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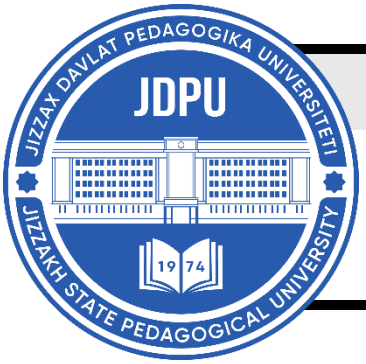

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SPATIAL PARAMETERS OF GAIT AND RUN IN HANDBALL PLAYERS DURING THE JUMP SHOT TECHNIQUE

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ABOUT ARTICLE

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Abstract: This study investigates the spatial parameters of gait and running in handball players while executing the ball-jumping technique during goal attempts. It analyzes kinematic and spatial characteristics such as stride length, step width, and joint angles to better understand how these elements influence the quality and precision of the jump and shot execution. Emphasis is placed on how biomechanical factors affect performance and efficiency in handball, offering insights for both skill development and injury prevention strategies. The findings aim to contribute to optimizing training protocols for enhancing this critical technique in handball.

Introduction

The jump shot is one of the most dynamic and essential techniques in handball, combining speed, power, and precision. This technique requires players to generate momentum through an efficient run-up, transition seamlessly into a jump, and execute an accurate throw toward the goal. To achieve optimal performance, the interplay of spatial parameters during the gait and run phases—such as stride length, step width, and body alignment—is critical.

Understanding the spatial parameters of gait and run provides valuable insights into the biomechanics underlying the jump shot. These parameters influence the generation of forward propulsion, stability during airborne phases, and overall shot effectiveness. Additionally, they contribute to injury prevention by ensuring proper load distribution and movement efficiency during this high-impact action.

Despite the significant role of spatial parameters in the jump shot, limited studies explore their precise influence on technique execution. Analyzing these biomechanical factors can offer coaches, players, and sports scientists valuable data to refine training methodologies and enhance performance. This study focuses on evaluating the gait-run spatial parameters of handball players during the execution of the jump shot, aiming to bridge this knowledge gap and contribute to performance optimization.

This body of work draws on a range of biomechanical and sports science studies to analyze the spatial and temporal parameters of gait and running in handball players, particularly during the execution of the jump shot technique. The studies cited address key factors such as stride length, step width, and running mechanics, which have direct implications for both performance optimization and injury prevention in handball (Wagner et al., 2014; Pori et al., 2018).

Wagner et al. (2014) explore the biomechanical analysis of running and jumping, highlighting how effective jump mechanics correlate with performance and injury reduction. The work emphasizes the role of the approach phase, which involves controlling the direction and speed of running to optimize force generation during the jump. Likewise, the significance of stride length and rhythm is underlined in studies by Pori et al. (2018), whose findings suggest a strong relationship between step width and jump height, thus influencing both shot accuracy and power.

The work by Lees and Nolan (2016), along with Slawinski and Yu (2015), delves deeper into the kinematic elements of the jump shot, illustrating how optimal foot placement and body alignment during the run-up affect shot success. Morin and Edouard (2017) provide further insight, emphasizing the combined influence of spatial parameters in creating an efficient jump shot, particularly through the timing of the acceleration and braking phases.

In parallel, understanding gait mechanics is critical not only for refining technique but also for preventing injury, a topic addressed by Gabbett (2016) and Ferber et al. (2014). Gabbett (2016) discusses the impact of training and playing load on the injury rates in handball, while Ferber et al. (2014) emphasize the importance of proper biomechanical execution to reduce overuse injuries and enhance athletic performance.

Lastly, Bishop (2016) highlights the role of physiological testing in assessing handball players, supporting the overall integration of biomechanical analysis with conditioning techniques for improved performance outcomes.

Aim of the Research: To analyze the spatial parameters of gait and running in handball players during the execution of the jump shot technique, focusing on identifying key biomechanical characteristics that impact performance and accuracy.

Tasks of the Research:

1. To measure the vertical oscillation of the center of gravity (COG) during the jump shot approach phase.
2. To assess and compare the braking distances of the right and left legs during the run-up phase.
3. To evaluate the propulsion distances of the right and left legs during the take-off phase.
4. To calculate the index of asymmetry (IA) for the braking and propulsion distances to identify potential imbalances.
5. To interpret the impact of spatial parameters on the quality of jump shot execution, including stability, power, and precision.

Research Organization. The research was conducted at the Uzbek State University of Physical Education and Sports, within the high-tech Sport Laboratory, equipped with advanced 3D motion analysis technology. This state-of-the-art facility allowed for precise measurements of biomechanical parameters, making it an ideal setting for studying athletic movements in detail. The subject of the study was a handball player with extensive competitive experience.

The controlled laboratory environment ensured the accuracy and reliability of data collection, providing valuable insights into the biomechanics of the handball player's movements during the jump shot technique.

Result: This table presents the gait and run spatial parameters of handball players while performing the technique of jumping to shoot the ball into the goal. The data was collected from 18 participants (n=18), who were observed during their execution of the jump shot in a controlled laboratory setting. The parameters analyzed include key biomechanical measures such as braking distances, propulsion distances, support distances, and coordinates of toe positions during contact. These spatial parameters provide valuable insights into the efficiency and mechanics of the jump shot technique, which can be further analyzed to improve performance and reduce injury risk in handball players.

Table-1

Gait-Run Spatial Parameters of handball players when performing the technique of jumping the ball into the goal (n=18)

№	Parameter	Value[mm] $\overline{X}$	σ	V,%
1	COG vertical oscillation	583.07	54	9.25
2	Right braking distance	270.31	26	9.61
3	Left braking distance	75.34	8.24	10.9
4	Right propulsion distance	-348.65	34.3	9.83
5	Left propulsion distance	-347.07	36.2	10.43
6	Support distance for right contacts	682.87	67.8	9.92
7	Support distance for left contacts	439.43	45.1	10.26
8	X coordinate of the right toe during contacts	-600.66	63.1	10.50
9	X coordinate of the left toe during contacts	787.35	81.1	10.30

This analysis examines the gait and run spatial parameters recorded for 18 handball players during the execution of the jump shot technique. Understanding these parameters is crucial for refining athletic performance, ensuring biomechanical efficiency, and minimizing injury risk. Each parameter is accompanied by its corresponding standard deviation (σ) and percent variation (V%) to assess the variability and consistency of the movements across the players (Table-1). Here's a more detailed analysis with scientific perspectives:

Handball players' COG Vertical Oscillation when using the jump shot method. 583.07 mm is the value. 54 mm is the standard deviation (σ). Variance in Percentage (V%): 9.25%. The vertical oscillation of the Center of Gravity (COG) is a key indicator of how much the player's body moves up and down during the jump phase. A larger COG vertical oscillation typically corresponds to a higher jump and effective propulsion. The observed variation is relatively low (9.25%), suggesting that players maintain a stable upward and downward motion. The consistency across participants reflects well-coordinated motor skills and efficient force transfer from the legs during takeoff. However, reducing this variation further could enhance jumping precision, leading to more consistent performance, especially in controlling landing forces and avoiding potential injuries.

The right braking distance of handball players is 270.31 mm. σ: 26 mm. 9.61% V%/ The right braking distance measures how far the athlete's body moves in the deceleration phase when preparing for the push-off. This distance is vital because it reflects the efficiency of braking mechanisms that allow the player to transition smoothly to the propulsion phase. The small standard deviation and moderate V% indicate that while there are individual differences,

most athletes demonstrate effective braking. Since braking is a critical phase for maintaining control during the jump, improving this aspect could reduce energy loss during the deceleration phase, enhancing overall speed and strength during takeoff.

The left toe's X coordinate during contact in handball players' method of leaping the ball into the goal σ: 81.1 mm; value: 787.35 mm. V%: 10.30%/ The X-coordinate for the left toe shows a forward placement during foot contact, reflecting a larger anterior position than the right foot. The greater variability in this parameter, as indicated by the higher standard deviation, suggests greater differences in foot placement among players. This variability may be a factor contributing to the asymmetry observed in braking and propulsion distances. Improving consistent foot placement on both sides could help ensure symmetry in the movements and contribute to the overall efficiency of the jump shot technique.

Conclusion:

From the analysis of these spatial parameters, it is evident that handball players demonstrate a high degree of variability in the execution of their jump shot technique, especially in terms of braking, propulsion, and support mechanics. The asymmetric use of the right and left sides is a common feature in most athletes, as seen in the differences in braking and propulsion distances. Enhancing left-right symmetry, improving consistency in foot placements, and optimizing the COG vertical oscillation could significantly improve the efficiency and power of the jump shot. Furthermore, targeted training for balancing strength and coordination between the legs would likely reduce the observed variability, promoting better performance consistency across different players.

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