

Improvement of the physical preparedness of canoe oarsmen by applying different modes of training loads

BOHUSLAVSKA VIKTORIIA^{1,2}, FURMAN YURIY¹, PITYN MARYAN², GALAN YAROSLAV³, NAKONECHNYI IHOR³

¹Vinnitsia State Mykhailo Kotsyubynskyi Pedagogical University

²Lviv State University of Physical Culture, Lviv, UKRAINE

³Yuriy Fedkovych Chernivtsi National University, Chernivtsi, UKRAINE

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Abstract:

The analysis of literature shows that there is no consensus on the volume and intensity of training loads for rowers during the preliminary basic training stage. In addition, the possibility of using various training modes, which take into account gender characteristics of young athletes, to improve the physical and functional preparedness of oarsmen during the preliminary basic training stage has not been sufficiently studied in scientific literature. The purpose of this study is the theoretical substantiation and development of canoeing training programs with different power supply modes, which are aimed at improving the physical and functional preparedness of athletes during the preliminary basic training stage. It is established that there are gender differences in how the aerobic and anaerobic training affects the physical and functional preparedness and the results of rowing competition exercises during the preliminary basic training stage. Training using the aerobic mode of power supply (with an intensity of 60% VO₂max) proved to be effective only for females. Training using the stimulation of anaerobic (lactate) energy supply processes proved to be more effective in improving the physical/functional fitness and results in competitive exercises for male adolescents. Regardless of the athlete gender, training using a mixed mode of energy supply (aerobic-anaerobic and anaerobic-aerobic) more effectively improves the physical and functional fitness compared with training using the aerobic energy supply mode. Regardless of the energy supply mode and training method, exercises based on the developed programs, which take into account the internal load, do not disturb the functional state of the body, according to the results of electrocardiography, spirometry and sphygmomanometry.

Keywords: canoeing, physical and functional preparedness, power supply mode, internal load, preliminary basic training stage.

Introduction

Sports results of winners and prizewinners of Olympics Games, Winter Olympic Games, world championships and other competitions have been steadily increasing (Guo, 2007; Briskin., 2014, 2015, 2016; Imas, 2017). Analysis of competition protocols confirms this tendency, particularly in rowing and canoeing. One of the reasons of this phenomenon is improvement of physical training process in all phases of athletes' preparation during many years (Bohuslavska, 2014).

Regardless of stage of a multi-year athletes training, the training process should be forwarded to optimizing specific adaptive restructuring of the body, which is caused by nature of physical exercise. At the stage of preliminary basic preparation of rowers, their age coincides with pubertate period of human ontogenesis and is characterized by cumulative (biochemical, morphological and functional) changes in body, associated not only with physical activities, but also with intensive age (physiological) changes in the organism (Bishop, 2002; Briskin, 2015, 2016). This should be considered when organizing training sessions, because before mentioned transformations contribute opportunities to improve physical preparedness of athletes (Choszcz, 2012; Khimenes, 2016; Galan, 2016).

Forcing adaptive processes during preliminary base preparation through the application of loads that do not correspond functional capabilities of athletes may affect not only dynamics of athletic performance, but also disrupt their health (Sanders, 1992; Romanchyshyn, 2015; Penichet-Tomas, 2016). In addition, excessive loads, applied during young athletes training, are likely to encourage rapid adaptation to them on the one hand, and on the other - contribute exhaustion of adaptive capacity in growing organism (Shynkaruk, 2011).

It is known that physical work while canoeing is accompanied by activation of those body systems that determine aerobic and anaerobic (lactate) energy processes. This primarily concerns cardiovascular and

respiratory systems. Efficiency of adaptive adjustment in these systems is caused by external and internal physical loads. Topic of canoeing training optimization is highlighted in many scientific studies. However, no consensus exists among scientists concerning the volume and intensity of training loads for oarsmen, practicing on the stage of preliminary basic preparation (Sanders, 1992; Bishop, 2002; Guo, 2007; Briskin, 2015; Choszcz, 2012; Bohuslavska, 2014; Choszcz, 2012; Penichet-Tomas, 2016).

The relevance of this research is caused by the fact that in scientific literature topic of possibility of different modes exercise application for improving physical and functional preparedness of oarsmen during preliminary basic preparation (considering genital features of young athletes) is highlighted insufficiently. Therefore, this topic requires further profound investigation.

Purpose of the research

The purpose of this study was to theoretically substantiate and develop programs of training exercises in canoeing, using different modes of power supply, aimed to improve physical readiness of athletes on the stage of preliminary basic preparation.

Materials and methods

To achieve the objectives, we have used a complex of interdependent research methods: theoretical analysis and analysis of scientific literature; pedagogical observation; pedagogical experiment; pedagogical testing using veloergometry, chronometry, pulsometry, electrocardiography, sphygmomanometry, spirometry; mathematical statistics.

The research was conducted at the Department of Biomedical Foundations of Physical Education and Physical Rehabilitation in Mykhailo Kotsiubynsky Vinnitsa State Pedagogical University and in Vinnytsia Specialized Youth School of Olympic Rowing Reserve named after Yu. Ryabchynska.

The study involved 99 oarsmen, among them - 45 females aged 14-15 years and 54 males aged 15-16 with sports qualifications of II and III categories. Total athletic experience in this athletes was 3-4 years.

Results

The process of improving physical and functional preparedness of oarsmen during preliminary basic training stage needed analyze of scientific data and methodical literature on rowers' physical training. We have examined morphological and functional differences between female and male body that should be considered when building training programs on canoeing. It is shown that during preliminary basic training stage, the improvement of physical and functional training in oarsmen comes amid intense age restructuring of organism, that must be considered when organizing educational and training sessions. On the basis of literature analysis, it is determined that issue of physical and functional preparedness improvement in oarsmen through the application of different modes of exercises at preliminary basic training stage is studied insufficiently.

Theoretical foundations for development of training exercises programs were fundamental provisions of general athletes training theory in Olympic Sports (Shynkaruk O., 2011, Briskin, 2015, 2016); training programs for children and youth in sports schools, specialized youth school of Olympic reserve, schools of higher sportsmanship. Results of pedagogical observation, whose objects were content of training sessions, nature and quantity of physical activities, health of athletes prior to, during and after classes; results of ascertaining experiment, namely physical and functional preparedness of rowers at preliminary basic training stage.

At the same time, we have been taken into consideration scientific data on dependency of exercises effectiveness to degree of aerobic and anaerobic processes stimulation of muscles' power supply; applied methods of training exercises, their frequency, intensity and duration (Guo, 2007; Choszcz, 2012; Bohuslavska, 2014); data about registration of probable increase in aerobic and anaerobic opportunities, not earlier than 16 weeks from the beginning of experiment (Bishop, 2002; Kerr, 2008; Sanders, 1992).

In this regard, we have developed four programs with training exercises regarding to functional preparedness of young athletes. These programs have been implemented in training process of oarsmen during previous base preparation. According to each program, sportsmen were divided into four groups. Duration of each training cycle was 16 weeks (November to February) and the number of classes per week was 6 in each program. Three of those were carried out under designed programs of training exercises (purposeful stimulation of aerobic or anaerobic energy supply processes), and during other three training sessions all athletes performed the same exercises: general physical training (cross, general developmental exercises, exercises with weights, sports, skiing and ice skating), special physical training (work on fitness facilities, special exercises in the shallows, canoeing with hydro-braking devices) and improving technical mastery.

Abovementioned programs of physical training were primarily distinctive by applied methods of exercising and regime of energy supply processes. Workouts were carried out in an area of optimum range of internal load, which was calculated individually for each athlete. Relying on the applied program of physical training, we have installed intensity of load during canoeing, which was expressed as a percentage of absolute value of maximal oxygen consumption (VO_{2max}). An installed intensity of work has corresponded to certain heart rate (HR), which was calculated for each subject separately. During exercising athletes had to comply with

established HR. Inner loads was measured by energy consumption (in calories), which was calculated by HR (according to L. Brouha, 1984, on the energy consumption of different HR). When dosing physical activities, we have proceeded from the fact that the inner load of performed work should be found in a zone of optimal range, which is limited by minimum and maximum permissible values of energy consumption. For this purpose, we have used methodology proposed by M. Furman (2005). Maximum permissible size of inside load (E_{max}) was determined in calories; inside value of performed work was expressed as a percentage relative to E_{max} (% of E_{max}). Descriptions of designed programs of training sessions that have been applied in experiment are shown below.

Work out in aerobic mode using standardized method of continuous exercise, was carried out under program I. Work in preliminary basic training stage lasted 45 minutes. Thus, intensity of load during canoeing was permanent and was equal 60% VO_{2max} . Both boys and girls with such intensity, HR on average has reached 153 beats·min⁻¹. During exercise sportsmen have crossed about 9-10 km. The inner load (energy per one workout) was in averaged 523.1 kcal, representing about 72.4% of E_{max} in boys and 82.0% of E_{max} in girls.

Workout in mixed mode of energy supply, using method of continuous variable exercise, was conducted under program II. In accordance with this program, sportsmen in preliminary basic training stage have performed 5 accelerations lasting 3 minutes each. Intensity of load during accelerations was 70% VO_{2max} ; between accelerations canoeing was carried out with intensity of 50% VO_{2max} and lasted 6 minutes. An average HR in boys and girls during accelerations has reached 165 beats·min⁻¹, and between accelerations decreased to 141 beats·min⁻¹. Within 3 minutes of work during accelerations athletes have crossed approximately 600-650 m. During one workout sportsmen have crossed 9-10 km. Energy consumption per one workout was in average 501 calories, which was total in males approximately 71.9% of E_{max} and approximately 80.8% of E_{max} in females.

Workout in mixed mode of energy supply using a variable interval exercise method was implemented by program III. In this program main part of the class included 2 series of accelerations with 90% VO_{2max} loads intensity during canoeing. In first series, sportsmen have performed 6 accelerations lasting 30s "on the move" and in second - 6 accelerations lasting 60s "from the start". Rest between accelerations was presented by low intensity canoeing (25% VO_{2max}). Duration of rest intervals between accelerations was around 3 minutes. Rest between series lasted for 15 minutes. HR on average during accelerations has reached 188 beats·min⁻¹ in males and 189 beats·min⁻¹ in females; between accelerations has decreased in males to 111 beats·min⁻¹, and to 112 beats·min⁻¹ in females. Over 30 s of work during accelerations, sportsmen have overcome approximately 140-150 m, and over 60 s approximately 200-230 m. For one workout sportsmen have crossed about 8-9 km. Energy consumption per one workout averaged 431 kcal in boys and 437,5 kcal in girls, representing about 60.4% of E_{max} in boys and 67.7% of E_{max} in girls.

Workout in mixed mode of energy supply has been conducted under standardized method of interval exercise, according to the program IV. In the basic part of class, oarsmen have performed 4 series of accelerations. Each series has included two accelerations lasting 2,5 minutes with loads intensity during canoeing 85% VO_{2max} . The rest interval between accelerations was 2,5 minutes, between series - 10 min. During the rest, sportsmen rowed with low intensity (25% VO_{2max}). On average, HR during accelerations has reached 182 beats·min⁻¹ in males and 183 beats·min⁻¹ in females; between accelerations HR has decreased and before next acceleration was around 110 beats·min⁻¹ in boys and 111 beats·min⁻¹ in girls. By 2,5 minutes of work on a segment, sportsmen have overcome 480-520 m. During one workout sportsmen have crossed about 9-10 km. Energy consumption per one workout averaged 555 calories in boys and 563 kcal in girls; this numbers have represented about 70,9% of E_{max} in boys and 85,1% of E_{max} in girls. In order to comply with requirements, designed within programs, we have focused on HR, which made it possible to maintain scheduled workload intensity during canoeing. Therefore, speed of crossing training segments and their length has been changing, which was due to the level of athletes' preparedness and phase of menstrual cycle (in women). This helped to avoid rapid addiction to proposed unidirectional exercises. Elucidation of influence features of different modes of training on physical performance, aerobic and anaerobic (lactate) productivity of organism, external respiration, oxygen consumption, bioelectrical activity of heart and blood pressure in a state of relative muscular rest has pointed to such conclusion.

Research results have revealed the presence of gender differences and influence of various physical trainings on oarsmen functional preparedness.

Thus, workout for sixteen weeks in aerobic mode using standardized method of continuous exercise (Program I), despite large energy consumption, were not effective for males. In contrast, women in such studies have contributed significant increase of physical performance by relative measure PWC170 (at 10.38%, $p < 0.05$) and aerobic productivity by relative size of VO_{2max} (at 6.06%, $p < 0.05$) (fig. 1).

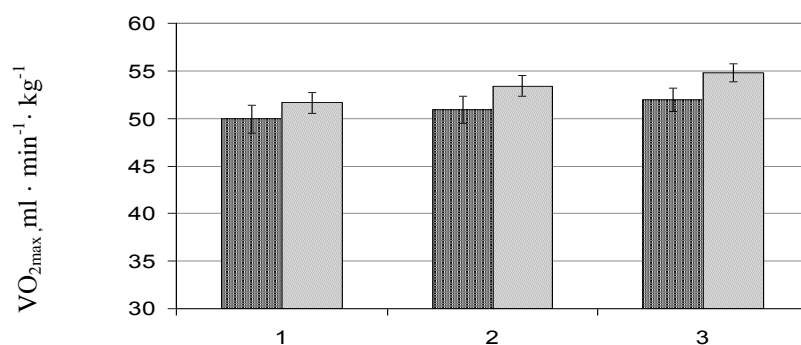


Fig. 1. Dynamics of relative VO_{2max} values under the influence of aerobic exercises using standardized method of continuous exercise (program I): - males - females; 1 - before beginning of training; 2 - after 8 weeks of training; 3 - after 16 weeks of training

Positive changes in bioelectric activity of heart during rest have been observed. This changes appeared in increasing of R-R intervals (at 3.46%, $p < 0.05$) and Q-T intervals (at 3.28%, $p < 0.05$).

Workout with mixed mode of energy supply, using method of continuous variable exercises (program II) during 16 weeks has contributed effective increase of physical performance, aerobic and anaerobic (lactate) productivity both in males and females.

In particular, in males PWC170 relative indicator has grown by 13.43% ($p < 0.01$), and among females - to 17.90% ($P < 0.01$); relative indicator VO_{2max} has improved by 7.70% in males ($p < 0.01$), and by 9,64% ($p < 0.01$) in females; relative index of maximum amount of external mechanical work per 1 minute (MAEW) has raised to 9.37% in males ($p < 0.01$), and to 6.85% ($p < 0.05$) in females (Table. 1).

Table 2. Dynamics of relative indicators of maximum number of external mechanical work (MAEW) per 1 minute in adolescent oarsmen, influenced by physical training using developed programs.

Index	Program	Gender	Average value, $\bar{x} \pm m$		
			Before trainings	After 8 weeks of trainings	After 16 weeks of trainings
MAEW, $\text{kg} \cdot \text{m} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$	I	M	33,98 ± 0,71	34,32 ± 0,88	34,95 ± 0,79
		F	24,31 ± 0,59	24,71 ± 0,51	25,19 ± 0,64
	II	M	35,33 ± 0,72	36,75 ± 0,84	38,64 ± 0,71**
		F	24,95 ± 0,52	25,64 ± 0,60	26,66 ± 0,56*
	III	M	35,65 ± 1,05	38,58 ± 1,04	40,93 ± 0,94***
		F	24,60 ± 0,53	26,22 ± 0,51	27,38 ± 0,76**
	IV	M	37,11 ± 0,69	39,67 ± 0,79*	42,50 ± 0,76***
		F	23,78 ± 0,39	25,23 ± 0,49*	26,61 ± 0,52***

Notes: 1. Probability of differences in relative indicators to initial data: * - $p < 0,05$; ** - $p < 0,01$; *** - $p < 0,001$; 2. M - males (boys); F - females (girls).

Meanwhile such training had caused significant increase of maximal pulmonary ventilation (MPV) in males to 13.47% ($p < 0.05$), and in females- to 14.31% ($P < 0.05$). This numbers indicated increased functions of respiratory system. An average expiratory reserve volume (ER), which shows how you can increase ventilation during canoeing, in males has increased to 1.58% ($p < 0.05$), and in females - to 2.22% ($p < 0.05$). Analysis of electrocardiograms of trained athletes showed growth of myocardial function economy in a state of relative muscular rest both in boys and girls, as indicated by increasing R-R and Q-T intervals. Physical training in girls in such regime has significantly enhanced lung capacity on 4.41% ($p < 0.05$), what indicates improvement of respiratory muscles' functions. Voltage of P wave has decreased, what is assessed as positive phenomenon in athletes who train "on endurance".

Both in males and females, workout in mixed mode of power supply with the use of variable interval exercise method (program III) has also contributed improvement of functional preparedness by the following indicators: physical performance, aerobic and anaerobic (lactate) productivity. PWC170 relative value in males had exceeded the output level on 15.54% ($p < 0.01$) on average; in girls - on 14,20% ($p < 0.05$). Relative magnitude of VO_{2max} on average has improved on 9.18% in boys ($p < 0.01$), and on 8,49% in girls ($p < 0.05$); MAEW on average has increased by 14.81% in boys ($p < 0.001$), and by 11,30% in girls ($p < 0.01$) (see. Table 1). This type of workouts has improved functionality of external respiratory system, as evidenced by growth of

MPV (on 14.52% in males, $p < 0.05$, and to 11.69% in girls, $p < 0.05$); has also enhanced efficiency of myocardial function in a state of relative muscular rest, as indicated by P wave voltage reduction and increase of R-R and Q-T intervals duration.

Training in mixed mode of power supply with the use of standardized method of interval exercise (program IV) with significant stimulation of anaerobic (lactate) processes appeared to be the most effective for representatives of both sexes. These activities might have promoted growth of physical capacity indexes, aerobic and anaerobic (lactate) productivity. In particular, PWC170 in males has improved by 19.61% ($p < 0.001$), by 18,86% in girls ($p < 0.001$); VO₂max in males has grown by 11.81% ($p < 0.001$), and in girls - by 10.81% ($p < 0.001$); MAEW has raised to 14.52% in boys ($p < 0.001$), and to 11,90% in girls ($p < 0.001$) (see Table 1). Influenced by such trainings, absolute (5.42% in males, $p < 0.05$; 4.72% in females, $p < 0.05$) and relative (5.33% in males, $p < 0.05$; 4.47% in females, $p < 0.05$) values of oxygen consumption in a state of relative muscular rest have significantly decreased. Such changes show formation of specific mechanism for respiratory function economization. Rates of MPV (on 15.90% in males, $p < 0.05$; on 11.26% in females, $p < 0.05$) and ER (on 2.27% in males, $p < 0.05$; on 2.26% in females, $p < 0.05$) have increased. Workout in mixed mode of power supply with the use of standardized method of interval exercise has facilitated economization of heart function, what is evidence by significant increase of R-R and Q-T intervals duration and reduce of wave R voltage.

Thereby, workout in mixed mode of power supply (aerobic-anaerobic and anaerobic-aerobic) contribute more effectively improve of oarsmen functional preparedness during preliminary basic training stage, comparing to workouts in aerobic mode. Moreover, such workouts have caused positive changes in physical capacity, aerobic and anaerobic (lactate) productivity, external respiration function, oxygen consumption and cardiac bioelectrical activity both men and women.

It should be emphasized that regardless of training programs, both in boys and girls, substantial changes in average indices of blood pressure and body weight within 16 weeks have not been registered.

Discussion

By means of conducted research was shown the impact of physical training using elaborated programs on results of adversarial distances overcoming in canoeing with kayaks (1000, 500 and 200 m) and on physical preparedness, which was determined by results of control exercises (tests). Control exercises included: speed (60 meters running), general endurance (1500 m running), explosive strength (long jump from place), agility (4×9 m shuttle run), speed-power endurance (lifting of trunk in seed from prone position, per 1 min), strength endurance (bending and unbending of hands in lying position), flexibility (trunk moving forward from a seated position).

Conducted studies evidence that level of physical preparedness in oarsmen is affected by mode of power supply and method of physical training. Furthermore, it was found that there are gender differences in various modes of canoeing training that influence level of physical qualities and results of overcoming competitive distances. Training in aerobic mode of power supply with the use of standardized method of continuous exercise (program I) was ineffective in influencing athletic results in both sexes. Nevertheless, trainings under this program after 16 weeks have significantly improved average index of general endurance in girls. In boys this type of workouts haven't significantly affected the level of physical qualities.

Physical training in mixed mode of power supply, using method of continuous variable exercises (program II), has improved athletic results in canoeing on 1000, 500 and 200 m distances in boys and on 1000 and 500 m distances in girls. Furthermore, such workouts have significantly affected level of total, speed-power and power endurance development in males; general and power endurance in females.

Regardless of gender, workout in mixed mode of power supply with the use of variable method of interval exercise (program III) is likely to enhance results of overcoming 1000, 500 and 200 m distances of competitive canoeing, and level of most physical qualities development.

Most efficient, concerning the influence on sports results, both in boys and girls have been workouts in mixed mode of power supply with the use of standardized method of interval exercise (program IV). Meanwhile, such workouts have greatly increased overall, speed, power and strength endurance.

It has been established that workout in mixed mode of power supply, regardless of sex, more effectively affects physical preparedness of oarsmen and improves outcomes of overcoming 1000, 500 and 200 m competitive distances, comparing to those in aerobic exercise mode.

The research received three types of data: that have confirmed, supplemented existing information, and brand new.

Received data confirms that effectiveness of physical and functional preparedness improvement depends on the mode of work power supply, exercise method and values of internal load (Briskin, 2008; Kerr, 2008; Shynkaruk, 2011; Romanchyshyn, 2015).

It has been also found that regardless of sex, body anaerobic productivity increase can occur only during training in mixed mode of power supply (aerobic-anaerobic and anaerobic-aerobic). Besides, these changes are accompanied by growth of aerobic capacity in athletes. In contrast, use of aerobic exercise facilitate only aerobic capacity improvement (Briskin, 2008, 2016).

Materials of our studies complement information on opportunities of improvement physical and functional preparedness adolescents oarsmen of both sexes (Guo P. 2008; Kerr, R., 2008; Choszcz, 2012; Penichet-Tomas, 2016) with information on loads parameters when applying different modes of training; dependence of sports results on the use of different modes of physical training; peculiarities of application of various workouts modes in oarsmen during preliminary basic training stage.

Completely new research work is developing a program for training classes that specifically stimulate aerobic and anaerobic energy processes in canoe oarsmen during preliminary basic training stage, considering level of functional preparedness of athletes; determining parameters of internal load (by power consumption levels) that can serve as a criteria of physiological stress during aerobic and anaerobic training in male and female oarsmen at the stage of preliminary basic training stage.

Conclusion

1. Studying features of physical and functional preparedness of canoe oarsmen during preliminary basic training allows to develop training exercises programs in canoeing. In the process of program developing it is advisable to consider not only external but internal load. To characterize internal load, energy value of each separate class should be determined. The last should be within optimal range. Parameters of optimal range (minimum and maximum allowable values of energy consumption) depend on functional preparedness of canoe oarsmen. Improved functional preparedness of sportsmen leads to increase of minimum and maximum values of energy consumption.

2. Impact of aerobic and anaerobic workouts on physical and functional preparedness and on results in competitive canoeing exercises during preliminary basic training has gender differences. Training in aerobic mode of power supply (with intensity of load during canoeing 60% VO_{2mah}) was found to be effective only in females. In girls, unlike boys, under the influence of such trainings, physical capacity ($PWC170_{rel.}$ on 10,38%, $p < 0,05$) and aerobic productivity ($VO_{2maxrel.}$ on 6,06%, $p < 0,05$) have significantly increased; cumulative changes in bioelectric activity of heart have occurred, which indicate economization of its functions in state of relative muscular rest; has improved general endurance (2,72%, $p < 0,05$), by result of running 1500 m distance. Training with stimulation of anaerobic (lactate) power supply processes was found to be more efficient for improving physical preparedness, functional preparedness and for outcomes in competitive exercise for adolescent males. Regardless gender of athletes, a workout in mixed mode of power supply (aerobic-anaerobic and anaerobic-aerobic) more effectively improves physical and functional preparedness, compared with exercise in aerobic mode of power supply.

3. Training in mixed mode of power supply, using methods of interval variable exercises (with 90% VO_{2max} load intensity during acceleration; around 25% VO_{2max} between accelerations) and interval standardized exercise (with 85% VO_{2max} load intensity during acceleration; around 25% VO_{2max} between accelerations) most efficient improves physical preparedness of oarsmen of both sexes. In particular, workout in mixed mode of power supply with the use of variable interval exercises method, has significantly improved level of majority physical qualities: speed-strength endurance (in males - to 15,52%, $p < 0,001$; in females - to 13,37%, $p < 0,01$), speed (in males - to 3,87%, $p < 0,01$; in females - to 3,26%, $p < 0,05$), general endurance (in males - to 3,53% $p < 0,05$; in females - to 2,89%, $p < 0,05$), explosive force (in males - by 2,54%, $p < 0,05$; in females - to 2,25%, $p < 0,05$), strength endurance (in males - to 18,61%, $p < 0,05$; in females to 16,11%, $p < 0,05$) and agility (in males - by 2,76%, $p < 0,05$). Workout in mixed mode of power supply with the use of method of standardized interval exercises, have more significantly contributed growth of average values of general endurance (in males - to 4,02%, $p < 0,01$; in females to 3,84 %, $p < 0,01$) and power endurance (in males - to 20,73%, $p < 0,01$; in females - 18,56%, $p < 0,01$).

4. Results of overcoming 200 meters distance (5,44% in males $p < 0,001$; 4,53% in females, $p < 0,01$) were improved the most effectively by a workout in mixed mode of energy supply, using method of interval variable exercises and exercise in mixed mode of power supply with the use of standardized interval exercises method; this modes have facilitated the largest increase in speed of overcoming 1000 m distances (3.13% in males, $p < 0,001$; 2.68% in females, $p < 0,01$) and 500 m distances (5.72% in males, $p < 0,001$; 4.31% in females, $p < 0,001$).

5. Cumulative changes, that have arisen under the influence of training in mixed mode of energy supply, using method of standardized interval exercises (with significant stimulation of lactate anaerobic processes), have appeared sooner than in other programs regardless of sportsmen gender. Besides, such exercises have significantly increased physical capacity ($PWC170_{rel.}$ to 19,61%, $p < 0,001$ in males and 18.86%, $p < 0,001$ - in females), aerobic ($VO_{2maxrel.}$ - 11 81%, $p < 0,001$ in males and 10,81%, $p < 0,001$ - females) and anaerobic (lactate) productivity (IPPC - to 14.52%, $p < 0,001$ in boys and to 11.90% $p < 0,01$ in girls). Under their influence, positive changes in cardiovascular system, external respiratory system and oxygen consumption in state of relative muscular rest have occurred, which indicate formation of a particular mechanism of cardiovascular and respiratory systems economization.

6. Regardless regime of energy supply and method of canoeing training, sessions conducted under designed programs with consideration of internal load, haven't caused any violations in functional state of the

body (by indexes of electrocardiography, spirometry and sphygmomanometry). Aerobic and anaerobic physical training, using various training programs in both genders, haven't caused any substantial changes in indices of blood pressure and body weight in sportsmen within 16 weeks of training.

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