

PHYSIOLOGY

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EFFECT OF AGE-RELATED CHANGES IN VASCULAR WALL ON HEMODYNAMIC PARAMETERS

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Annotation. The aim of the study was to evaluate the effect of age-related changes in the vascular wall on blood flow in the brachial artery. The study was conducted on 117 adult patients with no clinical signs of cardiovascular diseases, divided into age groups. By the method of compression oscillometry, we have found that with increasing age, the indicators of pulse blood pressure and vascular wall compliance decreased, while the indicators of pulse wave propagation velocity and total peripheral vascular resistance significantly increased. No indicators exceeded the threshold values in all age groups. The linear regression model revealed that 45% of dependencies on other variables remain unaccounted for in this model, which requires further search for other criteria.

Keywords: vascular age, compression oscillometry, hemodynamics.

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POLYMORPHISM OF THE B-TYPE ENDOTHELIN-1 RECEPTOR GENE (EDNB) AND HEMODYNAMIC INDICATORS OF VASCULAR TONE

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Annotation. The purpose of this study was to examine the possible effect of the EDNRB polymorphism (rs5351) (replacing G with A in position 1065) on hemodynamic indicators of vascular tone in the young population living in the Arctic region. It was found that the presence of polymorphic allele A in homo- and heterozygotes led to a change in the level of nitrogen oxide (NO) and endothelin-1 (EDN1), but did not have a statistically significant effect on the performance of the cardiovascular system and its functional (reserve) capabilities. It is necessary to introduce population studies more widely in order to search for candidate genes associated with cardiovascular diseases caused by vascular tone disorders.

Keywords: endothelin receptors, gene polymorphism, single nucleotide substitution, vascular tone, vasoconstriction.

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ASSESSMENT OF THE FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM IN YOUNG PEOPLE AGAINST THE BACKGROUND OF DIFFERENT FORMS OF EDUCATION

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Annotation. The aim of the study was to assess the stability of cardiac activity and autonomic homeostasis of the cardiovascular system in 58 adolescent schoolchildren who do not have chronic diseases in full-time and distance learning. The article presents the results of assessing the stability of cardiac activity, indicators of motor activity, autonomic homeostasis, state and trait anxiety. It was found that after distance learning, all high school students showed an increase in the reactivity of the autonomic nervous system, a violation of the flow of electrical processes in the myocardium, as well as high state anxiety and a predisposition to anxiety. More pronounced changes are observed in young men in all studied indicators and in both forms of education.

Keywords: forms of education, cardiac activity, adolescence, physical inactivity, autonomic homeostasis, dispersion mapping.

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COMPARISON OF THE RATE OF MAXIMAL OXYGEN CONSUMPTION IN THE TRADITIONAL STEP TEST AND IN THE ANAEROBIC WINGATE TEST

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Annotation. The maximal oxygen consumption (VO_{2max}) and peak oxygen consumption are compared when performing the Wingate test on a bicycle ergometer. 21 professional soccer players (age 28.8 ± 3.9 years, weight 79 ± 7.7 kg, VO_{2max} 44.7 ± 5.9 ml/kg/min) performed the step test and the 30-second anaerobic Wingate test. A significant correlation ($r=0.55$) was found between the rate of maximal oxygen consumption in the step test and the peak rate of consumption at the end of the Wingate test, with no statistically significant differences between the indicators ($p<0.01$). Maximal aerobic power moderately correlated ($r=0.68$) with maximal oxygen consumption.

Keywords: maximal oxygen consumption, Wingate test.

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INFLUENCE OF LICORICE EXTRACT ON DAPSONE-INDUCED CHANGES IN PERIPHERAL BLOOD PARAMETERS

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Annotation. Currently, the issue of studying possible complications when taking various drugs is of interest. One of these is 4,4'-Sulfonylbis[benzeneamine] (dapson), which has a bacteriostatic effect against *Mycobacterium leprae*, *Plasmodium*, *Pneumocystis jirovecii* and is the drug of choice in the treatment of such diseases as leprosy, Dühring's herpetiform dermatitis, bullous

pemphigoid, various types of vasculitis and others. The aim of this study was to evaluate the effect of licorice extract on dapsone-induced changes in peripheral blood parameters. The combined use of licorice root extract with dapsone prevented the development of dapsone-induced changes in the peripheral blood, namely anemia, presumably of hemolytic origin, as well as agranulocytic changes.

Keywords: licorice, dapsone, dapsone-induced changes, anemia, agranulocytosis.

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FEATURES OF BODY COMPOSITION OF GIRLS AGED 18-20 YEARS LIVING IN THE MIDDLE OB REGION

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Annotation. The aim of the study is to ascertain the features of body composition of girls aged 18-20 years living in the Middle Ob area. A number of features were revealed, manifested by deviation of the girls' body mass index towards both deficiency and increase. The values of the girls' basal and specific metabolic rate were on the lower limit of normal, which does not exclude the risk of obesity with age. The revealed increased values of the adipose mass, along with the low values of active cell mass and low proportion of active cell mass may testify to the insufficient protein intake. The average values of total body water and extracellular fluid in the surveyed females met the optimum values.

Keywords: students, physical development, body composition, anthropometry, metabolism, the Middle Ob region.

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INDIVIDUAL APPROACH TO IDENTIFYING THE FUNCTIONAL FITNESS OF THE BODY BY THE HEART RATE VARIABILITY ANALYSIS FOR CORRECTION OF STRENGTH TRAINING IN VOLLEYBALL

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Annotation. Honored Master of Sports of Russia, Olympic champion, leading player of the professional volleyball club Zenit-Kazan took part in the study during the competitive period (Cup and Championship of Russia, CEV Champions League). A total of 39 examinations were carried out using the express method of analyzing heart rate variability indicators in the morning immediately after sleep before exercise and breakfast, mostly before training in the gym. According to the average indicators of the main temporal ($MxDMn=365.6$ ms, $SI=55.8$ c.u.) and spectral ($VLF=606.7$ ms²) heart rate variability indicators, it can be concluded that the player has type III autonomic regulation (normovagotonia), and in some surveys it shifted towards type IV (hyper-vagotonia).

Keywords: heart rate variability, functional state, autonomic regulation, individual approach, volleyball, strength training.

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METHODS OF DEVELOPING SPECIAL ENDURANCE OF BASKETBALL PLAYERS BY MEANS OF ARTIFICIALLY CREATED HYPOXIA CONDITIONS

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Annotation. The article presents the results of experimental training of basketball players of the student team. The relevance of this study lies in the fact that in modern realities there is a need to adjust standard training sessions for the development of both general and special endurance, in particular by introducing a hypoxic training model. The hypothesis of the study was the assumption that the growth of athletic achievements occurs in parallel with an increase in individual resistance to hypoxia. The essence of the experimental technique was to create artificially created hypoxia conditions as an alternative to training athletes in middle altitude conditions. The physiological basis of endurance is analyzed, the relationship between endurance and the body's resistance to oxygen deficiency is highlighted, tests are selected that determine the level of development of the studied quality and the results of the experiment are presented. The results obtained indicate a positive effect of hypoxic training on increasing the level of special endurance and overall performance of basketball players.

Keywords: endurance, hypoxia, fatigue, performance, training process.

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ON PHYSICAL DEVELOPMENT OF ASTRONAUTS WITH DIFFERENT SOMATOTYPE

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Annotation. In the Gagarin State Scientific Research and Testing Cosmonaut Training Center, the authors have conducted a retrospective analysis of the medical records of 23 astronauts, whose age at the time of selection to the cosmonaut squad ranged from 29 years and 3 months to 32 years and 6 months. According to the Chernorutskij method, the examined astronauts were divided into three groups according to somatotypes – asthenic (n=4), normostenic (n=5) and hypersthenic body types (n=14). The revealed features of the physical development of astronauts with different somatotypes must be taken into account in the process of their professional training, in the selection of ways, methods and activity parameters in physical training, in the planning of the work and rest schedule, as well as when choosing criteria in the selection of candidates for astronauts and the formation of crews for flights to the International Space Station, and in the future for long interplanetary missions.

Keywords: astronauts, interplanetary expeditions, physical development, somatotype.

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FEATURES OF THE QUALITY OF LIFE AMONG STUDENTS OF A VOCATIONAL SECONDARY EDUCATION INSTITUTION IN TYUMEN

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Annotation. As part of the study of the quality of life properties of students enrolled in programs of vocational secondary education, we have examined 88 students (48 girls and 40 boys, age – 17-20 years) from the Tyumen Industrial University's Multidisciplinary College. In accordance with the results obtained after a dispensary examination, the participants were recognized as practically healthy. The quality of life was studied with a standardized Russian version of the popular SF-36 questionnaire. The results of the study have revealed that the quality of life indicators of students demonstrate an average and high level. The subjective evaluation of an important physical health and quality of life component (physical functioning) occupies a dominant position among all other indicators. The highest scores for indicators of physical and social functioning demonstrate high physical activity and socialization at this age. We have also identified non-uniform values of quality of life indicators in test groups. The information obtained can be applied when comparing students' quality of life from different regions and types of educational institutions.

Keywords: physical health, quality of life, psychological health, mental health, SF-36 questionnaire, college students, students.

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DYNAMICS OF GAS EXCHANGE INDICATORS DEPENDING ON RESPIRATORY CYCLES AND INCREASING LOAD

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Annotation. Oxygen supply occurs due to the heart pumping function and the respiratory system. Aside from oxygen supply, the other main function of the respiratory system is the release of carbon dioxide and gaseous products of metabolism. The article presents the indicators of gas exchange in male athletes aged 18 to 35 years, depending on respiratory cycles and increasing load. The subjects were divided into three groups depending on the respiratory cycle types (bradycardic, normocardic, tachycardic). When performing loads increasing from 50 W to 200 W, the highest rates of oxygen consumption and carbon dioxide release were identified in the group of athletes with the tachycardic type, lowest rates – in a group with the bradycardic type.

Keywords: gas exchange, increasing load, respiratory cycle, oxygen consumption, carbon dioxide release.

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**FEATURES OF SENSORIMOTOR REACTION INDICATORS OF ORIENTEERS
SPECIALIZING IN CROSS-COUNTRY ORIENTEERING DURING THE
COMPETITIVE PERIOD**

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Annotation. Orienteering is a sport in which the outcome of the competitive struggle depends on the speed of evaluation, the prevailing competitive situation, and the right decision made by the athlete. The article discusses the features of sensorimotor reactions of orienteers. The purpose of the study is to establish the relationship between the indicators of sensorimotor reactions and the attention dividing of athletes specializing in cross-country orienteering with qualifications and competitive results. To register the parameters of visual-motor reactions and the attention dividing, the software and hardware complex “Biomysch issledovatel’skaya KPF-01b” was applied. The study found that the Masters of Sports had a shorter reaction time in studies of simple visual-motor reaction and attention dividing.

Keywords: simple visual-motor reaction, complex visual-motor reaction, attention dividing, orienteering, cross-country orienteering, foot orienteering, biomysh, physiological indicators.

PSYCHOPHYSIOLOGY

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FEATURES OF THE SEVERITY OF THE EMOTIONAL BURNOUT SYNDROME AND COPING STRATEGIES OF BOYS AND GIRLS IN TYUMEN

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Annotation. As a result of studying this topic, it was found that students who have formed phases of emotional burnout syndrome preferentially use non-productive cognitive, emotional, behavioral coping strategies. In boys and girls with emerging phases of the emotional burnout syndrome, the picture in the emotional and behavioral sphere is much better, which is characterized by the priority use of productive coping strategies. The majority of students in the cognitive and behavioral spheres use mostly relatively productive coping strategies, and in the emotional sphere, there is almost the same ratio of productive and unproductive coping strategies with some predominance of productive ones. The study expanded the theoretical understanding of the burnout syndrome and its relationship with coping behavior in boys and girls, which contributes to the clarity of understanding of students' needs to adapt to the modern educational environment.

Keywords: coping strategies, burnout, senior school age, coping behavior, emotional burnout.

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DESCRIPTION OF PERSONAL PSYCHODYNAMIC PROPERTIES, MOTIVATION AND HEART RATE VARIABILITY IN YOUNG MEN WHEN PERFORMING A COGNITIVE TASK WITH UNEQUAL OUTCOMES

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Annotation. The aim of the study was to identify the characteristics of personal psychodynamic properties, motivation and heart rate variability in male subjects aged 18 to 23 years when performing a cognitive task with unequal outcomes. Based on the performance indicators of the "Schulte-Gorbov Tables" test, the sample of subjects (n=47) was divided into two clusters using cluster analysis (CL₁ – "low-scoring", n=18; CL₂ – "high-scoring", n=29). CL₁ subjects have lower values of the indicators "Self-esteem motive" (p=0.0275), "Assessment of one's potential" (p=0.0108), coefficient of variation in the initial state (p=0.0341), and higher stress index in the initial state (p=0.043) compared with the CL₂ subjects. The results of the correlation analysis reflect the unequal relationship between personal psychodynamic properties, motivation and performance indicators for the performance of the "Schulte-Gorbov Tables" test among members of different clusters. The data obtained in the course of this study demonstrate the existence of certain combinations of personal psychodynamic properties, motivational structure and heart rate variability, which are manifested, among other things, in the nature of correlation relationships, allowing the implementation of cognitive activity with a definite outcomes.

Keywords: psychodynamic properties, motivation, heart rate variability, purposeful behavior.

BALNEOLOGY AND REHABILITATION

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EFFECTIVENESS OF SHOCKWAVE THERAPY AND INSTRUMENT ASSISTED SOFT TISSUE MOBILIZATION IN PATIENTS WITH COXARTHROSIS AGAINST THE BACKGROUND OF INTRA-ARTICULAR USE OF HYALURONIC ACID PREPARATIONS

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Annotation. The authors have used an integrated approach to improve the rehabilitation effectiveness of patients with CA. The aim of the study was to evaluate the clinical efficacy of SWT and IASTM in patients with CA against the background of intra-articular use of hyaluronic acid preparations. Comprehensive treatment of CA with intra-articular hyaluronic acid injections and subsequent rehabilitation with IASTM and SWT improves the clinical condition of patients, increases the thickness of cartilage on articular surfaces to 0.2-0.4 mm and reduces the thickness of the tendons of the muscles in the enthesis zone to the indicators of the standard variant (according to the hip joints' ultrasound). The use of IASTM causes a pronounced clinical improvement in earlier periods of rehabilitation, and the use of SWT helps to achieve a prolonged, persistent therapeutic effect.

Keywords: coxarthrosis (CA), hyaluronic acid, shockwave therapy (SWT), Instrument Assisted Soft Tissue Mobilization (IASTM).

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USING THE METHODS OF PHYSIOTHERAPY AND THERAPEUTIC PHYSICAL CULTURE AT THE EARLY REHABILITATION STAGE AFTER AN ACUTE CEREBROVASCULAR ACCIDENT

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Annotation: Complications of acute cerebrovascular accident are of great social and economic importance, due to the fact that they can lead disability, and in severe cases – death. Clinical studies have shown that the use of methods of early medical rehabilitation after a stroke can reduce the level of disability and the number and severity of complications of the underlying and concomitant diseases, improve the quality of life of patients, reduce the dependence of patients on outside help, restore and maintain the ability of patients to self-care, move and communicate. The aim of the study was to analyze and describe the effective methods of physiotherapy and therapeutic physical culture used in clinical practice in the rehabilitation of patients after a stroke at an early stage.

Keywords: stroke, physiotherapy, medical rehabilitation, therapeutic physical culture.

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HEALTH RECOVERY AND PRESERVATION OF WOMEN OF THE SECOND ADULTHOOD WITH CORONARY HEART DISEASE AFTER THE COVID-19 PANDEMIC

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Annotation. For the first time in cardiology, from medical and pedagogical point of view, the article provides data on the study of physical performance (PP) in 49 women of the second adulthood living in the south of Western Siberia who received restorative treatment for coronary heart disease (CHD) after the COVID-19 pandemic. For the first time, the ninth period of human ontogenesis was conditionally divided into equal 5-year segments: from 36 to 40 years, from 41 to 45 years, from 46 to 50 years and from 51 to 55 years. Students were shown that to determine PP in cardiology, one of the easiest to use and extremely informative is the PWC 170 step test by V.L. Karpman. Thanks to the test, cardiologists have the opportunity to carry out competent and constant monitoring of the functional state of central hemodynamics and make timely adjustments to the ongoing rehabilitation treatment by means of physical therapy. The authors found a significant decrease in PP depending on the passport age of women.

Keywords: women, the period of second adulthood, coronary heart disease, medical and pedagogical approaches to identifying physical performance, consequences of the COVID-19 pandemic.

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PROSPECTS FOR USING THE EXTREMELY HIGH FREQUENCY THERAPY IN CARIOGENIC PULMONARY EDEMA (EXPERIMENTAL STUDY)

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Annotation. The aim of the work was to identify the features of the effect of EHF (extremely high frequency) radiation on the morphophysiological characteristics of erythrocytes in experimental cardiogenic pulmonary edema in rats. The activity of transmembrane transfer of the erythrocyte membrane, sorption properties, spontaneous and induced hemolysis, as well as the deformability of erythrocytes in cardiogenic pulmonary edema and after a course of therapy with EHF radiation to three acupuncture points were identified. We have found that the course mono-EHF-puncture had a positive therapeutic effect, which was expressed in an increase in glucose consumption and deformability of erythrocytes, a decrease in sorption capacity with a reduction in spontaneous and induced hemolysis of erythrocytes relative to the control group of animals.

Keywords: pulmonary edema, EHF-therapy, erythrocyte.

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APPLICATION OF GAME BIOCONTROLLED MECHANOTHERAPY IN THE RESTORATION OF MOTOR FUNCTIONS OF THE UPPER LIMB IN HEMIPARETIC FORM OF CEREBRAL PALSY

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Annotation. The article presents the results of the use of game biocontrolled mechanotherapy in the restoration of gross and fine motor skills of the upper limb in children aged 6-8 years with a hemiparetic form of cerebral palsy. The results of an automated test of gross motor functions of the upper limb, carried out on the Ortorent Motorika simulator, reflected a significant improvement in the movement amplitude when the affected limb was shifted to the right (by 23%), to the left (by 19.8%), upwards (by 12.3%), down (by 14.8%), forward (by 6%), back (by 18.1%). Restoration of fine motor functions is represented by an improvement in the range of motion of the hand of the affected limb in the automated simulation tests carried out with the Ortorent Motorika simulator: “Opening the door counterclockwise” (improved vertical wrist abduction by 21.2%), “Opening the door clockwise” (15.8% improvement in vertical wrist adduction), “Turning the key counterclockwise” (upright hand supination increased by 21%), “Turning the key clockwise” (upright hand pronation improved by 32.9%), “Unscrewing the cap counterclockwise” (hand supination in the horizontal position increased by 26.4%), “Twisting the cap clockwise” (hand pronation in the horizontal position increased by 18.4%), “Joystick Squeeze” (hand strength increased 21.5%). The results obtained indicate the effectiveness of using game biocontrolled mechanotherapy in restoring the motor functions of the upper limb in children with hemiparetic form of cerebral palsy.

Keywords: game biofeedback, mechanotherapy, motor functions, hemiparetic form, cerebral palsy.

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AEROBIC EXERCISE AS A FACTOR OF REDUCING THE RISK OF CORONARY HEART DISEASE

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Annotation. The article presents theoretical and practical aspects of aerobic exercise as a way of reducing the risk of coronary heart disease. The authors analyzed the scientific and methodological literature, used the observation, synthesis and analysis methods in order to objectify the information received to obtain a more complete picture of the use of rehabilitation measures for people with coronary heart disease. In the course of our study, practical guidelines were developed and tested. In this regard, the authors made conclusions about the most favorable effect of physical training on the factors of the disease’s occurrence if the used physical activity is performed in an aerobic mode and preventive, rehabilitation measures are conducted with the activation of the mitochondrial component of energy metabolism in people with the said disease.

Keywords: aerobic physical exercises, coronary heart disease (CHD), physical culture and health-improving activity, preventive physical culture, rehabilitation physical culture, physical training.

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ANALYSIS OF MODELING SPINAL CORD INJURY IN AN EXPERIMENT FOR THE DEVELOPMENT OF REHABILITATION TECHNOLOGIES AND EVALUATION OF THEIR EFFICIENCY

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Annotation. The article provides an analytical review of foreign publications on methods of modeling spinal cord injury (SCI) of various etiologies in experimental animals. It is shown that, in contrast to the acute model of SCI, such as spinal cord cutting, which is an anatomical model for assessing axon regeneration, contusion and compression injuries of the spinal cord are more preferable models in laboratory animals for studying the pathophysiological mechanisms of the SCI consequences. At the same time, it is necessary to work out the parameters of the strength and duration of the damaging effect, as well as to reduce the level of invasiveness of manipulations when creating an experimental model of SCI in laboratory rats, which can be used in pre-clinical studies of new rehabilitation and therapeutic technologies.

Keywords: spinal cord injury, experimental model, neuroregeneration, contusion, compression, laminectomy.

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STUDY OF THE ANTIDEPRESSANT ACTIVITY OF SCUTELLARIA BAICALENSIS GEORGI EXTRACT UNDER THE CONDITIONS OF “SOCIAL” STRESS

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Annotation. The work is devoted to the study of the antidepressant activity of the *Scutellaria baicalensis* Georgi extract under conditions of “social” stress. The *Scutellaria baicalensis* Georgi extract used in the study was prepared by maceration. The study of antidepressant and psychostimulant activity was performed on experimental animals – 80 non-linear rats, divided into four groups by using the behavioral despair (helplessness) method according to the Porsolt method, which consists in placing the animal in a cylindrical vessel (d=30 cm; l=65 cm) filled with water for 5 minutes. Anxiety-depressive disorder, according to the type of “social” stress, was formed by creating inter-male confrontations based on paired sensory communication. The results of the first and second stages of the analysis indicated that the introduction of the *Scutellaria baicalensis* Georgi extract significantly improved the psycho-emotional state of the experimental animals and suppressed the effect of “social” stress on them. The antidepressant effect was shown in an increase in the time of the latent period until the first immobility, the time of active swimming and the number of diving, which indicated the anxiety leveling, increased mental activity, and restoration of cognitive functions. In addition, there was a decrease in the period of immobility, the number of acts of immobility, the time of passive swimming and the number of boluses, which

indicates a decrease in emotional overstrain, despair and anxiety. The antidepressant activity of the extract may be associated with the presence of flavonoids in the *Scutellaria baicalensis Georgi* plant material, which affect the functioning of the central nervous system and the synthesis of neurotransmitters (adrenaline, norepinephrine, serotonin and dopamine).

Keywords: anxiety-depressive disorders, “social” stress, *Scutellaria baicalensis Georgi*, extract, biologically active substances, antidepressants, anxiolytic effect, psychostimulant activity, behavioral despair (helplessness), Porsolt's method, flavonoids.

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COMPARISON OF THE USE OF FUNCTIONAL TRAINING AND HYDROKINESITHERAPY FOR CORRECTING THE BODY MASS OF MIDDLE-AGED WOMEN AT THE SANATORIUM STAGE OF REHABILITATION

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Annotation. This article presents the results of comparing the efficacy of comprehensive body mass correction programs in sanatorium conditions. The programs were based on one of the proposed types of physical activity (hydrokinesitherapy or strength training), diet therapy, aerobic cyclic training in the form of Nordic walking, lymphatic drainage massage. According to the results of the study, we have revealed that the difference in the results of the programs has no statistical significance, and the main effect is given by the frequency and systematic nature of classes.

Keywords: overweight, body mass index, hydrokinesotherapy, functional training, Nordic walking.

SPORTS MEDICINE

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THE MOST COMMON SPORTS INJURIES AMONG YOUNG MIDFIELDERS IN SOCCER

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Annotation. Currently, midfielders in soccer have become the key players on the field. They play different and crucial roles, being responsible for defense and attack, passing a ball back to forwarders, protecting defenders. It requires strong psychological and physical fitness. Since soccer is a complicated sport that requires high physical, physiological, technical, and tactical skills, the risk of injuries is high. As such, the midfielder has the most probability to be injured, and injuries to young players can lead to long-term health consequences. The aim of this study is to identify the most common sports injuries among young soccer players by identifying the nature, location, type, period, and time of the injury. Nineteen participants of this study were young male midfielders of the Ural Sports Youth Soccer Academy team.

Keywords: sports injuries, soccer, midfielders, youth, prevention, training, competitions, academy, Ural team.

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STATE OF OXIDATIVE BALANCE IN ATHLETES OF DIFFERENT CATEGORIES DURING DOSED EXERCISE AND IN THE SHORT-TERM RECOVERY PERIOD

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Annotation. The study presents the results of oxidative balance in resting state, 5 and 30 minutes after bicycle ergometry in 71 male athletes of different qualification and specialization aged 18-25 years. The comparison group consisted of 15 untrained subjects. At rest, elite athletes demonstrated the intensification of free radical oxidation processes against the background of a reduced amount of ascorbic acid and α -tocopherol. We have carried out an analysis of changes in indicators after physical activity and short-term recovery period. It allows us to give reasonable recommendations for the use of antioxidant vitamins in sports nutrition. The state of oxidative balance directly depends on the level of fitness and sports orientation in the examined individuals.

Keywords: athletes, physical exercise, free radical oxidation, antioxidants, sports nutrition.

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THE POWER LEVEL OF THE ALPHA RHYTHM SPECTRUM IN A TRAINING SESSION FOR ELITE ATHLETES WITH AN EGALITARIAN TYPE OF HEART RATE MODULATION WITH VARYING SUCCESS RATES OF NEUROBIOFEEDBACK

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Annotation. In a placebo-controlled study, we have studied the effect of the neurobiofeedback course for increasing spectral power of the EEG alpha rhythm in the C₃A₁ lead on the spectral power of the alpha rhythm in athletes with an egalitarian type of heart rhythm modulation with varying success rate achieved at the end of the course. The main group included 69, the placebo group – 33 test subjects of both genders. We have identified effects of the neurobiofeedback course that significantly exceed the placebo effect. In the main group, the test subjects with average and high success rate ($p=0.0001$) were more frequent. The subjects from the main group with an average success rate had the higher alpha rhythm spectrum power level than in the placebo group ($p=0.024$).

Keywords: athletes, biofeedback, electroencephalogram, alpha rhythm, heart rate variability.

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POSSIBILITIES OF USING HYPERBARIC OXYGEN THERAPY IN BIOMEDICAL SUPPORT OF HIGH PERFORMANCE SPORT DURING INTENSE TRAINING IN MIDDLE ALTITUDE (ANALYTICAL REVIEW)

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Annotation. The purpose of the study was a theoretical analysis of research on possibilities of hyperbaric oxygen therapy in biomedical support of high performance sport and identification of the execution protocol of such therapy for athletes, who had COVID-19, during intense training in middle altitude. The conducted analysis shows that this method contributes to an improved oxygen transfer, reduced edema and pathological inflammation in case of sports injury, induced neovascularization and neoangiogenesis. These mechanisms activate recovery of athletes after activity and rehabilitation after injuries and diseases. A practical use of such treatment in sports, described in the works of Russian experts, shows a positive effect of improved functional state and increased physical and mental performance. However, data from foreign studies, conducted with the placebo group, is rather contradictory, mainly being evidence for no positive effects. It is possible that the used protocol, defined by pressure value and exposure time, plays a significant role, which must be considered and carefully developed when using this method, especially in middle altitude conditions.

Keywords: hyperbaric oxygen therapy, oxygen, pressure, athletes, adaptation, recovery, rehabilitation.

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CORRECTIVE PREVENTION METHOD FOR THE KNEE JOINT INJURY OF SAMBO WRESTLERS TAKING INTO ACCOUNT THE SPECIFICS OF PROFESSIONAL ACTIVITY

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Annotation. The steady increase in the level of injuries in combat sports causes the search, development and improvement of effective preventive programs for injuries of the musculoskeletal system, the knee joint in particular. The purpose of the study was to develop and evaluate the degree of influence of a corrective technique for preventing damage to the knee joint of sambo wrestlers, taking into account the specifics of professional activity, on the level of neuromuscular control of the lower limbs of athletes. A systematic literature search was carried out in the Pubmed and Google Scholar databases. The search time frame was 10 years (from 2012 to 2022). The following methods were used in the study: systematic literature search, pedagogical experiment, pedagogical testing, math-and-stats methods. 12 sambo wrestlers took part in the experiment (age – 19.9 ± 0.9 years, body mass – 71.1 ± 12.79 kg, qualification – 1st sports category, candidates for master of sports). As a complex test, we used the “tuck jump” exercise. A statistically significant reduction in negative test results was found ($p=0.014$). Among 75% of the subjects, the number of points decreased after the experiment. The corrective technique developed by us for the prevention of knee joint injuries, despite a short intervention, had a statistically significant ($p=0.014$) positive effect on the neuromuscular control skills of the lower limbs in sambo wrestlers.

Keywords: sambo, injuries, knee joint, prevention.

PHYSICAL CULTURE AND PROFESSIONAL PHYSICAL TRAINING

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COMPARATIVE ANALYSIS OF THE PHYSICAL DEVELOPMENT AND FITNESS INDICATORS OF STUDENTS WITH DIFFERENT LEVEL OF MOTOR ACTIVITY

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Annotation. The purpose of the study is to examine and analyze the indicators characterizing the cardiovascular system's functioning, morphofunctional and physical fitness indicators of the technical university students with different level of motor activity. The authors have identified quantitative values of said indicators of students with low, moderate and high level of physical activity that can be applied in further research, in control over the state of students during physical education classes, as well as in substantiation of ways to improve the physical education system in educational organizations.

Keywords: physical culture, students, functional state, motor activity, healthy lifestyle, physical fitness, university sports groups.

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ON THE ISSUE OF AN INTEGRATED APPROACH TO INCREASE THE PHYSICAL FITNESS OF THOSE ENGAGED IN PHYSICAL CULTURE

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Annotation. In this article, the authors provide an example of an integrated approach to improve physical fitness using the analysis of the influence of anxiety and myofascial syndrome on the physical performance of men aged 22-35, who work out, as part of physical culture and recreational activities. The relevance of this topic is determined in connection with the current state of the social environment and the need for men of the first mature age to maintain physical performance at an optimal level. The first mature age, chosen by the authors for scientific research, according to a number of researchers, is one of the long periods in human ontogenesis and has an increased social burden, etc. The authors substantiate the necessity of taking into account individual psycho-emotional characteristics (anxiety) and syndromic signs to optimize the mode of motor activity in this age group.

Keywords: integrated approach, anxiety, myofascial syndrome, physical fitness, people engaged in physical culture, physical culture, recreational activities.

THEORY AND METHODS IN SPORTS

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DEVELOPMENT OF SPECIAL DEXTERITY OF SOCCER PLAYERS AGED 11-12 WITH EXERCISES FROM RHYTHMIC GYMNASTICS

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Annotation. The study presents the development and implementation of the training process with the means of gymnastics in order to develop special agility of 11-12-year-old girls playing soccer. The authors have developed four sets of exercises that were used for six weeks in each training class. Results of the conducted pedagogical experiment evidence effectiveness of the developed sets of exercises applied in rhythmic gymnastics.

Keywords: young female soccer players, training process, special agility, rhythmic gymnastics, physical exercises.

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EFFECTS OF COMBINED TRAINING WITH ADDITIONAL RESPIRATORY RESISTANCE AND LONG-TERM PHYSICAL LOADS

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Annotation. The aim of the study was to evaluate the physiological effects of combined training with additional respiratory resistance (ARR) and prolonged exercise. It was found that in the group of combined training with ARR and physical activity, the ventilation threshold, the maximum cycloergometric load in exercise tests and the maximum voluntary ventilation significantly increased after training ($p < 0.05$). None of these variables changed significantly in the control group ($p > 0.05$). Thus, combined training with ARR and sustained physical activity is effective in improving endurance and respiratory muscle function.

Keywords: additional respiratory resistance, physical endurance.

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THE STATUS OF DIFFERENT TRAINING ASPECTS IN KETTLEBELL LIFTING (ACCORDING TO THE REVIEW OF FOREIGN PUBLICATIONS)

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Annotation. The purpose of the study is to summarize, give structure and analyze the information resource of foreign sources of scientific literature on various aspects of training in kettlebell lifting. The article highlights the results of current research by foreign authors on the biomechanical analysis of movement technique, issues of physical fitness, the possibilities of using elements of kettlebell lifting for training strength abilities in other sports, as well as for rehabilitation after

injuries and diseases of the musculoskeletal system. The focus of scientific publications, the methods used and the results obtained have been studied and analyzed.

Keywords: kettlebell lifting, training process, long-term sports training, kettlebell lifters.

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A METHOD OF YEAR-ROUND APPLICATION OF DEVELOPING TRAINING EFFECTS IN THE PROCESS OF PHYSICAL TRAINING OF YOUNG QUALIFIED SOCCER PLAYERS

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Annotation. The article actualizes the problematic issue of physical fitness of qualified young soccer players, potential candidates for the youth national teams of the Russian Federation. It presents a literature review and its own view on the way of year-round application of developmental training effects in the process of physical training of young qualified soccer players. Physical fitness at the considered stage of long-term sports training largely determines athletic prowess. In this regard, the construction of a one-year training cycle is justified from the standpoint of the year-round use of developmental training loads for a systematic increase in physical abilities that determine the structure of a soccer player's fitness. The block distribution of physical impacts of various direction seems to be the most rational method of training planning, which allows not only to maintain a high level of performance during the annual cycle, but also to increase the corresponding physiological indicators.

Keywords: young qualified soccer players, physical training, periodization of a one-year training cycle, multidirectional developmental load.

HEALTH AND ADAPTIVE PHYSICAL CULTURE

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PROBLEM ASPECTS OF IMPLEMENTING SPORT AND HEALTH SERVICES IN NON-GOVERNMENTAL ORGANIZATIONS

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Annotation. The purpose of the study was to identify and analyze the problematic issues of the implementation of sports and health programs for different age groups of the population in non-governmental organizations. The article materials cover the analysis of disadvantages in the standardization of types of services and requirements for institutions that implement such services, personnel, software and documentation support, the content and direction of physical culture, sports and health programs, pedagogical and biomedical support for monitoring load tolerance. The authors have carried out an analysis and identified the ways of solving the said problems in the direction of improving the quality of sports and health support for different population groups.

Keywords: sports and health programs, indicators of health and quality of life, non-governmental institutions, physical culture, healthy lifestyle.

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UDC 612.1; 376; 796.1

INFLUENCE OF ADAPTIVE PHYSICAL CULTURE ON THE PARAMETERS OF CENTRAL HEMODYNAMICS IN CHILDREN WITH MENTAL RETARDATION

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Annotation. This article presents the results of a study of the influence of adaptive physical culture on the change of parameters of cerebral hemodynamics, the study of which was carried out using the rheoencephalogram method in children aged 8-9 with mental retardation. Adaptive physical culture was practiced with these children for 9 months 2-3 times a week. We compared the rheoencephalogram parameters in this group with the parameters in children with mental retardation of the same age who did not engage in adaptive physical culture. The obtained results revealed that the presented corrective effect contributed to a change in the parameters of the rheoencephalogram of children who underwent rehabilitation, indicating its beneficial effect on the elastic properties of large and small vessels of the brain.

Keywords: mental retardation, adaptive physical culture, rheoencephalogram, children aged 8-9.

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OPTIMIZING SELF-CONCEPT OF THE ELDERLY WITH PSYCHOLOGICAL TECHNIQUES IN THE PROCESS OF PHYSICAL EXERCISE CLASSES OF A HEALTH DIRECTION

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Annotation. The aim of the study was to optimize the components of the Self-concept of personality in the elderly in the process of practicing health exercises using psychological techniques aimed at optimizing its psychological component. In the process of analyzing the results of the ascertaining study, the majority of 55–65-year-old women participating in the experiment revealed increased indicators of personal anxiety, mild situational depression and a subdepressive state (masked depression), as well as a strong degree of expression of attitude to the past (“cycling”) and a negative attitude towards the present and the future. After the teaching experiment, a positive result was obtained, consisting in optimizing the components of the Self-concept, such as psychological (optimization of self-esteem) and physical (perception of one's body image), as well as a decrease or complete disappearance of painful somatic sensations.
Keywords: optimization of the Self-concept of personality, old age, physical exercises, psychological technics.

BIOMECHANICS AND BIOENGINEERING

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KINEMATIC CHARACTERISTICS OF THE SQUAT TECHNIQUE OF UNIVERSITY STUDENTS WHO STARTED POWERLIFTING

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Annotation. The biomechanical characteristics of the barbell squat technique of students who started powerlifting are studied in the presented article. Identification of biomechanical characteristics is carried out on the basis of the application of an optical system of three-dimensional video analysis of movements. Their assessment was carried out based on the application of the systemic and symmetric method of cognition by comparing the biomechanical characteristics of the kinematic chain of the motor system of beginners in powerlifting and the biomechanical characteristics of masters of sports in powerlifting when performing squats.
Keywords: barbell squat technique, powerlifting, kinematic characteristics, symmetry, asymmetry, biomechanics.