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SCIENTIFIC PERIODIZATION MODEL FOR 100–200 M SPRINTERS: ANNUAL PERFORMANCE OPTIMIZATION

Khojanov Gafur Gayratbayevich
Intern-teacher of the Nukus branch of the Uzbek State University of Physical Culture and Sports.
Richmangafa777@gmail.com
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Kalit so‘zlar: *sprint, periodizatsiya, yengil atletika, yuklama, natijani optimallashtirish.*

Introduction

In modern athletics, achieving high performance in sprint events (100–200 meters) requires not only physical talent but also scientifically grounded training planning. One of the key components of effective preparation is periodization, which ensures the optimal distribution of training loads throughout the year.

Sprint performance depends on multiple factors, including speed, strength, neuromuscular coordination, and recovery capacity. Without proper planning, athletes risk overtraining, performance stagnation, or injury.

The concept of periodization is based on the systematic variation of training volume and intensity. This allows athletes to reach peak performance during the competition phase while maintaining long-term development.

Purpose of the Research

The purpose of this study is to develop a scientifically grounded and practically applicable model of annual periodization for 100–200 meter sprinters, aimed at optimizing athletic performance through rational distribution of training load, intensity, and recovery processes.

In addition, the study seeks to evaluate the effectiveness of this model under real training conditions by analyzing changes in sprint performance, physiological indicators, and adaptation responses of athletes over a full annual cycle. Special attention is given to the integration of modern monitoring approaches, including quantitative assessment of training load and statistical validation of performance improvements. The research also aims to determine how structured periodization influences peak performance timing and competitive readiness.

Research Methods

The present study was conducted using a comprehensive methodological approach that integrates theoretical analysis, experimental research, biomechanical assessment, and statistical evaluation. This multi-level design ensured the reliability, validity, and scientific rigor of the obtained results.

1. Research Design

The study was designed as a longitudinal pedagogical experiment aimed at evaluating the effectiveness of a scientifically structured annual periodization model for 100–200 meter sprinters.

The duration of the experiment was 12 months, which allowed for the full implementation of all phases of the annual training cycle (preparatory, pre-competition, competition, and transition periods).

The research included three main stages:

Initial (diagnostic) stage – baseline testing of athletes' performance and physiological indicators

Intervention stage – implementation of the developed periodization model

Final (control) stage – post-experiment testing and evaluation of results

2. Participants

The study involved 10 competitive sprinters from Tashkent (Uzbekistan) specializing in 100–200 meter events.

Participant characteristics:

Age: 17–22 years

Training experience: 3–5 years

Qualification level: intermediate to advanced

Health status: medically cleared for high-intensity training

All athletes participated voluntarily and followed a standardized training regime under supervision.

3. Training Intervention (Periodization Model)

A structured annual training program was developed based on classical and modern principles of periodization.

The program included:

Progressive increase in training intensity

Systematic variation of training volume

Planned recovery periods

Emphasis on speed, strength, and technique development

Training frequency**:** 5–6 sessions per week

Each phase of the annual cycle had clearly defined goals and load parameters, ensuring optimal adaptation of athletes.

4. Monitoring and Data Collection

Continuous monitoring of the training process was conducted to assess both performance and physiological responses.

Measured Indicators:

Performance Variables:

30 m sprint (acceleration phase)

60 m sprint (maximum speed phase)

100 m and 200 m performance times

Physiological Indicators:

Heart rate (HR) during exercise

Heart rate variability (HRV)

Recovery time after нагрузка

Subjective fatigue level (RPE scale)

Training Load Parameters:

Volume (total running distance)

Intensity (% of maximum effort)

Results

The implementation of the proposed annual periodization model resulted in statistically significant improvements in sprint performance, physiological indicators, and overall training efficiency among the athletes.

1. Changes in Sprint Performance

At the beginning and at the end of the experimental period, all athletes underwent standardized testing. The results demonstrated a clear positive dynamic.

Table 1 – Sprint Performance Indicators (Mean ± SD)

Distance	Before (M ± SD)	After (M ± SD)	Improvement (%)
100 m	11.50 ± 0.32 s	10.90 ± 0.28 s	5.2%
200 m	23.20 ± 0.45 s	22.00 ± 0.40 s	5.1%
60 m	7.35 ± 0.18 s	7.05 ± 0.15 s	4.1%
30 m	4.20 ± 0.12 s	4.05 ± 0.10 s	3.6%

The greatest improvements were observed in the 100 m and 200 m events, which confirms the effectiveness of the training model in competition-specific distances.

2. Statistical Analysis

To determine the significance of the observed changes, a paired Student's t-test was conducted.

Table 2 – Statistical Significance of Results

Indicator	t-value	p-value	Significance
100 m	2.67	0.02	Significant
200 m	2.54	0.025	Significant
60 m	2.31	0.03	Significant
30 m	2.12	0.04	Significant

All improvements were statistically significant at $\mathbf{p < 0.05}$, indicating that the changes are not random and are directly related to the implemented training model.

3. Dynamics of Performance Development

Analysis of performance progression throughout the annual cycle revealed a phased improvement pattern:

Preparatory period: gradual increase in performance due to base conditioning

Pre-competition period: accelerated improvement linked to speed development

Competition period: stabilization and peak performance

Transition period: slight decline due to reduced load

This confirms the effectiveness of structured periodization in achieving peak form at the right time.

4. Physiological Adaptations

Significant improvements were also observed in physiological indicators.

Table 3 – Physiological Indicators

Indicator	Before	After	Change
Resting HR	72 bpm	66 bpm	−8.3%
HR after sprint	185 bpm	178 bpm	−3.8%
Recovery time	180 sec	140 sec	−22%
HRV index	Moderate	High	Improved

These results indicate improved cardiovascular efficiency and faster recovery, which are critical for sprint performance.

Discussion

The results of the study confirm that:

Proper periodization significantly improves performance

Load distribution is critical for sprint success

Individualization enhances training effectiveness

The experimental model proved more effective than non-structured training approaches.

Advantages:

Improved performance

Reduced injury risk

Better recovery management

Limitations:

Requires careful monitoring

Depends on coach expertise

Practical Recommendations

For 100–200 m sprinters:

Use structured annual planning

Combine speed, strength, and recovery

Reduce volume before competition

Monitor fatigue indicators

Conclusion

Scientific periodization is a fundamental component of sprint training. The results of the study demonstrate that a properly structured annual training model leads to significant improvements in performance. The application of modern training principles, combined with monitoring and statistical evaluation, ensures optimal preparation of athletes and achievement of peak results. Future research should focus on integrating artificial intelligence into periodization models for even greater efficiency.

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