

## INCREASING ENDURANCE DURING THE PHYSICAL TRAINING OF ROWERS

Yanbu WANG<sup>1</sup>, Linqing LIU<sup>2</sup>, Yan GENG<sup>3</sup>

<sup>1</sup>Department of the Physical Training, Beijing Sports University, Beijing,  
People's Republic of China

<sup>2</sup>Department of Physical Education, Peking University, Beijing, People's  
Republic of China

<sup>3</sup>Department of Theory and Methods of Physical Education, National  
University of Ukraine on Physical Education and Sport, Kyiv, Ukraine

**Abstract:** *The relevance of the research of the article is conditioned upon the problem of improving sports achievements at the level of physical fitness of athletes. The purpose of the article is to develop a model for improving endurance in athletes in the direction of the sport of rowing. The method to study the highlighted problem is functional tests for determining endurance in various running parameters, including the index and coefficient of endurance, that will reflect the performance of the athlete's cardiovascular system, which at the level of cyclic and aerobic sports, like rowing, is an important physical indicator in his physical fitness to achieve high athletic results. The article presents a model of improving the physical quality of rowers, such as endurance, conditioned upon the combined use of breathing exercises during classes on the WaterRower M1 HiRISE rowing simulator, where synchronicity factors are monitored at the level of increasing the respiratory phase of exhalation beginning from the starting movement in the parameter of forced exit in duration at the level of performance of 3 strokes, after which the athlete produces a small inhalation and repeats the cyclicality of the respiratory cycle in the factor of performing several stroke movements on exhalation, considering the gradual increase in the number of these movements in the exhalation parameter. The developed model will contribute to the establishment of a stereotype of correct biomechanical movement at the level of a sports skill characteristic of rowing in a parameter that increases endurance, which physiologically directly depends on the degree of exhalation length, and this fact will be reflected in an increase in general and special endurance by heightening the metabolic capabilities of the athlete providing high characteristics for sports results, and this is of practical importance for the field of sports.*

**Keywords:** rowing, physical fitness, endurance, training activity, sport.

Currently, there are tendencies to strengthen the components of various criteria at the level of physical and psycho-emotional training of athletes, which are necessary for them to achieve high results in their sports activities at the level of their participation in various competitive events<sup>1</sup>. In the comparative criteria of analytical activity based on the results of sports skills and abilities, it is possible to trace the regular increases in quality indicators at all levels in the scope of various sports standards, movements, exercises, skills, in which all the constituent elements were increased at the level of extreme stress<sup>2</sup>. This trend

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<sup>1</sup> S.G. Farris, E.K. Burr., M.M. Kibbey, A.M. Abrantes, A.M. DiBello, "Development and initial validation of the exercise sensitivity questionnaire", in *Mental Health and Physical Activity*, 2020, vol. 19, article number 100346; E. Kharytonov, O. Kharytonova, A. Kostruba, M. Tkalych, Y. Tolmachevska, "To the peculiarities of legal and non-legal regulation of social relations in the field of sport [A las peculiaridades de la regulación legal y no legal de las relaciones sociales en el ámbito del deporte]", in *Retos*, 2021, vol. 41, p. 131-137.

<sup>2</sup> O.V. Ivanova, "Analysis of the system of public administration in the field of physical culture

dictates the need to develop additional means within the framework of training athletes, which would allow them to overcome the necessary indicators to increase their physical qualities at a level that allows them to largely possess all the criteria for victory, in which it is necessary to be faster, more resilient and stronger<sup>3</sup>.

One of the well-known and essential sports is rowing, which refers to cyclic, aerobic sports, where many components are important at the level of physical fitness of the body. The cyclical factor, reflected in the monotonous repetition of the same motor act at the level of physical exertion, acts on the body within the framework of dynamic movements in speed characteristics, which puts the athlete in conditions of high endurance, both cardiogenic and muscular<sup>4</sup>. The cyclical factor will also be reflected on the psycho-emotional sphere of the athlete from the position of psycho-emotional tension with the absence of elements of creative interaction, where at the level of teamwork the athlete needs to maintain a certain synchronicity and high muscle-speed work. Considering this direction, both physical and psycho-emotional preparation of an athlete comes to the fore, on which the sports result of the team as a whole will depend<sup>5</sup>. Existing methods of physical training of athletes allow creating criteria for the direction of effective action, which begins to lag behind competitive indicators against the background of almost annual growth, and this dictates the need to consider new options for creating methods, elements that would allow athletes to have higher physical criteria at the level of their physical properties, based on which they will be able to achieve higher results<sup>6</sup>. It must be remembered that in the factor of considering an athlete initially as a physiological organism, the indicative criteria at the level of development of various qualities will qualitatively differ from the usual norms of human physical development in an increasing coefficient, in which there will be a

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and sports in Ukraine”, in *Scientific Bulletin of Mukachevo State University. Series “Economics”*, 2021, vol. 8, no. 1, p. 46-57; N. Galvanetto, “Practical applications of atomic force microscopy in biomedicine”, in *STEMedicine*, 2020, vol. 1, no. 2, p. 1-15.

<sup>3</sup> N.J. Ni Cheilleachair, A.J. Harrison, G.D. Warrington, “HIIT enhances endurance performance and aerobic characteristics more than high-volume training in trained rowers”, in *Journal of Sports Science*, 2017, vol. 35, article number 1052-1058.

<sup>4</sup> B.R. Ronnestad, J. Hansen, H. Nygaard, C. Lundby, “Superior performance improvement in elite cyclists following short intervals vs. effort-matched long interval training”, in *Scandinavian Journal of Medicine & Science*, 2020, vol. 30, p. 849-857; A.A. Turganbekova, R.I. Ramilyeva, D.K. Baimukasheva, Z.K. Burkitbayev, S.A. Abdrakhmanova, “Characterization of the novel HLA-A\*32:95 allele, identified in the Republic of Kazakhstan”, in *HLA*, 2017, vol. 90, no. 2, p. 112-113.

<sup>5</sup> Y. Zhang, S. Qing, I.S. Kravets, “The features of modern students' internal motivation for physical exercises”, in *Scientific Bulletin of Mukachevo State University. Series “Pedagogy and Psychology”*, 2021, vol. 7, no. 2, p. 109-117.

<sup>6</sup> T.I. Gee, N. Caplan, K.C. Gibbon, G. Howatson, K.G. Thompson, “Investigating the effects of typical rowing strength training practices on strength and power development and 2,000 m rowing performance”, in *Journal of Human Kinetics*, 2016, vol. 50, no. 1, p. 167-177.

change at the level of the physiological level of health, which will be compensated by various sports training. It is so important to create criteria for physical activity that would contribute to improving the level of physical qualities in the criteria for preserving the health and well-being of athletes themselves in the factor of maintaining their active life<sup>7</sup>.

Thus, a structure is needed to attract athletes' performance in rowing at the level of optimisation of all components in increasing the values of their physical capabilities, with which they will be able to reach great heights in damage, both daily training activities and within the framework of competitive and pre-competitive work. And this criterion, which will allow providing at the level of increasing the qualitative component in sports activity, physical qualities are observed among which endurance plays a special role at the level of increasing the overall performance of the cardiovascular system within the sports activities of athletes rowers, and the development of an increase model, which is an important component for improving sports results at the level of sports competitions in rowing<sup>8</sup>.

### **Materials and methods**

The study was based on methods of functional diagnostic testing to identify the physical parameters of athletes, which are based on their physical quality endurance, on which the entire performance of the athlete depends on the level of both his training activities and during the preparation for competitions, where training methods are affected at the level of their maximum power, in which endurance has of paramount importance as an indicator of the performance of the cardiovascular system. It allows an athlete to withstand all sports, training loads at a high intensity level while maintaining high-quality indicators of speed and technological parameters in their full manifestation throughout the pre-competitive and competitive activities, which will significantly increase the chances of winning<sup>9</sup>.

The estimated functional tests for endurance were selected within the framework of performing muscular activity at the level of its intensity and

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<sup>7</sup> M. Araban, K.H. Jafarpour, A.A. Arastoo, Z. Gholammnia-Shirvani, A. Montazeri, A.A. Haeri-Mehrzi, "The impact of a theory-based education on physical activity among 'health volunteers': A randomized controlled trial", in *Health Education and Health Promotion*, 2021, vol. 9, no. 1, p. 11-18; O.V. Oliynyk, B.O. Pereviznyk, O.V. Yemiashev, A. Shlifirchyk, "The effectiveness of corticosteroid usage in complex therapy for severe sepsis and acute respiratory distress syndrome in cases of severe traumatic brain injury", in *Advances in Clinical and Experimental Medicine*, 2016, vol. 25, no. 6, p. 1223-1226.

<sup>8</sup> J.P. Zlotnicki, J.H. Naendrup, G.A. Ferrer, R.E. Debski, "Basic biomechanic principles of knee instability", in *Current Reviews in Musculoskeletal Medicine*, 2016, vol. 9, p. 114-122.

<sup>9</sup> G.P. Millet, O. Girard, A. Beard, F. Brocherie, "Repeated sprint training in hypoxia – an innovative method", in *German Journal of Sports Medicine*, 2019, vol. 70, p. 115-122.

characteristic factors of work. So, for the study of athletes, tests were used: running for 60 meters, running for 2,000 meters, running for 6 minutes, in which the heart rate is monitored at its level before passing the test and after it in factors immediately after stopping, and within the time indicator of restoring the heartbeat at the level of its normal indicators in a time interval that it is compared within the norm in the time criterion of up to 2-3 minutes<sup>10</sup>. The endurance index (IV) was also determined according to the standard formula:

$$IV = t - tk * n, \quad (1)$$

in which the product of the time of passing a part of the distance and the number of these parts are subtracted from the total time of passing the distance (t), the result was determined based on the factor of standard indicators, in which the lower the numerical indicators of the index, the higher the physical quality of endurance. The study also determines the endurance coefficient (KV), calculated based on the Kvas formula, where  $KV = RHR * 10 / \text{pulse pressure (PP)}$ . Where PP is calculated within the framework of the difference in systolic and diastolic pressure. The generally accepted norm of the endurance coefficient is within the numerical limits of 16. The indicators identified during the study are determined in the parameter, if the KV is greater, then this is defined as a decrease in the endurance factor, and if the indicators are below 16, then we can talk about an increase in endurance.

Thus, considering the data of the above-described tests of the physical quality of endurance, it is possible to identify trends in its increase, depending on the methods used in the physical training of athletes. When calculating the overall results of the study, the standard method of mathematical calculation and graphical representation of the results was used.

The pedagogical experiment was conducted based on Rowing Associations of China, Hong Kong, China. A diagnostic study was conducted among 49 athletes rowers, aged 18 to 25 years.

This problem was investigated in three stages, and at the first stage, a theoretical analytical study of the available research and methodological literature on the problem under study was conducted as part of the development of a model for the formation of the training process at the level of adaptation to an increase in load with indicative elements in the factor of improving the physical quality of endurance in athletes rowers<sup>11</sup>. In the course of this work, the existing problem, the main goal were identified, research

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<sup>10</sup> A. Mohammadzadeh, N. Ghanbari, S. Taj Abadipour, S. Arabnejad, "The effectiveness of acceptance and mindfulness-based therapy on physical activity increment and obesity decrement in the patients suffering from heart disease", in *Health Education and Health Promotion*, 2020, vol. 8, no. 2, p. 73-77.

<sup>11</sup> A. Lee, R.G. Reran, "Editorial: Better education and training to avoid medical mishaps", in *Medicine and Law*, 2019, vol. 38, no. 1, p. 1-4.

methods were selected and an active work plan was developed. At the second stage, a diagnostic study of athletes and the basic part of this experimental work was carried out with a detailed analysis of the results and formulation of conclusions. At the final third stage, the data were verified and the conclusions were clarified, including the systematised results obtained.

## **Results and discussion**

During the pedagogical experiment, the obtained results of diagnostic testing were analysed at the level of detailed semantic analysis, pedagogical observation with the necessary clarifications, which made it possible to determine important and relevant factors at the level of physical fitness of athletes in the direction of rowing. It will reflect their overall fitness at the level of preparation of their body for intense physical exertion as part of sports training at the level of an increase in all factors of physical properties necessary for adaptation at the personal level within the framework of increasing physical activity during training activities, pre-competitive and competitive, which in general will reflect the preparation of a rower athlete at the level of sustainable development to overcome his adaptive capabilities at the level of performing intense physical activity<sup>12</sup>. In the indicator under consideration, one of the important physical qualities is endurance, which is of particular relevance in the framework of considering a cyclic aerobic sport, which is rowing.

If we consider in detail the structural elements of the rowing training process, then they will be reflected to a greater extent in the factor of adaptation at the level of high intensity to aerobic exercise, for which the physical quality of endurance is responsible, including the technicality of performing rowing movements at the level of maintaining speed and within the framework of correct performance by biomechanical factors of cyclically repetitive movement characteristic of rowers what will be in the indicator of the correct fit, the coordinated work of the musculoskeletal muscles at the level of controlling the position of the body with the distribution of the necessary criteria in various loads on it, each of which will be responsible for its function, or maintaining a pose, or support, as well as static or dynamic movements. And in addition to performing technological at the level of correct movement in the factor of synchronicity, the trajectory of movements, the physical strength of this muscle group will also be important here, which should have criteria at the level of strength endurance for performing a full cycle of movements against the background of not only high intensity, but also in the parameter of a long time duration<sup>13</sup>. Since athletes must overcome various

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<sup>12</sup> M.J. MacInnis, M.J. Gibala, "Physiological adaptations to interval training and the role of intensity", in *Journal of Physiology*, 2017, vol. 595, article number 2915-2930.

<sup>13</sup> V.V. Kondratenko, I.A. Zaitsev, A.M. Nesterenko, L.V. Homon, G.N. Chykolba, "Modern

distances at the level of training and competitive action, and for this they will use various mechanisms at the level of creating a reflex motor act within the framework of the necessary sports trajectory of the rowing movement<sup>14</sup>.

Also, long-term overcoming of a sports distance implies not only local movement of the upper limbs at the level of rowing movement, but in the factor of the work of the entire musculoskeletal system, where other muscle groups will often be in a static position, exercising the effect of a lever for the movements of the upper shoulder girdle, which will build biomechanical lines of the body, and in such a way that the correct dynamic work of the shoulder girdle was disrupted at the level of biomechanics of movement in the factor of performing strokes of the proper level. Based on this, the entire musculoskeletal system at the level of physical fitness should be at the level of a harmonious distribution of power load, which will provide motor and speed stability during motor and cyclic strokes<sup>15</sup>.

Thus, there are several important components in the professional training of rowing athletes, in which the development of cyclic performance of rowing movements at the level of correct biomechanics, together with the position of the athlete's musculoskeletal system, should be at the level of developed reflex movement, including the second main component is general and special endurance, which will be an indicative criterion for success in training and competitive activity at the level of adaptation to high-intensity loads, and within the framework of overcoming long sports distances<sup>16</sup>.

Endurance is based on the factor of cardiovascular performance, which allows lengthening the time intervals within the framework of an individual's sports work at the level of increasing the duration of sports load at a high-speed pace to maintain its necessary intensity. It is also reflected in the framework of the integral process of the training process with significant dynamics indicators at the level of reducing or increasing the load within the adaptive system of maintaining cardio-respiratory system within the framework of contributing to the maintenance of normal vital signs of the athlete's body<sup>17</sup>.

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information technologies in the process of physical education in universities of Ukraine”, in *Scientific Bulletin of Mukachevo State University. Series “Pedagogy and Psychology”*, 2021, vol. 7, no. 2, p. 101-108.

<sup>14</sup> L.T. Yang, “Study on the adult physique with the Heath-Carter anthropometric somatotype in the Han of Xi’an, China”, in *Anatomical Science International*, 2016, vol. 91, no. 2, p. 180-187.

<sup>15</sup> F.J. Nugent, T.M. Comyns, N.J. Ni Cheilleachair, G.D. Warrington, “Within-session and between-session reliability of the seven-stroke maximal effort test in national level senior rowers”, in *Journal of Australian Strength and Conditioning*, 2019, vol. 27, p. 22-28.

<sup>16</sup> M. Bianchi, A. Renzini, S. Adamo, V. Moresi, “Coordinated actions of micro with other epigenetic factors regulate skeletal muscle development and adaptation”, in *International Journal of Molecular*, 2017, vol. 18, no. 4, p. 840; S.A. Abdrakhmanova, Z.Z. Zhanzakova, A.A. Turganbekova, Z.K. Saduakas, “Assessment of hematopoietic stem cell molecular engraftment based on STR analysis”, in *Cellular Therapy and Transplantation*, 2019, vol. 8, no. 3, p. 26-27.

<sup>17</sup> O.V. Oliynyk, M. Rorat, W. Barg, “Oxygen metabolism markers as predictors of mortality in

It is known that high indicators at the level of personal development within the quality of endurance allow an athlete to successfully cope with constant large aerobic sports loads, which also often increase at the level of psychogenic factors.

In rowing, the state of the psycho-emotional sphere also greatly affects the development and training within the physical criteria of athletes, so conditioned upon the specifics of the sport of rowing, which has a cyclical character at the level of monotony of performance, it makes up certain stress criteria for the psycho-emotional sphere. This is also observed at the level of preparation for competitive activity, which is a factor in achieving success in the sports career of every athlete, even those engaged not only professionally, but also at the level of personal hobbies, but psychological pressure factors in which it is necessary to overcome many personal opportunities at the level of the use of willpower, and in a borderline state for healthy functional indicators, where these criteria are aggravated by the exerting psychological pressure of competitive activity, which in turn burdens both the physical parameters of the body, and in the parameter of psychoemotional and physical training of the athlete<sup>18</sup>.

Thus, it is necessary to choose methods that increase personal sports potential, which is expressed at the level of development of the necessary physical qualities for rowing, where endurance is at the level of the main criterion, since it provides the necessary resources at the level of energy supply in the flowing aerobic mechanism at the level of the body, which will also ensure the maintenance of healthy life support for the athlete himself, as a person. It must be remembered that at the level of physiology, the human body has criteria at the level of clear boundaries in the factor of performing certain physical actions within the anatomical and physiological norm, and that within the framework of various movements can occur at different levels in parameters such as aerobic exercise in overcoming the threshold of the distance length in various forms at the level of time, speed factor or with an increase in muscle load, which would reflect an increase in the intensity factor and the power of tension, to perform the necessary tasks<sup>19</sup>.

Thus, the existing norm of physiological prerequisites and structure at the level of normal physiology and anatomy can be increased at the level of maintaining healthy energy conservation, only considering the level of

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severe COVID-19”, in *International Journal of Infectious Diseases*, 2021, vol. 103, p. 452-456

<sup>18</sup> I. Shigenori, “High-intensity interval training for health benefits and care of cardiac diseases- The key is an efficient exercise protocol”, in *World Journal of Cardiology*, 2019, vol. 11, p. 171-188; A.O. Gavrilov, S.M. Seĭdinov, A.A. Iusupov, “Structural and clinical characteristics of elderly and senile patients' treatment in regional surgical hospital”, in *Khirurgiia*, 2011, no. 6, p. 56-59.

<sup>19</sup> T.J. Kauh, “Building a culture of health through research: the role of the physical activity research center”, in *Preventive Medicine*, 2020, vol. 130, article number 105894.

physiological compensations based on various factors that are responsible for compensatory reactions that allow increasing the physical and psycho-emotional capabilities of the body along with maintaining the norms of functional physical health, and in case of non-compliance, which the athlete will develop various diseases, or the traumatic component will increase. So, for any athlete, factors are important that, along with an increase in his athletic potential, will contribute to the preservation of his health, which is also a factor indicating that various kinds of sports load were selected correctly, and criteria supporting the adaptive reactions of the body were preserved at the level of increasing the intensity of physical factors in the preparation of athletes, which are observed at the level of principles of gradualness, individually dosed load, as well as general concepts and conditions that are within the physiological parameters of the methods used in the training process<sup>20</sup>.

Proceeding from this, it is necessary to recall that the natural dynamic movements that are produced by athletes rowers at an intensive level in the factor of long and repeated repetition, it is required to train at the level of their physical movement in the factor that increases endurance, behind which among the various physical movements there are breathing exercises, and it is thanks to them that the above elements can be increased at the level of increasing endurance within the framework of physiological compensation that allows maintaining basic health indicators, both on the part of the musculoskeletal system and at the level of the cardio-respiratory system<sup>21</sup>. So in this consideration, it will also be important to combine the effects of physical exercises in their optimal ratio, which will support the parameters of both a training nature at the level of increasing the physical fitness of athletes and in maintaining physiological health factors.

Thus, there is a need to develop a model in sports physical training of athletes, considering the above-described selected elements and parameters that will make up the improvement of sports training in rowing at a level that increases various physical properties and criteria, which, when systematically applied at the level of the correct gradual dosage, will create methodological prerequisites and recommendations in the training process, which will increase and qualitative indicators at the level of physical achievements leading to high results at the level of competitive activity<sup>22</sup>.

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<sup>20</sup> E.A. Wikstrom, K. Song, B.G. Pietrosimone, J.T. Blackburn, D.A. Padua, “Visual utilization during postural control in anterior cruciate ligament- deficient and -reconstructed patients: systematic reviews and meta-analyses”, in *Archives of Physical Medicine and Rehabilitation*, 2017, vol. 98, article number 2052-2065.

<sup>21</sup> A.K. Baimbetov, K.A. Bizhanov, K.B. Abzaliyev, B.A. Bairamov, I. Yakupova, “Prediction of arrhythmia recurrence after atrial fibrillation ablation in patients with normal anatomy of the left atrium”, in *International Journal of Clinical Practice*, 2021, vol. 75, no. 6, article number e14083.

<sup>22</sup> P.S. Tandon, M. Klein, B.E. Saelens, D.A. Christakis, A.J. Marchese, L. Lengua, “Short term impact of physical activity vs. sedentary behavior on preschoolers' cognitive functions”, in



Considering the above, all the parameters and features identified in this study and analysed separately as its effective components were taken into account, which in its entirety opens the process of forming a model of training exercises that help to increase endurance in athletes of rowers. The result of the study under consideration is the degree of development of the model in question at the level of its implementation in the field of practical application at the level of sports activities in rowing.

This experimental research work with the created model of improving the physical quality of endurance with the help of combined physical exercises at the level of development of dynamic technological movements characteristic of rowing sports activities was introduced into the educational process in several stages, which included determining the initial level of physical indicators within the framework of qualitative indicators of physical performance at the level of endurance, due to the passage of the selected, above-described testing methods within the control and measurement data of the evaluation components to identify the existing degree of endurance in athletes rowers<sup>23</sup>.

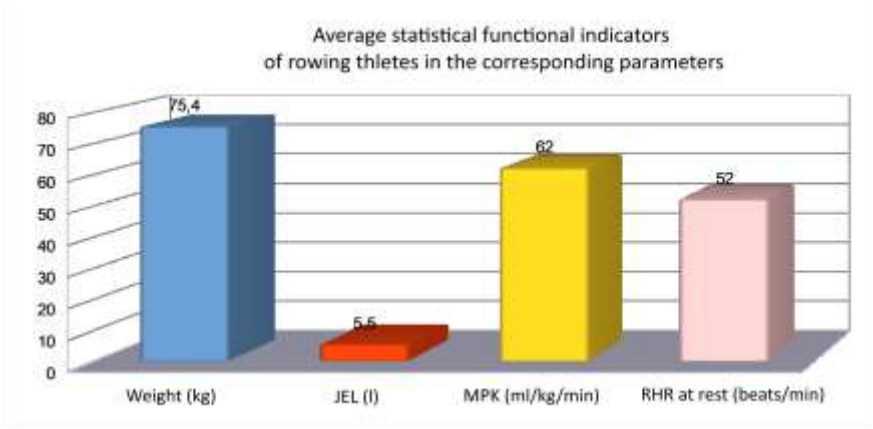
The data obtained were further statistically processed and then, at the next stage, the development and implementation of an important model based on the above parameters of the application of physical factors allowing the training process to increase physical performance in time for its subsequent introduction into the field of practical sports in the direction of rowing took place, which made it possible to determine the level of its importance and effectiveness at a high, important solution in the task of improving the professional training of athletes in rowing.

Thus, the pedagogical research covered 49 athletes in the category of rowing, who were examined at the level of evaluation functional tests, allowing to identify factors in the direction of physical and functional development at the level of physical fitness based on the necessary criterion for qualitative consideration, such as endurance. Also, before the main testing, the functional characteristics of athletes were determined at the level of determining their weight, vital capacity of the lungs (VCL), maximum oxygen consumption (MOC), resting heart rate (RHR) before the study, which reflect the physiological indicators of athletes. This is shown in Figure 1.

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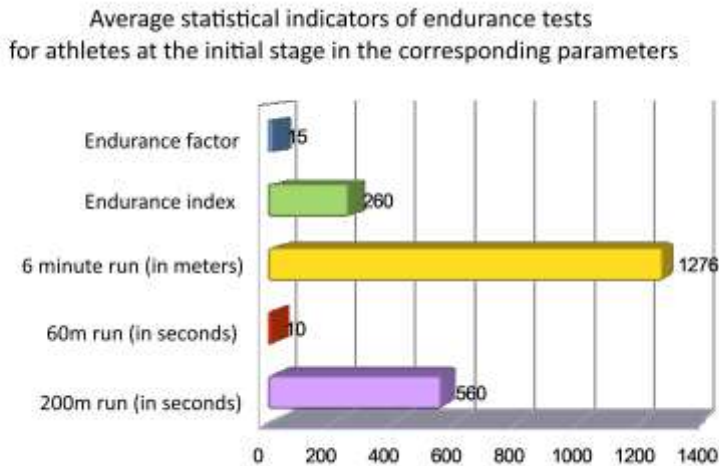
*Mental Health and Physical Activity*, 2018, vol. 15, p. 17-21.

<sup>23</sup> V.F. Gorban, A.O. Andreev, V.O. Stolbovyi, S.O. Firstov, M.V. Karpets, "Influence of the lattice parameter on physical properties of high-entropy coatings", in *Scientific Herald of Uzbborod University. Series "Physics"*, 2021, vol. 49, p. 61-65.



**Figure 1: Functional indicators of athletes rowers at the level of their average statistical data in the corresponding measurement units**

The results obtained during testing of the estimated functional component of endurance in various parameters are shown in Figure 2.



**Figure 2: Average statistical indicators of endurance assessment tests for rowing athletes at the initial stage of the study**

Thus, effective indicators were identified regarding the performance of functional tests to assess endurance in the framework of the performance of athletes by rowers running for 60 meters, running for 2,000 meters, running for 6 minutes, and their index and coefficient of endurance were determined. Based on the results obtained and reflected in Figure 1, we can say that the level of endurance is within the average indicators. Also, the revealed data

indirectly allow speaking about the level of their proficiency within the framework of physiological biomechanical work at the level of technological sports motor skills, reserve capabilities in the neuromuscular apparatus factor, which allows reflecting an increase in the quality indicators of technological sports movements, including the speed of using internal personal expenses at the level of various intramuscular energy sources. This generally reflects the indicators that can be improved by improving skills at the level of acquisition of reflex movement in the parameter of sports biomechanical movements in rowing<sup>24</sup>.

Conditioned upon the average endurance indicators, it can be said that athletes get tired during the training load and this increases with an increase in its intensity, which leads to an unacceptable change in the technique of sports rowing movements, and so subsequently the system of toning and coordinated work of the musculoskeletal system is disrupted, which leads to injuries and other pathological conditions<sup>25</sup>. And it is also reflected in general, in the violation of synchronisation in motor acts at the level of teamwork, and this is reflected in an amplifying reflection at the level of emerging and re-intensifying psychoemotional fatigue at the level of the impossibility of achieving the desired indicative training and functional results. And this, in turn, will affect the indicators of general physical fitness and, in fact, significantly reduce the chances of successful training and competitive results, in which there is a need to increase general and special endurance. It will generate factors of nervousness and uncontrolled physiological adaptive moments of loads, which should be clearly structured at the level of metered and individual gradualness, and so that it will again lead to violations in the systems of the athlete's body<sup>26</sup>.

During the competition, there is an increase in all reserve characteristics at the functional level of the athlete's body development, to the level of their maximum capabilities, which reflect both strength, speed, and energy,

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<sup>24</sup> S. Rahimi, M. Peeri, M. A. Azarbayjani, L. Anoosheh, E. Ghasemzadeh, N. Khalifeh, A.A. Salari, "Long-term exercise from adolescence to adulthood reduces anxiety-and depression-like behaviors following maternal immune activation in offspring", in *Physiology & Behavior*, 2020, vol. 226, article number 113130.

<sup>25</sup> B. Flores, T. Tran, "Use of neural networks in the formation of a high-quality smoothed audio signal", in *Scientific Herald of Uzbborod University. Series "Physics"*, 2021, vol. 49, p. 35-42; A. Tlemissov, B. Zhunissov, M. Buleshov, A. Buleshova, S. Seidinov, K. Sultanbekov, A. Talgatbek, T. Bulegenov, A. Myssayev, A.M. Grijbovski, "Does the number of injuries among elderly people in Kazakhstan increase during Ramadan?", in *Public Health*, 2017, vol. 142, p. 70-72; E.S. Baïmyshev, K.B. Abzaliev, "A rare form of internal hernia [Redkaia forma vnutrennei gryzhi]", in *Vestnik khirurgii imeni I. I. Grekova*, 1986, vol. 137, no. 9, p. 81-82.

<sup>26</sup> K. Karkazis, R. Jennifer, "U.S. Tracking, Professional athletes: the ethics of biometric technologies", in *American Journal of Bioethics*, 2016, vol. 17, no. 1, p. 45-60; E.S. Baïmyshev, K.B. Abzaliev, T.S. Karibekov, "Prevention of postoperative eventration [Profilaktika posleoperatsionnoi éventratsii]", in *Vestnik Khirurgii Imeni I.I.Grekova*, 1988, vol. 141, no. 7, p. 119-120.

including psycho-emotional indicators of the athlete, which at the same time may vary depending on the stage of the competitive process. Thus, indicative results at competitions are associated with various factors of functional reserve abilities of athletes, and the data obtained during the study show that the existing factors identified at the level of testing reflect that there are trends to increase these criteria, which within the adaptive system can be developed at the level of application of breathing exercises in justification with the factor of increasing the exhalation phase at the level of application of a physiological stereotype of movements, which will significantly increase the functional indicators of physical qualities, as well as increase their endurance<sup>27</sup>.

Breathing exercises for athletes at the level of improving methods in their physical training should be optimally performed at the level of performing special sports motor acts within the framework of forming a stereotype of physical movement, like strokes, at the level of their correct biomechanical movement, which together will contribute to maintaining conditions for a comprehensive impact at the level of developing a full-fledged sports motor act, where they will participate the muscular apparatus of the body and the cardio-respiratory system in the dosed load factor at the level of its gradual increase from the side of rowing movements. Also, cyclic and repeated repetition of rowing movements will allow developing special muscle strength, which are responsible for a professional motor act, and in the factor of increasing the load, training will manifest itself at the level of identifying the maximum muscle strength for the athlete, which will be enhanced at the level of increasing the quality of special endurance, in which general endurance will be of great importance<sup>28</sup>.

Cyclic strength training, in turn, will increase the muscle mass of various muscle groups involved in movement, which are necessary for the successful performance of professional sports movements, and this, in turn, will reflect the success of the training process, and by contributing to the increase in speed and strength factors of performing special rowing movements, thereby allowing at the level of competitive activity reflect the success in performing synchronous movements in the factor of team participation in rowing. Thus, it is necessary to create conditions for the development of automatism of professional sports movements, such as rowing in combination with the correct physiological movement in the factor of increasing at the level of

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<sup>27</sup> R.W. Kissane, S. Egginton, G.N. Askew, "Regional variation in the mechanical properties and fibre-type composition of the rat extensor digitorum longus muscle", in *Experimental Physiology*, 2018, vol. 103, p. 111-124.

<sup>28</sup> J.E. Simon, C.L. Docherty, "Health-related quality of life is decreased in middle-aged adults with chronic ankle instability", in *Journal of Science and Medicine in Sport*, 2018, vol. 21, no. 12, article number 1206-1209; N. Galvanetto, "Single-cell unroofing: probing topology and nanomechanics of native membranes", in *Biochimica et Biophysica Acta - Biomembranes*, 2018, vol. 1860, no. 12, p. 2532-2538.

physiological adaptation of respiratory acts, within the framework of performing physical exercises at the level of their dynamic mechanism, in the position necessary for the rower, including breathing exercises in the adaptive indicator at the level of increasing the necessary aerobic adaptive capabilities of athletes. This will provide athletes rowers with the opportunity to overcome training fatigue at the level of increasing endurance at the level of acceptable training load in different required intensity, as well as in the parameters of interval training and competitive activity<sup>29</sup>.

The above-described revealed parameters show the need to create a model to improve the physical quality of endurance in athletes of rowers at the level of improving the training process. Thus, the implementation of the conditions of pedagogical experimental research work required methodological analysis and allowed identifying its main parameters, which would be based on a generalised approach based on the creation and retention of physiological parameters of athletes' health based on the use of adaptive physical exercises at the level of development of compensatory reactions in their cardio-respiratory system.

Based on the position under consideration, a model was developed to improve the training process of rowing athletes, which allows increasing general and special endurance, and developing a combined stereotype of professional sports movement at the level of multiple cyclic repetition of strokes with combined breathing at the level of the developed system within the framework of increasing the adaptive abilities of the cardio-respiratory system, by performing special dynamic movements of the upper shoulder girdle when practicing on the WaterRower M1 HiRISE rowing simulator at the level of conscious control of respiratory movements. It will be performed as part of the extended forced exhalation starting from the initial starting movement phase, and the exhalation will continue at the level of athletes performing several rowing movements, followed by a natural small inhale, and then with a subsequent repetition of the forced extended exhalation in the factor of performing several motor rowing acts at the level starting from 3 strokes, and later with an increase in the described criteria of strokes, and this is cyclically repeated, and so at the level of increasing compensatory processes, there is a gradual increase in exhalation based on its duration at the level of increasing the strokes performed.

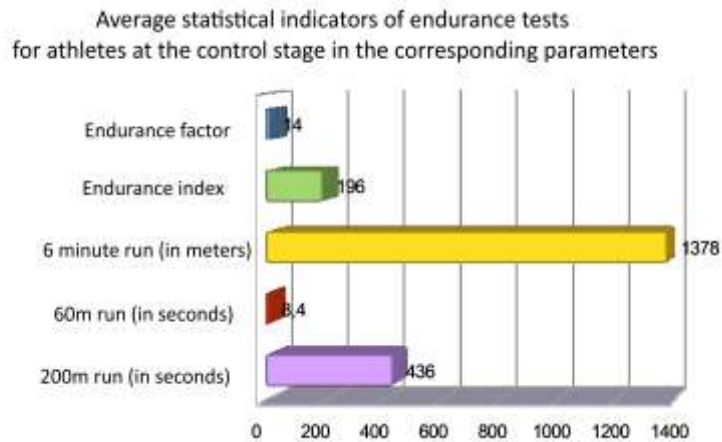
Further, at the control stage of the study, the obtained data were revealed within the framework of dynamics, considering the identified results after repeated functional testing of the estimated components of endurance after testing the developed method of improving the training process, which made it

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<sup>29</sup> H.P. Sari, "Program Evaluation Coaching Athletes Sports Week National Sports Badminton South Sumatra Province", in *Journal of Physical Education and Sports*, 2017, vol. 6, no. 3, p. 261-265.

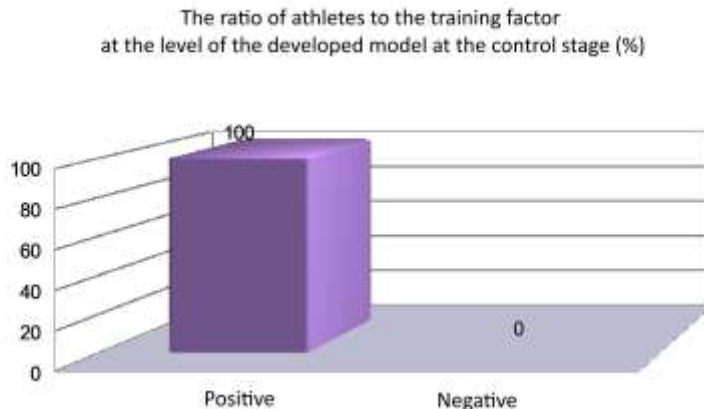
possible to identify its success at the level of increasing functional indicators reflecting a qualitative increase in physical performance at the level of endurance of the cardiovascular system.

Figure 3 shows the results of evaluation functional tests, which show a total increase in the indicators of increasing the possibilities of doing aerobic exercise.



**Figure 3: Average statistical indicators of endurance assessment tests for rowing athletes at the control stage of the study**

Also, the indicators of the resting heart rate of athletes were identified at the level of its decrease, the average calculated limits of its indicators were revealed within 47 beats per minute, and it should be noted that the return of heart rate after performing a training load according to the developed method was within the time norm. Also, at the level of pedagogical refinement, a positive attitude of athletes rowers to the developed method of the training process was identified, which allows increasing endurance at an effective level based on the control results obtained, which is important for their psycho-emotional sphere, and this is shown in Figure 4.



**Figure 4: Distribution of students depending on their attitude to the training process at the level of the developed model at the control stage**

The data obtained allow saying that the developed model is successful, and it makes it possible at a qualitative level to create conditions for increasing the physical quality of endurance at the level of formation of an automated motor act with a factor of combined performance at the level of respiratory phases, which together will be reflected in the level of increasing the efficiency of the cardiovascular system against the background of maintaining health parameters based on physiological aspects of the used elements of the developed training method.

In this study, its correctness was ensured. Since the characteristics and these parameters of the functional studies and the developed elements of the model were comparable in the study correctly, and the analysis of its results allowed determining that the developed model of increasing endurance at the level of physical fitness of athletes can significantly improve the training process for the preparation of athletes in rowing.

Professional sports training of athletes in rowing has important components for the development of physical qualities, among which endurance plays a special role, since rowing belongs to a cyclic aerobic sport in which endurance has comparable motor elements in the mutual connection of biomechanical manifestations, physical properties, physiological indicators, which makes the development of endurance a complex component at the level of sports training, in which professional sports skills should be provided along with the factors responsible for the athlete's performance. Throughout the training process, rowers perform many different physical exercises in which breathing exercises play a special role, because thanks to them, the functional support of the body is carried out at the level of inclusion of compensatory adaptive mechanisms that allow athletes to maintain their level of health along with their intensive training process, as well as in the factor of competitive

actions, since the use of respiratory movements at the level of the physiological mechanism of action in their application, they allow to increase the functional capabilities of the body of a rower athlete<sup>30</sup>.

Over time, with long classes, the developed training system will allow to reveal the personal potential of the athletes of the rowers, which will ultimately be expressed at the level of their successful competitive activity. Notably, the developed model for improving the training method also allows the administrative and training staff to monitor and control various processes at the level of athletes performing the necessary motor movements, landing, breathing, speed phenomena, phase elements within the framework of the integration of the training process at the level of increasing or decreasing the intensity of the load, which also carries great importance within the physical training of rowers in their coaching support. An increase in endurance also has a special role in the importance of increasing the rowing movement itself, which will qualitatively increase the necessary distance, but considering that an increase in professional rowing movement increases the load within the framework of increasing the load capacity on the body, and in this case, the factors of increasing endurance will carry a compensating moment within the framework of maintaining athletic performance among rowers<sup>31</sup>.

Thus, the developed model of increasing endurance among athletes rowers allows to improve the physical and functional capabilities of the athletes' body at the level of increasing their performance, speed and strength capabilities, and also creates conditions for the successful recovery of their nervous and energy processes after training or competition, and also allows to strengthen competitive results, which ensures the importance for the field of sports activity at the level of sports in the direction of rowing.

## Conclusions

The application of the developed model of the method at the level of the training process for athletes of rowers, which allows increasing the physical qualities of endurance, both general and special, which provides a significant

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<sup>30</sup> K. Till, B.L. Jones, S. Cobley, D. Morley, J. O'hara, C. Chapman, "Identifying talent in youth sport: a novel methodology using higher-dimensional analysis", in *PLoS ONE*, 2016, vol. 11, no. 5, article number 155047; I.R. Ramilyeva, Zh.K. Burkitaev, S.A. Abdрахmanova, A.A. Turganbekova, D.K. Baimukasheva, E.B. Zhiburt, "Distribution pattern for HLA specificities in the patients with acute myeloid leukemia", in *Medical Immunology (Russia)*, 2019, vol. 21, no. 5, p. 965-972.

<sup>31</sup> T. Rees, L. Hardy, A. Gullich, B. Abernethy, J. Coe, T. Woodman, C. Warr, "The great British medalists project: A review of current knowledge on the development of the world's best sporting talent", in *Sports Medicine*, 2016, vol. 46, no. 8, article number 1041-1058; N. Galvanetto, A. Perissinotto, A. Pedroni, V. Torre, "Fodis: software for protein unfolding analysis", in *Biophysical Journal*, 2018, vol. 114, no. 6, p. 1264-1266.



improvement in the indicators of sports achievements at the level of both training and competitive process, allows improving sports achievements at the level of physical fitness of athletes. Thus, the developed model of the method of increasing endurance includes the combined use of breathing exercises aimed at increasing exhalation during training on the WaterRower M1 HiRISE rowing simulator, where synchronicity factors will be present in performing dynamic and respiratory movements, at the level of the formed increase in exhalation starting from the starting movement in the parameter of the duration of the exit at the level starting from 3 strokes in the factor after this increase, and after which the athlete takes a small breath, and then at the level of cyclicality, the given stereotype of strokes on exhalation is repeated, and so taking into account the gradual increase in these movements in the necessary biomechanical criteria. Such classes will contribute to the development of a professional, automated stereotype of biomechanical sports movement at the level of sports skill in the direction of rowing, which in general will allow an athlete to increase his athletic performance at the level of aerobic exercise, and will create conditions for increasing his speed and technological qualities, thus ensuring his athletic results, which is of practical importance for the field of sports.

This experimental study makes a great contribution to the field of sports pedagogy and practical sports in rowing, and the cognitive component of this article will be useful for athletes, coaches, methodologists, and other workers in the field of sports, and can be applied in practice, which will contribute to improving the effectiveness of training successful professional athletes in rowing, thus solving one of the important tasks in the field of sports.