

PHYSIOLOGY

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ASPECTS OF CONTROL AND PREVENTION OF PATHOLOGICAL HEALTH CONDITIONS OF FIRST-YEAR UNIVERSITY STUDENTS WITH VISUAL IMPAIRMENT

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Annotation. The article deals with the issues of ensuring control over the health of first-year university students with visual impairment, using the simplest integrative methods for assessing the state of the body's adaptive capabilities in terms of the functional state of various systems. A set of exercises developed on the basis of respiratory gymnastics by A.N. Strel'nikova for use in physical education classes in order to create conditions for maintaining health at the proper level and preventing the disruption of adaptation reserves in the subjects. The beneficial effect of the developed set on the indices of the external respiration function and the adaptive capabilities of the body in first-year students with visual impairment was recorded.

Keywords: students with visual impairments, adaptive capabilities of the body, methods for assessing the integrative indicators of the functional state of the body, the functional state of the external respiration system, a set of respiratory gymnastics by A.N. Strel'nikova to increase the adaptive capacity of the body.

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AGE-RELATED CHANGES IN MICROCIRCULATION INDICES IN HEALTHY PEOPLE BEFORE AND AFTER PHYSICAL ACTIVITY

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Annotation. The aim is to study the effect of age on the microcirculation of the skin of healthy people before and after physical activity. The study was conducted on 136 adult patients with no clinical signs of cardiovascular diseases, divided into age groups. By the method of Laser Doppler flowmetry, an age-related decrease in microcirculation indicators was identified. The exercise test demonstrated that the mechanisms of active and passive control in the microcirculation system are activated with age. An excessive increase in the indices of neurogenic and myogenic vascular tone and the bypass index in the elderly and senile age probably reflects a decompensation in the vascular tone regulation in these age groups.

Keywords: microcirculation, Laser Doppler flowmetry, age changes, physical activity.

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EFFECT OF EXCESSIVE MANGANESE INTAKE ON HEPATOCYTES AND RED BLOOD CELLS OF WHITE RATS

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Annotation. The effect of prolonged excessive Mn intake on hepatocytes and red blood cells of white rats was studied. White male Wistar rats from 30 to 60 days of life received an aqueous solution of manganese sulfate in concentrations of 600 mg/l (group 1) and 2000 mg/l (group 2) as a single source of liquid. Control animals received water of standard composition. Excessive Mn intake did not cause changes in body weight and the mass of vital organs of animals. A significant increase in the number of nucleoli was found in the nuclei of hepatocytes of rats of groups 1 and 2. When analyzing the blood of group 2 animals, a significant decrease in the number of red blood cells and the amount of hemoglobin was recorded. In animals of groups 1 and 2, an increase in the resistance of red blood cell membranes to acid hemolysis was observed.

Keywords: manganese, hepatocytes, red blood cells, white rats.

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PHYSIOLOGICAL AND PATHOPHYSIOLOGICAL ASPECTS OF NEUROCOGNITIVE DISORDERS IN CARDIAC SURGERY PRACTICE OF ARTIFICIAL BLOOD CIRCULATION (PROBLEM OVERVIEW)

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Annotation. At present, due to the wide spread of pathologies of the cardiovascular system during cardiac surgeries, the artificial blood circulation technology is in demand. However, the use of it is associated with a combination of adverse factors (contact of blood components with the alien elements of artificial perfusion apparatus, alteration of physical and chemical blood constants, hydremia, ischemia/reperfusion, activation of proinflammatory mechanisms with the inflammation progress, hypothermia, the complexity of the cardiac surgery itself as well as the proper elements introduced for the proper in-vitro circulation, the psycho-emotional strain of patients due to the increased risks in surgeries of this type, etc.). Pronounced post-operative disorders can manifest themselves in different timescales and affect different organs and physiological systems. One of the common and poorly controlled consequences of heart surgery with artificial blood circulation is neurocognitive impairment, which significantly restricts normal human and social activity. The high frequency, severity and lack of safe effective remedies for higher brain function impairment provide a strain on national health systems. In this regard, it is necessary to consider the problem of post-operative neurocognitive dysfunction formation primarily from the perspective of the analysis of the key pathophysiological triggering mechanisms. This review presents the current understanding of proinflammatory triggers associated with the use of artificial blood circulation as well as the effect of emerging neuroinflammation on the functioning of selected neurotransmitter systems. The organization of cognitive processes and adaptive behavior are also considered in detail. In our opinion, the critical analysis of such mechanisms contributes to a broader discussion of the problem among specialists and outlines directions for finding effective and safe means of neurocognitive disorders correction in relation to the artificial blood circulation technologies.

Keywords: neurocognitive impairment, neuroinflammation, cardiopulmonary bypass, cardiac surgery.

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ASSESSMENT OF THE FUNCTIONAL STATE OF THE CARDIORESPIRATORY SYSTEM AFTER COVID-19

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Annotation. The purpose of the study was to analyze indices of the functional state of the cardiovascular and respiratory systems in people who have had COVID-19. 46 male students took part in the study. A comparative analysis of functional indices of the cardiovascular system demonstrated that in people who have recovered from COVID-19 there is an increase in heart rate and a predominance of the influence of the sympathetic division of the autonomic nervous system on heart rate regulation. Restrictive changes are observed in the respiratory system of people who have recovered from COVID-19.

Keywords: heart rate variability, vital capacity, COVID-19, cardiovascular system, respiratory system.

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ADAPTIVE RESPONSES OF THE CARDIOVASCULAR SYSTEM TO PHYSICAL ACTIVITY OF YOUNG BADMINTON PLAYERS

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Annotation. The article presents the adaptive features of the heart in young badminton players in a state of relative rest, during an active orthostatic test, as well as during the recovery period after physical activity. The applied functional tests led to the development of tachycardia, which was accompanied by multidirectional changes in the duration of waves on the electrocardiogram. When holding the breath in the control group, tachycardia manifested itself more strongly than in the experimental group. Adaptive responses of the heart were recorded faster in badminton players than in non-players.

Keywords: ECG, adaptation, RR interval, PR interval, P interval, $T_{\text{peak}}-T_{\text{end}}$ interval, functional test, badminton players.

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INFLUENCE OF IRON SUPPLEMENT ON THE BODY OF SKIERS WITH IRON DEFICIENCY ANEMIA DURING THE PREPARATORY PERIOD OF THE ANNUAL TRAINING CYCLE

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Annotation. We have presented the results of studies on the effect of iron supplement on the level of physical fitness of ski racers with iron deficiency anemia during the preparatory period of the annual training cycle. The study involved 54 people (38% female and 62% male) aged 18 to 23 years. The experimental group was asked to add an iron supplement in the form of ferroplex to their diet to identify its effect on the training process. After the training camps and the iron supplement course, the experimental group had a positive balance with the absorption of iron in the body. As a result of the ferroplex course, the athletes of the experimental group demonstrated a slight improvement in the indices of pedagogical tests at the end of the training camps.

Keywords: ski racers, iron deficiency anemia, ferroplex, preparatory period.

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UDC 612.17; 612.2

CARDIORESPIRATORY SYSTEM OF THE MIDDLE OB RESIDENTS (LITERATURE REVIEW)

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Annotation. The climate features of the northern territories place increased demands on the human body, forcing it to adapt to harsh climatic conditions. The study of adaptation mechanisms in various living conditions of the North is included in the section of priority medical and environmental scientific directions. Environmental factors determine the development of morphofunctional features of human populations living in the North for a long time. The functional state of the cardiorespiratory system in the Middle Ob inhabitants is due to climatic and geographical environmental factors. The study of the parameters of external respiration and the cardiac activity expand the understanding of the morphofunctional features of two important interrelated systems of the body.

Keywords: cardiorespiratory system, newcomer population, adaptation, northern region, Middle Ob.

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NEUROIMMUNE CHANGES IN EMOTIONAL STRESS IN ADOLESCENTS WITHOUT PARENTAL CARE

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Annotation. Psychoemotional stress is the main risk factor for the development of social maladaptation and psychosomatic disorders in adolescents without parental care. The aim of this work was to identify the degree of severity of psychoemotional stress in adolescents without parental care according to the results of psychological testing and the content of monoamine neurotransmitters (serotonin, dopamine, catecholamines) in blood and saliva, as well as the connection between the presence of certain autoantibodies and the degree of stress. The study involved 80 adolescents of both genders aged 13-18 years from the Azov Children's Aid Center, Rostov Oblast, from foster and birth families. Psychological testing was conducted using psychological methods of L.I. Wasserman, Buss-Darkey, and D.M. Mendelevich. The content of catecholamines (adrenaline, noradrenaline, dopamine, serotonin) and IgG antibodies to the receptors of 12 neurotransmitters in blood and saliva were registered by enzyme-linked immunosorbent assay. The main psychological risk markers for the development of psychoemotional stress in adolescents are anxiety, aggression and the presence of neurotic signs. At the physiological level, such risk markers are the level of catecholamines, primarily noradrenaline in saliva and serotonin in blood. We have revealed participation of the level of antibodies to neurotransmitter receptors in the regulation of catecholamine metabolism under stress. Significant differences in the level of antibodies to the receptors of such neurotransmitters as dopamine, β -endorphin, and S-100 protein were discovered depending on the severity of psychoemotional stress.

Keywords: adolescents, without parental care, adaptation psychoemotional stress, aggression, neurosis, catecholamines, neuronal antibodies.

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FEATURES OF BEHAVIORAL RESPONSES OF RODENTS UNDER CONDITIONS OF CHRONIC ETHANOL ADMINISTRATION IN IMMATURE ANIMALS

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Annotation. Currently, the concept of a comprehensive study of the effect of ethanol on the body has been formed. According to modern research, ethanol causes multifunctional changes in the nervous system, which significantly affect emotional, cognitive, and psychomotor functions. The purpose of this work was to study the effect of alcohol intoxication on the behavioral response features of immature rats in a model experiment. During the study in the Open field test, a significant decrease in both horizontal and vertical motor activity was noted, as well as a significant decrease in exploratory behavior. However, the Black and white test did not reveal statistically significant changes in the psychoemotional status of animals.

Keywords: ethanol, chronic administration, alcoholism, behavior, Open field test, Black and white test.

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OPTIMIZING TECHNOLOGIES OF FEEDING LABORATORY ANIMALS WITH THE EXPERIMENTAL COMPOUND FEED

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Annotation. The authors presented research work on the study of blood pressure fluctuations depending on the salt load in the diet and the possibility of its correction based on the combined feed for laboratory animals by adding a biologically active substance for laboratory nonlinear white rats based on *Salicornia perennans Willd* (soleros). Efficiency of the combined feed is determined by introduction of hypotensive effect of plant component into diet of laboratory white rats during a period of intensive growth. The trend was recorded to decrease systolic blood pressure by 18%, diastolic blood pressure – by 21% and heart rate – by 16% ($p \leq 0.05$). The authors propose to consider further study of the possibility of cultivating *Salicornia perennans Willd* (soleros) in the Caspian region of Russia.

Keywords: laboratory animals, nonlinear white rats, compound feed, hypotensive component.

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ABOUT ACTIVE METHODS OF BLOOD FLOW RESTRICTION: REVIEW

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Annotation. Blood flow restriction training, although the mechanisms are poorly understood, is a good method for improving muscle strength, aerobic and anaerobic performance. This method is used in strength training, though it can also have high potential in other modalities of physical activity. This review summarizes data from studies examining the effects of occlusion training using various methods of physical activity on muscle mass, performance indices, and the

musculoskeletal system's connective tissues. We included studies examining only active methods of blood flow restriction.

Keywords: blood flow restriction training, strength training, muscle strength, performance.

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MORPHOLOGICAL FEATURES OF CHILDREN IN EARLY CHILDHOOD NOT ENGAGED IN SPORTS AND ENGAGED IN JUDO AND RHYTHMIC GYMNASTICS

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Annotation. The purpose of the study: to identify the morphological features of children at the age of early childhood engaged in judo, rhythmic gymnastics and those not engaged in sports. The study involved 258 children aged 7-8 years (children not engaged in sports, young judokas and rhythmic gymnasts). Standard anthropometric methods were applied to identify morphological features. Morphological examination demonstrated that boys have a stronger physique than girls. All body length and mass characteristics of the children were within the age norm. According to proportionality indices, children were described with a thin physique, with the exception of boys involved in judo. We also found that judo training at this age contributes to weight gain in boys. Female gymnasts, on the contrary, have a more asthenic physique compared to their peers.

Keywords: children, early childhood, morphology, anthropometry, physical development, judo, rhythmic gymnastics.

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INFLUENCE OF SHORT-TERM HYPOBARIC HYPOXIA ON THE CENTRAL NERVOUS SYSTEM AND HEMODYNAMICS IN ELITE CANOPY FORMATION SKYDIVERS

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Annotation. The purpose of the work was to study the effect of short-term hypobaric hypoxia (4-5 min) on the functional indices of the central nervous system (CNS) and hemodynamics in 8 elite skydivers during training in canopy formation. Oxygen saturation (SaO₂) was measured before exercise, at an altitude of 2800-3000 m before the jump and immediately after landing. Before training and immediately after landing, the following were identified: time of simple visual-motor reaction (SVMR), system functional level (SFL), reaction stability (RS), level of functional capabilities (LFC); pulse, systolic (sBP) and diastolic blood pressure (dBP), central systolic blood pressure (cSBP). Using the Statistica 13.3 software, the median (Me), 25th and 75th percentiles (Q₂₅, Q₇₅) were calculated. The changes in the indices were assessed using the Wilcoxon signed-rank test (W). The correlation of SaO₂ with neuro- and hemodynamic indices was identified using the Spearman test (R). The results revealed that a short-term decrease in SaO₂ within the range of 87-92% at an altitude of 2800-3000 m during training in canopy formation correlates with an increase in the speed of psychomotor response and heart rate, but does not significantly affect the level of peripheral and central blood pressure. The optimal level

of central nervous system function in skydivers was recorded after repeated exposure to hypobaric hypoxia on a training day.

Keywords: hypobaric hypoxia, oxygen saturation, skydivers, canopy formation, high performance sports, functional state, central nervous system, psychomotor responses, neurodynamics, hemodynamics, pulse, central systolic aortic pressure, peripheral blood pressure.

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INDICES OF BLOOD OXYGENATION, NEURODYNAMICS AND HEMODYNAMICS IN ELITE CANOPY FORMATION SKYDIVERS DURING THE 2023 RUSSIAN CANOPY FORMATION CHAMPIONSHIP

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Annotation. The article presents the results of a study of the level of blood oxygenation, neurodynamics and hemodynamics in elite skydivers of the Ugra team (n=5) during the 2023 Russian Canopy Formation Championship. Before each round, at an altitude of 2800-3000 m before the jump and immediately after landing, oxygen saturation (SaO₂) was measured. Before the tour and immediately after landing, simple visual-motor reaction (SVMR) and hemodynamic indices (pulse, systolic (sBP) and diastolic blood pressure (dBP), central systolic blood pressure (cSBP)) were evaluated. Taking into account the results of SVMR test, the functional state of the central nervous system was estimated. Using the Statistica 13.3 program, we calculated the median (Me), 25th and 75th percentiles (Q25, Q75). Changes in the indices were assessed using the Wilcoxon signed-rank test (W). The correlation of SaO₂ with neuro- and hemodynamic indices was identified using the Spearman test (R). An individual analysis of the indices of each team athlete was carried out. The analysis demonstrated that SaO₂, SVMR, cSBP, sBP and dBP do not correlate with the age of elite skydivers. Short-term exogenous hypobaric hypoxia (4-5 min) at an altitude of 2800-3000 m is accompanied by an increase in the rate of SVMR at SaO₂ within the range of 88-93%. Hemodynamic response to hypobaric hypoxia depends on the initial parameters of skydivers, have multidirectional changes in sBP, dBP and cSBP and a general trend to increase heart rate.

Keywords: oxygenation, hypobaric hypoxia, skydivers, canopy formation, high performance sports, functional state, psychomotor response, neurodynamics, hemodynamics, pulse, central systolic blood pressure, peripheral blood pressure.

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ANALYSIS OF PHYSICAL PERFORMANCE OF MEN WITH DIFFERENT SOMATOTYPES WHEN PERFORMING A STEP TEST TO FAILURE ON A TREADMILL

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Annotation. The purpose of the research was to study physical performance indices in young men with different somatotypes after a load test. The study involved 82 healthy young men aged 18 to 23 years. All somatotypic groups consisted equally of qualified athletes of cyclic sports and practically healthy young men who work out actively. The subjects performed work on a

treadmill; the duration of running on each step was 3 minutes. The speed of each subsequent step increased by 1 km/h. All subjects were assessed for the type of functional response of the neuromuscular system: “sprinter”, “mixed”, “stayer” (Kaznacheev's technique), somatotype – with the Heath-Carter method, arm strength using a dynamometer, heart rate (HR) – with a heart sensor. To approximately determine the anaerobic threshold, we relied on heart rate readings (170 beats/min). The pauses between steps for athletes were 10-15 seconds, for young men without sports qualifications – 15-25 seconds. It was shown that representatives of mesomorphic somatotype, in comparison with young men of other somatotypic groups, demonstrated high results of work performed at average costs with the trend towards a sprint type of response. Men of the ectomorphic type revealed the inclinations of stayers and were leaders in the test results with the least expenditure and a greater contribution of oxidative phosphorylation processes. Young endomorphic men had the highest heart rates with less work done and less aerobic energy input. The type of functional response in this group of men tended to be intermediate.

Keywords: Heath-Carter somatotype, functional type according to Kaznacheev, energy supply to muscle activity, step test on a treadmill.

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ECHOCARDIOGRAPHIC INDICES OF THE HEART OF MIDDLE-AGED MEN PLAYING ICE HOCKEY

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Annotation. The aim of the study is to identify the features of a physiologically normal heart in men aged 45-59 years who play (EG, n=30) and do not play (CG, n=30) ice hockey. It was found that the anthropometric indices and age of both groups did not differ. Hockey players have higher muscle mass, bone mass, water and basal metabolic rate compared to non-players, who have a higher percentage of total and visceral fat ($p<0.05$). The sizes and volumes of the left and right ventricles of the heart and maximal oxygen consumption of hockey players are significantly higher than those of non-players.

Keywords: body size and composition, echocardiography, men, 45-59 years, ice hockey.

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FUNCTIONAL STATE OF THE PERIPHERAL PART OF THE NEUROMUSCULAR SYSTEM OF ELITE SKI RACERS

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Annotation. The purpose of this study was to investigate the functional state of the neuromuscular system of the upper and lower limbs of ski racers during the step-increasing load test in the preparatory period of the annual macrocycle. The specific physical load consisted of a test with a step-increasing load to failure on the Concept2 SkiErg machine. Rapid assessment and indication of the current state of the neuromuscular system were carried out using chronoximetry. This method is based on the effect of acoustic emission of a contracting muscle when it is stimulated by single electric impulses of increasing amplitude, making it possible to measure the latency time of induced contraction of the H-reflex and M-response. The performed study allowed for the first time to obtain a quantitative and qualitative estimation of the functional state of the peripheral part of the neuromuscular system of the upper and lower limbs of ski racers. Different variants of responses to the step-increasing load were revealed, manifested in the symmetry of

responses of motor units to the electric stimulus. Practical significance and prospectivity of the research consists in development of differentiated estimation scales for the functional state of the neuromuscular system of ski racers, direction and standardizing of training activity.

Keywords: ski racers, preparatory period, neuromuscular system, Concept2 SkiErg machine, latency time of induced contraction, asymmetry, symmetry, upper limbs, lower limbs.

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GENDER DIFFERENCES IN AUTONOMIC REGULATION OF HEART RATE IN STUDENTS

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Annotation. The purpose of this work was to study the gender differences in the autonomic regulation of heart rhythm in students. The study involved 50 young men and 50 young women (students of the Ivanovo State Medical Academy) aged 18 to 20 years. The young women were examined during the follicular and luteal phases of the menstrual cycle. Analysis of the results of the study revealed the predominance of the activity of parasympathetic nerve centers over the sympathetic ones, which is more evident in men. In women, the sympathetic-parasympathetic balance depends on the phase of the menstrual cycle. In the luteal phase, the percentage of sympathetic influences in the general regulation of heart activity is expressed to a greater extent than in the follicular phase.

Keywords: heart rate variability, autonomic nervous system, gender features.

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THE FEATURES OF INHIBITORY CONTROL IN ADOLESCENCE

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Annotation. The ability to cognitive (inhibitory) control is necessary for successful learning and communication with peers in adolescence. This cognitive skill is part of a set called executive functions. This work complements the already known data on the development of inhibitory control in adolescence. A total of 89 students (43 girls and 46 boys) aged 11 to 17 years took part in the research. For comparison and identification of age characteristics, the respondents were divided into groups: students of grades 5 and 6, students of grades 7 and 8, students of grades 9, 10, 11. The computer technique "ReBOS" developed by E.G. Vergunov and E.I. Nikolaeva was chosen for the research of inhibitory control. From the conducted research, as indices of the inhibitory control development in adolescence, it is possible to distinguish an increase in reaction time and a reduction in the number of errors in actions requiring complex sensorimotor reaction.

Keywords: inhibitory control, executive functions, adolescence.

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VALUE OF RESPIRATORY FUNCTION PARAMETERS AIMED AT OXYGEN UTILIZATION IN ATHLETES DEPENDING ON RESPIRATORY CYCLES AND LOAD OF INCREASING POWER

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Annotation. Taking into account the gas exchange indices, one can determine the nature and depth of the training effect on the body. Depending on metabolic activity, each organ requests oxygen, but this is ensured to one degree or another due to the morphophysiological conditions of the blood circulation of a given organ. The study involved 59 male people aged 17 to 36 years, who exercised regularly. Based on respiratory indicators, athletes were divided into groups: bradycardic, normocardic and tachycardic. The oxygen utilization coefficient at a load of 150 W reached the highest levels in all three groups. The indicators of the arteriovenous difference in oxygen during the stepwise increase in power increased gradually and reached high values at a load of 200 W.

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

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INDICES OF THE FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM OF FIRST-GRADERS LIVING IN THE ARCTIC ZONE

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Annotation. The objective of the study was to evaluate the indices of the functional state of the cardiovascular system of 7-year-old children living in the Arctic zone. It has been found that under the influence of the orthostatic test, girls have a greater contribution of parasympathetic influence to the regulation of heart function than boys. In the orthostatic test, the temporal and spectral characteristics in boys decreased, which reflects an increase in rhythm rigidity and a decrease in the influence of the parasympathetic system. During the recovery period, changes in heart rate variability show activation of the adaptive reserves of the cardiovascular system.

Keywords: cardiovascular system, blood pressure, heart rate variability, autonomic nervous system.

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COMPARATIVE ANALYSIS OF THE SEVERITY OF OXIDATIVE STRESS IN THE INDIGENOUS AND NON-INDIGENOUS POPULATION OF THE YAMALO-NENETS AUTONOMOUS OKRUG

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Annotation. We conducted a survey of 200 persons – indigenous and non-indigenous residents of the Yamalo-Nenets Autonomous Okrug (YANAO) of different genders. The main group consisted of 100 indigenous residents of the Yamalo-Nenets Autonomous Okrug, the comparison group included 100 non-indigenous residents who had lived in the region for 5 years or more. The groups consisted of persons aged 35 to 65 years, among whom 115 (57.5%) were female and 85 (42.5%) male. The results obtained allowed us to state some advantages of the indigenous population in comparison with the non-indigenous residents in terms of the functional state of the body, which coincided with a change in the intensity of a number of ways of formation of reactive oxygen species, nitrogen and the resulting intensification of lipid peroxidation processes.

Keywords: indigenous, non-indigenous population, oxidative stress, oxidative metabolism.

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BIOSOCIAL ASPECTS OF PHYSICAL HEALTH OF MODERN STUDENTS

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Annotation. In order to study the mutual influence of the biological and social aspects of the health of student youth, we carried out a questionnaire, took anthropometric measurements, and identified physical health (PH) and biological age among 720 students aged 17-23 years. It was found that the higher the level of PH, the slower the rate of aging, and, conversely, with the acceleration of the rate of aging, the level of PH decreases. The mutual influence on PH of such social factors as sports, primary disease incidence, academic performance and the study-work balance is equally the same for both young men and women. For young men, more than for young women, PH indices are interrelated with smoking, family income and place of primary residence. For young women, to a greater extent than for young men, PH indices are interconnected with family composition, with the amount of time devoted for homework and time spent on devices.

Keywords: physical health, biological age, biological and social health factors.

BALNEOLOGY AND REHABILITATION

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TESTS FOR ASSESSING BEHAVIORAL AND MOTOR ACTIVITY IN SPINAL CORD INJURY IN AN EXPERIMENT

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Annotation. The literature analytical review examines the types of behavioral tests for assessing the locomotor function deficit in spinal cord injury in an experiment. The difference between the tests is due not only to the different parameters and systems of motor activity assessments in modeling spinal cord injury, but also to the level and degree of its damage. According to the analytical review, the most reliable and valid ones are the Basso, Beattie and Bresnahan scale, the Horizontal Ladder test and the tapered/ledged beam-walking test.

Keywords: spinal cord injury, experiment, behavioral tests, locomotor function, Basso, Beattie and Bresnahan scale.

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THE EFFECTIVENESS OF DOSED WALKING IN SANATORIUM-RESORT TREATMENT OF ELDERLY WOMEN WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Annotation. In order to assess the effectiveness of dosed walking in a course of sanatorium-resort treatment, 25 women aged 60-70 years with chronic obstructive pulmonary disease (COPD) were examined, 10 of whom attended dosed walking classes. The indices of spirometry (FEV₁ %, FEV₁/FVC, %), 6-minute walk test (6 MWT), severity of symptoms questionnaire – the COPD Assessment Test (CAT), and the severity of dyspnea on the Borg scale were studied. The study demonstrated that sanatorium-resort treatment helped to reduce the clinical symptoms of the disease and improve the well-being of all patients with COPD. In 10 women, who were engaged in dosed walking, a more significant increase in tolerance to physical activity and a decrease in the severity of shortness of breath were noted, which was not detected in the rest of the subjects.

Keywords: chronic obstructive pulmonary disease, sanatorium-resort treatment, dosed walking.

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AUTOLOGOUS PLATELET-RICH PLASMA EFFECTIVENESS IN THE TREATMENT OF PATELLAR TENDON INJURY: FOREIGN LITERATURE REVIEW

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Annotation. We carried out the analysis of data from foreign literature devoted to certain aspects of the use of platelet-rich plasma (PRP) in case of patellar ligament injury. The world experience of using PRP in traumatology and sports medicine is summarized on this topic. The search was carried out using the electronic databases Pubmed, MEDLINE, Embase, Scopus, eLibrary for the period from 2010 to 2022. To search, we used following keywords and their combinations: “PRP therapy”, “knee pain”, “jumper's knee”, “patellar ligament injury”, “patellar tendon injury”, “athletes”. According to the results, it was found that PRP therapy can be considered a useful treatment option patients with patellar ligament injury. According to the results of the search, 1042 articles were found. Nine studies met the inclusion criteria. A limited number of reliable works have been published in the available literature. Further research is needed to understand the short- and long-term effects of PRP on patients with patellar ligament injury.

Keywords: PRP therapy, knee pain, jumper's knee, patellar ligament injury, patellar tendon injury, athletes.

SPORTS MEDICINE

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UDC 796.071.2; 796.012.1; 577.121.7; 612.744.24

THE DEPENDENCE OF PROTEIN METABOLISM INDICES ON THE LEVEL AND ORIENTATION OF SPORTS TRAINING AT DIFFERENT FUNCTIONAL STATE ASSOCIATED WITH PHYSICAL ACTIVITY

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Annotation. The study presents the findings of protein metabolism parameters at rest, in 5 and 30 minutes after cycle ergometry in 71 athletes and 15 non-athletes of the comparison group aged 18-25 years. In professional athletes characteristic features of protein metabolism were revealed as intensification at rest, more powerful phosphate bioenergetics and less contrasting changes in the studied parameters after cycle ergometry, which can be considered as a criterion of adaptation to physical activity. The features of protein metabolism in professional athletes engaged in cyclic sports is the possibility of using medium molecular weight peptides in bioenergetic reactions. The study of protein metabolism indices in trends represents the level of training and is recommended to assess the functional state of an athlete.

Keywords: athletes, physical activity, metabolism.

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UDC 612

AGE DYNAMICS OF PHYSICAL ENDURANCE AND ITS CONNECTION WITH CARDIAC ACTIVITY IN MEDICAL UNIVERSITY STUDENTS

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Annotation. The cardiovascular system is one of the limiting systems of the human's working capacity. An issue of physical endurance of students at medical universities is of relevance, since a significant part of the work of the medical staff is directly related to dangerous conditions. The work included a study on physical endurance and their connection with hemodynamics in 3rd and 5th year medical university students. The study included 67 untrained young men and women in the age of 19-23 years (37 3rd year students and 30 5th year students). We identified indices of hemodynamics, physical endurance (Samko's cardiorespiratory index) and conducted a factor analysis to reveal their connection. The results have shown that there are age-related features in connections of physical endurance to the cardiovascular system's parameters. Cardiac output, which is the main oxygen transport determinant, has a significant effect on physical capabilities of 3rd year students.

Keywords: cardiovascular system, physical endurance, students.

PHYSICAL CULTURE AND PROFESSIONAL PHYSICAL TRAINING

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UDC 796.01; 612

RATIONALE FOR THE CHOICE OF A METHOD FOR ASSESSING STUDENTS' MOTOR ACTIVITY

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Annotation. The study was conducted to identify the most informative method for assessing the level of motor activity (LMA). In 650 students aged 17-24 years, LMA was identified in 3 ways: based on belonging to a sports or physical education group; based on a developed test, including various forms of physical activity (sports, physical exercise, labor, tourism, hardening, dancing, etc.); with the International physical activity questionnaire. A comparative analysis of the results of three assessment methods revealed that among students from the main, preparatory and special medical groups there are also boys and girls with high LMA, and not just among athletes. The conducted research shows the importance of taking into account various forms of physical activity, and not just students' belonging to a physical education group, for an objective assessment of the LMA of boys and girls during their study at the university.

Keywords: students, motor activity, physical education groups, test "Level of motor activity", International physical activity questionnaire.

THEORY AND METHODS IN SPORTS

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PHYSICAL PERFORMANCE AND PSYCHOMOTOR QUALITIES OF 18-20 YEARS OLD JUDOKAS WITH MASS RANKS

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Annotation. The article presents a comparative analysis of the special physical performance and psychomotor qualities of young judokas aged 18-20 years and young men engaged in physical culture. The study involved 10 male judokas with mass ranks and 11 young men engaged in recreational physical culture. In amateur athletes, levels of general and special performance, psychomotor and mental working capacity were identified. As studies have shown, judo classes contribute to the development of strength endurance, psychomotor skills and mental working capacity. However, while considering judo as a method of health-improving physical culture, it is necessary to note its lesser impact on the development of aerobic endurance and, consequently, the functions of the cardiovascular and respiratory systems compared to running.

Keywords: judo, performance, psychomotor skills, reaction time, ergospirometry, aerobic capabilities.

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PHYSICAL DEVELOPMENT AND FITNESS OF TEENAGE JUDOKAS AGED 11-14 YEARS

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Annotation. Russian and foreign experts note the importance of proper physical development and total physical fitness for young judokas, as the foundation for a further successful sports career. In this connection, the purpose of the study was to identify the features of the physical development and fitness of adolescent judokas aged 11-14 years. The study was conducted on 60 young male judokas aged 11-14 years, who train in a specialized sports school. The results of the study revealed that young judokas are described by average parameters of height and weight, length dimensions, physique and strength indices relative to teenage boys of their age. The chest girth of the examined athletes was slightly above average. From 11-12 to 13-14 years, the parameters of body mass, length and girth dimensions, as well as strength parameters increase. The importance of physical fitness and special physical qualities has been determined to increase alongside with the age-related development of judokas.

Keywords: judo, performance, psychomotor system, reaction time, ergospirometry, aerobic capacity.

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AGE-RELATED FEATURES OF PHYSICAL DEVELOPMENT AND PSYCHOPHYSIOLOGICAL STATUS OF BEGINNER AND ELITE BANDY PLAYERS

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Annotation. The aim of the work was to identify age-related features of physical development and psychophysiological status of beginner and elite bandy players. The study was conducted at SKA Neftyanik in Khabarovsk and the Department of Theory and Methodology of Football and Hockey of the Far Eastern State Academy of Physical Culture. Beginner (age – 7-10 years, 99 people) and elite (age – 15-17 years, 23 people) bandy players were tested. The testing was carried out using the hardware and software complex "Sports orientation for children and adolescents". The study revealed that in the age period from 7-8 years to 9-10 years, young bandy players increase in weight, body length, functional indices of external respiration, mental performance, strength and speed-strength abilities, as well as physical performance. Elite players aged 15-16 and 17 years do not differ significantly in their morphological and functional status, psychological and psychophysiological characteristics, performance and level of development of physical qualities. There is a trend towards larger body dimensions and greater physical capabilities (strength and endurance) in athletes aged 15-16 years.

Keywords: bandy, testing, anthropometry, functional state, mental abilities, physical qualities, performance.

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UDC 796.015; 796.88

EFFECTIVENESS OF THE TRAINING PROCESS OF WEIGHTLIFTERS USING THE BIOCHEMICAL INDICES OF CREATININE

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Annotation. Growing competition in modern sports implies further search for effective means and methods of sports training, as well as new models of training process. The study included 16 elite weightlifters (women), members of the Kazakhstan National Team. The test subjects were divided into two groups 8 people each: control and experimental. The control group trained according to the traditional models. The experimental group trained according to an experimental model that focused on increasing physiological load on the creatine phosphate mechanisms of muscle work energy supply. A statistically significant relationship was identified between sports results shown in scores, which express absolute sports results without taking into account one's own body mass and creatinine values per kg of one's own body mass. The correlation coefficient amounted to 0.670 ($p < 0.01$). The sports result in the sum of the Olympic Weightlifting shown in points (Sinclair coefficients), excluding the influence of body mass, was 29.1 points higher in the experimental group than in the control group ($p < 0.01$). The biochemical values of creatinine, which amounted to 1.87 mmol/L per kg of one's own body mass, were higher in female athletes of the experimental group by 0.34 mmol/L per kg of body mass than in those of the control group ($p < 0.05$). The study provided an opportunity to obtain experimental data, which allowed to establish that training of female athletes according to a training model aimed at the development of creatine phosphate mechanisms of energy supply turned out to be more effective and allowed to achieve higher rate of improvement in sports and technical results.

Keywords: elite weightlifters, creatine phosphate mechanism of energy supply, creatinine indices, training process model, training macro-cycle.

HEALTH AND ADAPTIVE PHYSICAL CULTURE

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EXPERIMENTAL SUBSTANTIATION OF THE METHODOLOGY FOR THE DEVELOPMENT OF FINE MOTOR SKILLS OF CHILDREN WITH SPEECH DISORDERS

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Annotation. The article presents the content of an experimental method for the correction and development of the muscles of the hand and fingers of 3-4 years old children with speech disorders attending speech therapy groups in the Child Development Center – Kindergarten No 16 located in Kazan. To assess the development of small muscle groups of the hand and fingers, we used the following tests: identifying the shifting of finger movements (by A.R. Luria); determining the accuracy of finger movements; the formation of the ability to hold a given position of the fingers; hand coordination when tracing a circle (test by V.A. Kalyabin). A total of 14 primary school age children with delay in speech development took part in the testing procedure. To identify the level and volume of 3-4 years old children's vocabulary, we applied the following methods: "Definition of concepts" (by R.S. Nemov); "Name of objects and actions" (by A.N. Kornev). Using a random sampling method, two groups (control and experimental) of 7 people each were formed. The content of adaptive physical education and health classes was aimed at solving the problems of the connection between motor and speech activity of 3-4 years old preschoolers, developing the accuracy and coordination of movements of the hand and fingers, improving balance and coordination of movements when performing physical exercises. The obtained results of the pedagogical experiment indicate a positive impact of the experimental methods on the level of development of speech and fine motor skills of 3-4 years old children with speech disorders.

Keywords: children, delay speech development, adaptive physical culture technique, testing, fine motor skills, coordination, balance.

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POSTURAL STABILITY FEATURES OF ATHLETES WITH SENSORINEURAL HEARING LOSS

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Annotation. The article discusses the features of postural stability in athletes with sensorineural hearing loss. Specific markers of statokinesiography have been identified that characterize the features of the pressure center's deviation in the implementation of the motor strategy, depending on the state of the hearing organ and motor activity. The postural stability maintenance in athletes with sensorineural hearing loss is due to the predominance of visual proprioceptive control, with the predominance of the peripheral visual field, the implementation of the ankle strategy.

Keywords: sensorineural hearing loss, postural stability, athletes, disability.

BIOMECHANICS AND BIOENGINEERING

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BIOENGINEERING ASPECTS OF ORAL MUCOSA: REVIEW AND AUTHORS' RESEARCH

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Annotation. Taking into account the obtained literature data, we have analyzed such biomechanical aspects of *oral mucosa* as linear elasticity, two-phase and multi-phase elasticity. We also examined the estimated semiphenomenological exponential model, as well as hyperelastic models of *oral mucosa*: Mooney-Rivlin, Ogden, polynomial and Veronda-Westmann models. We have identified their parameters, as well as material constants and statistical modelling indices. Among all investigated models, the lowest deviations of model from experimental data were demonstrated by the first-order Ogden model (mean square error – 0.0078, maximum absolute error – 0.017, maximum relative error – 1.951%, coefficient of correlation between empiric and model data – 0.9997, residual – 0.001), the highest ones – by the neo-Hookean solid (mean square error – 0.233, maximum absolute error – 0.275, maximum relative error – 31.037%, coefficient of correlation between empiric and model data – 0.69, residual – 0.977).

Keywords: oral mucosa, biomechanics, hyperelastic models.

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ON THE ISSUE OF BIOMECHANICS OF ORAL MUCOSA AND DENTAL TISSUE: REVIEW AND AUTHORS' RESEARCH

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Annotation. We have examined aspects of physical rheological and biomechanical properties of the oral mucosa: viscosity, apparent Poisson's ratio and friction coefficient, as well as Poisson's ratio of dental tissues as a medium with hexagonal symmetry. Numerical values of the parameters for the oral mucosa obtained experimentally and used in the literature in computer modeling are given. It is established that in the model of dental tissues Poisson's ratio can reach in a certain direction 0.54 for dentin and 0.47 for enamel, which is extremely unusual for dentin even with average values of 0.312 and 0.286 respectively, close to the experimental data. It is noted that a proper understanding of the interactive response between the denture design and the oral mucosa is crucial to prevent soft tissue damage and trauma associated with occlusal loading transfer.

Keywords: oral mucosa, biomechanics, Poisson's ratio.