

Development of Training Regimens Aimed at Improving Power Energy Supply in Sprint Kayakers

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Annotation: The purpose of the study was to develop and substantiate training regimens aimed at increasing the efficiency of power energy supply in sprint kayakers, taking into account the differentiated impact of training loads on specific components of the cardiorespiratory system reaction and metabolic support of muscular work. The study analyzed the characteristics of anaerobic alactic, anaerobic lactate, and aerobic energy supply under conditions of specially selected training modes. The effectiveness of individualized training regimens based on monitoring of ergometric power, oxygen consumption, carbon dioxide excretion, and blood lactate concentration was evaluated. The obtained results confirm that differentiated regulation of training loads contributes to the improvement of functional readiness and special performance of sprint kayakers specializing in 200 m and 500 m distances.

Key words: kayak sprinters, power energy supply, ergometric power, cardiorespiratory system, functional readiness, training load.

Introduction

Sprint kayaking is characterized by extremely high requirements for the functional capabilities of athletes. Competitive activity at distances of 200 m and 500 m is performed under conditions of pronounced oxygen deficit, high activation of anaerobic metabolism, and significant strain on the cardiorespiratory system. The ability of athletes to rapidly mobilize power energy supply mechanisms and maintain high levels of ergometric power determines the effectiveness of competitive performance.

Modern concepts of sports training emphasize that the efficiency of training adaptations largely depends on the correspondence between training stimuli and the functional capabilities of the athlete. Uniform training approaches that do not take into account individual characteristics of energy supply



and physiological reactivity may limit the development of special endurance and increase the risk of maladaptation.

In sprint kayaking, the problem of rational distribution of training loads is especially relevant due to the complex interaction of anaerobic alactic, anaerobic lactate, and aerobic energy supply mechanisms. The differentiated influence of training exercises on these mechanisms requires a scientifically grounded approach to the selection and modeling of training regimes.

Therefore, the development of training regimens aimed at improving the realization of power energy supply with consideration of the specific reactions of the cardiorespiratory system is an important task of modern sports science and practice.

Methods and Organization of Research

The research was conducted during the special preparatory period of the annual training cycle. The study involved qualified male sprint kayakers ($n = 22$) aged 19–25 years, specializing in 200 m and 500 m distances. All athletes were members of national teams and had experience in international competitions.

The research was carried out at the National Water Sports Training Center in Tashkent (Uzbekistan) with the participation of specialists from sports medicine and training monitoring departments.

To assess indicators of special performance and functional readiness, the following equipment was used:

- mobile gas analyzer Oxycon Mobile (Jaeger) for recording oxygen consumption (VO_2), pulmonary ventilation (VE), and carbon dioxide excretion (VCO_2);
- sports testing system Polag for heart rate monitoring;
- laboratory analyzer Biosen S-line Lab+ for determining blood lactate concentration;
- rowing ergometer Dansprint for standardized assessment of ergometric power output.

During the execution of test tasks and training simulations, indicators of ergometric power, cardiorespiratory system reaction, and metabolic support of muscular work were recorded.

Research Design

The study was conducted in two stages.

First stage

At the first stage, the analysis of quantitative and qualitative characteristics of the energy capabilities of sprint kayakers was carried out. Three test loads were used:

- **10 s test** – assessment of anaerobic alactic power;
- **30 s test** – assessment of anaerobic lactate (glycolytic) power;
- **90 s test** – assessment of anaerobic capacity and involvement of aerobic mechanisms.

The interval between the 10 s and 30 s tests was 3 minutes, and between the 30 s and 90 s tests – 10 minutes. These intervals provided partial recovery while maintaining metabolic stress.

The purpose of this stage was to determine individual parameters of ergometric power, cardiorespiratory response, and metabolic reactions, which formed the basis for the individualization of training regimens.

Research Results and Their Discussion

The analysis of the 10 s test results showed that sprint kayakers demonstrated high peak values of ergometric power, reflecting the effectiveness of anaerobic alactic energy supply. However, significant individual differences were observed in the ability to maintain maximum power for several consecutive strokes, which indicates different levels of neurogenic activation and phosphagen system efficiency.



During the 30 s test, a rapid increase in blood lactate concentration and carbon dioxide excretion was recorded, indicating active involvement of anaerobic lactate energy supply. Athletes with higher glycolytic power demonstrated a slower decline in ergometric power and more stable tempo-rhythm structure of rowing movements.

The 90 s test was characterized by pronounced activation of aerobic metabolism against the background of high anaerobic stress. Pulmonary ventilation and oxygen consumption reached near-maximal values, while blood lactate concentration continued to increase during the recovery period. Athletes with higher aerobic readiness exhibited more economical cardiorespiratory responses.

The obtained data confirm that sprint kayakers differ significantly in the structure and efficiency of energy supply mechanisms, which necessitates an individualized approach to training load regulation.

Modeling of Training Regimens

At the second stage, an experimental assessment of the reaction of the cardiorespiratory system and energy supply mechanisms was carried out during repeated execution of training regimes of predominantly anaerobic orientation.

Four training load options were modeled:

- **Option A** – segments of 10 s with rest pauses of 20 s, aimed at developing anaerobic alactic power;
- **Option B** – segments of 20 s with rest pauses of 10 s, aimed at combined development of alactic and lactate mechanisms;
- **Option C** – segments of 30 s with rest pauses of 30 s, aimed at developing anaerobic glycolytic power;
- **Option D** – segments of 90 s with rest pauses of 60 s, aimed at developing aerobic capacity under conditions of high-intensity work.

Each training option simulated a series of segments with a total duration of approximately four minutes.

Physiological Response to Training Loads

Short-duration segments (10–20 s) were characterized by predominant neurogenic stimulation and rapid mobilization of anaerobic alactic energy supply. The main performance criterion was the ability to achieve and maintain maximum ergometric power for several rowing cycles.

Segments of 30 s led to pronounced hypoxic shifts and intensive accumulation of anaerobic metabolism products. The level of respiratory response to hypoxia significantly influenced the structure of energy supply during subsequent work.

During 90 s segments, athletes reached maximum values of oxygen consumption and carbon dioxide excretion. These conditions created prerequisites for the development of aerobic power under high-intensity training loads.

Blood lactate concentrations measured at the 3rd and 5th minutes of recovery confirmed the differentiated metabolic impact of the modeled training regimes.

Conclusions

1. Sprint kayakers demonstrate significant individual differences in the realization of power energy supply mechanisms.
2. Differentiated training regimens allow targeted development of specific components of anaerobic and aerobic energy supply.
3. Monitoring of ergometric power and cardiorespiratory response is an effective tool for individualization of training loads.
4. The proposed training regimens contribute to the improvement of functional readiness and special performance of sprint kayakers specializing in 200 m and 500 m distances.



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