

PHYSIOLOGY

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EFFECT OF BLACK CUMIN OIL ON THE MORPHOFUNCTIONAL CHARACTERISTICS OF PLATELETS IN EXOGENOUS THROMBINEMIA

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Annotation. Lipid peroxidation of platelet (PLT) cell membranes leads to changes in the processes of stationary cell functioning, activation of membrane phospholipases, formation of matrices to trigger a cascade of enzymatic reactions of hemostasis. The first and visible sign of PLT activation is a change in their shape. The purpose of our work was to study the dietary supplement "Ethiopian black cummin oil" on morphofunctional characteristics and quantitative distribution of blood plasma PLT in rats with exogenously induced thrombinemia. In the experiment, 60 males of non-inbred white rats were used. Animals from the experimental groups were additionally administered dietary supplements at a dose of 0.5 ml for 21 days. Exogenous thrombinemia was caused by intravenous injection of a thrombin suspension into the jugular vein. Blood was taken from animals for further investigation of morphological features, measurement of the mean platelet volume (MPV) and calculation of the total number of PLT after 0.5 hours and 1 hour. The data obtained shows the positive effect of the additional administration of the supplement on hemostasis, which was manifested in the restriction of PLT activation and the degree of consumption thrombocytopenia in conditions of exogenous thrombinemia.

Keywords: platelets, reactive oxygen species, oxidative stress, lipid peroxidation, black cummin, black cummin oil, *Nigella sativa*.

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PHARMACOKINETICS AND PHARMACODYNAMICS OF CLONIDINE IN ITS EFFECT ON ALPHA-2-ADRENORECEPTORS OF RABBIT LIMB ARTERIES ON DAY 10 OF COLD ADAPTATION

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Annotation. The article presents the results of changes in alpha-2-adrenergic receptors of rabbit limb arteries to clonidine after 10 days of cold adaptation. Such periods of cold adaptation are often observed when spending holidays at ski resorts, during ski trips, during rotational expeditionary work, when the weather changes, when moving to colder regions. It has been established that after 10 days of cold adaptation, the vasoconstrictive effect of clonidine as a selective α_2 -adrenergic agonist is enhanced. Physiological analysis of this result in Linuver-Burke double inverse coordinates demonstrated that after cold adaptation, the number of active (Pm) pressor postsynaptic α_2 -adrenergic receptors of limb arteries increased by 43%. The sensitivity of α_2 -adrenergic receptors of arteries also increased by 67% after 10 days of cold adaptation.

Therefore, an increase in the number of active α_2 -adrenergic receptors in the arteries and their sensitivity after cold adaptation leads to an increase in the pressor response of arterial vessels to α_2 -agonists.

Keywords: cold adaptation, α_2 -adrenergic receptors, arteries, clonidine, rabbits.

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USING EFSMA RECOMMENDATIONS IN INTERDISCIPLINARY STUDIES OF ELITE PARACHUTE JUMPERS

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Annotation. The article presents the results of studying the relationships and physiological state of elite athletes, considering the EFSMA (European Federation of Sports Medicine Associations) recommendations based on the results of heart rate variability measurements. Mathematical statistics allow us to consider psychological indicators in relation to the physiological state in different variations. It studied the physiological state of elite female parachute jumpers in terms of heart rate variability and self-esteem during the competitive period at the Russian Championship with international participation at the age of 25 to 49 years. It revealed that self-esteem is interconnected with age characteristics. The data obtained allow us to consider self-esteem as a marker of the physiological state, including the stress resistance of elite female athletes. New medical technologies recommended by the EFSMA can be applied in the psychological analysis of the individual health protection of elite athletes (IPM).

Keywords: self-esteem, heart rate variability, physiological state, individual protection measures, elite sports, elite athletes.

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ASSESSMENT OF AUTONOMIC REACTIVITY OF GIRLS WITH DIFFERENT BODY MASS INDEX DURING DISTANCE LEARNING

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Annotation. The aim of the work was to assess the impact of distance learning on the autonomic reactivity of girls of graduating classes with different body mass index. The article presents the cardiointervalography results when performing an active orthostatic test in full-time and distance learning. The study involved 78 girls who graduated from medical classes of secondary schools in Moscow, differing in body mass index. We have found that under the influence of an orthostatic test against the background of distance learning in girls with a body weight deficit, the state of regulatory systems' tension and a decrease in adaptive reserves of the body prevails, less pronounced in schoolgirls with normal body mass and overweight. In this group, there is an increased reactivity of the sympathetic division of the autonomic nervous system.

Keywords: distance learning, girls, cardiovascular system, cardiointervalography, active orthostatic test, physical inactivity.

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FEATURES OF THE PSYCHOEMOTIONAL MATURATION OF ANIMALS EXPOSED TO SOCIAL ISOLATION IN EARLY POSTNATAL ONTOGENY: MODEL BIOMEDICAL RESEARCH RESULTS

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Annotation. On the basis of the conducted research, the article deals with the main issues related to the specifics of some psychophysiological functions after social isolation in early postnatal ontogeny. The authors have discussed possible mechanisms underlying some pathologies and disorders of adaptive capacity caused by isolation. The purpose of this review is to study in a model experiment the features of the psychoemotional formation and the dynamics of behavioral reactions in animals subjected to social isolation in early postnatal ontogeny.

Keywords: social isolation, early life stress, psychoemotional field, motor activity, ontogeny, holistic behavior.

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POSSIBILITY OF USING PROTEINS AS NEUROINFLAMMATION MARKERS TO EVALUATE COGNITIVE STATE OF CHILDREN

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Annotation. The article presents the results of an experimental study aimed at clarifying the possible role of neuron-specific enolase (NSE) and S100 protein in the pathogenesis of autism spectrum disorder and language development disorders in children. Blood samples of 106 children aged 5-13 years were studied, 85 of them were diagnosed with autism or severe language development disorders. The association of the severity of developmental disorders and the level of NSE and S100 has not been revealed. It was found that neurotypical children may also have increased levels of neuron-specific proteins. Neuron-specific proteins can play various roles at different stages of ontogenesis, including participating in apoptosis and synaptic pruning. In children with developmental disorders, critical periods of development can be significantly shifted. It can be assumed that an increase in the level of neuron-specific proteins in this case is not a sign of neuroinflammation.

Keywords: neuroinflammation, autism spectrum disorder, NSE, S100, neuron-specific enolase, children.

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THE FEATURES OF STRESS-INDUCED CHANGES OF HEART RATE VARIABILITY IN RATS IN CASE OF THE BLOCKADE OF AUTONOMIC GANGLIONS,

MUSCARINIC ACETYLCHOLINERGIC RECEPTORS AND β -ADRENERGIC RECEPTORS

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Annotation. In conditions of acute stress, the rat heart rate is described by high frequency (400-440 beats/min), a moderate increase in intensity (up to 50 c.u.), trends towards weakened high-frequency and increased low-frequency wave power, increased very-low-frequency wave power and index of centralization. Blockade of muscarinic acetylcholinergic receptors (atropine, 1 mg/kg) neutralizes the stress-induced increase in heart rate frequency, while blockade of β -adrenergic receptors (anaprilin, 2 mg/kg) weakens it by 45-65 beats/min. There is no increase in low-frequency and very-low-frequency power waves and index of centralization against the background of those two blockers. Autonomic ganglions blockade attenuates the effects of atropine and anaprilin in relation to rate variability, reduces the power of low-frequency and very-low-frequency waves at rest. The combination of autonomic ganglions blockade (hexamethonium, 7 mg/kg) with blockade of muscarinic acetylcholinergic and β -adrenergic receptors completely neutralizes not only the power of the spectrum waves and index of centralization, but even heart rate frequency under stress. Consequently, the interaction of ganglion and effector levels of adrenergic and cholinergic regulation channels is necessary for the development of changes in heart rate variability at stress. Sympathetic and parasympathetic mechanisms are involved in shaping the amplitude of fluctuations in the duration of cardiointervals at all basic frequencies.

Keywords: heart rate variability, blockade of muscarinic acetylcholinergic receptors, blockade of β -adrenergic receptors, blockade of autonomic ganglions, atropine, anapriline, hexametonium, acute stress, rats.

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PHYSIOLOGICAL AND PATHOPHYSIOLOGICAL ROLE OF MYOKINE IRISIN

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Annotation. Discovered a decade ago, myokine irisin has a wide spectrum of physiological and pathophysiological activity. The main site of irisin production is contracting skeletal muscles, where it is produced by cleavage of fibronectin type III domain-containing protein 5 (FNDC5). The most known effect of irisin is the ability to transform white adipose tissue into brown. Irisin is present in the blood plasma, it promotes the uptake of glucose by skeletal muscles, improves lipid metabolism, facilitates the deposition of glucose in the liver, prevents the occurrence of hyperglycaemia and hyperlipidaemia, due to which it has a beneficial effect in the pathogenesis of obesity and type 2 diabetes. Irisin acts on bone tissue, increasing the mineral density, improving bone geometry and strength. Irisin has antitumor and anti-inflammatory activity, penetrates the blood-brain barrier. In addition, its expression has been registered in various parts of the brain. At the central nervous system level, irisin is a neurochemical factor responsible for the neuroprotective effects of exercise and mitigation of oxidative stress, improving synaptic plasticity, reducing ischemic neuronal damage, and preventing memory and synaptic impairment in Alzheimer's disease. A wide range of positive effects of irisin is the basis for the development of new therapeutic methods for the prevention and treatment of a number of diseases.

Keywords: irisin, myokines, white and brown fat, metabolic disorders.

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ANALYSIS OF ELECTROPHYSIOLOGICAL INDICATORS OF HEART RATE VARIABILITY IN CATTLE

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Annotation. Heart research is important in veterinary practice due to insufficient attention to heart diseases in cattle at the present stage of development of veterinary medicine. Analysis of heart rate variability is a widely used method in medical practice to assess autonomic regulation and state of the heart. Mathematical analysis of heart rate rhythms to identify state of the autonomic nervous system is important for the pathogenetic treatment of many diseases. At the present stage of development of society, an important place is occupied by the issue of meeting the needs of the population in dairy products. For this reason, the livestock industry is developing rapidly. However, when improving dairy cattle breeding, it is necessary to take into account the physiological capabilities and features of animals at all stages of their ontogeny. The cardiovascular system study is of great importance in veterinary medical and preventive work.

Keywords: cardiovascular system, autonomic status, electrocardiogram.

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FEATURES OF THE EXTERNAL RESPIRATION FUNCTION AND RESISTANCE TO HYPOXIA OF HOCKEY PLAYERS IN THE LONG-TERM TRAINING PROCESS

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Annotation. The article presents results of long-term studies of the respiration system in hockey players of different age. The purpose of the work was to identify features of the external respiration and resistance to hypoxia in hockey players in the long-term training process. The study included 172 players aged 11-21 (11-12 years (n=36), 13-14 years (n=34), 15-16 years (n=34), 17-18 years (n=37) and 19-21 years (n=31)). The comparison group (CG) included 211 teens and young men, who did not engage in sports, also distributed by age groups. The study of external respiration and hypoxic tests' indices in hockey players at different stages of the long-term sports training allows to identify an increase in values of the investigated indices in age aspect and during the process of long-term adjustment to the chosen sport. Adaptation to hypoxia in hockey players occurs due to an adjustment to anaerobic conditions that take place during the game and an increased anaerobic (speed-strength) loads in the training process.

Keywords: hockey players, long-term training process, external respiration function, hypoxic tests.

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SEASONAL DYNAMICS OF THE AUTONOMIC CHARACTERISTICS OF STUDENTS WHO PLAY SPORTS

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Annotation. This article is devoted to the study of seasonal dynamics of the autonomic characteristics of students, the interest in which is often of applied significance. The goal is to reveal the seasonal rhythm of some autonomic characteristics of students who play sports. The observation was carried out on students of the Samara University. Basic and calculated indices describing the state of the cardiovascular system, as well as adaptive potential and some metabolic processes, were collected and processed. Considering the results of a two-year observation of a group of athletes as a basis, the authors have obtained results that demonstrated the seasonal rhythmic dependence of autonomic characteristics.

Keywords: blood pressure, Ruffier test, Kerdo index, adaptive potential, basal metabolism.

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BLOOD FLOW RESTRICTION TRAINING FOR ATHLETES: AN UMBRELLA REVIEW OF SYSTEMATIC REVIEWS

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Annotation. In recent years, there has been a significant increase in the interest of athletes in training with blood flow restriction. Objective of the study: conduct a systematic search and synthesis of systematic reviews and/or meta-analyses on the effect of blood flow restriction training on the physical performance of athletes. Literature searches were performed in the PubMed, Cochrane Library and Epistemonikos databases. The period for the search was not set, but the search itself ended on 15.04.2023. The methodological quality of the included articles was assessed with A Methodological Quality Assessment Tool for Systematic Reviews (AMSTAR-2). Three systematic reviews were included and analyzed. The overall methodological quality of the 3 included reviews assessed by AMSTAR-2 demonstrated a very low confidence rating (critically low, n=2, low, n=1). In general, the analysis and synthesis of all the results of the included systematic reviews on the effect of training with blood flow restriction on the functional parameters of athletes revealed mixed results. The authors of the 3 systematic reviews included in this umbrella review did not reach a consensus on the positive effect of blood flow restriction training on the physiological performance of athletes.

Keywords: occlusion training, blood flow restriction training, athletes, exercise, performance.

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PHYSIOLOGICAL EFFECTS OF MILLET (PANICUM MILIACEUM) AQUEOUS EXTRACT IN NORMAL RATS AND IN MODELING KIDNEY PATHOLOGY WITH ETHYLENE GLYCOL

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Annotation. The work is devoted to the study of the physiological effects of millet aqueous extract in normal rats and in the modeling of renal pathology with ethylene glycol. The study was carried out on 63 male outbred rats, divided into 7 groups. During the experiment, it was shown that ethylene glycol led to a functional impairment of the kidneys, and the most significant pathological changes were manifested when 0.6% ethylene glycol was administered to animals for 21 days. At the same time, there was a slight increase in the number of erythrocytes in 1 μ l of urine, a significantly significant increase in the number of leukocytes, the level of protein in the

urine, the level of creatinine in the blood plasma in comparison with similar indicators in control male rats. In animals treated with 1% ethylene glycol for 10 days, the number of erythrocytes and the level of creatinine also slightly increased, while the number of leukocytes increased significantly compared to intact male rats. The millet aqueous extract had a protective effect, reducing the effect of ethylene glycol on the functional parameters of the kidneys.

Keywords: aqueous extract of millet, ethylene glycol, leukocyturia, creatinine level, uric acid level, protective effect.

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ADAPTIVE CHANGES IN THE BLOOD SYSTEM DURING PHYSIOLOGICAL PREGNANCY, TAKING INTO ACCOUNT FETAL SEXUAL DIMORPHISM

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Annotation. The hematological system undergoes a number of adaptive changes in preparation for the hematopoiesis of the fetus and its well-being, and also serves as protection from the expected blood loss during childbirth. As a rule, adaptive changes in the mother's blood system begin already at the 6th week of pregnancy, pass by the 6th week after delivery and are determined by the fetus's sex. The aim of the work is to summarize the available literature data on adaptive changes in the blood system during physiological pregnancy, taking into account fetal sexual dimorphism, with the results of our own research obtained at the regional level. The article presents data obtained by statistical processing of 3017 medical records of women in labor, including the main indicators of the blood system and their dynamics by trimester of pregnancy. As a result of generalizing our own data with the available literature sources, it becomes obvious that the sex of the fetus affects almost all indicators of the mother's blood system. Thus, it was found that during pregnancy with a boy, there is an increase in the concentration of hemoglobin and erythrocytes, and for girls, relatively higher values of leukocytes and basophils were noted. The adaptive changes are also observed in the platelet hemostasis system during pregnancy with a male fetus.

Keywords: physiological pregnancy, homeostasis, hemostasis, blood system, adaptation, sexual dimorphism.

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CHRONOPHYSIOLOGY OF THE CHILDBIRTH'S DAILY PERIODICITY, TAKING INTO ACCOUNT FETAL SEXUAL DIMORPHISM

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Annotation. Chronophysiological arrangement of the "mother-placenta-fetus" system is fundamental in solving gestational tasks minimizing the risk of various disorders. However, aside from the main parts of the system (mother and placenta), it is important to consider sex of the fetus, which causes significant adaptation shifts in the physiology of the mother's body both during pregnancy and the following periods of its ontogeny. The aim of the study is to combine the available data and the results of our own research on the chronophysiological mechanisms of the "mother-placenta-fetus" system, taking into account fetal sexual dimorphism, and to determine the possible effects of fetal sex on the daily periodicity of childbirth. We have used methods of information analysis, descriptive statistics, statistical significance was calculated considering a confidence probability of 95% and computational accuracy of 0.05. It was revealed

that most of the children are born in the daytime and have no significant differences in the time of the labor's end, depending on the sex of the newborns. Apparently, this phenomenon is associated with the medical and social features of the delivery, as well as a decrease in the melatonin concentration, which determines the circadian biorhythms of many body systems and plays one of the key roles in starting the labor process. For nighttime, there were no patterns in most cases. However, in the summer season of the year girls were born significantly more often at 24.00-6.00, which can be explained by lower concentrations of melatonin due to longer daylight hours. Circadian rhythms in the mother (including the placenta complex) and their role in conception and birth's terms is a field requiring further study, which has great potential for implementation in clinical practice during normal pregnancy.

Keywords: chronophysiology, circadian biorhythms, sexual dimorphism, pregnancy, childbirth, melatonin metabolism.

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INFLUENCE OF MOTOR DOMINANCE PROFILE ON ELECTROENCEPHALOGRAM AND HEART RATE VARIABILITY WHILE IMAGINING AND PERFORMING COMPLEX LEG MOVEMENTS

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Annotation. The purpose of the study was to analyze changes in the spectral power of electroencephalogram (EEG) rhythms and heart rate variability parameters, to identify correlations between them during imaginary and real leg movements in right-handers, left-handers and ambidexters. It was found that in right-handers, EEG changes in sensorimotor areas were more pronounced with imaginary leg movements, in ambidexters – with real ones. In left-handers, the EEG pattern did not significantly depend on the type of motor task. Correlations between EEG changes and heart rate variability prevailed during imaginary actions. The number of correlations depended on the type of motor dominance, being the largest in right-handers and the smallest in ambidexters.

Keywords: right-handers, left-handers, ambidexters, EEG spectral power, heart rate variability, imaginary and real leg movements.

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INFLUENCE OF PHYSICAL LOAD ON HEART RATE VARIABILITY DURING MENTAL ACTIVITY DEPENDING ON THE REACTIVITY OF THE PARASYMPATHETIC DIVISION OF THE AUTONOMIC NERVOUS SYSTEM

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Annotation. The purpose of the study is to examine the effect of physical activity on mental performance and heart rate variability in cognitive work of students with different reactivity of the parasympathetic nervous system. Mental stress leads to the sympathetic system's activation. The change in heart rate variability parameters does not depend on the type of parasympathetic reactivity. Preliminary physical activity is accompanied by a decrease in the stimulating effect of mental activity on the sympathetic mechanisms of regulation. In people with low parasympathetic reactivity, the tension of regulatory mechanisms is more pronounced. Physical activity leads to a

decrease in mental performance and the development of fatigue, regardless of parasympathetic reactivity.

Keywords: mental activity, physical activity, heart rate variability, autonomic nervous system.

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TYOLOGICAL FEATURES OF THE NERVOUS SYSTEMS PROPERTIES IN ELITE ATHLETES OF DIFFERENT SPORTS

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Annotation. The purpose of the work – a theoretical and experimental study of features of temperament and the nervous system properties in athletes of different sports. The work included a content analysis of scientific articles from Russian and foreign scientists on issues of psychophysiological features, properties of temperament and the nervous system in athletes. The nervous system properties and the temperament type were identified with the “Individual time unit identifier” software (Program registration certificate no. 2005611543; 23.06.2005). The study included 553 athletes: 323 men and 230 women (qualification – 1st rank to the Master of Sports of International Class). The conducted analysis reveals contradictive data on features of the nervous system’s functional properties in athletes of different sports, however most of them conclude that higher qualification correlates with the strong nervous system and high functional mobility of nervous processes. It was also confirmed that the typological features of the nervous system properties are the basis for the development of motor abilities. The received experimental data show that the most favorable temperament type is sanguine.

Keywords: temperament, athletes, nervous system properties, time unit, time perception, tapping test.

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FUNCTIONAL PREDICTORS OF HIGHER SCHOOL TEACHERS' PERFORMANCE DECREASE WHEN THE STEREOTYPE OF PROFESSIONAL ACTIVITY IS CHANGED IN THE NORTHERN REGION

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Annotation. The article presents the results of a study of functional predictors of changes in the performance of male and female higher school teachers in the northern region during the transition to a remote format of professional activity in the lockdown due to the coronavirus pandemic. To predict the decline in performance, the index of functional efficiency (FE) of teachers patented by the authors was used. It is 2.2 times more common in male teachers than in women. An unsatisfactory level is 2.7 times more common in female teachers than in men. After distance teaching, the number of women with satisfactory FE increased by 1.72 times and the frequency of women with an unsatisfactory level of FE decreased by 2.3 times. After the distance teaching period, a number of male teachers with satisfactory FE decreased by 2.4 times while the proportion of male teachers with borderline FE values increased by 2 times.

Keywords: higher school teachers, functional predictors, performance, prediction of functional efficiency, central nervous system, autonomic regulation, psychophysiological state, stereotype of professional activity, north.

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MORPHOPHYSIOLOGICAL FEATURES OF MEN AGED 45-59 PLAYING AND NOT PLAYING ICE HOCKEY

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Annotation. The aim of the study was to reveal the morphophysiological features of the body of men aged 45-59 who play (n=30) and do not play (n=30) ice hockey. The authors have found that anthropometric indicators and age of both groups have no differences. Hockey players have higher muscle mass, water and basal metabolic rate compared to non-hockey players, who have a higher percentage of total and visceral fat ($p<0.05$). In terms of cardiorespiratory system indicators, players are significantly ahead of non-hockey players, but no discrepancies were found related to heart rate variability.

Keywords: body size and composition, cardiorespiratory system, men, 45-59 years of age, ice hockey.

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THE EFFECT OF BODY POSITION ON HEART RATE VARIABILITY DEPENDING ON THE FEATURES OF THE AUTONOMIC NERVOUS SYSTEM CENTERS TONE

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Annotation. The features of the autonomic nervous system centers tone determine the body's adaptation signs to postural changes. The aim of the research was to study the effect of postural changes on heart rate variability (HRV) depending on the tone of the autonomic nervous system divisions in students. We have evaluated HRV in 50 men aged 18-20 years with active orthostasis, passive orthostasis and passive antiorthostasis. Active orthostasis leads to activation of sympathetic mechanisms in all subjects. This is most pronounced in vagotonics and to a lesser extent in sympathotonics. Passive orthostasis increases the activity of sympathetic cardiac centers in normotonics and vagotonics and does not affect the HRV of sympathotonics. As a result of passive antiorthostasis, an increase in the activity of parasympathetic cardiac centers was found in normotonics and vagotonics.

Keywords: postural changes, heart rate variability, autonomic nervous system.

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FEATURES OF THE ELECTRICAL ACTIVITY OF THE WRESTLERS' BRAIN IN COMPARISON WITH PEOPLE WHO DO NOT PLAY SPORTS

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Annotation. In order to study the features of the electrical activity of the wrestlers' brain in comparison with non-athletes, the authors of this study have analyzed the frequency ranges of delta, theta, alpha, beta 1 and beta 2 rhythms of the electroencephalogram at rest in 60 boys aged 19-20 (30 wrestlers and 30 non-athletes) years. It is shown that the neural advantage of wrestlers

over non-athletes is expressed only in a decrease in alpha rhythm fluctuations. The involvement of fewer neural resources without reducing efficiency confirms the hypothesis of “neural flexibility” of the athletes' brain.

Keywords: EEG, electrical activity of the brain, wrestlers, athletes, non-athletes, central nervous system.

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INDIVIDUAL AND TYPOLOGICAL FEATURES OF MOTOR ACTIVITY IN TODDLERS

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Annotation. The purpose of the study – to identify individual and typological features of the motor activity level in toddlers. We have examined 113 healthy children (58 boys and 55 girls, age – 14.5 ± 1.2 months). The pedometry method was applied to study individual indices of the motor activity level's daily volume, the statistical data processing was also implemented. The authors have identified the individual and typological features of motor activity in 2-3-year-old children by dividing them into three groups – with low, average and high level of habitual motor activity.

Keywords: habitual motor activity, speech development, toddlers.

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EFFECT OF GLIPROLINE NEUROPEPTIDES ON THYROID HORMONE LEVELS IN EXPERIMENTAL HYPERTHYROIDISM

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Annotation. The aim of the study was to examine the effect of glyproline neuropeptides on the level of thyroid hormones in experimental hyperthyroidism. Hyperthyroid state in animals was modeled by intragastric administration of L-thyroxine sodium salt pentahydrate. Laboratory animals were divided into 4 groups: intact animals (control); animals receiving L-thyroxine sodium salt pentahydrate (hyperthyroidism); rats treated with Thr-Lys-Pro-Arg-Pro-Gly-Pro (selank) and rats treated with Pro-Gly-Pro at doses of 87 and 33 mcg/kg/day respectively, intraperitoneally, daily for 21 days. It was found that the studied glyproline peptide compounds contributed to the correction of the level of thyroid hormones and thyroid-stimulating hormone, also restoring animal behavior, body weight, heart rate and rectal temperature. Thus, the results obtained when studying the effect of glyproline neuropeptide compounds Thr-Lys-Pro-Arg-Pro-Gly-Pro and Pro-Gly-Pro on the level of thyroid hormones in experimental hyperthyroidism indicate the presence of an antithyroid effect of these peptides, which was manifested in the correction of physiological parameters and concentrations of triiodothyronine, thyroxine and thyroid-stimulating hormone.

Keywords: hyperthyroidism, glyprolins, selank, Pro-Gly-Pro, triiodothyronine, thyroxine, thyroid-stimulating hormone.

PSYCHOPHYSIOLOGY

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SOME PSYCHOPHYSIOLOGICAL FEATURES OF PEOPLE PRONE TO PERFECTIONISM

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Annotation. On the basis of the conducted research, the article discusses some psychophysiological features of people demonstrating perfectionist traits in their personality type. The authors examined the association of such traits with the level of anxiety. An analysis of the risk of developing eating disorders in young people was carried out. The purpose of this review is to study the association of perfectionism, the level of anxiety and the risk of developing eating disorders in students.

Keywords: perfectionism, personality type, anxiety, eating disorders.

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NEGATIVE MOTIVATION AS THE MAIN INCENTIVE TO ENGAGE IN SPORT AMONG MIDDLE-AGED AND OLDER PEOPLE IN RUSSIA

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Annotation. One of the important tasks in the field of physical culture is the study of the needs of the population, willingness to engage in sport, the interests of people of different age groups in certain sports, etc. Motivation acts as the subject matter in this article, while the object is one of its forms, namely – negative motivation. Negative motivation is of interest in the context of the main driving force and incentive that give the necessary impetus to middle-aged and older people to start engaging in sports. Taking an action or no action at all is the final component in the structure of the negative motivation formation.

Keywords: motivation, negative motivation, sport, physical culture, psychology, middle and older age.

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PSYCHOEMOTIONAL STATE OF YOUNG GIRLS AND BOYS IN TYUMEN DURING THE PRE-EXAMS PERIOD

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Annotation. The influence of the educational environment increases before exams, and the purpose of this study is to examine the level of mental and physical exhaustion (emotional burnout) typical of this period. The results of the study have revealed that most often students have signs of the resistant phase at the formation stage. The predominant symptom of this phase is the sign of an inadequate selective emotional response. The phases of exhaustion and

tension, which shared the second place in terms of symptom frequency, are less common than the resistance phase symptoms. In the exhaustion phase, the signs of emotional exhaustion remain dominant. To analyze the level of emotional burnout, we have used a diagnostic technique developed by V.V. Bojko.

Keywords: young boys and girls, emotional burnout symptoms, emotional burnout syndrome, psychoemotional state.

BALNEOLOGY AND REHABILITATION

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NORDIC WALKING AS A REHABILITATION METHOD FOR PATIENTS WITH CORONARY HEART DISEASE WHO HAD COVID-19

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Annotation. In a state of physiological rest and after controlled physical activity in the form of Nordic walking (NW), we have examined the indicators of heart rate (HR, beats/min), systolic (sBP, mm Hg) and diastolic (dBP, mm of Hg) blood pressure, coefficient of endurance (CE, c.u.) and coefficient of blood circulation efficiency (BCE, c.u.) at 8, 12, 16 and 20 hours on different days of the week. The results of the study of the heart rate's weekly dynamics indicated that it did not exceed the normative values common for each age period before the exercise, i.e. did not go beyond 90 beats/min, which was the basis for systematic studies of NW. After the end of NW sessions, all the examined people had a normotonic type of reaction of the cardiovascular system to physical activity, because the heart rate did not exceed 100% of the initial value, and the sBP did not increase by more than 35 mm of Hg, which is considered as a favorable (normotonic) reaction of central hemodynamics to controlled physical activity.

Keywords: Nordic walking, coronary heart disease, central hemodynamics, second adulthood, old age.

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MEDICAL REHABILITATION TECHNOLOGIES FOR THE MUSCULOSKELETAL AND NERVOUS SYSTEMS OF ASTRONAUTS IN SANATORIUM-RESORT CONDITIONS

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Annotation. The authors have developed a program of effective medical rehabilitation of the musculoskeletal and nervous systems of astronauts in sanatorium-resort conditions, including drinking mineral water, taking mineral baths, mud treatment, hydromassage, massage, magnet therapy, hydrokinesiotherapy, barotherapy, biofeedback mechanotherapy on robotic sets. To assess the therapeutic course's effect, we have applied densitometry, heart rate variability, pulse oximetry and sudomotor response measurement, dynamometry of lower limbs' muscles and autochthonous trunk muscles, stabilometry, blood biochemical and clinical test and urine complete test. The received data have revealed that inclusion of such cutting-edge therapeutic methods as the robot-assisted mechanotherapy allows not only to correct the already existing disorders, but also to enhance the functional state of the musculoskeletal and nervous systems by optimizing muscle balance, increasing proprioceptive sensitivity and forming correct motor stereotypes.

Keywords: astronauts, rehabilitation, recovery, sanatorium-resort treatment, mechanotherapy.

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UDC [612.173+616.127]; 796.015

INFLUENCE OF RESISTANCE TRAINING ON BLOOD LACTATE LEVEL IN MEN WITH METABOLIC SYNDROME

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Annotation. In metabolic diseases, fasting lactate is elevated and may be a predictor of the development of metabolic syndrome and type 2 diabetes mellitus. Plasma samples were analyzed for fasting lactate in men with and without metabolic syndrome. The relative muscle strength of the upper extremities was also assessed for all participants. Thereafter, subjects with metabolic syndrome completed a 12-week course of resistance training at varying intensities. Fasting plasma lactate concentration data were evaluated before and after a course of strength training. Subjects with metabolic syndrome had higher fasting lactate levels ($p=0.0001$). In the group with high relative muscle strength, fasting lactate concentration was statistically significantly ($p=0.012$) lower than in the group with low relative muscle strength. 12 weeks of resistance training significantly reduced fasting lactate concentrations in the high-intensity resistance exercise group ($p=0.006$) and low-intensity resistance exercise with blood flow restriction ($p=0.007$) in men with metabolic syndrome. Fasting plasma lactate levels were elevated in men with metabolic syndrome compared with healthy men. Muscle strength may be a protective factor against elevated fasting lactate levels. Fasting lactate concentration was reduced by regular resistance exercise.

Keywords: lactate, metabolic syndrome, resistance training, blood flow restriction training, mitochondrial dysfunction, muscle strength.

SPORTS MEDICINE

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FEATURES OF MAGNESIUM DEFICIENCY IN ELITE ATHLETES BEFORE THE COMPETITION PERIOD

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Annotation. To achieve high sports results, especially in the period of preparation for competitions, it is important to identify magnesium deficiency in athletes. The study made it possible to reveal the presence of magnesium deficiency below the average in 69.8% of athletes, manifested by a spectrum of clinical syndromes. Significant correlations of magnesium deficiency with various factors provoking it were identified: irrational nutrition of athletes, abuse of thermal procedures to maintain weight and the presence of chronic pathology of the gastrointestinal tract. The association of magnesium deficiency with the use of biologically active or sports supplements containing magnesium has not been confirmed. Conclusions are drawn about the need to correct magnesium deficiency exclusively with drugs as prescribed by a specialist. Purpose and objectives of the study: to identify risk factors for the manifestation of clinical syndromes in elite athletes against the background of magnesium deficiency; to determine the effectiveness of dietary supplements with magnesium to compensate for its deficiency in the body. The material for the work was the questionnaire data, clinical and laboratory studies, competition protocols and sports qualifications. The research was carried out at the Departments of Physical Culture of the Astrakhan State Medical University and the Kuban State Medical University in the 2021/22 academic year. The analysis of clinical and laboratory studies, the results of the survey, the level of sports qualifications was carried out. The work uses standard methods for analyzing the dynamic series and the method of correlation analysis. A significant relationship between Mg²⁺ deficiency and the presence of gastrointestinal pathology was revealed, the detected magnesium level in the body of elite athletes did not have a pronounced relationship with sports specialization. Based on the results of the study, in our opinion, it can be considered appropriate to adjust the level of Mg²⁺ in the body with the use of drugs. According to the data obtained, the presence of Mg²⁺ in the body of athletes does not have a significant correlation with sports specialization. It was also found that dietary supplements with magnesium did not have a significant effect on its concentration in the body of athletes.

Keywords: elite athletes, magnesium deficiency, risk factors.

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UDC 797.215; 615.835.3

EFFECT OF MIDDLE ALTITUDE HYPOXIA AND SHORT-TERM HYPEROXIA ON THE FUNCTIONAL PERFORMANCE DYNAMICS IN DIVERS DURING THE MAXIMUM ERGOSPIROMETRIC TEST

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Annotation. The aim of the work – to study the effect of middle altitude hypoxia and short-term hyperoxia on the functional performance dynamics of divers during the maximum ergospirometric stress test. As the results of the experimental study revealed, hypoxia causes a decrease in aerobic capacity of the body even in divers, consequently being the most resistant to

this factor. At the same time hyperoxic inhalation before the maximum workload causes a significant increase of aerobic performance and the performed aerobic load power. The use of oxygen before the test, and to a greater extent during urgent recovery immediately after its completion, promotes faster recovery of cardiovascular system parameters: heart rate at 1 and 2 minutes of recovery, blood pressure at 3,4 and 5 minutes of recovery. The obtained data allow recommending the method of mountain training of athletes described as “Live high – train low with supplementary oxygen” in order to simultaneously increase aerobic potential and a more significant increase in fitness compared with traditional training in middle altitude. A modification of this method, which can be possibly described as “Live high – train high – recover with supplementary oxygen” is also recommended.

Keywords: athletes, middle altitude, hypoxia, hyperoxia, ergospirometry, functional state.

PHYSICAL CULTURE AND PROFESSIONAL PHYSICAL TRAINING

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IMPACT OF DIET QUALITY ON STUDENTS' FITNESS AND HEALTH

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Annotation. The article presents the results of assessing fitness and health of 414 students with application of a developed method based on 5 indicators (strength index, endurance coefficient, Skibinskaya index, body composition index, physical fitness) obtained during examinations at the Center for Health and Educational Process at the university. It was found that half of the students have average levels of fitness and health, good and high marks were registered more frequently in girls than boys. A comparative analysis of the actual nutrition of students with different levels of fitness and health demonstrated that in order to maintain high level, the diet should have a lower content of carbs and higher content of proteins and (polyunsaturated) fats compared to the recommended physiological references of nutrient intake.

Keywords: health and fitness, students, caloric intake, proteins, fats, carbs.

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UDC 159.9; 612; 796

EFFECT OF DOSED PHYSICAL ACTIVITY ON THE FUNCTIONAL AND PSYCHOEMOTIONAL STATE OF STUDENTS ENGAGED IN SPORTS SECTIONS AND ELECTIVE PHYSICAL EDUCATION CLASSES

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Annotation. The functional system's response to physical activity in conditions of physical culture and sports is different, being an evidence of many studies. Opinions regarding the beneficial and negative effects of sports on the body also differ, however sometimes they are absolutely polar in terms of assessing the impact of physical activity on the body. In the context of the educational process, the health-preserving aspect of student training is significant. In connection with this, the assessment of the impact of physical culture and sports means on the body is of great relevance. The purpose of the study: an analysis of the impact of physical culture and sports on the functional and psychoemotional state of students. We have found that sport has a positive effect on the functional and psychoemotional state. The level of adaptation of the body of athletes to changing environmental conditions is much higher than that of students involved in physical education classes. This is confirmed by the results of the study of the cardiorespiratory system and the psychoemotional sphere of students.

Keywords: physical culture, sport, functional state, motor function, psychoemotional state.

THEORY AND METHODS IN SPORTS

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DEVELOPMENT OF COORDINATION ABILITIES IN TEENAGE GIRLS ENGAGED IN TENNIS

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Annotation. An urgent problem for tennis is the search for effective methods to develop coordination abilities of athletes. Therefore, the aim of the study was to evaluate the methodology designed by the authors for the development of coordination abilities in teenage girls who play tennis. As a part of a pedagogical experiment, 20 female tennis players aged 11-13 were observed for 8 months. The girls were randomly divided into 2 groups: control and experimental (10 people each). The tennis players of the control group were following the previously approved training program based on the conditions of schoolchildren’s additional education. The athletes of the experimental group, in addition to the approved program, practiced a set of exercises for coordination, static and dynamic balance, including acrobatic exercises, outdoor games and relay races for 1 hour 3 times a week. At the beginning and at the end of the experiment, tennis players were evaluated according to the standard testing results. The obtained data confirmed the effect of the proposed method of directed influence and increase in the duration of classes on the development of coordination abilities in teenage girls engaged in tennis.

Keywords: coordination abilities, development, tennis, girls, adolescence, static balance.

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ASSESSING AGILITY OF YOUTH SOCCER LEAGUE REFEREES

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Annotation. A soccer referee’s playing activity involves a constant change of movement, resetting and gaining speed with a change of direction, sudden stops and turns, which places high demands on the referee’s coordination skills. The article presents an ascertaining study aimed at evaluating the level of agility among referees of the Youth Soccer League and Russian Soccer Youth Championship. Taking into account the obtained data, the level of physical fitness of referees, in particular coordination skills, is assessed, which allows to expand the level of knowledge, develop and improve tools of training.

Keywords: agility, soccer referee, physical training, coordination fitness.

HEALTH AND ADAPTIVE PHYSICAL CULTURE

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ANALYSIS OF MECHANICAL PROPERTIES OF HUMAN HAIR USING HYPERELASTIC MOONEY-RIVLIN MODELS

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Annotation. We have examined 2, 3, 5 and 9 parameter hyperelastic Muni-Rivlin models of human hair and identified their parameters. The lowest correlation coefficient with experimental data was demonstrated by the 2 parameter model (0.974), the highest – by the 9 parameter model (0.999). The initial Young's modulus of the 9 parameter model was $E_0=2.84$ GPa, which coincides with the empirical literature data in order of magnitude. The calculation results obtained in the Mathcad system differ significantly from those obtained using the ANSYS software, which is obviously due to the different calculation algorithms used by the programs. When entering data into the ANSYS PC, both engineering stresses, deformations and true values were applied. The stability of the models was evaluated using the Hill and Drucker stability criterion. It was found that certain restrictions on the parameters of the Mooney-Rivlin C_{ij} models are not met, which was confirmed by the analysis of the σ - λ curves.

Keywords: hair, stresses, deformations, hyperelastic models, Mooney-Rivlin model, modulus of elasticity.

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PARAMETERS OF HYPERELASTIC MODELS OF UROGENITAL ORGANS' BIOLOGICAL TISSUES OF HUMAN AND ANIMALS

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Annotation. We have studied hyperelastic models of biological tissues in urogenital organs of human and animals: the Neo-Hookean model, the 2 parameter Mooney-Rivlin model, the Ogden model, 5 parameter polynomial hyperelastic models and the Veronda-Westmann model. The hyperelastic model parameters were calculated with 2 alternative methods: in the Mathcad 13.0 system (using linfit and genfit functions) and in the ANSYS 2022 R2 software package. The matter constants of the tissue models were identified. Values of μ , C_{10} , C_{01} , C_{20} , C_{02} and C_{11} were presented in MPa, the α constant in the Ogden model – as a nondimensional parameter. For the Neo-Hookean model, the μ parameter was identified, for ANSYS – 2μ . The authors have studied deforming properties of the tissues: the σ - ε curves and the differential elastic modules.

Keywords: biomechanics, hyperelastic models, tissues of organs of the urinary and reproductive systems.

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INFLUENCE OF NORDIC WALKING ON HEART RATE VARIABILITY OF MATURE WOMEN

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Annotation. To assess the efficiency of health training based on Nordic walking, stress levels and the degree of tension of regulatory systems in mature women, a study of heart rate variability may be applied. The study involved women who regularly engaged in health classes based on Nordic walking (n=10) – the experimental group and women who did not regularly exercise (n=10) – the control group. The authors have found that the functional state of women who regularly engage in health classes is more characterized by an optimal level of regulation of physiological functions. It was also revealed that women who do not exercise regularly are in a state characterized by pronounced depletion of regulatory systems.

Keywords: Nordic walking, functional state, heart rate variability, ECG, autonomic nervous system, stress index.