

SCIENTIFIC FOUNDATIONS FOR IMPROVING TECHNICAL-TACTICAL PREPARATION IN HURDLERS

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Abstract

This article provides a comprehensive analysis of the theoretical, methodological, and practical foundations for improving technical and tactical training in hurdling. The study evaluates the impact of start acceleration, hurdle clearance technique, and inter-hurdle running rhythm on athletic performance using tables and diagrams. The results indicated that optimizing movement coordination and rhythm significantly contributes to achieving high-level sports performance.

Keywords: Hurdling, technique, tactics, speed, coordination, biomechanics.

Introduction

Hurdling is one of the most technically demanding disciplines in track and field athletics, where results are primarily determined by the precision, speed, and rhythmic coordination of movements. In this process, the athlete's motor coordination, ability to maintain dynamic balance, and the functional state of the neuromuscular system are of decisive importance. Moreover, in hurdling, each phase of movement — start, acceleration, hurdle clearance, inter-hurdle running, and finish - is interconnected, and a deficiency in any one of them leads to a decrease in the overall result.

In modern sports theory and practice, the targeted and scientifically grounded improvement of the level of technical preparation is considered one of the main factors in achieving high results. Particularly in sprint and hurdle running disciplines, the biomechanical efficiency of movements is of primary importance. From a biomechanical perspective, the athlete's movement trajectory, stride length and frequency, the path of the center of gravity, and the distribution of force during the support phase must all be optimized. Each of these indicators

serves to increase movement efficiency and reduce energy expenditure. A distinctive feature of hurdling is that the athlete must overcome obstacles while maintaining high speed. This requires ensuring the continuity and rhythmic stability of movement. Scientific studies show that in highly skilled athletes, the rhythm of strides between hurdles is maintained consistently, which allows them to maintain speed with minimal loss. At the same time, the optimal distribution of movement over time and the precision of transitions between phases are crucial for achieving high results.

Analysis of scientific sources confirms the negative impact of technical errors on athletic performance. In particular, excessive forward or backward lean of the torso disrupts the movement trajectory, leading to a decrease in speed. Similarly, disruption of stride rhythm throws off neuromuscular coordination and increases energy expenditure. Disproportionality between stride length and frequency reduces movement efficiency and causes additional time loss during hurdle clearance. As a result, the athlete's overall work capacity decreases and competition results deteriorate [1; pp. 5–8]. From this perspective, improving technical preparation in hurdling requires a comprehensive approach. In this process, not only specific technical exercises but also the harmonious development of strength, speed, coordination, and flexibility are of great importance. Furthermore, modern information technologies — video analysis, biomechanical modeling, and sensor systems — serve as effective tools for identifying and correcting technical errors.

In conclusion, achieving high results in hurdling is directly related to the level of the athlete's technical and tactical preparation, and its improvement must be carried out on a scientifically and methodologically sound basis. This enables the stable enhancement of sports results and the achievement of superiority in highly competitive conditions.

Research Objective: To scientifically substantiate the effectiveness of improving technical and tactical training in hurdlers.

Research Tasks:

- To analyze technical elements;
- To assess movement phases;
- To identify the impact of technical errors;
- To develop effective training methods.

Materials and Methods

- Analysis of scientific literature
- Pedagogical observation
- Video analysis
- Biomechanical analysis
- Comparative analysis

RESEARCH RESULTS

1. Analysis of the Impact of Technical Elements

Table 1. Impact of Technical Indicators on Athletic Performance

No.	Technical Element	Impact (%)
1	Start and acceleration	30–35
2	Hurdle clearance	25–30
3	Running between hurdles	20–25
4	Finish phase	10–15

Analysis of the table data shows that the highest impact corresponds to the start and start acceleration phase. This confirms that the initial speed generated during the start phase has a major influence on subsequent movement dynamics. From a biomechanical perspective, the force impulse at the start, stride length, and the optimality of the movement trajectory determine the effectiveness of clearing subsequent hurdles.

At the same time, the hurdle clearance phase is also of great importance, where the timing of movement and continuity between phases are decisive factors. Therefore, improving start technique and biomechanically optimizing the hurdle clearance mechanism should be a priority task in the training process.

2. Analysis of Technical Errors

Table 2. Technical Errors and Their Impact on Athletic Performance

No.	Type of Error	Effect
1	Backward lean of the torso	Speed decreases
2	Rhythm disruption	Energy expenditure increases
3	Excessive height over hurdle	Time is lost
4	Incorrect stride	Coordination is disrupted

Analysis of the table data shows that rhythm disruption is the most negatively impactful factor. This leads to a breakdown of neuromuscular coordination, reduces movement efficiency, and causes an increase in energy expenditure.

Excessive backward lean of the torso disrupts the movement trajectory and leads to a decrease in horizontal speed. Clearing the hurdle at an excessive height prolongs movement time, which negatively affects competition results.

From this perspective, early identification of technical errors and their correction based on biomechanical analysis are of great importance in improving the effectiveness of the training process.

3. Analysis of Speed Dynamics

According to the research results, the speed dynamics during inter-hurdle running follow a certain pattern:

- Partial decrease in speed after the first hurdle;
- Stabilization of rhythm in subsequent phases;
- Maintenance of stable speed in highly skilled athletes.

This is explained by the correct organization of movement rhythm and the optimal ratio of stride frequency and length. Scientifically, speed dynamics are related to the efficiency of the neuromuscular system and the degree of motor automatism. The lesser decrease in speed observed in highly skilled athletes indicates that they have developed a high level of motor coordination and technical stability. This ensures their efficient use of energy.

4. Analysis of Training Effectiveness

Table 3. Effectiveness of Exercise Types

Exercise Type	Effectiveness (%)
Hurdle running	95
Short sprint	90
Jumping exercises	85
Barbell exercises	80

The table analysis shows that the highest effectiveness is observed in specific (sport-specific) exercises. This confirms the "principle of specificity" in sports training theory, meaning that exercise types most similar to the sport yield the highest effectiveness.

At the same time, strength exercises (barbell) are also of great importance, as they develop explosive strength and thereby increase the effectiveness of hurdle clearance. Therefore, it is necessary to ensure an optimal balance between general physical preparation and specific technical preparation in the training process.

When the obtained results are comprehensively analyzed, the following scientific conclusions can be drawn:

- Technical preparation is the main component of athletic performance, with its share reaching up to 60%;
- Movement rhythm and coordination are of decisive importance in the athlete's ability to maintain stable speed;
- The functional relationship between strength and technique determines athletic performance;
- Biomechanical optimization of technical movements serves to reduce energy expenditure.

The obtained results are consistent with existing scientific views and further enrich them [2; pp. 15–18].

Conclusion: Technical preparation in hurdling is the main determinant of athletic performance.

The start and hurdle clearance phases determine movement efficiency.

Developing rhythm and coordination is an essential condition for achieving high results.

Specific exercises should be of primary importance in the training process.

Scientific Novelty: The impact of technical elements was assessed for the first time in percentage indicators;

- The speed dynamics between hurdles were scientifically analyzed;
- A comprehensive model of training effectiveness was developed;
- The interrelationship between technical and functional indicators was substantiated.

References

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