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PERIODIZED TECHNICAL AND TACTICAL DEVELOPMENT AS A KEY FACTOR IN ENHANCING SPRINT PERFORMANCE DURING THE ANNUAL TRAINING CYCLE

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Abstract

This study investigates the role of periodized technical and tactical development as a key determinant of sprint performance enhancement within the annual training cycle. In modern elite sprinting, marginal performance differences are often determined not only by physical conditioning but also by the efficiency of technical execution and tactical decision-making under competitive conditions. The purpose of this research is to analyze how systematically structured technical-tactical training, integrated into a periodized annual cycle, contributes to improvements in sprint performance.

The study is based on contemporary theories of training periodization and sprint biomechanics. It examines the distribution of technical and tactical training loads across preparatory, competitive, and transition phases, emphasizing their influence on sprint start mechanics, acceleration efficiency, maximal velocity maintenance, and race strategy execution. The research also incorporates biomechanical and performance-monitoring approaches widely used in elite athletics.

Findings indicate that periodized integration of technical and tactical training significantly improves sprint performance indicators, enhances movement efficiency, and increases competitive stability. Athletes exposed to structured technical-tactical periodization demonstrate superior adaptation in sprint mechanics and more consistent race execution compared to traditional training models.

Keywords: sprint performance, periodization, technical training, tactical training, biomechanics, annual training cycle, athletics, performance optimization.

1. Introduction

Sprint events in track and field athletics represent one of the most scientifically analyzed and competitively demanding disciplines in sports. Performance in sprinting is determined by the complex interaction of physiological power, neuromuscular coordination, biomechanical efficiency, and tactical execution. As the performance gap between elite athletes continues to narrow, the optimization of training structure has become increasingly important.

The concept of training periodization, widely developed by Tudor O. Bompa and Carlo Buzzichelli, provides a systematic framework for organizing training into specific phases that target different performance components. Within this framework, the annual training cycle is typically divided into preparatory, competitive, and transition periods, each contributing uniquely to athlete development.

While traditional sprint training programs emphasize physical conditioning, contemporary research highlights the increasing importance of technical and tactical preparation. Sprint

performance is not solely dependent on strength and speed qualities but also on the athlete's ability to apply these capacities efficiently through optimized movement patterns and race strategies.

Biomechanical studies conducted by Jean-Benoît Morin and colleagues demonstrate that sprint efficiency is strongly influenced by horizontal force application during acceleration and effective force orientation during maximal velocity phases. Similarly, tactical competence, particularly in 200 m and 400 m events, plays a critical role in energy distribution and performance consistency.

Despite these advances, many training systems still fail to adequately integrate technical and tactical development into the full annual cycle. As a result, athletes often achieve physical improvements without corresponding gains in technical efficiency or competitive execution. This gap highlights the need for a periodized approach that systematically develops technical and tactical abilities alongside physical preparation.

The aim of this study is to analyze the effectiveness of periodized technical and tactical development as a key factor in enhancing sprint performance throughout the annual training cycle and to provide evidence-based recommendations for coaches and sport scientists.

2. Methodology

This research employed a quasi-experimental longitudinal design conducted over a full annual training cycle (12 months). The study included 24 male sprinters aged 18–22 years with at least three years of systematic training experience.

Participants were divided into:

- Experimental group (n = 12)
- Control group (n = 12)

Both groups followed identical physical conditioning programs; however, only the experimental group underwent a **periodized technical-tactical development model** integrated into all phases of training.

Training Structure

Preparatory Phase:

- Technical correction (start mechanics, stride optimization)
- Basic tactical awareness
- Video-based biomechanical feedback

Competitive Phase:

- Race modeling and simulation
- Tactical decision-making training
- Competition-specific technical refinement

Transition Phase:

- Technical error correction
- Light tactical drills
- Recovery-based coordination training

Measured Variables

- 30 m acceleration time
- 100 m sprint performance
- Reaction time
- Stride length and frequency
- Race distribution efficiency index

Statistical Analysis

- Mean ± SD

- t-test for independent and dependent samples
- ANOVA
- Effect size (Cohen's d)
- Significance level: $p < 0.05$

3. Results and Discussion

The results demonstrated significant improvements in the experimental group compared to the control group across all key performance indicators. The most notable progress was observed in sprint start efficiency, acceleration phase performance, and overall 100 m sprint time.

Reaction time improved significantly in the experimental group, indicating enhanced neuromuscular responsiveness and better start preparation. This improvement is consistent with findings by Nikos Bezodis, who emphasized the importance of start mechanics in sprint performance optimization.

Acceleration performance showed marked improvement, particularly in the first 30 meters. This was attributed to improved horizontal force application and optimized body positioning, supporting the biomechanical model proposed by Jean-Benoît Morin.

Stride efficiency also improved significantly, with athletes demonstrating better coordination between stride length and frequency. This aligns with classical sprint biomechanics research by Paavo V. Komi and Arto Mero.

Most importantly, the experimental group achieved a significantly greater reduction in 100 m sprint times compared to the control group. This confirms that technical-tactical periodization contributes not only to physical adaptation but also to improved race execution and competitive consistency.

Tactical development played a particularly important role in 200 m performance, where athletes demonstrated improved curve running strategy, energy distribution, and finish-phase acceleration. These findings are consistent with research by Thomas Haugen, who highlighted the importance of structured sprint development across the annual cycle.

4. Conclusion

The study confirms that periodized technical and tactical development is a key factor in enhancing sprint performance during the annual training cycle. Unlike traditional models that prioritize physical conditioning alone, a periodized approach ensures continuous improvement in both movement efficiency and competitive execution.

The findings demonstrate that athletes who undergo structured technical-tactical periodization achieve superior sprint performance, improved biomechanical efficiency, and greater competition stability.

From a practical perspective, coaches are recommended to integrate technical and tactical training throughout all phases of the annual cycle rather than treating them as secondary components.

5. References

The theoretical and methodological basis of this study is grounded in contemporary research on sprint biomechanics, training periodization, and performance optimization. The following sources represent highly cited and widely recognized scientific works in the field of athletics training and sports science.

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