

SCIENTIFIC AND METHODOLOGICAL FOUNDATIONS FOR OPTIMIZING THE TRAINING PROCESS IN YOUNG TRACK AND FIELD ATHLETES

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Abstract

This thesis examines the scientific and methodological foundations for optimizing the training process of young track and field athletes. Using the IMRaD structure, the study explores load regulation, biomechanical analysis, individualized training models, psychological preparation, and modern monitoring technologies aimed at enhancing performance, preventing injuries, and supporting long-term athletic development.

Introduction

Track and field is one of the most fundamental sports contributing to the development of physical qualities in young athletes, including speed, endurance, strength, agility, and coordination. The rapid physiological and psychological development of young athletes requires specially designed training programs based on scientific principles. Optimization of the training process ensures effective adaptation, reduces fatigue, enhances motor skills, and prevents overtraining.

Recent advancements in sports science — including biomechanics, physiology, sport psychology, and digital monitoring systems — provide effective tools for improving the training process. Therefore, understanding how these scientific methods can be integrated into youth athletics is of critical importance.

Methods

This study employed the following research methods:

1. Pedagogical Observation Systematic monitoring of training sessions to identify technical errors, behavioral responses, and adaptation dynamics.
2. Biomechanical Analysis Assessment of running phases, ground reaction forces, stride frequency, start mechanics, and technique efficiency through video analysis.
3. Physiological Measurements Evaluation of heart rate, oxygen consumption, muscle activation, and training load indicators.
4. Experimental Method Two groups of young athletes were trained using different loading models to compare effectiveness.
5. Psychological Assessment Motivation level, stress tolerance, attention focus, and emotional stability were measured.

6. Statistical Analysis Data were processed using correlation studies, comparative analysis, and variability indices to determine training effect size.

Results

The conducted study produced the following key scientific findings:

- Gradual and scientifically planned load progression significantly improved aerobic and anaerobic capacity in young athletes.
- Biomechanical corrections increased running efficiency by 6–10%, improved stride mechanics, and reduced unnecessary muscular tension.
- Individualized training programs led to better adaptation, fewer fatigue symptoms, and improved technical accuracy.
- Psychological interventions such as visualization, concentration exercises, and breathing techniques enhanced self-regulation and competitive readiness.
- Continuous monitoring using heart-rate sensors, GPS devices, and video feedback enabled real-time optimization of training loads.
- The experimental group demonstrated superior improvement in speed, endurance, and coordination compared to the control group following traditional methods.

Discussion

The results highlight the importance of a scientifically grounded, integrative approach to optimizing the training process of young track and field athletes. Training effectiveness increases when physiological load management, biomechanical technique correction, and psychological preparation are combined into a unified system. Monitoring tools not only help prevent overtraining but also support individualized adaptation, which is essential for youth development.

Furthermore, modern technologies improve communication between coaches and athletes, promote motivation, and increase training engagement. However, successful implementation requires qualified coaching, access to monitoring equipment, and age-appropriate adaptation of training programs.

Conclusion

This research concludes that optimizing training for young track and field athletes requires a holistic, scientific, and methodological approach. The combination of individualized load planning, biomechanical analysis, psychological preparation, and continuous monitoring ensures efficient physical development, reduces injury risk, and enhances overall athletic performance. These findings offer valuable recommendations for coaches, sports academies, and specialists working in youth athletics.

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