveness of the backcourt smash.

#### *Temporal Scope*

The duration of the proposed intervention and evaluation period will be between March 5, 2024 and May 14, 2024. This timeframe will allow a pre-training evaluation to be conducted before training begins, the conduct of the training, and a post-training evaluation to determine the level of change.

#### *Spatial Scope*

All training sessions and evaluation will be conducted in the sports hall in the city of Ramadi. This would enable the conditions under which training is conducted to be made more standardized and the data collected made more valid.

### **Research Methodology and Field Procedures**

#### **Research Method**

The researchers employed an experimental method appropriate for the nature and objectives of the study, utilizing a single-group design with pre-test and post-test measurements.

#### **Research Population and Sample**

The research population comprised volleyball players from Abu Risha Club, participating in the 2023/2024 premier league season, totaling 14 players. After excluding injured players, the research sample intentionally consisted of 12

players, representing 85.7% of the initial population.

### Tools and Equipment Used for Data Collection

#### Devices Used

Electronic laptop (HP)

- Four stopwatches

#### Tools Used

- Official volleyball court
- Ten volleyballs
- Measuring tape
- Colored adhesive tape

#### Methods of Data Collection

- Literature and reference materials
- Observations
- Tests and measurements

### Definition of Research Variables

The dependent variables identified by the researchers include the composite kinetic performance speed for three skills: receiving the serve, setting the ball, and executing the backcourt smash, as well as the skill performance level, which takes into account the accuracy and timing of these skills (Fitts). Consequently, the researchers determined the independent variable to be specific anaerobic exercises, designed to enhance the dependent variables that represent both the problem and the objective of the study.

#### Tests Used

*Kinetic Speed Test (Ibrahim, 2000):*

- Purpose: To measure the kinetic performance speed.
- Tools: Official volleyball court, volleyball, stopwatch.
- Performance Specifications: The player receives the ball sent from the opposing court, sets it forward, and then performs a backcourt smash from position 6, as illustrated in Figure 1.

- Recording: Time is recorded from the moment the ball is received until the ball is struck.

*Diagonal and Straight Smash Test from Position (6) (Jabbar, 2009):*

- Purpose: To measure the skill level of the smash from position (6).
- Tools: Volleyball court, volleyballs, colored adhesive tape, stopwatch.
- Performance Specifications: The court is marked with squares (1.5×1.5 m, 1.5×3 m). The player performs the smash from position (6) after receiving and setting the ball from a serve delivered from the opposite side of the court,

attempting 15 trials divided into 5 straight and 5 diagonal attempts towards positions (1) and (5).

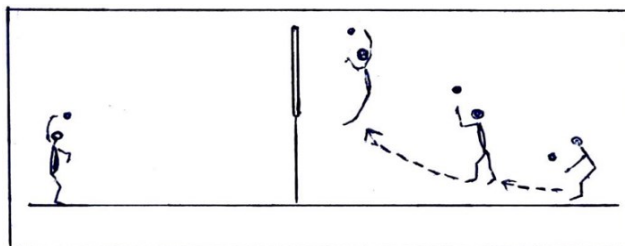


Figure 1. The Kinetic Performance Speed Test. Description: The figure explains the arrangement of the kinetic speed test in which a volleyball player does a backcourt smash from position 6. It measures the time taken to perform the smash after receiving the ball.

- Recording: Points are awarded based on where the ball lands: three points for square (A), two points for square (B), and one point for the shaded area. Zero is given otherwise. (See Figure 2)
- Skill Performance Level Calculation: Performance level = (Total Accuracy Points) / (Total Time Taken)

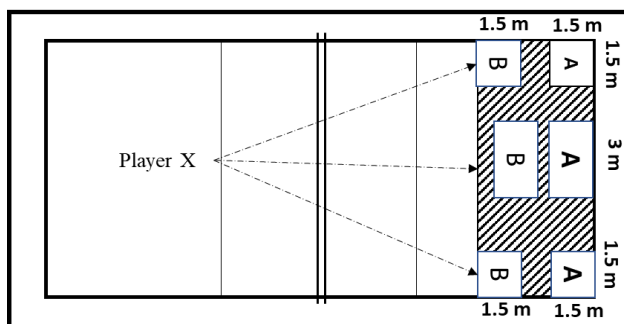


Figure 2. The Skill Performance Level Test for the Backcourt Smash. Description: This figure illustrates the position of the court when performing the diagonal and straight smash tests from position 6. The court includes squares for the measurement of the accuracy with each square assigned a point value according to the position of the ball.

### Pilot Study

A pilot study was conducted with four players from the research sample on Sunday, March 12, 2024, at 4 PM at the sports hall in Ramadi. The objective was to ensure the suitability of the prepared exercises and skill tests and to make necessary adjustments related to time, measurements, and the support team.

### Field Research Procedures

#### Pre-tests

Conducted on Thursday, March 16, 2024, at 4 PM at the sports hall in Ramadi with the assistance of the support team.

#### Main Research Trial

The main research experiment was applied on Sunday,

March 19, 2024, continuing for eight weeks with three training units per week on Sundays, Tuesdays, and Thursdays. The specific anaerobic exercises were applied with an intensity ranging from 85-100% of maximum, during the first 15 minutes of the practical part of the main section in each training unit. These exercises were repeated multiple times for impact and to solidify players' movements, enhancing them through repetitions and conditions mimicking competitive exercises, focusing on increasing player motivation through skill interplay and correct, rapid execution, as intended by the research design. The trial concluded on Thursday, May 11, 2024.

*Post-tests*

Conducted under the same conditions as the pre-tests on

Sunday, May 19, 2024.

*Statistical Tools Used (Yasin & Al-Obaidi, 1999)*

- Percentage
- Mean
- Standard deviation
- Paired sample t-test

**Results, Analysis, and Discussion**

This section displays the results of the statistical analysis performed, focusing on changes in the pre-test and post-test results in relation to kinetic performance and skill levels in volleyball. (See Table 1)

Table 1. Statistical Analysis of Pre-test and Post-test Scores

Statistical Variables	Unit	Pre-test		Post-test		M Difference	SD Difference	Calculated T-Value	Significance
		(M)	(SD)	(M)	(SD)				
Kinetic Performance Speed	Seconds	6.21	0.63	5.53	0.60	0.68	0.41	5.66	Significant
Skill Level Performance (Straight)	Points/sec	1.09	0.11	1.60	0.10	0.51	0.35	5.10	Significant
Skill Level Performance (Diagonal 1)	Points/sec	1.25	0.12	1.73	0.09	0.48	0.34	5.33	Significant
Skill Level Performance (Diagonal 2)	Points/sec	0.92	0.15	1.39	0.11	0.47	0.38	4.27	Significant
Average Skill Level	Points/sec	1.08	0.12	1.57	0.10	0.48	0.35	4.76	Significant

Note: SD = Standard Deviation, M = Mean. Critical T-value: 2.20 at Degrees of Freedom: 11, Significance Level: 0.05.

*Detailed Analysis*

The T-values obtained for all the tested variables were higher than the critical T-value highlighting a significant enhancement from pre-test to post-test. These improvements were noticed in kinetic performance speed and also in specific skill performance in terms of volleyball smashes from backcourt positions towards centers (1) and (5). The large statistical values indicate that the specific styles of the anaerobic activities incorporated into the training sessions helped increase the speed and accuracy necessary to compete at high levels of volleyball competition. The exercise programs selected for this research study were chosen for their versatility, allowing them to offer generalized adaptations towards human athletic performance as well as sport-specific adaptations.

**Discussion**

These positive effects can be attributed to anaerobic exercise routines that incorporated a variety of movements tailored to the specific demands of volleyball. By following a structured guide for anaerobic exercises, players can improve the timing, skill, and quality of their execution in ball attacks. Through these exercises, adaptations in muscle cell contraction and systemic physiological responses that support fast and efficient movements during volleyball matches were achieved. Several authors, including (Al-Rubaie, 2001; Bajrić et al., 2021; Hrysonmallis, 2011), highlight the necessity of

combining motor skills and physical abilities in sports and note that the efficiency of the skills is only possible when the athlete's physical condition meets the requirements of the event. Furthermore, the findings of this study confirm with the research proposal that the introduction of new high intensity exercises, as highlighted by (Naseef & Hussein, 1988) produces improved and enhanced performance quickly.

Will More (2004) has supported this by pointing out that high power, short time activity helps to increase the enzyme activity and muscle strength, which is essential in improving performances in sports (Wilmore et al., 2004). Some of these physiological changes are essential for the enhancement and the ability to maintain peak physical performance especially in volleyball where the athlete needs to have a fast reaction and strong impacts (Ibrahim, 2000).

**Conclusions and Recommendations**

*Conclusions*

• In essence, the execution of the specific targeted anaerobic exercises was observed to enhance the speed of kinetic performance among the participants in this study, thus supporting the argument that such exercises aid in improving athletic responsiveness.

• Moreover, the specific anaerobic training enhanced the degree of accuracy and dexterity of the volleyball players in performing the backcourt smash and thereby emphasizing the importance of the appropriate physical workout regimes

for fine-tuning the skills of performers.

## Recommendations

- The results obtained in this study suggest that it is beneficial to incorporate these particular forms of anaerobic exercises into training programs for volleyball players, especially those aimed at improving the speed and accuracy of backcourt attacks.

- Future research should consider using similar anaerobic training protocols with different athletes and on additional sports types to determine the extent and efficacy of these protocols for improved athletic performance.

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