Optimization of training loads at the pre-competition stage of preparation in cyclic sports

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Abstract
Objective of the study was to increase the efficiency of pre-competition preparation management in cyclic sports based on optimizing the ratio of special loads.
Methods and structure of the study. An analysis of the ratio of special loads was carried out, ensuring the attainment of peak sports form. The testing involved 48 athletes, men aged 18-20 years, 16 middle-distance runners, 18 kayakers and 14 freestyle swimmers. 41% of the subjects are masters of sports (MS) and 59% are candidate masters of sports. An information and analytical platform has been developed that allows monitoring changes in mechanical productivity, biodynamic parameters and oxygen transport functions.
Results and conclusions. At this stage, an increase in competitive speed and an improvement in functional state is achieved by optimizing the tempo SR, the length of the "step" SL, the rhythm R, and the power WR. The effectiveness of the regulator is confirmed by a statistically significant improvement in results in rowing K-1 1000 m, running at a distance of 800 m and swimming at a distance of 200 m h/s.

Keywords: *algorithmization, customization, metabolism, power, propulsion, resistance, taxonomy.*

Introduction. Increasing the reliability of pre-competition preparation, where the cost of an error in resource allocation is high, is one of the most important tasks of elite sport (A.P. Bondarchuk, 2007) [1]. Interest in this area of research in rowing, athletics and swimming is due to the search for a ratio of loads that would ensure the readiness of athletes for maximum realization of the psychophysical potential of athletes in competitions [5].

The historical maximum of competitive success of Soviet sports in the 1970-1980s was ensured by the implementation of the ideas of program-targeted management (L.P. Matveev, 2005). The change in the balance of power in the international arena in the 1990s led to a revision of the basic principles of managing the training of Russian athletes. V.B. Issurin actively promotes the ideas of block-modular concentration of training resources, which complement and expand the functionality of the L.P. model. Matveeva. Since the 2000s, hybrid models have been introduced to minimize the gap between the expected and actual results achieved under conditions of competitive hyperstress (N.Zh. Bulgakova, 2009) [2].

The problem area is the parametric regulation of motor skills (step length L, rhythm R, power WR, pace SR), associated with the personalized preparation of athletes for major competitions [6].

Objective of the study was to increase the efficiency of pre-competition preparation management in cyclic sports based on optimizing the ratio of special loads.

Methods and structure of the study. At the first stage, an analysis of training stimuli and resources that increase special performance and readiness for competitions was carried out. 48 athletes were observed, men aged 18-20 years, 16 middle-distance runners, 18 kayakers and 14 freestyle swimmers. 41% of the subjects had the qualification of a master of sports and 59% were a candidate master of sports.

The resource base for training intermediate athletes has been analyzed, including tracks 8x300 m; 2x (6x200) m. Kayakers' resistance to single loads was assessed: 50 m, 100 m, 200 m, 500 m, 1000 m; 3x(10x50 m); 3x (10x100 m). On G. Razumov's tensodynamic platform, speed Vmax, tempo SR, stroke length SL, force Fmax, front of force increase Tf, expended Ws and propulsive power Wp were recorded. Similar studies in a group of swimmers were supplemented by monitoring Fmax (N) and average cycle effort Fcycle, power Wt and power in the working phase Ppull phase. VO_2 testing was carried out on a Beckman gas analyzer. Blood lactate La was measured by the Lactate-Pro gadget. Pulse responses to loads and SR rate were recorded by Polar RS300X. The cardiac output was calculated using the Fick formula. Analysis of visual-motor reactions VOD, RDO (reaction to a moving object) The load test made it possible to maintain the quality of training [3].

Based on discriminant analysis of 246 aggregated variables, an information and analytical platform has been developed that allows tracking the growth of mechanical productivity, biodynamic parameters and oxygen transport functions [6].

Observations carried out during a 6-week pre-competition training cycle, allowing us to assess the effectiveness of the regulator. Verification of making adjustments is determined by deviation from the planned results in the 800 m run, rowing at the K-1 1000 s distance and in swimming 200 m high/s. The stability of connections was determined based on correlation analysis using Microsoft Access, Excel, BIOSTAT.

Results of the study and discussion. The current condition of the athletes was assessed according to parameters V, L, SR, R. Training in the AP-1 - AP-2 mode (in the zone of the first - second lactate threshold) in the amount of 16-18% in the preparation of kayakers, middle-distance runners and swimmers is aimed to synchronize kinesiological, physiological and metabolic functions within the boundaries of the energy minimum. Within one iteration, coordination of speed V 2.9±0.2 m/s, amplitude-frequency variables SR 2.8±0.1 m/s, step length L and vertical oscillations is achieved. The adequacy of the effect is indicated by the parameters VO_2 1.8±0.02 l/min, heart rate 104.2±2.1 beats/min, cardiac output 12.8±0.1 l/min (t=2.4 p<0 .05) and MVR (minute volume of respiration) 34.0 ±1.1 l/min (t=2.7 p<0.05). Maximizing the impact of aerobic training in a group of kayakers is achieved by regulating energy expenditure 500-560 kcal/hour, heart rate 122.2±2.1 beats/min, La 1.1±0.01 mmol/l, VO_2 2.7±0, 04 l/min, arteriovenous difference a-vO_2 for CO_2 (r=0.456).

Iterations of loads in the anaerobic threshold (AnT) zone (11-14%) are associated with controlled adjustment of motor parameters and functional state [2]. The specificity of kayakers' training increases at each new turn when setting the speed mode V 5.1±0.1 m/s, SR 3.1±0.2 sh/s and rolling (r=0.521). Calculation of the volume and intensity of the load is carried out within the boundaries of adaptation reserves, oxygen pulse heart rate 178.2±1.1 beats/min., cardiac output 24.2±0.3 l/min. Changes in a-vO_2 for CO_2 of 148.1±1.9 ml/l, achieved in groups of kayakers and swimmers, show the tension of tissue metabolism and an increase in the lactate threshold La to 5.1±0.2 mmol/l (r = 0.461) [4].

Combining loads of submaximal power WR 262.4±21.1 W (4-6%) is aimed at resonances of neurophysiological and biochemical changes. Accordingly, proactive adjustment of urgent effects of running on 6x600 m tracks; 2x800 m in V mode 6.8±0.2 m/s, SR 3.7±1.1 b/s and heart rate 187.6±2.1 beats/min is aimed at resonances of motor skills and energy functionality. The target of corrective efforts is the threshold parameters of gas exchange, cardiac output 29.1±0.1 l/min, CO 152.1±1.1 ml, La 9.8±0.1 mmol/l, energy consumption 620.4±22, 1 kcal/hour (EC 0.36±0.1 kcal min/l) (t=2.7 p<0.05). As can be seen from Fig. 1 Interval training of intermediate athletes in the 8x300 m mode is associated with an increase in motor functions SR 3.1±1.1 w/s, WR, activation of metabolic processes that stimulate an increase in the mechanical efficiency of maximum work (r = 0.671) [6].

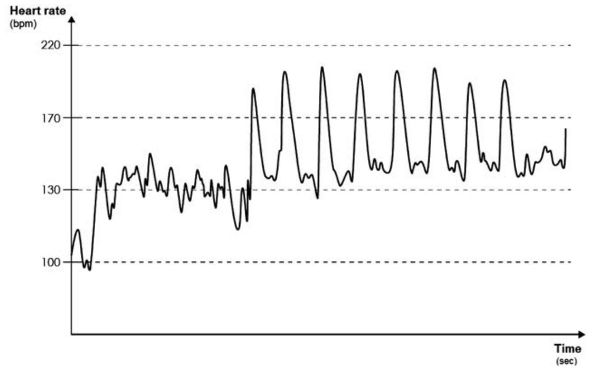

Figure 1. Heart rate kinetics during 8x300 interval trainingм

Positive factors include achieving peak heart rate values of 201.21±1.16 beats/min and muscle acidification La 11.2±0.1 mmol/l (r=0.473), characteristic of extreme work. Training leads to optimization of oxidative stress, neuromuscular potentiation, growth of structural and enzymatic proteins. This expresses the relationship between speed and energy consumption of 676.2±41.1 kcal/hour, (EC 0.3±0.01 kcal min/l), respiratory rate 39.4±0.2 cycle/min, a-vO_2 for CO_2 148.2 ±1.6 ml/l within the physiological norm (r=0.521).

Speed training on 6x100 m tracks; 8x150 m in the mode 7.7±0.2 m/s, SR 3.4±0.1 w/s (1.5-2%) put forward new requirements for programming biodynamic parameters. Speed training stimuli regulate the speed of acquiring a state of athletic fitness and competitiveness [2]. Loads provide adaptive reactions HR 198.1±1.2 beats/min, La 6.3±0.2 mmol/l, WR 386.2±17.2 W, energy expenditure 681.3±21.1 kcal/hour (EC 0.3±0.01 kcal min/l). In the groups of intermediate athletes and kayakers, synchronization of muscle metabolism and elastic muscle energy during high-intensity training was noted (r=0.501). Against this background, the swimmers showed an improvement in the psycho-emotional state of the SAN (r = 0.461), the speed of visual-motor reactions of the RMO (r = 0.420), T-t (r = 0.406), characteristic of transitional states.

The key results of training kayakers on sections K-1 200 m at a speed Vmax 5.1±0.12 m/s, SR 137.1±0.1 g/min., is the expansion of motor and functional limits. Operation in a given speed mode stimulates an increase in the force on the blade Fmax 20.1±1.2 kg and the force increase front Tf 0.13±0.01 s. The load causes an increase in alactic anaerobic productivity (energy consumption 675.1±26.1 kcal/h. EC 0.38±0.1 kcal min/l).

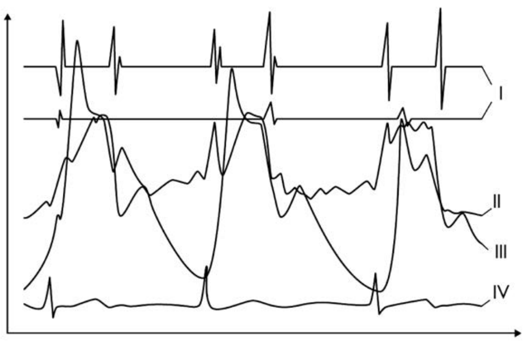

Figure 2. Fragment of a polycardiogram recording: I – phonocardiogram; II – apical cardiogram; III – carotid sphygmogram; IV – electrocardiogram in lead II

The regulatory platform of the 2-week cycle is aimed at the resonances of cumulative effects achieved by narrowing the volume of the load. The advantage of the proposed approach, along with the ability to synchronize the main and auxiliary processes of the management chain, is risk diagnostics. This is indicated by changes in heart rate within the limits of ΔRR 0,21±0,01 s and the absolute value of the mode Mo up to 0,91±0,032 (t=2,4 p≤0,05). The time limits for isometric contraction (IC) were recorded to be 0.035±0.002 s and the myocardial tension index to be 24.1±0.3% (Fig. 2). An increase in readiness is indicated by the optimization of visual-motor reactions of RMO by 0.02 s (t=2.21 p≤0.05), a decrease in VOD by 0.11 s and an increase in T-t by 6.2±0.3% (t=2.34 p≤0.05).

Conclusions. The results obtained confirm the feasibility of individual adjustment of the parameters of the motor, energy and cardiac systems when getting into sports shape. The representativeness of the proposed approach is indicated by the maximum results in competitions achieved through an increase in competitive performance, improvement of technique and functional state. Thanks to the mobilization of reserves and morphofunctional settings, 86% of the subjects in the three groups were at the peak of their form and increased their individual achievements by 3.1-3.9%. The model has predictive potential and creates new points of support for the theory of sports.

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