

PHYSIOLOGY

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MODERN METHODS FOR STUDYING RODENT BEHAVIOR IN MODEL BIOMEDICAL STUDIES (PROBLEM REVIEW)

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Annotation. Based on a review of literature data and methodological documents, a comparative analysis of modern methods for studying the behavior of laboratory animals in biomedical research was carried out. We have considered main problems of assessing the properties of higher nervous activity and analyzed methods for studying the effect of drugs and various models of pathological and functional states on behavioral patterns. The purpose of this review is to systematize modern methods for studying the behavior of animals in model biomedical experiments, as well as to analyze the strategy for choosing behavioral tests depending on the purpose of the experiment.

Keywords: animal behavior, biomedical research, model experiments.

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INTEGRATED APPROACH AS A WAY TO REVEAL THE INTERCHANGEABILITY OF MECHANISMS FOR SUPPLYING OXYGEN TO ATHLETES' BODY

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Annotation. An integrated approach was used to identify the mechanisms for providing the body of athletes with oxygen. The purpose of the study was to consider this approach as one of the ways to identify compensation of mechanisms for providing the body of athletes, involved in endurance sports, with oxygen, depending on their age during motor activity. The results were obtained, indicating that the interchangeability of mechanisms for providing the body of athletes with oxygen depends on the age of the subjects, and it is advisable to recommend an integrated approach as a way to identify the most rational and effective mechanisms for providing the body with oxygen.

Keywords: integrated approach, cardiorespiratory system, mechanisms for providing the body with oxygen, external respiration, blood circulation, gas exchange, people engaged in sports.

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MAXIMUM OXYGEN CONSUMPTION AND MUSCLE MASS WORKING DURING THE STEP TEST: A PILOT STUDY

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Annotation. Determination of maximum oxygen consumption is an important part of physical performance testing in sports and recreational physical culture. However, the very identification of the maximum values still causes a number of difficulties for experts. It is not always possible to identify the phenomenon of the so-called “plateau” on the dependence of oxygen consumption to load. It is well shown that oxygen consumption by the body depends on the amount of working muscle mass. The authors suggested that the additional activity of the arm muscles during maximum exercise may affect the maximum oxygen consumption. A pilot study was organized in which the subject was asked to perform curls with dumbbells during a standard exercise test on a bicycle ergometer. Three tests were performed: test 1 – without additional arm work, test 2 – with curls with 1.8 kg dumbbells, and test 3 – with curls with 3 kg dumbbells. Oxygen consumption kinetics differed between tests 1 and 2 over the entire exercise range, and maximum oxygen consumption was 24.5, 30.3 and 30.7 ml/kg/min for tests 1, 2, and 3 respectively. Heavier dumbbells did not lead to an additional increase in oxygen consumption because the oxidative capacity of the arm muscles has possibly reached its maximum. Additional work with the arms did not affect the respiratory coefficient and the maximum power achieved when training on a bicycle ergometer. The results obtained confirm that the activity of additional muscles can influence the oxygen consumption during the performance of the main exercise.

Keywords: maximum oxygen consumption, VO_2 max, functional diagnostics, physical performance.

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CYTOKINE THEORY OF OVERTRAINING SYNDROME

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Annotation. At the present moment, the study of the issue of overtraining in athletes is relevant. Under the conditions of the training process, an athlete goes through various stages from insufficient fitness to a state of overstrain or overtraining. Studies in recent decades confirm the active production of cytokines during the training process. Cytokine levels rise in response to both short-term intense exercise and long-term low-intensity exercise. In this regard, a detailed study of the overtraining syndrome and the associated cytokine profile is required to determine a unified approach to the diagnosis, treatment, and prevention of this problem.

Keywords: cytokines, immune system, overtraining syndrome, athlete, adaptation.

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AGE-RELATED CHANGES OF THE INITIAL AUTONOMIC TONE IN 2- AND 6-MONTH CALVES

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Annotation. The article reflects the study of the initial autonomic tone with the heart rate variability method of calves of different ages, taking into account the features of age-related changes in the formation of regulatory centers. The presented research methods have high diagnostic efficiency. The results obtained make it possible to identify higher parameters of the integral indicator of the stress index at an early stage. Such a method allows for a preliminary prediction of the cattle productivity, which ensures the effective agricultural use of animals.

Keywords: initial autonomic tone, vagus, autonomic regulation, stress index, autonomic homeostasis.

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IDENTIFICATION OF THE R.M. BAEVSKIJ INDICATORS IN HOLSTEIN BULLS AT THE AGE OF 6 MONTHS

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Annotation. The article reflects the study of the R.M. Baevskij parameters and the identification of the initial autonomic tone for six-month-old bulls of the Holstein breed. The presented research method has high efficiency. The results obtained make it possible to use all the indicators developed by R.M. Baevskij in a comprehensive way.

Keywords: initial autonomic tone, autonomic regulation, stress index, index of autonomic equilibrium, autonomic rhythm index, indicator of adequacy of regulation processes.

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COORDINATION PARAMETERS OF ATHLETES OF DIFFERENT QUALIFICATIONS SPECIALIZING IN SHOCK MARTIAL ARTS

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Annotation. Currently, it is still relevant to search for effective components that allow increasing the technical and tactical level of athletes engaged in shock martial arts. At the same time, many specialists focus on increasing strength and speed-strength qualities in the training process, sometimes completely “underestimating” the process of developing coordination capabilities. The aim of the study was to determine the parameters of coordination in athletes of different qualifications specializing in shock martial arts. The hardware and software complex “NS-Psychotest” was used to implement the parameters of coordination measurement. 38 athletes of different qualifications specializing in shock martial arts participated in the multiple examinations. The obtained data were processed using statistic programs. The parameters of coordination geometry in the observed groups of athletes were established. As the sports skill improves, by optimizing the ability of

central structures to consolidate afferent and efferent signals, the formation and regulation of movements is much better in highly qualified athletes engaged in shock martial arts.

Keywords: shock martial arts, athletes of different qualifications, coordination.

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INDIVIDUALLY DIFFERENTIATED APPROACH TO THE STUDY OF HEART RATE VARIABILITY IN WEIGHTLIFTERS, TAKING INTO ACCOUNT THE TYPES OF AUTONOMIC REGULATION

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Annotation. The aim of the study was to examine the features of heart rate variability (HRV) in weightlifters at rest, after training and in a short-term recovery period with different individual and typological features of regulation. The HRV analysis was carried out in eight weightlifters (candidates for master of sports) at rest, during the training process and in the short-term recovery period in the laying and standing positions with the Varicard 2.51 device and the ISCIM-6 software. It has been shown that in the weightlifters of the same skill level, with the same amount of physical activity, but with different types of autonomic regulation of the heart rate, heart rate variability indicators in both the laying and standing positions differ significantly. The weightlifters with type III have improved functional capabilities at rest after the previous day of rest and after the training activity. During the short-term recovery period, the activity of the sympathetic division of the autonomic nervous system (ANS) decreases. In orthostasis, the level of autonomic reactivity adequate to the stage of the study is preserved. The weightlifters with type I, with the same amount of physical activity, have the increased intensity of regulatory mechanisms, which remains unchanged in the recovery period. In orthostasis, a hyperreactive response is often replaced by a paradoxical response.

Keywords: weightlifting, physical activity, heart rate variability, types of regulation.

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THE EFFECT OF BALANCE TRAINING ON THE VERTICAL POSTURE REGULATION IN HEALTHY GIRLS

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Annotation. The aim of the work was to study the effect of prolonged balance training on the regulation of a monopodal posture in healthy girls. Postural regulation was analyzed on the "Stabilan-01" force plate. We have found a decrease in the velocity, amplitude and power of very low frequency oscillations of the center of pressure in the sagittal plane, as well as the oscillations velocity in the frontal plane after training only in a posture with closed eyes. Thus, balance training has a positive effect on the static postural balance in monopodal posture in healthy subjects. Changes in spectral indicators indicate that the mechanisms of balance training are probably associated with the automatization of new postural corrections and increased central inhibitory effects on spinal reflexes.

Keywords: vertical posture regulation, posturography, balance training.

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FEATURES OF PHYSIOLOGICAL INDICATORS FORMING PHYSICAL HEALTH IN STUDENTS WITH DIFFERENT LEVEL OF MOTOR ACTIVITY

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Annotation. In this study, we have presented the results of a comparative analysis of the physical health parameters of students with different level of physical activity (low, medium and high levels). Physical health level was identified in 694 students aged 17-22 years with the G.L. Apanasenko method. In the course of the study, it was revealed that motor activity has a significant impact on the physical health of students. Students with a high level of motor activity have a large proportion of high scores in the Robinson index, strength and vital index and faster recovery of heart rate after exercise. The results of the study point to the need to expand mass sports and health-improving work at the university in order to increase physical activity among modern students.

Keywords: physical health, physical activity, students, vital and strength indices, Robinson index, pulse recovery.

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“SOCIAL” STRESS – A RELEVANT MODEL OF ANIMAL ANXIETY AND DEPRESSION

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Annotation. Numerous studies confirm the high prevalence of depressive disorders in different age groups in recent years, which makes it urgent to study the factors influencing their occurrence and course. The attention of many researchers in case of studying some endophenotypes of depression and identifying the antidepressant activity of pharmacological compounds is attracted by the model of stress of social defeat. The purpose of the study was to examine the behavior of laboratory rats under the influence of “social” stress. The results of the study of the psycho-emotional state of animals in the Suok (“ropewalking”) test revealed the formation of pronounced depressive-like behavior, accompanied by inhibition of locomotor and orienting-exploratory activity, as well as an increase in the general level of anxiety.

Keywords: behavior, “social” stress, sensory contact, depression, Suok (“ropewalking”) test.

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CENTRAL NERVOUS SYSTEM REACTIVITY IN KICKBOXERS WITH DIFFERENT SPORTS QUALIFICATIONS

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Annotation. We have carried out a neurophysiological assessment of the reactivity of the kickboxers' central nervous system depending on the sports qualification at the final stage of preparation for socially significant competitions. The analysis of intra-hemispheric coherence in

the groups of subjects revealed “significant” and “high” levels of coherence with a predominance in the frontal sections. During the electroencephalography tests, a greater stability of the functional state and stress resistance of the brain was revealed in kickboxers of the highest sports skill, compared with a group of elite kickboxers.

Keywords: reactivity, electroencephalography, central nervous system, kickboxers.

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THE EFFECT OF TRANSCRANIAL ELECTRICAL STIMULATION ON THE HORMONAL STATUS OF SKI RACERS

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Annotation. The purpose of the research was to study the effect of a session of transcranial electrical stimulation (tES) by pulsed current on the change in the hormonal status of elite ski racers. The analysis of the study results contributed to the identification of the alleged mechanisms of tES action. The main effect of tES is on the hypothalamus, which activates the adenohypophysis. As a result of the latter's activity, hormonal changes are noted in ski racers: an increase in beta-endorphin, testosterone, acetylcholine; a decrease in the concentration of stress hormones – cortisol, adrenocorticotropic hormone. We have discovered that the use of a tES session has an effect on autonomic regulation: reducing the activity of the sympathetic department and increasing the activity of the parasympathetic department of the autonomic nervous system.

Keywords: ski racing, testosterone/cortisol, hypothalamus, heart rate variability.

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STUDYING THE NEUROPROTECTIVE ACTIVITY OF THE SCUTELLARIA BAICALENSIS GEORGI EXTRACT DURING THE DEVELOPMENT OF A CONDITIONAL PASSIVE AVOIDANCE REFLEX UNDER THE CONDITIONS OF “SOCIAL” STRESS

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Annotation. The study is devoted to the examination of the neuroprotective activity of the *Scutellaria baicalensis Georgi* extract in the development of a conditioned passive avoidance reflex (CPAR) under conditions of “social” stress. We used an extract obtained by maceration from the underground part of *Scutellaria baicalensis Georgi*. The study of cognitive processes was carried out on 100 male non-linear rats aged 7-9 months, which were divided into five groups. Modeling of “social” stress in groups was carried out by developing inter-male confrontations under conditions of paired sensory contact. Cognitive functions were analyzed using a standard CPAR setting. The results of the study indicate the ability of the *Scutellaria baicalensis Georgi* extract to have a neuroprotective effect during the development of stress, significantly reducing its negative effect, which manifests itself in the deterioration of the memorization and reproduction of CPAR to a greater extent for animals with an aggressive type of behavior. The presence of a nootropic effect in the extract reflects the prospects for further detailed study of its biopharmaceutical activity.

Keywords: “social” stress, nootropics, neuroprotective activity, *Scutellaria baicalensis Georgi*, extract, biologically active substances, conditioned passive avoidance reflex, aggressors, victims.

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FEATURES OF FUNCTIONAL PARAMETERS OF THE HEART ASSOCIATED WITH MINOR CARDIAC ABNORMALITIES

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Annotation. The debatable nature of the role of minor abnormalities of heart development in functional abnormalities in people involved in sports determines the relevance and prospects for further research of the problem. The aim of this study was to identify the features of morpho-functional heart parameters in adolescent athletes with the presence or absence of various types of minor cardiac abnormalities. Echocardiographic examination revealed no differences in the heart parameters of the group of athletes with mitral valve prolapse and the group without abnormalities. In athletes with combined abnormalities (mitral valve prolapse and false chords of the left ventricle), the analysis of correlations of echocardiographic parameters revealed features of cardiac remodeling under the influence of physical activity against the background of heterochronous development of the heart and blood vessels in this age period.

Keywords: minor cardiac abnormalities, mitral valve prolapse, false chords, echocardiography, adolescent athletes.

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REPRODUCTIVE PROFILE OF WOMEN REGULARLY ENGAGED IN FITNESS WITH DIFFERENT INITIAL TONE OF THE AUTONOMIC NERVOUS SYSTEM

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Annotation. The aim of this study is to characterize the features of autonomic regulation of the hormonal reproductive profile in women who regularly do various physical activities (fitness). When analyzing the hormonal background in women with different levels of physical activity, we have found that regular fitness classes harmonize the phases of the ovarian menstrual cycle. The contribution of the predominant level of autonomic nervous system is implemented through various mechanisms. Sympathotonus reactivity is determined by the level of gonadotropins, vago- and normotonus – by the level of peripheral sex hormones. A different element of harmonization during regular fitness activities set the energy level of the first phase of the ovarian menstrual cycle and ensured the economization of the second phase.

Keywords: autonomic tone, physical activity, sex and gonadotropic hormones.

PSYCHOPHYSIOLOGY

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POSSIBILITIES FOR DEVELOPING REACTIVE ABILITIES OF YOUNG JUDOKAS

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Annotation. The purpose of the study is to develop and test a methodology for developing reactive abilities of young judokas and determine the quantitative range of the possibility of developing these abilities in the age range of 8-9 years under the influence of accentuated training. The article gives a brief description of the content of the developed methodology, its components, means of developing reactive abilities for beginner judokas, and discloses the algorithm for implementing the methodology in the training process. The results of experimental testing have been noted. We have conducted an analysis of growth rates of various indicators of reactive abilities under the accentuated impact.

Keywords: judokas, reactive abilities, initial sports training.

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THE ASSESSMENT OF FINE MOTOR SKILLS BASED ON THE AUTHOR'S METHOD AND THE FINGERFIT SOFTWARE APPLICATION

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Annotation. The study includes investigation on the possibility of automating the assessment of fine motor skills using the author's methodology. We have formed the task and created the algorithm using accumulated experience. After that, we have also created a computer application for testing fine motor skills with the HTML programming language. The construction of 64 gestures in the test takes from 4 to 13 minutes. The research protocol is compiled according to test results. It includes the clear data: tables, graphs and total conclusion. The application allows identifying the following indicators: the total testing time, the individual complexity of constructing each gesture, the lateral asymmetry coefficient, levels of fatigability/warming-up.

Keywords: fine motor skills, test, complementarity, gesture, asymmetry, FingerFit, reaction.

BALNEOLOGY AND REHABILITATION

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EFFECT OF ELECTROSLEEP THERAPY ON SMOKING AND NON-SMOKING YOUNG MEN AND WOMEN

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Annotation. The aim was to study the effect of the electrosleep therapy on smoking and non-smoking young men and women. While applying the technique, we have found that the Baevskij index is significantly reduced in non-smoking young men and women. The activity of the sympathetic division in the examined group of non-smokers is also significantly reduced, and the activity of the parasympathetic division increases after the electrosleep session. The data obtained may indicate the sedative effect of electrosleep. The heart rate and entropy indices significantly decrease in non-smoking young men and women after the session. The results obtained have shown that the electrosleep therapy has a diverse effect on smoking and non-smoking young men and women.

Keywords: electrosleep therapy, pulse oximetry, tobacco smoking, smoking young men, smoking young women, non-smoking young men, non-smoking young women.

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THE EFFICIENCY ANALYSIS OF THE WAYS TO CORRECT ABNORMALITIES AND LONG-TERM CONSEQUENCES OF THE CERVICAL SPINE (C₁-C₂) NATAL INJURIES IN CHILDREN AGED 5-7 YEARS

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Annotation. The aim of this study was to identify the efficiency of the developed ways to correct the musculoskeletal system in children aged 5-7 years with long-term signs of abnormalities caused by birth spinal cord injuries. Using somatoscopic and physiometric methods, we have tested the hypothesis that many abnormalities of posture and movement in children are a distant consequence of a natal injury of the cervical spine and, when a set of corrective actions are provided, they are reversible to the physiological standard.

Keywords: birth spinal cord injury, correction methods, manual techniques.

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PROSPECTS FOR THE APPLICATION OF BIOFEEDBACK TRAINING ON THE BETA RHYTHM OF THE BRAIN IN THE POST-FLIGHT REHABILITATION OF ASTRONAUTS

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Annotation. The article presents the prospects and rationale for the use of biofeedback training on the beta rhythm of the brain in the correction of deviations of psychophysiological parameters (or psychophysiological state) in the post-flight rehabilitation of astronauts. Analysis of metadata on the study of the negative impact on the body of factors associated with space flights and the study of the effects obtained from the use of biofeedback training in athletes whose professional activities, along with astronauts, belong to the category of extreme ones, make it possible to substantiate the expediency of applying neurobiofeedback technology for beta rhythm of the brain for the correction of the psychophysiological state during the post-flight rehabilitation of astronauts.

Keywords: astronauts, psychophysiological state, neurofeedback, biofeedback training, beta rhythm of the brain, post-flight rehabilitation.

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OCCUPATIONAL THERAPY AT AN EARLY STAGE OF PARKINSON'S DISEASE

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Annotation. Foreign clinical guidelines report that occupational therapy is indicated for people at an early stage of Parkinson's disease. However, in Russia, occupational therapy is rare compared to other forms of rehabilitation. This article describes the results of a study involving a sample of 16 women aged 50-75 years at the early stage of Parkinson's disease, the duration of the disease was 5-20 years. We have demonstrated main instrumental activities causing difficulties at this stage of the disease. Grip strength, pinch strength, dexterity and coordination of the upper extremities and quality of life were studied and compared with the norm. The dynamics after the experiment is described in the form of a significant improvement in all the studied parameters.

Keywords: occupational therapy, Parkinson's disease, physical rehabilitation.

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DYNAMICS OF PRESSURE, PULSE AND OXYGEN SATURATION OF HEALTHY ADULTS DURING A 10-DAY COURSE OF SPELEOTHERAPY

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Annotation. Speleotherapy is a popular modern method of restoring human health, actively used in clinics and in sanatorium-resort treatment. The purpose of the study was to examine the

dynamics of pressure, pulse and oxygen saturation of an adult healthy person during a 10-day course of speleotherapy. Volunteers of the 2nd year of the Voronezh State Medical University took part in the study. The analysis of the obtained data was carried out using Excel and StatPlus Pro. An increase in the median of the pulse and pulse pressure was revealed on the 4th day of speleotherapy and at the end of the course – on the 7th-9th days of speleotherapy. Oxygen saturation increased on day 4 and remained at 99% until the end of treatment. The data obtained cast doubt on the generally accepted (adaptive) theory of the impact of this environment on the human body, at least in the field of visceral mechanisms, and require additional research in this direction.

Keywords: speleotherapy, pulse, pulse pressure, oxygen saturation.

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EVALUATION OF GASTROPROTECTIVE AND REGENERATIVE ACTIVITY OF THE ELAEAGNUS ANGUSTIFOLIA LIQUID LEAF EXTRACT

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Annotation. The aim of the study was to evaluate the gastroprotective and regenerative activity of the liquid leaf extract of *Elaeagnus angustifolia*. The results obtained demonstrate the presence of gastroprotective and regenerative action of the liquid extract of *Elaeagnus angustifolia* leaves, that is confirmed by a significant reduction of the Paul's "ulcer index" for all structural changes of the stomach mucosa and an increase of the coefficient of anti-ulcer activity, with the most significant changes being observed in the group of animals, which received the investigated preparation before the ulcer process modeling in the stomach.

Keywords: peptic ulcer, "aspirin" ulcer, anti-ulcer activity, *Elaeagnus angustifolia*.

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COMPREHENSIVE MEDICAL REHABILITATION FOR PATIENTS WITH CORONARY HEART DISEASE IN SOCHI RESORT

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Annotation. Optimizing programs for cardiac rehabilitation of patients with chronic coronary syndromes in the subtropical climate of the resort city of Sochi is an urgent problem. The article presents data of a comparative analysis of the results of comprehensive rehabilitation of patients with stable forms of coronary heart disease in the conditions of Sochi. We have revealed that the inclusion of the enhanced external counter-pulsation in the cardiac rehabilitation program significantly reduces the number of angina attacks and increases exercise tolerance in patients of the main group compared to the control group, and also stabilizes the parameters of central hemodynamics and improves subjective indicators of quality of life.

Keywords: cardiac rehabilitation, enhanced external counter-pulsation, coronary heart disease, stable angina.

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IMPLEMENTATION OF THE SPORTS ORIENTATION OF CHILDREN TO RHYTHMIC GYMNASTICS COMPLEX TO STUDY AGE-RELATED FEATURES OF 4-8-YEAR OLD RHYTHMIC GYMNASTS

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Annotation. Testing and implementation of the hardware and software complex (HSC) Sports orientation of children to rhythmic gymnastics (including a software program and its hardware part – an input device with markers and LEDs) were done in the sports school of Zheleznovodsk. The testing included 50 gymnasts aged 4-8 years (beginners, youth grades and the 3rd adult grade). The conducted study has demonstrated the efficiency of the developed HSC in identifying the morpho-psychofunctional development and fitness of girls to rhythmic gymnastics classes. We have received significant data with a scientific and practical interest about age-related differences of young gymnasts in morphological and functional indicators, level of the physical qualities’ development, physical and mental performance.

Keywords: rhythmic gymnastics, female athletes, morphological state, mental development, functional state, age-related features.

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EVALUATING MORPHOFUNCTIONAL PARAMETERS OF GYMNASTS ACCORDING TO THEIR PERFORMANCE IN SPECIFIC DISCIPLINES

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Annotation. Morphofunctional parameters influence the manifestation of physical qualities and determine the performance of athletes in specific sports and disciplines. Morphofunctional parameters undoubtedly depend on genetic predisposition, but at the same time undergo changes in the process of adaptation to specific physical activity during multiannual sports training. Assessment of parameters in elite athletes of various sports is requested on the basis of the specifics of sports activities and performance in specific disciplines. A retrospective analysis made it possible to identify significant differences between athletes by gender, age and morphofunctional parameters in different disciplines of the same sport.

Keywords: athletes, adaptation, performance, anthropometry.

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CORRECTION OF SCOLIOTIC DEFORMITIES IN ELITE GYMNASTS

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Annotation. The article presents the results of applying a corrective program in elite gymnasts with grade I scoliosis in the thoracolumbar spine. There was a decrease in deformity in terms of scoliometry and the Cobb angle, calculated from the X-ray data. The indicators of the respiratory system function increased (vital capacity, forced vital capacity, breath holding tests on inhale and exhale), strength endurance of the back muscles also increased. The results obtained can be taken into account in the training and recovery process of elite gymnasts with scoliotic changes in the spine, which will reduce the risk of disease progression, prevent early onset of fatigue and increase the productivity of professional activity.

Keywords: gymnasts, athletes, rhythmic gymnastics, scoliosis, spinal deformity, correction, respiratory system.

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UDC 612.821.8; 612.833.8

RELATIONS OF THE BRAIN RHYTHMOLOGICAL ACTIVITY WITH PSYCHOMOTOR CHARACTERISTICS IN ADOLESCENT WATER POLO PLAYERS

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Annotation. The article describes the relationship between brain rhythms and psychomotor characteristics in adolescents engaged in water polo. The features of the relationship of brain rhythms with the response time to sensory light and auditory stimuli of a static and dynamic nature, with the choice reaction, endogenous chronobiological assessment of the astronomical unit of time, and mental performance characteristics were revealed. The obtained information about the relationship between brain rhythms and psychomotor characteristics in teen water polo player will allow us to identify early predictors of the occurrence of adverse conditions of fatigue, to carry out prevention and take measures for the timely correction of conditions associated with fatigue, e.g. neurobiofeedback, in the course of their athletic and training activity.

Keywords: athletes, adolescents, water polo, brain rhythms, psychomotor characteristics.

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IMPACT OF BIOFEEDBACK TRAINING ON COGNITIVE FUNCTIONS OF ATHLETES

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Annotation. The article presents changes in the indicators of cognitive functions of athletes under the influence of biofeedback training on the beta-rhythm of the brain. There was an improvement in indicators of attention (performance efficiency, mental stability, warm-up time, switchability and speed of test execution), memory (working, for numbers, for figures), and operational thinking. The obtained information about the improvement of cognitive functions under the influence of biofeedback training on the beta-rhythm of the brain will allow leveling and preventing adverse conditions in the cognitive system associated with fatigue or under-recovery in the professional activity of athletes.

Keywords: athletes, cognitive functions, attention, working memory, operational thinking, biofeedback training, beta-rhythm of the brain.

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EFFECT OF ECDYSTERONE ON BODY COMPOSITION AND PERFORMANCE IN RESISTANCE TRAINING: A SYSTEMATIC REVIEW OF RANDOMIZED CONTROL STUDIES

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Annotation. Ecdysterone is considered as a supplement capable of increasing strength and muscle mass, as well as increasing the performance of athletes. The aim of the study was to conduct a systematic review of randomized controlled trials evaluating the effects of ecdysterone supplementation on performance and body composition during resistance training. Literature search was carried out in the PubMed and Google Scholar international databases. The search took 10 years (from 2012 to October 1, 2022). Of the 26 articles reviewed, only 2 studies met the inclusion criteria. A systematic search and generalization of studies has shown that at the moment it is impossible to draw a conclusion about the effect of ecdysterone on body composition and performance of people engaged in resistance training.

Keywords: ecdysterone, spinach extract, doping in sports, World Anti-Doping Agency, doping.

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UDC 796.01; 612

**ATHLETIC HEART IN ATHLETES WHO EXERCISE IN TRAMPOLINE JUMPING:
HEART ADAPTATION ACCORDING TO ELECTROCARDIOGRAM AND
ECHOCARDIOGRAPHY DATA**

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Annotation. Sudden cardiac death in young athletes is the leading cause of death among athletes while playing sports. Specific knowledge about the heart's adaptation is needed to better understand the underlying causes of such events. We have carried out a retrospective analysis of the electrocardiogram and echocardiography data obtained during the annual medical examination of the entire youth trampoline team of the Astrakhan region. Initially, we have used data from the first survey. In a second step, data from two surveys 2 years apart were analyzed for the selected subgroup to obtain more information on adaptation to trampoline jumping. The data from the subgroup were compared with the control group of the corresponding age and gender from the youth team of the Astrakhan region in artistic gymnastics. 47 young trampoliners (20 girls, 27 boys) were examined once. The electrocardiogram and echocardiography have revealed no pathology. Left ventricular measurements were between those for athletes and non-athletes. Eight boys and six girls from this group were examined twice within 27.5 months. All left ventricular measurements have increased over time. After 2 years, the parameters of trampoliners were comparable to those of artistic gymnasts.

Keywords: pediatric cardiology, adolescent athlete, cardiomyopathy, athletic ability test, eccentric hypertrophy, concentric hypertrophy.

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**NUTRITION FEATURES OF ATHLETES DEPENDING ON RS2228570
POLYMORPHISM (VDR GENE)**

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Annotation. Nutrition is the most important factor ensuring the adaptation of the athlete's body to physical and psychological stress, specific working capacity. However, the role of genetic polymorphisms in the violation of eating behavior and the structure of the actual nutrition of athletes has not been studied enough. The study of the effect of rs2228570 polymorphism of the vitamin D receptor gene (VDR) on the daily caloric content of the diet, the content of fat, saturated fatty acids, cholesterol, calcium and phosphorus in the daily diet of athletes has revealed the absence of a statistically significant association of this polymorphism with the studied indicators of actual nutrition.

Keywords: nutrition of athletes, rs2228570 polymorphism of the VDR gene, eating behavior.

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USING HYPO- AND HYPEROXIC FACTORS IN THE MEDICAL AND BIOLOGICAL SUPPORT OF ATHLETES (ANALYTICAL REVIEW)

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Annotation. The purpose of this work was a theoretical analysis of literature data on the issue of using hypo- and hyperoxic factors in the medical and biological support of sports training. Results of the content analysis of Russian and foreign literature sources demonstrate that the use of hypo- and hyperoxia in the medical and biological support of training elite athletes can be efficient for improving functional adaptive capabilities and for rehabilitation and recovery after diseases, including COVID-19.

Keywords: hypoxia, hyperoxia, middle altitude, athletes, sports training, medical rehabilitation, adaptation, functional capabilities.

PHYSICAL CULTURE AND PROFESSIONAL PHYSICAL TRAINING

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PHYSICAL STATE OF TECHNICAL STUDENTS IN THE PROCESS OF LEARNING

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Annotation. The purpose of the research is to analyze the indicators of the physical state of technical students in the process learning. We have presented the results of a comparative analysis of physical state indicators among students of different courses of study (on the example of male students of a transport university). A number of negative aspects have been revealed, mainly related to the functional indicators of the cardiorespiratory system, which reflects the lack of efficacy of physical education classes as part of learning at the university. The potential for solving the problem of worsened functional state of students lies in the expansion of extracurricular forms of physical activity. This may be independent physical training of students. However, the most effective one is the implementation of organized additional classes in the sports bases and sports grounds of an educational institution.

Keywords: physical culture, physical state, cardiorespiratory system functions, students.

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INDICATORS OF SPEED ABILITIES' DEVELOPMENT IN MEDICAL STUDENTS

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Annotation. The development of speed abilities among medical students is conducted in accordance with the Federal Educational Standard 3 +++ and the Physical Education program that are presented in the "Track-and-field" section. This development has significant value in the system of student physical training. The secondary protocols, passing control tests at the end of the year that identify the level of development show a substantial difference of results in groups of students who engage in different sports. It gives the reason for the search of scientific tools and methods for the comprehensive development of speed qualities. The aim and main tasks of the study: to identify the differential level of developing speed qualities among first-year students (young men aged 18-19 years), justify experimentally the method of developing the said qualities during the year. We have examined the physical fitness level in 143 first-year students of the Faculties of Therapy, Pediatrics and Dentistry. According to the medical check-up results, they were allowed to visit physical education classes without limitations (medical group A). The study took place in the Physical Education Department of the Astrakhan State Medical University and in the Department of Physical Education, Exercise Therapy and Medical Supervision of the Kuban State Medical University in 2021-2022. We have carried out an analysis of the development level during the year. The statistical data processing was made with standard software packages (Microsoft USA). The significance of differences was defined with generally accepted math-and-stats methods. The differences deemed significant if $p < 0,05$. The research has demonstrated that according to the final testing results there was a significant difference in the aforementioned indicators in the group that is identified through the type of sports.

Keywords: 18-19 years old students, speed abilities, differential method, team sports, power training.

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PEDAGOGICAL MODEL OF TEACHING UNSUPERVISED WORK ON PHYSICAL EDUCATION AT THE UNIVERSITY

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Annotation. The article presents the content and organization of the pedagogical model in the process of physical education at the university, which ensures its effectiveness and motivates students to do physical activity. The content of the methodology for teaching informational tasks has been supplemented (logical tests-tasks). The content of the logical tests-tasks developed by the students was implemented as the subject of problem solving lectures, which ensured the organization of lectures with elements of a scholastic debate. We have developed progress sheet of student labor and recreation. It included the following: preparation for academic subjects, self-control, sleep schedule, motor activity according to interests, participation in university events, including sports, and other activities.

Keywords: students, methodology, project developing, modeling and project developing activities.

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HARMONIZING OF PHYSICAL FITNESS OF STUDENTS WITH THE MOBILE APP

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Annotation. The article presents the content of the application for mobile devices “Testing the physical qualities of students”. The program is designed for self-diagnosis and correction of the individual level and harmony of the development of physical qualities of young students of the main medical group. A feature of this application is the directed impact on the harmonization of physical fitness of students. In our study, by harmonizing physical fitness, we mean achieving proportionality in the development of the tested individual physical qualities of students. Harmonization of physical fitness of students is achieved through the algorithm implemented in the application for translating test indicators into points based on percentile scales, building an individual profile of physical fitness, using the final assessment of physical fitness, taking into account the absence of underdeveloped physical qualities, learning self-control and forming a conscious attitude to the process of individual physical training.

Keywords: students, mobile app, harmony, proportionality of development of physical qualities, physical fitness, self-control, individual profile.

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UDC 796/799

**ON IMPROVING THE EFFECTIVENESS OF PROFESSIONAL AND APPLIED
PHYSICAL TRAINING OF FUTURE TEACHERS BY MEANS OF FITNESS**

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Annotation. The purpose of the study is a theoretical and methodological justification for the application of modern types of fitness in the professional physical training of future teachers. We have conducted a survey in the Google Forms format for female students of the Foreign Languages Faculty in the Ilya Ulyanov State Pedagogical University, during which the level of students' motor activity, the reasons for their low motivation for working out, as well as preferences in choosing modern types of fitness programs were identified. In order to substantiate the author's working program of a physical education elective course with modern fitness programs for 1-year students, we have held a 2-week trial course called the “Student Sports Workshop”.

Keywords: physical education, professional and applied physical training, healthy lifestyle, fitness, students, motivation, motor activity.

THEORY AND METHODS IN SPORTS

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TO THE PROBLEM OF ORGANIZING SPORTS TRAINING OF ATHLETES, ACCORDING TO THEIR INDIVIDUAL AND TYPOLOGICAL FEATURES (THEORETICAL ANALYSIS)

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Annotation. The authors analyze the issues of the need to take into account the individual and typological features of the information perception of athletes in the process of sports training. The relevance of the topic is due to the influence of such features on the efficiency of mastering the technique of performing motor actions, as well as the amount of time spent at the same time. The authors substantiate the need to take into account the level of individual and typological features of the information perception in athletes that affect the calculation of the occupancy rate of sports training groups and the establishment of the normative number of psychologists professionally involved in correcting certain features.

Keywords: individual and typological features of information perception, neurophysiological processes, group training, quantitative composition of the group, staffing of groups, sports training, quality of mastering the stages of sports training.

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DEVELOPMENT OF PHYSICAL QUALITIES IN SOCCER PLAYERS AT THE EARLY STAGE OF RECOVERY WITH ROBOT-ASSISTED TRAINING DEVICES

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Annotation. We have conducted evaluation of the developed method with robot-assisted training devices for developing physical qualities in athletes at the early stage of recovery after injuries. It was revealed that application of these training devices ensures a more successful formation of physical qualities, firstly because of effective recovery of mobility in the knee joint. The results obtained allowed recommending the use of robot-assisted training devices after knee joint injuries at the early stage of recovery.

Keywords: soccer players, injuries, recovery, training devices, training.

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UDC 796

BINARY OPPOSITION OF INDIVIDUAL STYLE OF JUDO WRESTLERS

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Annotation. This scientific article analyzes the theoretical and practical aspects of the binary opposition of the individual style of judo wrestlers. We have presented terminological concepts on this research topic. Binary oppositions to this problem of research as a rational description of the world are identified and analyzed, where two opposite concepts are simultaneously considered, one of which asserts a quality, and the other denies. The objective of this study was to identify variably stable characteristics in the individual style of activity of judo wrestlers and to determine their hierarchy. The study included three groups of judo wrestlers (1st – young men, rated athletes; 2nd – Candidates for Master of Sports and Masters of Sports; 3rd – the strongest judokas of the country; n=118). To diagnose the strength of the nervous system by excitation, we have applied the slope-based and CCI-2 (chronic circulatory inefficiency) methods, as well as tapping test. The authors' position is that vivid and reliable typological differences in certain indicators, their similarity in different age and qualification groups indicate the presence of genetic links between the hierarchical characteristics of the style.

Keywords: binary opposition, individual style, self-control, symmetrizing, sports activity, existentialism, transpersonal.

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IMPROVING BALL RECEPTION WITH VARIOUS COMBINATIONS OF TRACKING TIME AND FLIGHT SPEED

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Annotation. This scientific article analyzes the theoretical and practical aspects of improving ball reception with various combinations of tracking time (TT) and flight speed (FS). We have presented comparative characteristics of the efficiency of ball reception training with different combinations of TT and FS. The existence of the skill transfer when receiving the ball during training in one way to the success of receiving in another way was identified. Signs of the skill transfer to the success of receiving the ball in the same way as in training, but with TT and FS that were different from training ones, were noted. The experiment involved 28 basketball players of the first category – students of the Altai State Pedagogical University, Altai State Medical University, average age – 20.6 years with at least 7 years of basketball experience. Before the experiment, they were divided by the random number method into 4 experimental groups, 7 people each. The author's position is that training in ball catching with low FS allows increasing the success of this method of ball reception only with long TT. At the same time, there is the skill transfer to the success of ball catching with FS higher than the one during training. Training in catching with high FS is ineffective. Training in clearance in case of short with long TT allows increasing the success of ball clearance only with long TT. The skill transfer from clearance to ball catching exists only in case of short TT.

Keywords: technical and tactical skill of basketball players, physical qualities, training process, timing, occlusion period, method of multivariate analysis of variance, method of pair comparison.

HEALTH AND ADAPTIVE PHYSICAL CULTURE

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DEVELOPMENT OF MOTOR COORDINATION ABILITIES OF CHILDREN WITH INTELLECTUAL DISABILITIES ENGAGED IN TABLE TENNIS

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Annotation. The article reveals the structure and content of the program for the development of motor coordination abilities of 12-13-year-old table tennis players with intellectual disabilities. We used motor tests to identify the level of development of the studied physical capability indicators of young athletes with mental disorders, methods for assessing the concentration and volume of dynamic attention of children and adolescents with intellectual disabilities. We also presented the results of the influence of the training means from the program for the development of motor coordination abilities of 12-13-year-old table tennis players with intellectual disabilities on the level of their physical and technical fitness.

Keywords: mental disorders, table tennis, program, motor coordination abilities, attention.

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DEVELOPING COGNITIVE ABILITY OF YOUNGER SCHOOLCHILDREN IN SPORTS AND RECREATIONAL ACTIVITIES

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Annotation. The article reveals the methodology of sports and recreation classes conducted after school hours with the introduction of team sports (basketball, floorball), interactive technologies that will contribute to the development of physical conditions and cognitive abilities of younger schoolchildren. The purpose of this work is to study the influence of extracurricular sports and recreational activities on the development of cognitive abilities of younger schoolchildren. The proposed forms and methods of organizing extracurricular activities with the inclusion of interactive game technologies and tasks allowed increasing the cognitive abilities of younger schoolchildren.

Keywords: junior schoolchildren, sports and recreational activities, cognitive abilities, physical culture.

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UDC 796

POSSIBILITIES OF MYOFASCIAL DIAGNOSTICS IN PHYSICAL CULTURE AND HEALTH-IMPROVING ACTIVITY

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Annotation. The article presents the theoretical and practical aspect of the possibility of myofascial diagnostics in physical culture and health-improving activities. We have analyzed and

considered the possibilities of myofascial diagnostics in physical culture through the prism of understanding pathogenesis of the myofascial pain syndrome. As a rule, the etiological factor that causes it is a local overstrain of the musculoskeletal system, especially in case of a sedentary lifestyle. In this regard, the authors have concluded that physical education instructors need to include elements of myofascial diagnostics in somatoscopy and monitoring for further consideration of the identified symptoms in rehabilitation sessions. In case of untimely diagnosis, myofascial syndrome can lead to persistent pain syndrome. Myofascial diagnostics would allow identifying limitations and clarifying the degree of damage against the background of degenerative disk diseases and adjust the rehabilitation program of motor activity.

Keywords: trigger point, kinesiotherapy, decompression mode, degenerative disk disease, myofascial pain syndrome, myofascial diagnostics, physical culture and health-improving activity.

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ANALYSIS OF THE USE OF NORDIC WALKING IN 65-70-YEAR-OLD WOMEN WITH THORACIC KYPHOSIS

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Annotation. Among the elderly, changes in the physiological curves of the spine, decreased mobility and associated pain syndrome are observed. This article compares the use of nordic walking, therapeutic swimming and therapeutic gymnastics on the posture and strength of the shoulder girdle muscles of elderly patients. The aim of the study was to compare the effectiveness of classes with different recommended means of physical rehabilitation (therapeutic gymnastics, therapeutic swimming, nordic walking). The result of the study was the confirmation of the hypothesis that any physical activity has an equally positive effect on the core muscles of elderly people, reduces pain and increases mobility of the shoulder girdle.

Keywords: nordic walking, posture disorders, the elderly, thoracic kyphosis, stooping, therapeutic swimming, 65-70-year-old women.