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EFFECTIVENESS OF A BLOCK APPROACH TO TRAINING WITH DOUBLE PERIODIZATION IN ROWERS AGED 14-16 YEARS

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Abstract
Introduction. Rowing at the age of 14-16 allows you to form a reserve of functional and physical training of rowers for the transition to the stage of higher achievements. The issue of a block approach to training of young rowers has been little studied. The purpose of the study was to determine the impact of a block approach with double periodization of training on the physical training and performance of rowers at the age of 14-16 years at distances of 500 m and 1000 m within the annual training program. ***Material and methods.*** Forty-three male athletes who were randomly divided into experimental and control groups took part in the study. Monitoring of the results of rowing on water (500 m and 1000 m) was carried out in three stages: 1st stage – September 2023, the beginning of the study; 2nd stage – March-April 2024, the end of the winter stage; and 3rd stage – September 2024, the end of the summer stage. ***Results.*** A more pronounced improvement in the rowing results of the experimental group at a distance of 500 m by 5.09% ($p < .001$) and at a distance of 1000 m by 3.81% ($p < .001$) was noted compared to the control group. ***Conclusions.*** A more pronounced improvement in the results of the experimental group athletes compared to the control group can prove the feasibility of further research and using the block approach concept in practice to optimize programs and periodization of sports training.

Keywords: double periodization, block approach, canoeing, physical training, rowing

Introduction

High competition in kayaking and canoeing requires a significant training level of athletes, which prompts an increase in training load volumes. Considerable progress has been observed in the development of training methods and sports technologies for monitoring heart rate, oxygen consumption, pace of movement, and training simulators for rowing. The use of such tools allows you to evaluate the effectiveness of training and maintain a more favorable psychological environment [1, 2]. Modern logistical support plays an extremely important role in the training process of rowers [3]. In addition, the number of competitions during the season has increased significantly. That is, the basis of the functional training of rowers is the development of large volumes of rowing on water. The optimal proportions of training periods in the annual cycle from the total term are: 60% (preparatory), 35% (competitive), 5% (transitional), which is indicated in the rowing curriculum that regulates training in children's and youth sports schools of Ukraine [4].

Some authors [5, 6, 7] note that such a traditional system of training and periodization is outdated. In their opinion, excessive loads, reduced rest and increased volume of rowing have a negative effect on the training of rowers. Coaches are constantly searching for ways to improve the effectiveness of annual training planning and periodization [8, 9, 10]. In addition, scientists [11, 12] draw attention to the fact that the use of large volumes of training loads at the age of 14-16, which do not correspond to the functional capabilities of the athletes' bodies, can negatively affect not only the dynamics of sports results, but also cause health disorders. Studies have shown [13] that the cardiovascular system of rowing athletes in their youth can undergo significant changes, changing the structure and function of the heart and arteries.

Training at the age of 14-16 years falls on the puberty period, which is characterized by the accelerated development of functional capabilities [11, 14] and by biochemical, morphological and functional changes in the body, which must be taken into account when organizing the educational and training process and periodization. Studies among professional rowers [15, 16] show that the effects of training and heavy loads do not have as many negative consequences for the body.

According to their specific features, different modes of rowing training cause certain demands on the body, which is manifested by characteristic changes in individual organs and systems [17]. This requires special attention of coaches to increase the effectiveness of the training process, which determines the need to find ways to improve the entire structure of training young athletes to ensure their competitiveness in the conditions of sports competitions.

However, research [11, 12] showed that large volumes of training at the age of 14-16 years, which do not have functional preparedness, can negatively affect the psychological state, reduce the dynamics of the increase in results and worsen the health of young athletes. The training process using a block approach allows you to focus on optimizing special changes in the body of young athletes that are caused by special physical exercises in kayaking and canoeing. That is why the block model of training creates advantages for young rowers:
- load volume is reduced;
- multilateral development is improved;

- division of training into blocks allows you to prepare for a large number of competitions in the season;
- more time for recovery after each mesocycle;
- allows better training for the main competitions of the year.

As noted by [6], the training year can be divided using single and double periodization. Taking into account the specifics of training in kayaking and canoeing, we divided the year into two stages (macrocycles): winter and summer. The dual model of training has three types of blocks: preparatory – for the development of rowing technique and aerobic capabilities, transitional – for the development of specific physical qualities from the sport, primarily anaerobic capabilities and special technical skills, and competitive – for the development of maximum speed, improvement in specific rowing tactics and recovery before the start. These three mesocycle blocks form the training phase.

It is worth noting that there are other theories of periodization. For example, scientists [9, 18] offer three-cycle and five-cycle models of periodization which allow you to ensure a fairly high level of readiness for competitions during a certain part of the year. However, when building a training process, it is necessary to take into account the specifics of the sport, individual capabilities of the athlete, and the competition calendar.

The wrong approach to the training process and excessive duration of the preparation stages leads to negative consequences, which reduces the probability of achieving the highest level of readiness for the main competitions of the year. Other analyzed options of periodization are more effective for training athletes of higher achievements, and have less impact on the results of athletes of an average level [5, 6].

The relevance of this study is determined by the fact that the question of a block approach to training by rowers of an intermediate level of training is not sufficiently disclosed in the scientific literature. That is why the main goal of the study was to determine the impact of the block approach with double periodization on the physical training and performance of rowers of the experimental group at distances of 500 m and 1000 m within the annual training program for young men aged 14-16, and compare it with the dynamics of indicators of the control group rowers who worked according to the traditional training model.

Material and methods

Participants and procedure.

Forty-three middle-level young male athletes from the children's and youth sports school for water sports in the city of Ternopil, aged 14-16 years, participated in the study. They were randomly divided into 2 comparable groups: the control group (CG) (n = 21) and the experimental group (EG) (n = 22). Monitoring of the results of rowing on water (500 m and 1000 m) was carried out in three stages: 1st stage – the beginning of the study, September 2023; 2nd stage – the end of the winter stage, March-April 2024, and 3rd stage – the end of the summer stage, September 2024. Testing was carried out at the end of each stage of preparation after rest according to the traditional training program with a standard drinking regime and nutrition. The rowers were familiarized with the research design and gave their consent to participate in the tests. CG athletes trained according to the educational and training program, which included three consecutive training periods in the annual cycle: 60% – preparatory, 35% – competitive and 5% – transition. The training of EG rowers was carried out using a block approach to training and included double periodization [6]. All study participants followed the proposed training program. The average number of omissions was nine training sessions (4.46% from the total number of trainings during the year). Taking into account the specificity and seasonality of rowing, the year was divided into two stages (macrocycles): winter, which consisted of 3 mesocycles and lasted from October to March, and summer, which incorporated 6 mesocycles and lasted from April to September. Each macrocycle at both stages consisted of three blocks: preparatory, transitional, competitive. These three mesocycle blocks form the training phase. 500 m and 1000 m rowing measurements were taken after the completion of each phase of the study using a Garmin Fenix 6 and a standard stopwatch to minimize error. All tests took place in the Ternopil rowing channel "Water Arena" with exact marks of 500 m and 1000 m under the same weather conditions and wind speed during the tests, which did not exceed 1.5 m/s, which allowed the rowers to complete the distance as efficiently as possible.

The research adhered to the principles of the Declaration of Helsinki and was approved by the Commission on Ethics in Scientific Research and Experimental Development of Ternopil Volodymyr Hnatiuk National Pedagogical University (952/03-40).

Statistical analysis

We determined the average value – Mean (Mx) and standard error (Se). The data in the tables are presented as Mx ± Se. The distribution of data for normality in the samples was checked using the Shapiro-Wilk test. To determine the reliability of dynamic changes within groups for dependent samples, the Student's t-test was used for normal distribution, and the Wilcoxon test was used for non-normal distribution.

To determine the reliability of the differences between the comparison groups in the case of normal distribution, the Student's t-test for independent samples was employed. As for non-normal distribution, the Mann-Whitney U-test was used.

Results

Table 1 presents the dynamics of rowing indicators of 500 m and 1000 m during the winter macrocycle in both groups. At the first stage of the study, it was found that the rowing times of both groups for 500 m and 1000 m were comparable. After the completion of the second stage, CG participants showed a modest yet significant improvement at the distance of 500 m (-2.52%, p = .001) and 1000 m (-1.85%, p = .001) compared to those at

Table 1. Dynamics of rowing indicators during the winter macrocycle

Distance	CG (n = 21)				EG (n = 22)			
	1st stage, sec	2nd stage, sec	%	p_1	1st stage, sec	2nd stage, sec	%	p_2
500 m	121.19 ± 1.86	118.14 ± 1.56	-2.52	< .001	122.61 ± 1,78	115.95 ± 1.25	-5.44	< .001
1000 m	260.11 ± 2.75	255.31 ± 2.45	-1.85	< .001	259.79 ± 2.93	247.53 ± 1.46	-4.72	< .001

500 m – rowing at the distance of five hundred meters; 1000 m – rowing at the distance of one thousand meters; CG – control group; EG – experimental group; p1 – statistical significance of differences in CG indicators at 1st and 2nd stage; p2 – statistical significance of differences in EG indicators at 1st and 2nd stage.

Table 2. Dynamics of rowing indicators during the summer macrocycle

Distance	CG (n = 21)				EG (n = 22)			
	2nd stage, sec	3rd stage, sec	%	p_1	2nd stage, sec	3rd stage, sec	%	p_2
500 m	118.14 ± 1.56	116.06 ± 1.24	-1.76	.006	115.95 ± 1.25	111.18 ± 0.86	-4.11	< .001
1000 m	255.31 ± 2.45	249.90 ± 1.94	-2.12	< .001	247.53 ± 1.46	239.65 ± 0.96	-3.18	< .001

500 m – rowing at the distance of five hundred meters; 1000 m – rowing at the distance of one thousand meters; CG – control group; EG – experimental group; p1 – statistical significance of differences in CG indicators at 2nd and 3rd stage; p2 – statistical significance of differences in EG indicators at 2nd and 3rd stage.

Table 3. Comparison of the increase in results between groups during the study

Distance	Improvement at the 2nd stage in CG, sec	Improvement at the 2nd stage in EG, sec	The difference between EG and CG improvement, times	p_1	Improvement at the 3rd stage CG, sec	Improvement at the 3rd stage EG, sec	The difference between EG and CG improvement, times	p_2
500 m	-3.05 0.41	-6.67 0.69	2.18	< .001	-2.08 0.67	-4.76 0.61	2.28	.01
1000 m	-4.8 0.48	-12.26 1,6	2.55	< .001	-5.42 0.83	-7.88 0.77	1.45	.035

500 m – rowing at the distance of five hundred meters; 1000 m – rowing at the distance of one thousand meters; CG – control group; EG – experimental group; p1 – statistical significance of differences in the dynamics of CG and EG indicators at 2nd stage; p2 – statistical significance of differences in the dynamics of CG and EG indicators at 3rd stage.

the 1st stage. After the 2nd stage completion, the time of EG participants in both tests significantly improved at the distance of 500 m (-5.44%, p = .001) and 1000 m (-4.72%, p = .001) compared to those at the 1st stage, which was significantly better than that of CG participants (p < .001).

Table 2 shows the dynamics of rowing indicators during the summer macrocycle in both groups. After the 3rd stage, CG participants manifested a small yet significant improvement at the distance of 500 m (-1.76%, p = .006) and 1000 m (-2.12%, p = .001) in comparison to the 2nd stage. At the same time, significant and more pronounced progress was found in EG participants after the completion of the 3rd stage – they improved significantly at the distance of 500 m (-4.11%, p = .001) and 1000 m (-3.18%, p = .001). Moreover, there was an improvement in the individual results of each athlete in both groups. Table 3 compares how results improved between groups during the study at the distance of 500 m and 1000 m.

Discussion

The results of the study showed that CG athletes who were trained according to a traditional educational and training program with large volumes of rowing showed an improvement in time by 4.23% at the distance of 500 m and by 3.92% at 1000 m during the study. EG rowers who trained according to the block system with double periodization improved their results by 9.32% at the distance of 500 m and by 7.75% at 1000 m. Rowers who trained with a block approach showed a significantly better increase in results than athletes with a traditional training model, while being in the same age category, which may indicate the effectiveness of the block approach in this age group.

Rowers had the opportunity to focus on training individual physical qualities and better prepare for competitions. However, the effects of environmental changes likely add variability to the results [18, 19], so we measured rowing performance using a Garmin Fenix 6.

The improvement in results at the 2nd stage of the study in EG at the distance of 500 m was more pronounced by 2.18 times (p < .001), and at 1000 m – by 2.55 times (p < .001) compared to those in CG. After the 3rd stage, the difference in the increase in EG at 500 m became even greater by 2.28 times (p = .01), and at 1000 m the result improved by 1.45 times (p = .035) compared to those in CG. The division of the training year into blocks could be one of the reasons for the more pronounced improvement in the results of EG rowers. We observed that shorter training periods of up to 6 months, reflecting the block approach concept, had significant differences in 500 m and 1000 m rowing performance. Perhaps with a block approach, the training effect would be even better if we increased the duration of training with such an approach for a longer period than we investigated.

Research [21, 22, 25, 26] revealed the effectiveness of the block approach in comparison with the traditional organization of training in endurance athletes, and improved adaptation to the load with the block approach was established.

A number of studies [5, 7, 20, 23, 24] included the periodization of high-intensity training (HIT) and low-intensity training (LIT), respectively, using training blocks that included mainly HIT or LIT loads within the traditional mesocycle, and compared the results. There are also traditional models that usually use simultaneous HIT and LIT loads.

Breil [23] and Garcia-Pallares [24] draw attention to the fact that block approach is superior to the traditional model; however, in these studies, the means of HIT intensity prevail. The above-mentioned research indicates a significant training block approach for the training of young athletes.

Also, the results could be affected by the small number of rowers in the groups and the absence of girls. The age of 14-16 years is characterized by the accelerated development of functional capabilities and more active biochemical, morphological and functional changes in the body, which could affect the assessment of the effectiveness of the training process [11, 14]. Training with a block approach offers an alternative training strategy for coaches and athletes and in no way negates the effectiveness of the traditional training model. Block approach can be used to supplement traditional models used in kayaking and canoeing. The results of our research will help coaches to plan the training process more effectively, which will improve the results of young rowers. Therefore, taking into account the positive dynamics in EG, the block approach to training with double periodization needs further research.

Conclusions

A more pronounced improvement in the rowing results of EG at the distance of 500 m by 5.09% ($p < .001$) and at the distance of 1000 m by 3.81% ($p < .001$) compared to CG may indicate the great potential of applying the concept of the block approach in practice for optimizing programs and periodization of sports training.

The results of this study can be used in the practical activities of rowing coaches for more effective training of young rowers, and a gradual transition from children's to professional sports without significant overloads of the body compared to traditional training programs with large training volumes.

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