**УДК 796.06.09**

**Совершенствование спортивной подготовки стайера на этапе спортивной специализации**

**IMPROVING THE SPORTS TRAINING OF THE STAYER AT THE STAGE OF SPORTS SPECIALIZATION**

**Поборончук Татьяна Николаевна**, **Poboronchuk Tatiayna,** кандидат технических наук, доцент, доцент кафедры физической культуры и здоровья, Сибирский государственный университет науки и технологий им. М.Ф. Решетнева, г. Красноярск, Россия, https://orcid.org/ 0000-0005-0080-2778, e-mail:poboronchuk\_tn@mail.sibsau.ru

**Мартиросова Татьяна Александровна**, **Martirosova Tatiayna,** доктор педагогических наук, доцент, профессор кафедры физической культуры и здоровья, Сибирский государственный университет науки и технологий им. М.Ф. Решетнева,г. Красноярск, Россия, https://orcid.org/0000-0002-2193-3120, e-mail: [tat.martirosova@yandex.ru](mailto:tat.martirosova@yandex.ru)

**Лимаренко Ольга Владимировна,**

**Таксономия:**

**Поборончук Татьяна Николаевна (СИ, ПИ)**

**Мартиросова Татьяна Александровна (М, ПИ)**

**Лимаренко Ольга Владимировна (ПР).**

**Abstract.**

***Introduction.*** To achieve high sports results, a well-functioning training system for stayer athletes is required. The main component of this system is competitions that act as an end, means and method of sports training. The sports training system is a set of knowledge, means, methods, organizational forms, conditions that interact with each other in practical activities. They operate on the basis of pedagogical principles and principles of sports training, rules that ensure the highest degree of the stayer readiness enabling them to achieve the highest sports achievements, therefore, it is necessary to improve the process of sports training of the stayer at all stages of the training process. Studies conducted to improve the performance of stayers are relevant.

***The purpose of the study:*** to identify, implement and experimentally test sports training factors that contribute to increasing the performance of stayers at the sports specialization stage.

***Materials and methods.*** The experiment was attended by 15 13-year-old stayers of the "Fast, strong, hardy" ("Быстрые, сильные, выносливые") athletics club in Krasnoyarsk. They have qualifications of the II sports category. The main research methods were the analysis of scientific and methodological literature, polling, testing of the functional state by performing the PWC170 test with bicycle ergometer, statistical processing of results.

***Results***. Before the experiment, the results of the PWC170 test were 1500±220 kgm/min; relative PWC170 - 20±2 kgm/min/kg; the relative value of the maximal oxygen consumption - 58±8 (MOC/kg); cardiac index when performing the PWC170 test - 2,6±0,5. At the end of the experiment, the PWC170 test results were 1861±250; relative PWC170 - 23±2 kgm/min/kg; the relative value of the maximal oxygen consumption - 62±7 (MOC/kg); cardiac index when performing the PWC170 test - 3.2 ±0,5.

***Conclusions.*** The study was carried out during the general sports training preparation period, which explains the not so high results of 13-year-old stayers. However, the results show a good prospect for revealing the functional-adaptive, physical potential of those involved and improving their sports training at the sports specialization stage.

**Ключевые слова:** спортивная подготовка, стайер, легкая атлетика, спортивная специализация.

**Key words:** sports training, stayer, athletics, sports specialization.

**Introduction**. The Ministry of Sport of the Russian Federation, on the basis of the Federal Law "On Physical Culture and Sports in the Russian Federation" dated 04.12.2007 N 329-FZ, developed the Federal Standard for Sports Training for each sport discipline. It determines the set of requirements for sports training in organizations engaged in this type of activity [11]. Sports training system includes not only knowledge, means, methods and forms, the interaction of participants in the training process, but also the factors of its implementation, organized on the basis of the principles of sports training, the rules that ensure the athlete's highest readiness for the best possible sports achievements. Children and youth sports schools, sports clubs should conduct sports training while taking into account the specifics of the training process and competitive activities in it. In our experiment, the athletics training process of the sports club "Fast, strong, hardy" ("Быстрые, сильные, выносливые") in Krasnoyarsk city was studied, in which the components of the long-term training system include stages, levels, cycles, types and other elements of training. The experiment was carried out at the sports specialization stage of stayers. The duration of the stage was 5 years in groups of children aged 13 years. The sports training program included 6 training sessions per week with a total duration of 12 hours per week. The sessions were conducted in accordance with the requirements of the Federal Standard for Sports Training in Athletics for sports disciplines. These include running at a distance of more than 400m, the total number of training hours per year is 624, training sessions - 312. At the stage of sports specialization in the training process of stayers, the following goals should be achieved: improving the level of general physical and special physical, technical, tactical and theoretical training; improvement of physical traits, taking into account age, influencing the increase in the sportsmanship of the stayer and its effectiveness. In the training process, the achievement of the above goals is possible by increasing the positive dynamics of sports performance of athletes, leading to the improvement of the skill of the stayer at the stage of sports specialization [11].

**Materials and methods**. The experiment involved 15 13-year-old stayers of the athletics club "Fast, strong, hardy" in Krasnoyarsk city with qualifications of the II sports category. The main research methods were the analysis of scientific and methodological literature, a survey, testing of the functional state by performing the PWC170 test with bicycle ergometer (Karpman, Belotserkovsky, Gudkov, 1988: 78-79) and statistical processing of the results.

**Results**. We conducted a step-by-step experiment, at the first stage of which it was revealed that overheating, dehydration (a decrease in the volume of intra- and intercellular fluid), electrolyte imbalance, an increase in the concentration of electrolytes in body fluids, a decrease in the contractility of all muscles and deterioration of the trophism of working muscles which causes uncoordinated functioning of all body systems lead to a decrease in performance during sports training. Therefore, at the first stage of the study, it was necessary to establish significant factors that affect sports performance. These factors include: the oxygen content in the environment, its temperature and humidity during sports training, the lack of cold acclimatization of stayers. During the training process which involves intense and prolonged workload periods (stayer distances), elevated temperature and humidity of the environment, lack of cold acclimatization, athlete's hypoxia lead to a decrease in sports performance as an athlete's effective productive capacity per unit of time, which is required to be maintained at a high level to achieve high sportsmanship (Murzin, 2016: 238-244; Popov, 1985: 3-12; Sonkin, 2007: 81-99) [4; 6; 8].

At the second stage of the experiment, we proposed training that takes into account factor of a low oxygen content in the environment, as a result of which the athlete develops hypoxia. At the sports specialization stage of the stayer, this leads to a decrease in working capacity and his skill. The experiment was carried out in middle altitudes (middle mountains) conditions, in Ergaki (Eastern Sayan). In mid-mountain conditions (altitude 1500-3000 m) in the stayer’s organism, a decrease in partial and barometric pressure occurs during sports training, which creates conditions for hypobaric hypoxia. The external resistance to the moving body decreases, which allows the runner to develop a greater speed due to rarefied air (Artemenkov, 2018: 5-15; Borisova, 2017: 217-273) [1; 2]. As a result of gradual ascents to high-altitude tracks in the experiment, the gravitational forces decreased, athlete’s adaptation to a low oxygen content increased, the body used it more efficiently, the athlete's speed increased, and, consequently, his skill as well. An increase in pulmonary ventilation led to a decrease in the anaerobic threshold, and the warming-up of the circulatory system caused oxygen deficiency. Due to the increased work of the respiratory and cardiovascular systems, the energy cost of work increased, and prerequisites for the faster development of athletes' fatigue arose. Overcoming fatigue in the training process led to the efficient use of oxygen by the body for aerobic energy generation and adaptation to high physical exertion, increasing sports performance. Improvement of adaptive mechanisms to high physical loads and acclimatization in middle altitudes conditions is an adaptation to the conditions of staying and performing significant physical loads of an athlete at higher altitudes, achieved through increased oxygen transport to tissues and its effective use by the body. The minimum acclimatization period for an athlete depends on the altitude, for the middle mountainous altitudes it is 8-10 days. Since cellular structural and metabolic changes require a long time, the increase in maximal oxygen consumption (MOC) occurs gradually, and only after 3-5 weeks of staying at the higher altitude, it only becomes 10-15% less than at sea level. At first, the athlete's performance at higher altitudes initially decreases, and after returning to the lower altitudes, it increases as a result of adaptation to the studied factors. Sports training was performed in the same conditions as the competition. The results achieved by using speed-strength and coordination exercises remained practically the same, although they became higher during sprint. Recovery proceeds slowly, so the repetition of exercises caused faster fatigue, the experiment took into account the phase nature of the reacclimatization process.

The following studied factors that contribute to an increase in performance in sports training are increased temperature and humidity (Grazhbovskaya, Lizikhina, 2019: 85-86; Popova, Zrozhevskaya, 2018: 285-287) [3; 7]. In the experiment, a sauna, a bath and special thermal suits were used, which enhance the stayer's adaptation to these factors. These factors increase the performance and, consequently, the skill of the stayer at the stage of sports specialization. Under conditions of thermal and physical adaptation of the body, a systematic and gradual increase in the power of physical activity in the training process led to the improvement of not only adaptive mechanisms, but also sports performance. The heart rate (HR) was systematically monitored, since due to its increase, the cardiac output (CO) increases as well. Thermal adaptation was improved throughout the experiment. Gradually increasing physical activity simultaneously with the improvement of the mechanisms of thermal adaptation in the 13-year-old stayers developed endurance. In the same conditions of the training process, as in simulation, in order to prepare for competitions held in conditions of high temperature and humidity, athletes began to train in advance, 7-12 days before the competitions. To create a water reserve in the athlete's body, the following water consumption schedule was introduced: 30 minutes before the start, athletes drank 250 ml of water, and while running they received additional 100 ml of a chilled hypotonic solution with a low sugar content (up to 2.5%), which ensured a high water losses replenishment rate and contributed to the restoration of the heat balance. Sports training in such conditions led to the following changes in functional characteristics: a decrease in heart rate, an increase in the efficiency of mechanical work, a decrease in the basic oxygen exchange cost of standard work and the tonicity of the sympathetic nervous system.

At the stage of sports specialization of stayers, cold acclimatization was used as a sports performance-increasing factor that improved their skill. It causes an increase in heat production in the athlete's body, narrowing of the skin vessels (a decrease in convection heat transfer from the inside to the skin surface), an increase in thermogenesis, when the minute blood volume increases due to an increase in its systolic volume and not due to heart rate. Sports training in conditions of low temperatures led to an increase in heat loss due to thermal conductivity and convective heat exchange, this ensured an increase in heat production. Scientists have found that when conducting a sports training in conditions of low ambient temperature, physical activity of any power replenishes heat loss by generating energy in the form of heat. We noted that at a rate of oxygen consumption of about 2 l/min, which corresponds to the critical level of heat production, the working body temperature stabilizes. In turn, hypothermia of the body leads to a decrease in MOC due to a decrease in heart rate and stayer performance (Sonkin, 2007: 81-99; Tsakoev, 2018: 47-48) [8; 9].

The sports performance of the stayers was measured at the beginning and at the end of the experiment on a bicycle ergometer by performing a three-stage control testing. At the beginning of testing, the HR during preparations was 120-130 bpm for 4 minutes. At the second, 4-min stage, the HR was equal to 170 bpm, at the third stage it was more than 180 bpm when the load was performed for 1 minute, of which warming up took 30 seconds and the other 30 seconds were dedicated to performing a maximum intensity workload on a bicycle ergometer. The rest interval between steps was 2 minutes. Sports performance was measured before the start of the experiment in aerobic training conditions, when there was no lack of oxygen, temperature and humidity increase during sports training and there was no cold acclimatization. Additional measurements were conducted after the experiment, when adaptive mechanisms were formed that made it possible to use oxygen efficiently, maintain resistance to low and high temperature and humidity of the environment and increased physical activity. Evaluation of performance indicators was calculated taking into account the average value of the mean-square deviation. The validity of differences in mean values of sports performance indicators was determined by Student's t-test (t) at a 5% level of significance. The experiment was attended by 15 stayers of the athletics club in Krasnoyarsk.

Sports training was conducted under aerobic and anaerobic conditions at both low and middle altitudes (Table 1).

Table 1

Sports performance indicators of stayers (X±õ)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Indicators | PWC170 test, kgm/min | Relative PWC170, kgm/min/kg | Maximal oxygen consumption relative value (MOC/kg) | Cardiac index during PWC170 testing |
| Before the experiment | 1500±220 | 20 ±2 | 58 ±8 | 2,6 ±0,5 |
| After the experiment | 1861±250 | 23 ±2 | 62 ±7 | 3,2 ±0,5 |

**Discussion.** The results shown in Table 1 indicate that, in general, the performance of athletes is not very high compared to the results of the pre-competition period. Since the study was conducted in the general preparation period of sports training, this explains the not very high results of 13-year-old stayers. But the use of the following factors during sports training that increase performance: the oxygen content in the environment, its temperature and humidity, the lack of cold acclimatization of stayers, has a good prospect for revealing the functional-adaptive physical potential of stayers and improving their sports training at the stage of sports specialization in the competitive period.

**Conclusion.** The experiment showed that the training of stayers at the sports specialization stage using the studied factors made it possible to increase sports performance and improve their skills. The stayers’ cardiac index during the PWC170 testing before the experiment and after the use of sports training in various conditions showed that after sports training in conditions of high altitudes, low and high temperatures and humidity with a gradual increase in physical activity increased, which indicates an increase in sports potential and the skill improvement of the athletes. During the competitive period, each of the participants in the experimental group improved their skills. After the experiment, the sports school achieved high sports performance in competitive activities among the teams of the Krasnoyarsk Territory.

**Библиографический список**

Артеменков А.А. Запредельное торможение и работоспособность при экстремальной деятельности человека. Спортивная медицина: наука и практика. – 2018. – Т. 8. – № 4. – С. 5-15. DOI: [10.17238/ISSN2223-2524.2018.4.5](https://doi.org/10.17238/ISSN2223-2524.2018.4.5).

Борисова Т.А. Влияние физических нагрузок на работоспособность человека. Научное сообщество студентов. Междисциплинарные исследования. Электронный сборник статей по материалам XXXV студенческой международной научно-практической конференции. – 2017. – С. 271-273.

Гражбовская С.Н., Лизихина И.А.Влияние температуры на работоспособность человека в условиях производства. Вестник Студенческого научного общества. – 2019. – Т. 10. – № 2. – С. 85-86.

Мурзин Д.Л. Влияние климатических условий на работоспособность человека в регионах Арктической зоны России. Экономика и социум. – 2016. – № 6-2 (25). – С. 238-244.

Новикова В.С., Фатеева И.В., Шустов Е.Б. Перспективы и физиологическое обоснование выбора средств коррекции работоспособности человека в экстремальных условиях деятельности. Вестник образования и развития науки Российской академии естественных наук. – 2020. – № 1. – С. 89-94. DOI: [10.26163/RAEN.2020.12.88.014](https://doi.org/10.26163/RAEN.2020.12.88.014)

Попов А.К. Работоспособность человека. Психологический журнал. – 1985. – Т. 6. – № 1. – С. 3-12.

Попова М.В., Зрожевская Ю.А. Роль физической культуры в повышении уровня работоспособности организма человека. Современные технологии в физическом воспитании и спорте. Материалы всероссийской научно-практической конференции с международным участием. Под ред. А.Ю. Фролова. – 2018. – С. 285-287.

Сонькин В.Д. Физическая работоспособность и энергообеспечение мышечной функции в постнатальном онтогенезе человека. Физиология человека. – 2007. – Т. 33. – № 3. – С. 81-99.

Федеральный стандарт спортивной подготовки по виду спорта «легкая атлетика» от 20 августа 2019г. № 673.

***Сведения об авторах***

**Поборончук Татьяна Николаевна, к**андидат технических наук, доцент, доцент кафедры физической культуры и здоровья, Сибирский государственный университет науки и технологий им. М.Ф. Решетнева, 660037, г. Красноярск, проспект им. газеты «Красноярский рабочий», д. 31, а/я 1075, poboronchuk\_tn@sibsau.mail.ru

**Мартиросова Татьяна Александровна,** доктор педагогических наук, доцент, профессор кафедры физической культуры и здоровья, Сибирский государственный университет науки и технологий им. М.Ф. Решетнева, 660037,

г. Красноярск, проспект им. газеты «Красноярский рабочий», д. 31, а/я 1075, [tat.martirosova@yandex,ru](mailto:tat.martirosova@yandex,ru)

**Лимаренко Ольга Владимировна, к**андидат педагогических наук, доцент, Сибирский федеральный университет, 660041, г. Красноярск, пр. Свободный, 79, [olga\_limarenko@mail.ru](mailto:olga_limarenko@mail.ru).

***Т.Н. Поборончук ,*** [*poboronchuk\_tn@mail.sibsau.ru*](mailto:poboronchuk_tn@mail.sibsau.ru)*, https://orcid.org/* [*0000-0005-0080-2778*](https://orcid.org/0000-0005-0080-27782)*,*

***Т.А. Мартиросова,***[*tat.martirosova@yandex,ru*](mailto:tat.martirosova@yandex,ru)*, https://orcid.org/*[*0000-0002-2193-3120*](https://orcid.org/0000-0002-2193-3120)*,*