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CONSTRUCTION OF A MACROCYCLE FOR HIGHLY QUALIFIED ATHLETES IN ROWING

Kh. Yu. Matnazarov
PhD in Pedagogical Sciences, Associate Professor
Alfraganus University
E-mail: xmatnazarov@gmail.com
Tashkent, Uzbekistan

ABOUT ARTICLE

Key words: academic rowing, training process, individual training models, shock-intensive microcycles, load optimization, microcycles, speed-strength qualities, athletic performance.

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Abstract: The article substantiates the construction of a macrocycle for highly qualified athletes in academic rowing, taking into account the individualization of training loads. The experimental group that trained according to a model based on shock-intensive macrocycles demonstrated statistically significant improvements in key parameters of technique and physical fitness. The results confirm the effectiveness of the proposed model for the preparation of elite rowers.

Introduction. The modern system of training highly qualified athletes in academic rowing requires a rational organization of the training process throughout the entire annual cycle. In the practice of sports training, various models of constructing an annual macrocycle are used -single-cycle, double-cycle, and triple-cycle structures - each with its own advantages and limitations depending on the athletes’ level of preparedness, age, and sports qualification [4,5].

The determining factor in selecting the structure of the annual plan is the competition calendar, which necessitates a flexible adaptation of the training process. At the same time, the athletes’ age and qualification define the stage of long-term preparation, determine the optimal focus of training loads, and thereby increase the effectiveness of the annual cycle [1,2,4].

The problem of constructing a macrocycle is especially relevant for elite athletes who are operating at the limits of their capabilities. This category of rowers typically follows a year-round training system based on a rational alternation of competitive activities, recovery periods, and maintenance training. Therefore, the scientific substantiation of the macrocycle structure in academic rowing is an essential condition for improving athletic performance and achieving sustainable progress in the preparation of elite athletes [3,4].

Purpose of the Study

To analyze and make ongoing adjustments to the training process of highly qualified athletes in academic rowing.

Research Objectives

1. To determine the physical and functional state of highly qualified athletes in academic rowing;

2. To develop and implement shock-intensive microcycles in the training process of elite academic rowers;

3. To conduct a comparative analysis of the obtained data and identify the effectiveness of the proposed approaches.

Research Methods

Analysis of scientific and methodological literature, classification, comparative analysis, pedagogical observation, pedagogical experimentation, and mathematical-statistical methods.

Research Results and Discussion

Issues of speed-strength training, as a key component of athletes' special physical preparation, have been reflected in a number of modern studies-both in the context of long-term development and within the structure of the annual macrocycle.

An analysis of the scientific and methodological literature made it possible to identify two main approaches to the distribution of strength-oriented training loads within the annual cycle of qualified athletes.

The first approach is characterized by a relatively uniform distribution of strength loads throughout the annual cycle, ensuring gradual development of the necessary qualities and contributing to the maintenance of stable athletic form.

The second approach involves the concentration of strength loads in the preparatory period, allowing for the targeted formation of a foundation for further improvement of speed-strength indicators during the competitive and pre-competitive stages.

Based on these principles, we developed training programs of various durations that included models of weekly microcycles and training tasks aimed at developing and enhancing the speed-strength qualities of academic rowers. The experimental substantiation of the effectiveness of these programs formed the basis of the conducted research.

The main objective was to create individualized models of specialized training focused on optimizing training loads and predicting athletic performance.

The results of the analysis showed that under two-cycle training planning, the most probable high results can be achieved at the end of the first cycle, while the peak athletic form and best performance indicators are recorded at the completion of the second cycle.

Particular importance is attached to the methodologically correct organization of aerobic training, which forms the foundation for the successful manifestation of speed-strength qualities.

During the study, both aerobic and shock-intensive microcycles were used in planning sessions at the pre-competition stage, the effectiveness of which was confirmed by practical data (Table 1).

Table 1

Recommended Structure of an Aerobic Microcycle

<table>
<tr><th colspan="3">Days</th><th>M</th><th>T</th><th>W</th><th>Th</th><th>F</th><th>Sa</th><th>Su</th></tr>
<tr><td rowspan="6">Aerobic Microcycle</td><td rowspan="3">Session 1</td><td>Priority direction</td><td>AE</td><td>AE (Main)</td><td>MC (Main)</td><td>AAA</td><td>AE (Main)</td><td>MS</td><td rowspan="6">Rest</td></tr>
<tr><td>Additional direction</td><td>TECH</td><td>AAA</td><td>AE</td><td>AE</td><td>TECH</td><td>AAA</td></tr>
<tr><td>Load level *</td><td>7-9</td><td>7-9</td><td>6-7</td><td>4-6</td><td>6-7</td><td>7-9</td></tr>
<tr><td rowspan="3">Session 2</td><td>Priority direction</td><td>MS</td><td>TECH</td><td rowspan="3">Rest</td><td>AE</td><td>-</td><td rowspan="3">Rest</td></tr>
<tr><td>Additional direction</td><td>AAA</td><td>-</td><td>MS</td><td>TECH</td></tr>
<tr><td>Load level *</td><td>4-6</td><td>2-3</td><td>7-9</td><td>2-3</td></tr>
</table>

Notes: AE – Aerobic endurance, MS – Maximum strength, AAA – Anaerobic alactic abilities (maximum speed), TECH – Movement technique, Main – Main training session, Load level – expressed in conventional units (Table 3)

The data presented in the table illustrate an example of a weekly microcycle organization focused on developing aerobic endurance in academic rowers. The structure is based on the principle of primary and secondary training emphases within each session, as well as on the regulation of training load levels.

In the first half of the week (Monday-Wednesday), the focus is placed on aerobic endurance (AE), maximum strength (MS), and anaerobic alactic abilities (AAS), which contribute to forming a solid functional base and stimulate the development of speed-strength potential. On Thursday, there is a relative decrease in load intensity (4–6 conventional units) with an emphasis on anaerobic abilities, creating conditions for partial recovery.

On Friday and Saturday, the load intensity increases again (6-9 conventional units), incorporating the main sessions focused on aerobic endurance and maximum strength, while Sunday is used for active or complete rest.

The secondary training directions (movement technique, development of anaerobic abilities, and supporting aerobic exercises) are distributed throughout the microcycle to maintain technical proficiency and provide variability in the training process.

While the structure of the aerobic microcycle (Table 1) is primarily aimed at developing general and specific aerobic endurance, which serves as the foundation for further improvement of work capacity, the next stage of preparation emphasizes intensification of loads and the development of speed-strength qualities under predominantly anaerobic energy conditions.

For this purpose, the training process includes an intensive microcycle designed to develop anaerobic glycolytic strength (AGS), strength endurance (SE), and anaerobic alactic abilities (AAS). This type of microcycle involves a higher concentration of high-intensity loads, while maintaining a methodologically justified alternation of recovery sessions and rest periods.

The recommended structure of the intensive microcycle is presented in Table 2.

Table 2

Recommended Structure of an Intensive Microcycle

Days			M	T	W	Th	F	Sa	Su
Intensive Microcycle	Session 1	Priority direction	AGS	AGS (Main)	AGS	SE (Main)	AAS	AGS	Rest
		Additional direction	TECH	AAS	SE	AGS	TECH	SE	
		Load level *	7 - 9	6 - 7	7 - 9	6 - 7	4 - 6	7 - 9	
	Session 2	Priority direction	SE	TECH	Rest	TECH	AGS (Main)	Rest	
		Additional direction	AAS	-		-	-		
		Load level *	4 - 6	2 - 4		2 - 4	6 - 7		

Notes: SE - Strength endurance (mainly anaerobic), AAS - Anaerobic alactic abilities (maximum speed), AGS - Anaerobic glycolytic strength, AGC - Anaerobic glycolytic capacity, TECH

- Movement technique, Main - Main training session, Load level - expressed in conventional units (Table 3)

The intensive microcycle presented in the table is focused on developing athletes' anaerobic capacities-primarily anaerobic glycolytic power (AGP), strength endurance (SE), and anaerobic alactic capacity (AAC). Unlike the aerobic microcycle (Table 1), which emphasizes building functional endurance and maintaining technical proficiency, this model features a high concentration of high-intensity loads aimed at enhancing speed-strength qualities that are critically important for competitive rowers.

During the first three days of the microcycle (Monday-Wednesday), the main focus is on the development of anaerobic glycolytic power (AGP) and strength endurance (SE), with training loads reaching 7-9 conditional units, corresponding to a high-intensity regime. On Thursday, the emphasis shifts toward strength endurance with a moderate load (6-7 conditional units), while Friday's sessions target the development of anaerobic alactic capacity and speed qualities (4-6 conditional units), allowing athletes to realize their speed potential.

On Saturday, exercises aimed at developing anaerobic glycolytic power are reintroduced with maximum intensity (7-9 conditional units), while Sunday is designated for recovery. Additional directions-such as technique refinement and the enhancement of speed and strength capacities-are integrated into the microcycle to maintain technical stability under high-intensity conditions.

When analyzing the structure of the aerobic and intensive microcycles (Tables 1 and 2), special attention should be given not only to the primary focus of the training but also to the load level assigned in each session. The optimal distribution of intensity and volume within the weekly cycle allows for effective management of adaptation processes, prevention of overtraining, and the achievement of the desired training effect.

To achieve this, a gradation of training load levels was employed, reflecting the relationship between the intensity and volume of work performed. This classification is presented in Table 3.

Table 3

***Training Load Levels**

Load Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Intensity of Load	Low	Low	Low	Moderate	Moderate	Moderate	High	High	High
Training Volume	Low	Medium	High	Low	Medium	High	Low	Medium	High

The gradation of training load levels reflects the ratio between the intensity and volume of the work performed, allowing for a structured approach to regulating athlete workload and recovery throughout the microcycle.

If the proposed methodology for developing individual models of specialized training-based on the optimization of training loads and the forecasting of athletic success-is viewed not as a final recommendation but as a creative tool for evaluating and realizing athletes' potential, then the obtained results can be considered satisfactory.

Academic rowing belongs to the category of cyclic sports, where performance is directly determined by the speed of the boat's movement, which, in turn, depends on the efficiency and power of the repetitive rowing strokes executed by the athlete using an oar in the water.

During the study, the proposed program was implemented into the training process of an experimental group of highly qualified academic rowers. The application of this program had a positive impact on the dynamics of athletic performance indicators, and the results showed statistically significant differences by the final stage of the experiment (see Table 4).

Table 4

Statistical Analysis of Technical Indicators of Athletes from the Control Group (CG, n=12) and Experimental Group (EG, n=12) during a 500 m Test on the Concept-2 Ergometer

Indicators		At the beginning of the experiment			At the end of the experiment			Increase		t	P
		$\overline{X}$	σ	V, %	$\overline{X}$	σ	V, %	Absolute, %	Relative, %		
Total number of strokes during the distance, count	CG	44,68	4,38	9,80	41,73	3,83	9,18	2,95	6,60	1,76	>0,05
	EG	45,94	4,64	10,10	39,52	3,73	9,44	6,42	13,97	3,74	<0,01
Time, s	CG	1:46,63	9,04	8,48	1:46,43	8,19	8,15	6,20	5,81	1,76	>0,05
	EG	1:47,79	9,64	8,94	1:34,43	7,74	8,20	13,36	12,39	3,74	<0,01
Speed (m/sec)	CG	2,38	0,28	11,76	2,63	0,3	11,41	0,25	10,50	2,11	<0,05
	EG	2,24	0,27	12,05	2,82	0,32	11,35	0,58	25,89	4,80	<0,001
Average force applied to the handle, kg	CG	67,31	7,09	10,53	72,46	7,24	9,99	5,15	7,65	1,76	>0,05
	EG	66,36	7,17	10,80	77,84	7,84	10,07	11,48	17,30	3,74	<0,01

Maximum force applied to the handle, kg	CG	127,47	10,89	8,54	135,17	10,72	7,93	7,70	6,04	1,75	>0,05
	EG	128,47	11,38	8,86	145,72	11,21	7,69	17,25	13,43	3,74	<0,01
Stroke length, m/cm	CG	1,32	0,13	9,85	1,44	0,134	9,31	0,12	9,09	2,23	<0,05
	EG	1,21	0,12	9,92	1,46	0,133	9,11	0,25	20,66	4,83	<0,001

Notes: CG - Control Group, EG - Experimental Group, σ - Standard deviation, V, % - Coefficient of variation, t - Student's t-test value, P - Statistical significance level

This table presents a comparative statistical analysis of rowing performance indicators for control and experimental groups, illustrating significant improvements in stroke efficiency, time, speed, and force parameters in the experimental group.

The results of the statistical analysis presented in the table make it possible to evaluate the effectiveness of the developed training program for academic rowers in the experimental group.

At the beginning of the experiment, no significant differences were recorded between the control and experimental groups in key technical parameters ($p>0.05$), indicating their comparable initial level of preparedness. However, by the end of the study, the athletes in the experimental group (EG) demonstrated statistically significant positive dynamics across all indicators.

Thus, the total number of strokes over the 500-meter distance among EG participants decreased from 45.94 to 39.52 (an improvement of 13.97%), indicating an increase in the efficiency of the rowing cycle. The time to cover the distance decreased by 13.36 seconds (12.39%, $p<0.01$), while the average speed increased by 25.89% ($p<0.001$), which is one of the most important criteria of performance effectiveness.

In addition, the experimental group showed a significant improvement in strength characteristics: the average handle force increased by 17.30% ($p<0.01$), and the maximum handle force — by 13.43% ($p<0.01$). A notable increase was also observed in stroke length (20.66%, $p<0.001$), which reflects an improvement in the biomechanical efficiency of movements.

At the same time, in the control group, the changes were statistically insignificant or less pronounced. For instance, the increase in speed, strength, and stroke length in the control group ranged from 6–10% and was accompanied by $p>0.05$ values, which does not allow us to speak of any systemic improvement.

Thus, the obtained data confirm the effectiveness of the proposed program aimed at optimizing training loads and developing the speed-strength qualities of academic rowers, which resulted in a significant increase in their technical and competitive performance.

Conclusions. Analysis of the training process showed that the choice of single-, double-, or triple-cycle preparation depends on the athlete's age, level of sports qualification, state of training, and competition schedule. The optimal structure of the annual cycle must take into account the combination of these factors, which ensures the achievement of maximum athletic results.

The developed and implemented individual models of special preparation, based on the optimization of training loads, demonstrated a positive impact on the development of speed-strength qualities of rowers. The effectiveness of the methodology is confirmed by statistically significant improvements.

The introduction of shock-intensive microcycles contributed to an increase in the level of physical and functional fitness of athletes, especially during the pre-competition period. The application of these microcycles led to marked improvements in the key indicators of athletic performance.

Compared to the control group, the rowers of the experimental group, who trained using the proposed methodology, showed statistically significant advantages:

• a reduction in the total number of strokes over the 500 m distance by 13.97% ($p \leq 0.01$);

• an improvement in distance completion time by 13.36 seconds ($p \leq 0.01$);

• an increase in boat speed by 25.89% ($p \leq 0.001$);

• an increase in average and maximum handle force by 11.48% and 17.25%, respectively ($p \leq 0.01$);

• and an increase in stroke length by 20.66% ($p \leq 0.001$).

The obtained results indicate that the application of an individualized methodology for optimizing training loads is an effective tool for improving the athletic preparedness of academic rowers. The feasibility of using the proposed microcycles is confirmed by both practical results and their statistical significance, which allows recommending this methodology for the preparation of high-level athletes.

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