on the blood supply to the uterus is characterized by a change in the established Doppler parameters.

Conclusions:

- in women with uterine fibroids, menarche began at an early age, and menorrhagic disturbances of menstrual function were more often observed, causing posthemorrhagic anemia;
- the clinical course of the disease in women with uterine fibroids depends not on the patient's age, but on the number, size and location of myomatous nodes;
- in patients with isolated uterine fibroids, primary infertility prevailed;
- secondary infertility and duration of infertility prevailed in patients in whom fibroids were found along with other benign diseases of the uterus;
- in patients with uterine fibroids, early, recurrent miscarriages and premature births were more common;
- with Doppler ultrasound of the uterine artery, IR, PI and S/D indicators in women with uterine fibroids were lower than in healthy patients;

In the end, we can conclude that timely assessment of clinical symptoms and early diagnosis in women with uterine fibroids can become the basis for pathogenetically based treatment, which can lead to improving women's lives, restoring menstrual function and achieving reproductive desire.

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CHARACTERISTICS OF METABOLIC INDICATORS OF BODY STUDENTS DOING BOXING

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The assessment of metabolic parameters in students engaged in boxing at the training stage was carried out. According to the results of the study, normal functional parameters of the body, BMI, and satisfactory AP were established. According to biochemical parameters, the group of athletes showed an excess of the range of normal values of CK, HDL, a decrease in LDL and the de Ritis coefficient (CDR), in the beginner group – an increase in CDR and a decrease in VLDL. Significant differences between the groups were found in the values of TG, VLDL ($p<0.005$), HDL glucose and KA ($p<0.05$). Conclusion. The athletes showed metabolic indicators indicating formed adaptive and metabolic changes to training loads in comparison with the beginner group.

Keywords: students, athletes, beginners, metabolic, biochemical parameters, boxing

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Introduction. Each meal supplies our metabolic pathways with new metabolites, but nothing changes the rate of metabolic reactions as much as intense exercise [18]. The three main pathways of metabolism – energy metabolism, anabolism, and catabolism – are profoundly altered in response to exercise [20]. Studies of biochemical parameters in blood serum and functional systems of the body provide insight into the development of adaptation, the level of exposure to a stress factor and the degree of recovery of the body during intense physical activity [5, 19]. Understanding by coaches and scientists of the physiological adaptation of martial arts athletes can provide valuable information for adjusting training programs that help improve the performance of athletes [17].

The purpose of the study: to characterize the metabolic parameters of the body of students engaged in boxing during the training period.

Materials and methods of research. 36 young men of the NEFU named after M.K. Ammosov of indigenous nationality who are engaged in boxing at the training stage (average age 20.5 (19.25; 23) years) were examined. 23 of them had a sports category or the title of KMS and MC (athletes), 13 had been engaged in boxing for more than 1 year, had no sports category (beginners). The study was conducted in compliance with the ethical medical and biological requirements set out in the Helsinki Declaration. Determination of biochemical parameters (aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase (LDH), creatine phosphokinase (CK), alkaline phosphatase (ALP), gamma-glutamyltransferase (GGT), glucose, total cholesterol (TCH), HDL cholesterol, LDL cholesterol, VLDL cholesterol, triglycerides (TG), uric acid (MC), urea, creatinine, total protein, and albumin were measured in blood serum using a Labio – 200 biochemical analyzer. Blood sampling was performed from 8 a.m. to 10 a.m. from the ulnar vein, after a 12-hour abstinence from eating. The following indicators were calculated: the de Ritis coefficient (CDR=AST/ALT), the index of muscle tissue damage according to the formula (MDI=CK/AST) and the coefficient of atherogenicity (KA=(TH –HDL)/HDL). The anthropometric measurement of body length (P, cm) was performed using a height meter and body weight (MT, kg) on an electronic scale (Massa-K, Russia). The body mass index was calculated using the formula: BMI = weight (kg)/height 2 (m²). Blood pressure was measured in a state of relative muscle rest on the right arm in a sitting position after a 5-minute rest using an automatic blood pressure monitor PRO-33 with the recording of the average value of 3 measurements. The adaptive potential (AP) was calculated according to the formula of R.M. Baevsky (1987): AP=0.011*HR+0.014*SBP+0.008*DBP+0.009*MT-0.009*H+0.014*A-0.27, where HR is the heart rate at relative rest, SAD is systolic pressure (mmHg), DBP-diastolic pressure (mmHg),H-height (cm), MT-body weight (kg), A-age (years). Interpretation: below 2.60-satisfactory adaptation, 2.60-3.09-tension of adaptation mechanisms, 3.10-3.49-unsatisfactory adaptation, 3.50 or more-failure of adaptation. The results of the study were processed using the IBM SPSS Statistics 22.0 program. Statistical hypotheses about the distribution law of a normal population and the parameters of a normal distribution were tested using the Kolmogorov-Smirnov and Shapiro-Wilk criteria. The analysis data is presented in the table as Me (median) and the interquartile range of the first (Q1) and third (Q3) quartiles (quartiles 25 and 75%). The statistical significance of the data obtained was checked using the nonparametric Mann-Whitney criterion (U). The results were considered statistically significant when the achieved significance level was $p<0.05$.

Results and discussion. According to the results of the study, SBP, DBP, heart rate, and calculated BMI in both compared groups were in the range of normal values (systolic pressure less than 120 mmHg and diastolic pressure less than 80 mmHg [11], heart rate 60-80 beats per minute according to WHO, BMI within -18.5-25 kg/m²) (Table 1). It has been established that physical activity has a positive effect on the cardiovascular system of athletes as a result of the adaptive response of the myocardium [9]. There was a significant decrease in blood pressure during all types of training [14]. At the same time, athletes of various qualifications had SBP and heart rate above normal values; DBP above normal values was noted in athletes of speed-power and jet-power sports [9]. It was shown that the proportion of athletes with an increased blood pressure response increased with age. According to some authors, in competitive athletes, during physical activity testing, an increased blood pressure reaction was diagnosed in 6.8% -19.6% of athletes without known hypertension [16].

The AP value makes it possible to assess the level of physical fitness, as well as the functional maturity of hormonal and vegetative links in the regulation of homeostasis [4]. Among the students we examined, the median values of adaptive potential were satisfactory in both groups compared – 2.05 (1.9; 2.3) and 2.0 (1.87; 2.15). It has been shown that positive adaptive changes occur due to the stressful effects of physical exertion during the training process [1]. The obtained functional indicators (SAD, DBP, HR), BMI and AP of the examined contingent, corresponding to normal values, are most likely related to the study during the training period. It is believed that the signs of the development of adaptation or disadaptation during physical exertion in athletes and non-athletes may be metabolic features [8].

Numerous studies have proven that blood counts can serve as markers of the metabolic response to physical activity in professional and non-professional athletes and assess the level of metabolic potential [15]. During the study of biochemical parameters of blood serum in the group of athletes, an excess of the range of normal values of CK, HDL, a decrease in LDL and CDR values was found, in the group of beginners – an increase in CDR (AST/ALT) and a decrease in VLDL values (Table 2). Significant differences in TG and VLDL values were found between the compared groups ($p<0.001$), glucose, HDL, and KA ($p<0.05$). The urea value was also found at the lower limit of the reference values for beginners (2.6 (1.79; 3.53)) and not high for athletes (3.17 (2.51; 4.33)).

Table 1

The average values of age, length and body weight, SBP, DBP, heart rate, BMI and AP in the compared groups (Iu (Q25; Q75))

Indicator	The Athletes (n=23)	Beginners (n=13)	p
Age, years	20.5 (19; 23)	20 (18.75; 21.5)	0.987
Height, m	174.25 (171.75; 176.78)	178.15 (173.45; 180.78)	0.348
Body weight, kg	64.725 (59.3; 72.25)	72.5 (68.35; 78.05)	0.531
SBP, mmHg	116 (112; 127)	117 (108.75; 130)	0.608
DBP, mmHg.	70.5 (64.75; 74)	73.5 (65.75; 75.25)	0.087
Heart rate, beats per minute	61.5 (56.5; 65)	64.5 (60; 73.75)	0.161
BMI, kg/m²	20.35 (19.3; 22.45)	21.6 (19.88; 25.53)	0.373
AP, units	2.05 (1.9; 2.3	2.0 (1.87; 2.15)	0.553

According to literature data, a gradual increase in the level of enzymes in the blood serum during intensive physical training is an adaptive reaction of the body [3]. An increase in the level of CK is also noted during the recovery period [21]. Among athletes, an increase in the value of this enzyme indicates a higher intensity of physical activity compared to beginners.

As a rule, prolonged training leads to an increase in the concentration of urea in the blood [10]. It has been shown that an increase in the urea content in the blood is crucial for muscle activity. During short-term operation, it is insignificant, and during prolonged operation, the load can increase 4-5 times [5].

However, a low urea content may indicate an anabolic orientation of the processes, minimal use of protein as an energy substrate (during gluconeogenesis) and a higher energy supply to muscles. The level of urea in blood serum as the most important indicator of protein metabolism with values less than 5.75 mmol/l reflects the ability of athletes to better tolerate the training and competitive loads [10]. Low urea values in some athletes may be associated not only with this statement, but also with insufficient intake of protein-containing foods and sports nutrition.

Table 2

Biochemical parameters of blood serum (Me (Q25; Q75))

Indicator	The Athletes (n=23)	Beginners (n=13)	p
LDH (225-450 U/l)	351 (326; 381)	350 (306.5; 399.5)	0.934
CPK (< 190 U/l)	200 (115; 283)	165 (109.5; 254)	0.521
ALP (< 258 U/l)	225 (190; 292)	209 (193.5; 286.5)	0.961
GGT (11 – 50 U/l)	20 (18; 36)	21 (18.5; 27.5)	0.754
ALT (< 30 U/l)	17 (13; 23)	16 (10.5; 20.5)	0.355
AST (< 40 U/l)	23 (20; 25)	24 (21; 31)	0.180
CDR (1.3 – 1.5)	1.26 (1.08; 1.47)	1.71 (1.11; 2.12)	0.103
IPMT, units	8.32 (7.35; 12.57)	5.45 (4.79; 10.34)	0.103
MK (men 268-488 µmol/l)	263 (204; 291)	278 (239.5; 325.5)	0.236
Urea (2.5 – 8.3 mmol/l)	2.6 (1.79; 3.53)	3.17 (2.51; 4.33)	0.063
Creatinine (50 – 120 µmol/l)	98 (92; 100)	96 (92.5; 100)	0.586
Glucose (3.3 – 5.5 mmol/l)	4.9 (4.6; 5.4)*	4.5 (4.1; 5.1)	0.013
Total protein (65 – 85 g/l)	76.2 (75; 80)	75 (73; 77.5)	0.141
Albumin (34 – 48 g/l)	47 (45; 49)	46 (45; 48)	0.319
TG (0.5-1.7 mmol/l)	0.82 (0.70; 1.22)**	0.54 (0.44; 0.65)	<0.001
TC (3.6-6.5 mmol/l)	4.24 (3.85; 4.68)	3.99 (3.43; 4.36)	0.134
HDL-C (0.78-2.2 mmol/l)	2.48 (2.15; 2.72) *	1.98 (1.44; 2.21)	0.005
LDL cholesterol (1.68-4.53 mmol/l)	1.24 (0.95; 1.68)	1.78 (1.14; 2.19)	0.070
VLDL cholesterol (0.26-1.5 mmol/l)	0.38 (0.33; 0.56)**	0.25 (0.21; 0.30)	<0.001
KA (<3.5)	0.6 (0.5; 0.86)*	1.25 (0.57; 1.79)	0.046

Note. * – differences are significant, p<0.05, ** – differences are significant, p<0.001

The CDR value exceeding the normal range in the beginner group is associated with the predominance of catabolic processes. At the same time, a decrease in the urea value against the background of an increase in the CDR value in the beginner group may indicate unformed metabolic rearrangements of the body. In athletes, the CDR value is slightly reduced, which is associated with the predominance of anabolic metabolic processes, indicating an excellent functional state and good adaptive reserves of the body sufficient to overcome intense and prolonged physical exertion [22].

According to sources, exercise and training also cause adaptation of glucose metabolism, which improves glucose utilization in athletes and helps reduce insulin resistance in non-athletes [19]. The mechanism of biological reliability in muscular activity consists in excessive mobilization of carbohydrates from the depot, which is necessary to meet the energy needs of other functional systems, prevent hypoglycemic conditions, etc. With a decrease in glucose levels during physical work, the energy supply of other functional systems that ensure the vital activity of the body will decrease [2]. The established significant difference between the groups in glucose levels may be due to the difference in the intensity of the training process and the high consumption of carbohydrate-containing foods among athletes.

The lipid status of athletes' blood deserves special attention. In professional athletes, the lipid status was found to be more favorable compared to the sex- and age-appropriate population leading a sedentary lifestyle [8, 12]. Athletes have lower levels of TG, LDL, and comparable or higher HDL levels in the blood [12, 19]. HDL is an anti-atherogenic particle that ensures the release of cells from excess cholesterol. LDL is known to contribute to the formation of atherosclerotic plaques [13]. The above statements explain the high HDL values, low LDL and TG values close to the lower limit of normal values in the group of athletes, as well as lower HDL and high CA compared to athletes in the beginner group. It has been shown that a significant part of cholesterol in athletes is involved in the biosynthesis of steroid sex hormones and corticosteroids, in the formation of blood cells (erythrocytes), the secretion of sebaceous glands and bile acids [7]. Positive changes in the lipid profile in athletes are also associated with the rheological properties of blood [6]. Along with this, VLDL values are lower than the reference values in the beginner group, possibly due to the intensity of the training process and insufficient intake of saturated fatty acids from food.

Conclusion. According to the results of the study of boxing students, metabolic changes characterized by the predominance of anabolic processes, optimal lipid profile and characteristic enzymemia in athletes were revealed, which allow us to assert the formed adaptive and metabolic rearrangements to training loads, as well as the incompleteness of metabolic rearrangements in the beginner group, manifested by low values of urea, VLDL and an increase in CDR.

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STUDY OF COAGULATION HEMOSTASIS IN RATS UNDER CONDITIONS OF INDUCED GENERAL MODERATE HYPOTHERMIA

The use of induced hypothermia in clinical practice can lead to coagulopathy, increasing the risk of peri- and postoperative bleeding. The aim of this study was to investigate the effect of cooling the body to moderate hypothermia on the hemostatic system in rats. Activated partial thromboplastin time (APTT), thrombin time (TT), and prothrombin time (PT) were determined upon reaching a rectal temperature of 32°C and after prolonged two-hour hypothermia while maintaining the animal’s temperature at the same level. It was shown that cooling the animals to moderate hypothermia resulted in an increase in activated partial thromboplastin time, thrombin time, and prothrombin time, indicating the development of hypocoagulation shifts and impairment of the secondary hemostasis. With prolonged hypothermic exposure, a decrease in APTT, TT, and PT parameters from the achieved values was observed, which probably indicates some suppression of coagulation reactions with prolonged exposure to moderate hypothermia. It is suggested that impaired thrombin generation may be a key factor in hypothermia-induced coagulopathy.

Keywords: moderate hypothermia; hemostatic system; rats.

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