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BUILDING A CONNECTION BETWEEN INDIVIDUAL TRAINING OPPORTUNITIES DURING EDUCATION AT HIGH SCHOOL FOR ATHLETES OF THE NATIONAL TABLE TENNIS TEAM

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Sports training is a process of sports improvement, guided by scientific and especially pedagogical principles, the purpose of which is to bring the athlete to high and record-breaking results in this sport through a planned and systematic effect on the capabilities and preparedness of the athlete. The causes of overexertion syndrome can be changes in the individual capabilities of athletes. There are different ways of myocardial adaptation processes. The less trained athletes in table tennis (1 category), the greater the risk of stress on the cardiovascular and muscular system. The table tennis team of candidates for masters of sports has a positive trend to increase the rating from 50-59 units (this is the number of points scored, if the athlete wins the competition, as an indicator of the athlete's skill), which indicates a stability to stressful situations and increased sports performance in this group of athletes. Thus, the connection is traced between technical training and sportsmanship in general. It is recommended to further study the psycho-emotional state of athletes and compare it with the functional capabilities of the body during the educational and training process in HEI (Ivano-Frankivsk National Technical University of Oil and Gas).

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The author's complex of therapeutic exercises was developed, as well as constant pedagogical control over the functional state of athletes, which consists in correcting the work of the musculoskeletal system directly by the trainer and preventing injuries. Quantitative and qualitative criteria for assessing the impact and correction of functional status on the relationship of individual capabilities of athletes in table tennis with injuries at different stages of long-term training, using a set of author's exercises. Only the reaction of the heart rate can be considered a reliable indicator of training. The main tasks - the absolute using of tools that can cause a rapid restructuring of the adaptation processes of athletes and individualization of training in the process of educational activities. The priority is in rational construction of sports training, adhering to its basic pedagogical principles, including the principle of eliminating risk factors for sports injuries.

Key words: *pedagogical principles, table tennis, cardiovascular system, 2functional state, long-term training, sportsmanship, individual capabilities.*

ПОБУДОВА ЗВ'ЯЗКУ МІЖ ІНДИВІДУАЛЬНИМИ МОЖЛИВОСТЯМИ ПІДГОТОВКИ ПІД ЧАС НАВЧАННЯ У ЗВО ДЛЯ СПОРТСМЕНОК ЗБІРНОЇ КОМАНДИ З НАСТІЛЬНОГО ТЕНІСУ

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Причинами виникнення синдрому перенапруження можуть бути зміни індивідуальних можливостей спортсменок. Залежно від вегетативної регуляції ритму серця спостерігаються різні шляхи адаптаційних процесів міокарду ($P<0.05$ у порівнянні із майстрами спорту. Чим менш треновані спортсмени з настільного тенісу (1 розряд), тим більший ризик навантаження на серцево-судинну та м'язову систему. У спортсменок збірної групи з настільного тенісу кандидаток у майстри спорту спостерігається позитивна тенденція до зростання рейтингу від 50-59 одиниць, що свідчить про стійку стабільність до стресових ситуацій та підвищення спортивних результатів у даної групи спортсменок. Отже, використання побудови індивідуальних можливостей з настільного тенісу дозволить досить ефективно впливати на взаємозв'язок технічної підготовки та спортивної майстерності в цілому, а також для подальшої профілактики травматизму та виявлення своєчасних ознак перевтоми. Розроблені авторські критерії оцінки для профілактики травматизму та корекції функціонального стану спортсменок спрямовані на корекцію опорно-рухової системи, ефективність яких полягає у видиху під час розтягнення м'язів. Рекомендується в подальшому вивчати психоемоційний стан спортсменок та порівнювати його з функціональними можливостями організму під час навчального та тренувального процесу у ЗВО (Івано-Франківському національному технічному університеті нафти і газу).

Наведено схему обстежень електрокардіографії для виявлення взаємозв'язку індивідуальних можливостей у спортсменок. Дана схема дає змогу встановити взаємозв'язок етапу максимальної реалізації індивідуальних можливостей спортсменок настільного тенісу з травматизмом та уникнути перевантажень на різних етапах багаторічної підготовки. Розроблений авторський комплекс лікувальних вправ, а також критерії оцінки функціонального стану спортсменок спрямовані на корекцію опорно-рухової системи та профілактики травматизму. Визначено кількісні та якісні критерії оцінки впливу та корекції функціонального стану на взаємозв'язок індивідуальних можливостей спортсменок з настільного тенісу з травматизмом на різних етапах багаторічної підготовки, застосувавши комплекс авторських вправ. Симптоми, які в принципі дозволяють діагностувати стан перенапруження та попередити ознаки травматизму та включають: збільшення вмісту у крові ферментів, що знаходяться всередині клітин; підвищене споживання кисню при фіксованій інтенсивності роботи; коли рівень м'язової діяльності знизився; аномальні показники ЕКГ; підвищення реакції ЧСС при фіксованій інтенсивності роботи. Тільки реакцію ЧСС можна вважати надійним показником натренованості. На етапі максимальної реалізації індивідуальних можливостей значно збільшується кількість засобів спеціальної підготовки у загальному обсязі тренувальної роботи, суттєво зростає обсяг змагальної практики. Основні завдання – максимальне використання засобів, здатних викликати бурхливу перебудову адаптаційних процесів спортсменок та індивідуалізація підготовки у них у процесі навчальної

діяльності. Важливим завданням є корекція функціонального стану включаючи фактори впливу на серцево-судинну систему. Уникнути даної ситуації можливо тільки при раціональній побудові спортивної підготовки, притримуючись його основним педагогічним принципам, включаючи принцип усунення факторів ризику спортивного травматизму.

Ключові слова: *ознаки перевтоми, комплекс авторських вправ, рейтинг, серцево-судинна система, функціональний стан, індивідуальні можливості, спортсменки, настільний теніс.*

Introduction of the issue. *Problem statement and its connection with important scientific or practical tasks.* The key problem of modern development of table tennis is the prevention of injuries at different stages of long-term training of qualified athletes, considering the model characteristics and individual capabilities of physical training of athletes during training in Higher education institution (HEI) [1; 2]. Many works emphasize that further growth of sportsmanship of qualified athletes is possible if the individualization of the training process considers the functional state of the body to prevent and treat injuries [3].

Current state of the issue. Most experts in the field of physical culture and sports believe that the training and competitive loads of today are mostly excessive and contribute to high injuries from 30% to 70%. These sensations are the result of mechanical damage to connective tissues [4]. This work was performed in accordance with the "Consolidated plan of research work in the field of physical culture and sports of Ukraine" of the Ministry of Education and Science of Ukraine 2016-2021. on the topic 2.4.1. "Systematic analysis of morphofunctional changes in the human body in the process of adaptation to physical activity" (№ state registration 0106U01077).

Studying the dynamics of sports injuries, most scientists also came to a single conclusion that a large number of injuries are the result of errors in the construction of the training process. These errors contributed to excessive local muscle fatigue, a decrease in the ability of the muscle and the extinguishment of the impact force, and as a result, an increase in the load on the bones. These sensations are the result of mechanical damage to connective tissues, ischemia, and spasm of the motor apparatus. Specific mistakes lead to signs of overexertion and lead to the beginning of a training session without an effective warm-up – 27% of fractures.

Avoiding this situation is possible only by rational construction of sports training, adhering to its basic principles, including the principle of eliminating risk factors for sports injuries. A well-balanced system of long-term sports training of tennis players should consider the possibility of organizing educational and training activities, corresponding to the features of the age-related development of motor function parameters, which ensures success sports, technical and tactical training.

There are scientific and methodical developments that do not contain sufficiently substantiated recommendations for the current state of age-specific learning and training. These provisions are aimed at solving the tasks of technical, tactical and special physical training of tennis players under the time and content structure of each of the stages of training, preceding the final period of the formation of high sports skills.

Outline of unresolved issues brought up in the article. The criteria for assessing the prospects of young tennis players, which are necessary for deciding on their transfer to the next stage of sports training, remain insufficiently studied. The analysis of literary sources makes it possible to state that the search for ways that ensure the improvement of the training process of tennis players when they move into different age groups is a problem of world sports in general. A comprehensive approach is a general methodological principle and acts as a leading approach and in the process of optimizing table tennis training, it requires holistic planning of sports

training tasks (at the stages of preliminary, basic and advanced sports specialization).

The following criteria determine the training and competitive workload in the system of long-term training in table tennis: allocation of terms of active classes and performances at competitions; determination of quantitative characteristics of stages; distribution of years of training by stages as a single pedagogical process.

The most difficult thing in the process of training classes is its continuity and multi-vector nature of creative efforts, when already during work it is necessary to constantly make changes to their initial plan. Therefore, at present, the main features and important qualities of sportswomen are dynamism, the ability to differentiate the main problems and find effective ways to solve them.

Great importance is attached to female hormones in the adaptive reactions of the body, development of rehabilitation measures to restore the menstrual function of female athletes in the event of violations arising under the influence of significant physical exertion.

The significant loads that female athletes overcome require an intensive search for means of recovery, optimization of the training process and forms of rest.

As for the system of training in high-achievement sports, it currently still retains positive results that are associated with the previous achievements of sports science.

The most acute problem of rapid application of positive scientific results in practice is felt at the final stage of training athletes. The problem is not so acute at the initial stages, since the application of the general theoretical provisions of sports training is considered to be sufficiently effective until now.

However, at the final stages, specialists note their insufficient effectiveness due to known reasons. The analysis of the main studies on the improvement of the training process of highly qualified athletes serves to objectify and improve the technology of managing the training process.

Aim of research *is analysis of recent research and publications, which initiated the solution of this problem, highlighting previously unresolved parts of the overall problem to which the article is devoted.* Studying the dynamics of sports injuries, most scientists have come to the only conclusion that many injuries are the result of errors in the construction of the process of long-term training [5]. There are also virtually no works that would study the relationship between the parameters of physical fitness, signs of fatigue, competitive activities, and functional status of athletes of the national team of table tennis in the Institution of Higher Education [6]. Addressing these issues will help optimize and correct the training process, considering the training of athletes and injury prevention. In recent years, the possibility of managing the training process of qualified athletes based on the use of model characteristics has been widely analyzed. Considering that the ability to recover develops and is also trained, just like motor qualities, specialists pay great attention to the development of means and methods of active action on recovery processes, in order to achieve high and general working capacity. In sports practice, different mechanisms of control actions, methods and modes of restorative means are used. Their application is based on the implementation of a number of methodological provisions, the most important of which are:

- the effectiveness of the use of restorative means depends on the nature and volume of training loads;
- prolonged use of the same means reduces the results of the training process, as a result of the manifestation of the Poncelet principle;
- the complex application of some means of restoration strengthens the actions of each and increases their overall positive effect, as a result of the implementation of the principle of conformity.

Formulation of the purpose of the research (setting tasks):

1) to develop quantitative and qualitative criteria for assessing the impact and correction of the functional state of the relationship between the individual capabilities of athletes in table tennis at the stages of long-term training in the institution of higher education;

2) provide a scheme of electrocardiography examinations to identify the relationship of individual capabilities with injuries in athletes;

3) develop a set of author's exercises for injury prevention.

Research methods and organization. Theoretical analysis and generalization of literature sources on table tennis and injury prevention. In the basis of the development of the theoretical foundations of the organization, planning and management of the multi-year training process, female athletes – tennis players, who are the basis of the physiological processes of the methodology of sports training for women in this sport, are considered.

Data from scientific domestic and literary sources show multifaceted connections between physical exertion and the process of restoring specific functions of the female body. To identify the relationship of individual capabilities in athletes was observed functional status and presented a scheme of electrocardiography (ECG). The number of study groups was 40 participants. The research was conducted on the basis of Ivano-Frankivsk National Technical University of Oil and Gas. The method of vectorcardiography (VCG) was chosen as an available research method that could be used repeatedly with sufficient simplicity, information, and reliability. The reason for this was that VCG differs in the stability of the graphics during dynamic observations and is quantifiable, which allows the widespread use of this method in the diagnosis of the functional capabilities of the heart of athletes. The technique of vectorcardiography was a quantitative spatial vectorcardiography of a three-plane system of leads with mathematical analysis. Ventricular cardiograms of ventricles and atria in three mutually perpendicular planes were registered: frontal, sagittal and transverse in 3 groups of sportswomen: masters of sports, candidates for masters of sports and 1 category. The projection of moment vectors every 0.01 s, as well as the projection of the initial (I), main (M) and final (F) vectors – ventricular loop, as well as the projection of the right (P wave 1), left (P wave 3) and both atria were determined) – atrial loop. This information was used to calculate the modules of moment vectors every 0.01 second; angles (Ex, Eu, Ez), which characterize their spatial orientation and the spatial area of the complexes QRS and P waves [7]. The state of competitive activity was also examined by determining the rating of athletes during training and coaching activities. In the course of the study, the rating was determined by the contribution of the athletes' meetings, based on the formula used to calculate the number of points scored or lost. These scores – applications as a result multiplied by the "tournament odds" adding or subtracting from the current rating, which determines the "strength" of the athlete. The "tournament coefficient" of the personal championship of Ukraine is 1.5 in other competitions, but it ranges from 0.5 to 1.4. Methods of mathematical statistics were used to analyze and compare data in the study.

Results and discussion. Presentation of the main material with the analysis of the obtained scientific results. The ranking of athletes in table tennis allowed to influence the technical fitness, sportsmanship, and individual opportunities for further of injuries.

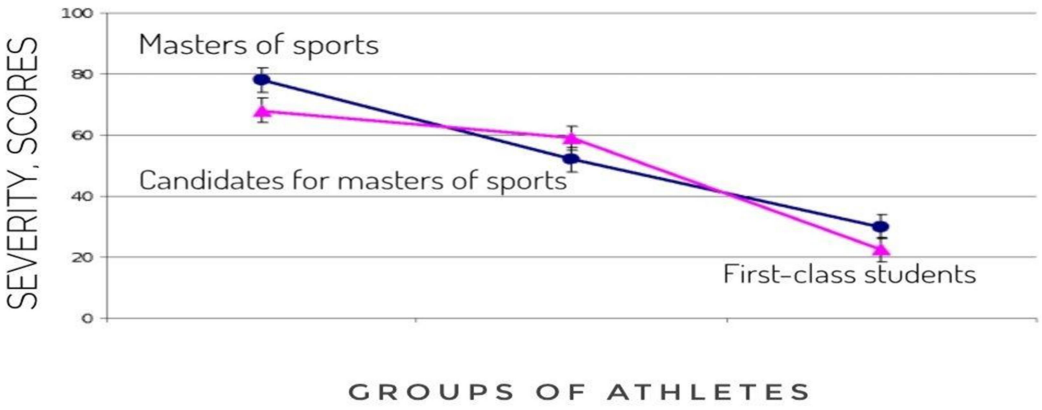


Fig. 1. Rating of athletes (M ± m) (n = 40) before and after competitions

Note:

– rating of athletes after competitions;

– rating of athletes before competitions.

In the CMS there is a positive trend to increase the rating from 50-59 units (this is the number of points scored, if the athlete wins the competition, as an indicator of the athlete's skill), which show stability to stressful situations and improved sports performance in this group of athletes. We can see it in Figure 1. Considering the individual characteristics of athletes in table tennis (character, willpower, temperament, emotions, personal and situational anxiety, aggression) we can form a specific technical and tactical style of sportswomen for further research.

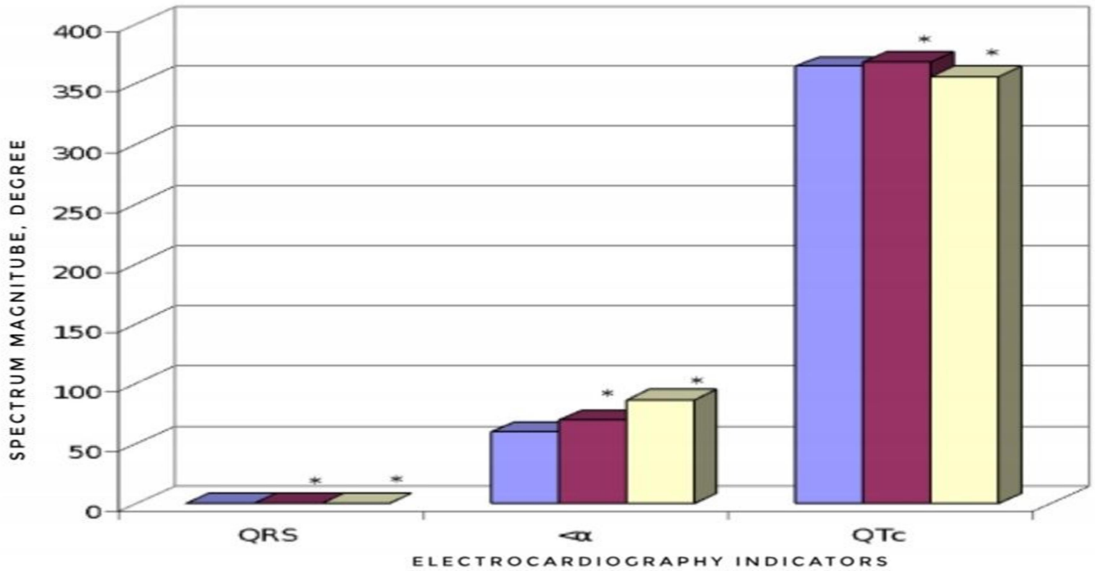
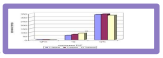
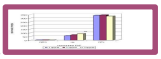
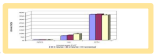


Fig. 2. Changes in vector-cardiography after training load

Notes: 1. * P <0.05 compared to MS;

1.  – first-class students;

2.  – masters of sports (MS);

3.  – candidates for masters of sports (CMS).

- QRS – is the complex at the electrocardiography that represents ventricular depolarization;
- ∠α – is the angle that is founded according to special tables or schemes, having previously determined on the electrocardiogram the algebraic sum of waves of a ventricular complex (Q + R + S) in I and III standard assignments. When the deviation of the electrical axis

of the heart in the corner of the alpha has a value in the range of 70-90 °. This state of the electrical axis of the heart is called a rectangle;

- QTc (corrected QT interval) - is an indicator that reflects the heart rate-adjusted QT interval.

The results of the electrocardiogram show evidence of adaptive changes in the training load of athletes of different qualifications and slight adaptation of the left and right heart, which revealed the presence of S-T segment depression in the left heart and right heart overload in candidates for masters of sports [8]. The obtained data prove that the more trained athletes (MS and CMS), the greater economization of functions is observed in the indicators of the cardiovascular system (P <0.05 compared to 1 category – Fig. 2). Data of the 1st category indicate unstable adaptation at rest.

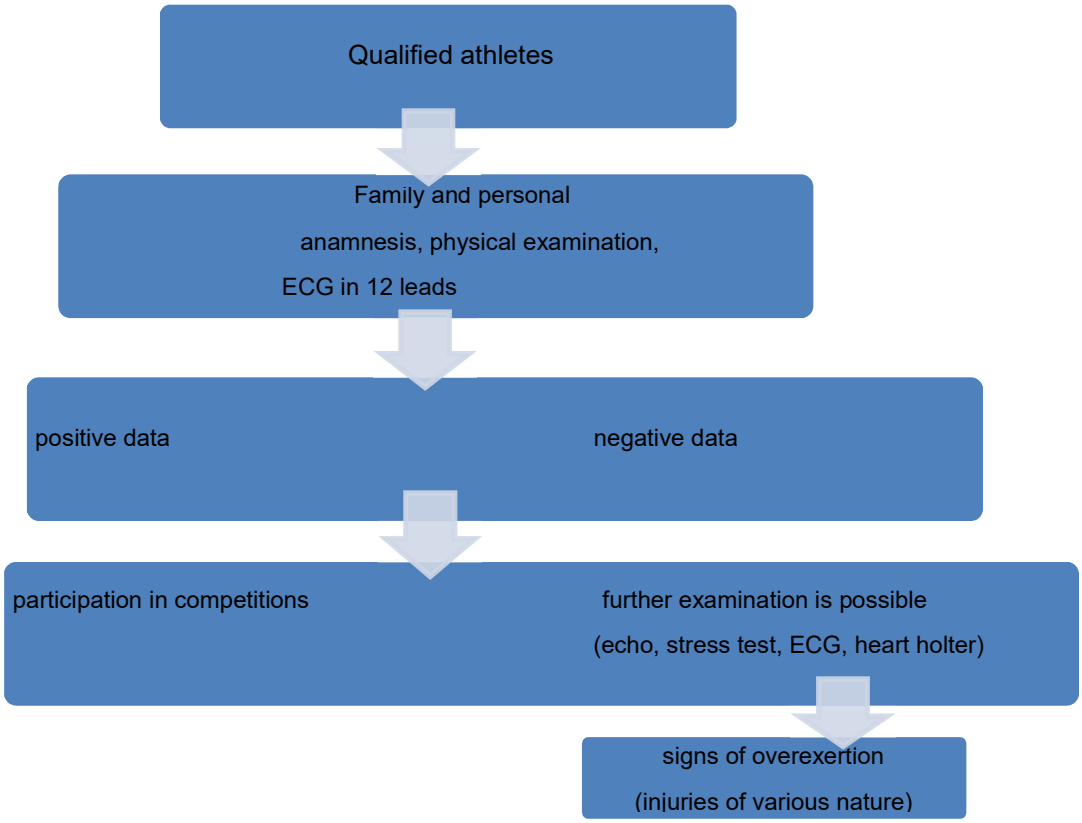


Fig. 3. Scheme of electrocardiograph examinations to identify the relationship of individual capabilities with injuries in athletes

The above scheme (Fig. 3) allows to establish the relationship between the stage of maximum realization of individual capabilities of table tennis athletes with injuries and helps to avoid overloading at different stages of long-term training. The data obtained confirm that with moderate physical activity, a higher level of aerobic fitness is manifested by a lower heart rate when performing work of a certain intensity in training.

Symptoms that in principle allow you to diagnose overexertion and prevent signs of injury include: increased levels of enzymes in the blood inside the cells; increased oxygen consumption at a fixed intensity of work; when the level of muscle activity has decreased; abnormal ECG parameters; increasing the response of heart rate at a fixed intensity of work [8]. Only the reaction of the heart rate can be considered a reliable indicator of training.

At the stage of maximum realization of individual opportunities, the number of means of special training in the total amount of training work increases

significantly, the amount of competitive practice also increases significantly. The main tasks – the absolute using of tools that can cause a rapid restructuring of the adaptive processes of athletes and individualization of training. The total values of the volume and intensity of training work reach a maximum, classes are planned with heavy loads in the process of educational activities. The volume of psychological and integral training is also growing sharply [9].

Therefore, an important task was to correct the functional state, including the above-mentioned factors affecting the cardiovascular system. This situation can be avoided only with the rational construction of the educational process, adhering to its basic pedagogical principles, including the principle of eliminating risk factors for sports injuries (which is absent according to V.M. Platonov). Moreover, following the basic principles of planning according to V.M. Platonov: preliminary basic training, specialized basic training, maximum realization of individual capabilities, preservation of sporting achievements.

The psychophysiological state of the athlete is a component of the general functional state of the body. The functional state combines, on the one hand, the athlete's mental reactions in the conditions of training and competitive activity, on the other hand, the state of the physiological systems that ensure the performance of sports preparedness. The study of the structure of sports activities of complex coordination sports, sports games and martial arts indicates the presence of regulatory systems of the body responsible for the functional and coordination aspects of the preparation of a highly qualified athlete, among which psychomotor and cognitive components of pedagogical influence on the athlete are revealed.

The results of functional studies are used to predict the success of sports activities, as well as for individual correction of training and competition processes (for example, with a weak nervous system there is a resistance to monotony, a continuous method of training is recommended, an interval method for a strong, mobile nervous system, which is characterized by resistance to fatigue).

Therefore, the functional state is a reflection of the way of ensuring mental functions, the integral expression of which is conscious, socially determined behavioral motor activity, including sports activity. The functional system of the psychophysiological state includes mental, physiological, and behavioral levels for pedagogical influence. Historically, scientific and especially scientific-pedagogical development of the problem of training was largely concerned with ways to achieve the maximum possible sports result.

The system-creating factor, according to which the modern idea is the result, is fundamentally important in sports training. But as important as sports results are as a specific goal, from general socio-pedagogical positions they cannot ultimately become an end in themselves. On the way to them, a more specific goal should always be pursued, which is that through the achievement of high sports results to develop the spiritual and physical qualities of an athlete in order to use sports activities as a factor of harmonious personality formation and upbringing.

The developed set of the author's therapeutic exercises was aimed at correcting the musculoskeletal system (according to the method of the American scientist Joseph Pilates), including the principle of eliminating risk factors for sports injuries. The effectiveness of the exercise is to exhale while stretching the muscles:

Exercise 1. Neck muscles:

1. Apply a bandage to the cervical spine to keep the vertebrae in the correct position. Wear 4-6 hours a day for a month.

2. Inhale 1-5 – tilt your head to the left, get the shoulder girdle. Exhale 1-5. Inhale 1-5-tilt your head to the right, get a shoulder nose. Exhale 1-5. Inhale 1-5-tilt your head forward. Exhale 1-5.

Inhale 1-5-tilt your head back. Exhale 1-5.

Exercise 2. Muscles of the shoulder girdle: One of the best known is the method proposed by G.A. Ilizarov. The device is applied to the shoulder girdle. After removing the device, it is advisable to exercise in the pool (rabbit on his back) while rowing on the inhale 1-5 and exhale 1-5 and swimming breaststroke.

Exercise 3. Muscles of the lumbosacral region and spine in general:

1. Sleep or lie on a hard surface for at least 5-6 hours a day.
2. S.P. (starting position) – holding on to the gymnastic wall. On the inhale 1-5 withdrawal of the right arm and right leg at the same time. On the exhale 1-5 return to starting position (3-5 times).
3. S.P. (starting position) – holding on to the gymnastic wall. On the inhale 1-5 withdrawal of the left arm and left leg at the same time. On the exhale 1-5 return to starting position (3-5 times).
4. S.P. (starting position) – lying on your back. On the inhale 1-5 bent left leg pulling as much as possible to the chest (helping hands). On the exhale 1-5 return to SP (3-5 times).
5. S.P. (starting position) – lying on your back. On the inhale 1-5 bent right leg pulling as much as possible to the chest (helping hands). On the exhale 1-5 return to SP (3-5 times).
6. S.P. (starting position) – lying on your back. On the inhale 1-5 bent two legs pulling as much as possible to the chest (helping hands). On the exhale 1-5 return to SP (3-5 times).
7. S.P. (starting position) – lying on your back. On the inhale 1-5 lifting the right leg straight up, pulling as much as possible to the chest (helping hands). On the exhale 1-5 return to SP (3-5 times).
8. S.P. (starting position) – lying on your back. On the inhale 1-5 lifting the straight left leg up, pulling as much as possible to the chest (helping hands). On the exhale 1-5 return to SP (3-5 times).
9. S.P. (starting position) – lying on your back. On the inhale 1-5 exercise "bike" forward. On the exhale 1-5 "bike" back (2-3 minutes).
10. S.P. Holding the gymnastic wall with the right hand, lunges with the right foot forward. On the inhale 1-5 squats forward, back straight. On the exhale 1-5 return to SP.
11. S.P. Holding the gymnastic wall with his left hand, he lunges his left foot forward. On the inhale 1-5 squats forward, back straight. On the exhale 1-5 return to SP.
12. Exercises in the pool (rabbit on the back) with rowing on the inhale 1-5 and exhale 1-5 are appropriate.

Conclusions and research perspectives. An important task is the correction of functional status, including factors affecting the cardiovascular system. This situation can be avoided only with the rational construction of sports training, adhering to its basic pedagogical principles, including the principle of eliminating risk factors for sports injuries. The obtained data prove that the more trained athletes (MS and CMS), the greater the economization of functions is observed in the indicators of the cardiovascular system ($P < 0.05$ compared to 1 category). Data of female athletes of the 1st category indicate unstable adaptation at rest. In the CMS there is a positive trend to increase the rating from 50-59 units, which indicate a stability to stressful situations and increase athletic performance in this group of athletes in the educational process.

There is also a diagram of electrocardiography examinations to identify the relationship between individual abilities in athletes. This scheme helps to build the relationship between the stage of maximum realization of the individual capabilities of athletes in table tennis and avoid overloading them at different stages of long-term training. An author's set of therapeutic exercises has been developed. It contains criteria for assessing the functional state of athletes, which correct their musculoskeletal system and prevent injuries.

Further research should consider that athletic performance interacts with the functional state of athletes and sets clear

requirements for teachers and athletes to avoid injuries, which is possible only with the rational construction of sports training, including the principle of eliminating risk factors for injuries. It is recommended to further study the psycho-emotional state of athletes and compare it with the functional capabilities of the body during the educational and training process in HEI (Ivano-Frankivsk National Technical University of Oil and Gas), avoid harsh criticism of personal qualities of the athlete, motivate him to succeed, reduce subjective significance of complex competitive tasks (do not overestimate the level of motivation).

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