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THE RELATIONSHIP OF HYPERURICEMIA WITH ARTERIAL HYPERTENSION AND RISK FACTORS FOR CARDIOVASCULAR DISEASES IN THE WORKING POPULATION OF SOUTHERN YAKUTIA

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A one-stage population study was conducted in the working population in south Yakutia. The 174 people of non-indigenous nationality were examined. Increased uric acid (UA) levels were found in 27% of the individuals. The association of UA level with BMI, OT, lipid spectrum was revealed mainly in men, systolic blood pressure and blood glucose in women. Abdominal obesity was equally frequently recorded in both men and women, regardless of the presence or absence of hyperuricemia, Logistic regression showed satisfactory information content of the prognostic significance of the level of UA with hypertension only in the female population. Hyperuricemia was not an independent risk factor for the development of cardiovascular pathology.

Keywords: uric acid, hypertension, obesity, lipid spectrum, non-indigenous population, south Yakutia.

Arterial hypertension (AH) remains one of the most common diseases of the cardiovascular system, becoming epidemic in nature. Correction of risk factors, along with decreasing blood pressure, affect the prevention of cardiovascular complications. Over a 20-year period, the prevalence of hypertension in Russia increased from 39.2% to 45.7% [1].

In recent years, there has been a trend towards an increase in hyperuricemia (HU) among the world's population [8]. Multicenter studies by URRAH and NHANES have shown that asymptomatic HU is associated with the development of hypertension, coronary heart disease, obesity, diabetes mellitus, etc. [8,16]. Foreign authors have proven the influence of HU on the prognosis of cardiovascular complications as well [10,12,14]. A retrospective cohort study of 5899 people demonstrated that an increase in UA levels is a powerful factor in the transformation of prehypertension into hypertension [12], and also increases the risk of developing metabolic syndrome, dyslipidemia, diabetes and CKD [14]. Certain data is based on the fact that HU activates the renin-angiotensin system (RAS) and blocking RAS inhibits the action of xanthine oxidase [15]. Nevertheless, a possible direct connection of HU with the development of hypertension is still being discussed.

The aim of the study was to identify the relationship of hyperuricemia with arterial hypertension and its risk factors in the working population of non-indigenous nationality in Southern Yakutia.

Materials and methods of research. A single-stage study of the working population of the Republic of Sakha (Yakutia) of the Aldan district according to the list of industrial businesses was conducted within the framework of research on the State assignment of the YSC CMP "Normal and pathological regional peculiarities of biochemical, immunological and morphological indicators in the indigenous and alien population of the Republic of Sakha (Yakutia)" (FGWU-2022-0014) with a response rate of 75%. 174 people, representatives of non-indigenous nationality (Russians, Ukrainians, etc.) arrived for the examination. The median age was 44 [36; 52] years. 108 women, and 66 men were examined. They were comparable in age for analysis. The main condition for inclusion in the study was the absence of gout, subcutaneous tofuses.

All respondents underwent a questionnaire, an anthropometric study measuring height, body weight, waist circumference (WC) and hips circumference (HC), and blood pressure (BP) measurement. For laboratory tests, venous blood was taken on an empty stomach in the morning 12 hours after the last meal. All par-

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ticipants in the study signed a voluntary consent for the conducted examinations. The study was approved by the Ethics Committee of the YSC CMP.

The body mass index (BMI) or Quetelet II index was calculated using the formula: BMI (kg/m2) = body weight (kg)/ height (m2). Overweight was established at a BMI value of ≥25 and <30 kg/m2, obesity was recorded at a BMI of ≥ 30 kg/ m2 [5].

To detect abdominal obesity, WC was measured from a standing position. The measurement point is the midpoint of the distance between the apex of the iliac crest and the lower lateral edge of the ribs. It doesn't have to be at the navel level. At > 94 cm in men and > 80 cm in women, it can be assumed that the patient has abdominal type of obesity [3].

Laboratory research methods included: determination of the lipid spectrum (total cholesterol (TC), low-density lipoproteins (LDL), high-density lipoproteins (HDL), triglycerides (TG)), uric acid concentration (UA) and glucose in blood plasma.

Values of 400 mmol/l in men and 360 mmol/l in women were considered as elevated uric acid levels [1].

Blood pressure levels of ≥ 140/90 mmHg or constant use of antihypertensive drugs were considered as hypertension [7, 18].

Statistical processing of the obtained results was carried out using the SPSS program (version 26.0). Qualitative variables are described by absolute and relative frequencies (%), quantitative variables are described using the mean and standard error of the mean, median (Me) and interquartile range (Q1-Q3). The analysis of variance was carried out using the nonparametric Spearman criterion χ2. The odds ratio (OR) and 95% confidence interval (95% CI) were calculated. Spearman's coefficient was used for correlation analysis. The statistical significance of the differences (p) was assumed to be less than 5%. The significance of the relationship between quantitative indicators was also assessed using logistic regression and ROC analysis.

Results and discussion. Among the participants of the study, hyperuricemia (HU) was detected in 47 respondents, which was 27%. It was slightly more common in men 28.8% than in women 25.9% (χ2=0.17, p=0.680). Our data are consistent with the results of the epidemiological study of ESSE-RF [1]. The following results were obtained in the correlation analysis of UA with anthropometric data (BMI, WC). The UA level was significantly correlated with both BMI (r=0.222, p=0.003) and WC (r=0.271, p=0.000) (Fig.1). Similar results were obtained for sex. Our data confirms the results of a number of foreign authors [11,13,14,17]

Overweight in the general group was detected in 32.2%, obesity by BMI in 44.3%, among whom overweight was significantly more often registered in men (40.9%) compared with women (26.9%) (OR 2.88; 95% CI [1.19-6.99], p=0.017), obesity by BMI, on the contrary, was equally often detected in both men and women (43.9% and 44.4%, respectively) (OR 1.87; 95% CI [0.80-4.37], p=0.144). In individuals with elevated UA, BMI obesity was found in more than half of men (57.9%) and half of women (50%), with no significant difference among the compared groups (χ2=0.633, p=0.426).

Abdominal obesity (AO) was detected in 67.2% of respondents, it was slightly more common in the female population (69.4%) compared with men, who were also frequently diagnosed (63.6%) (χ2=0.694, p=0.405). Next, a variance analysis was performed for the presence of AO in individuals with HU, as a result of which more than two thirds of men with HU (73.7%) and 82.1% of women had AO (OR 0.60; 95% CI [0.14-2.48], p=0.486). In the general population, in the presence and absence of HU, AO was equally common. In particular, AO was registered without HU in 80 cases, which was 63% of all persons with normal UA levels, of which 31 were men (65.9%) and 50 were women (46.2%) (OR 0.86; 95%CI [0.40-1.82], p=0.695). The connection between HU and AO can be traced in our study, but without a significant relationship.

The analysis of the prevalence of hypertension among the study participants revealed a high frequency of its occurrence (56.3%), no statistically significant differences in sex were revealed, it was 62.1% for men and 52.8% for women (χ2=1.45, p=0.227).

HU as a risk factor for the development of cardiovascular complications is described in a number of literary sources. A meta-analysis of 18 prospective cohort studies, including 55,607 participants, showed an association of HU with an increased risk of hypertension (OR 1.41; [95% CI] 1.23-1.58) [10]. A 5-year cohort study of 5,899 individuals in Japan showed an association of asymptomatic hypertension with an increase in the number of patients with hypertension, dyslipidemia, overweight and obesity [14]. In Yakutia, studies were previously conducted among indigenous and non-indigenous populations for the presence of an

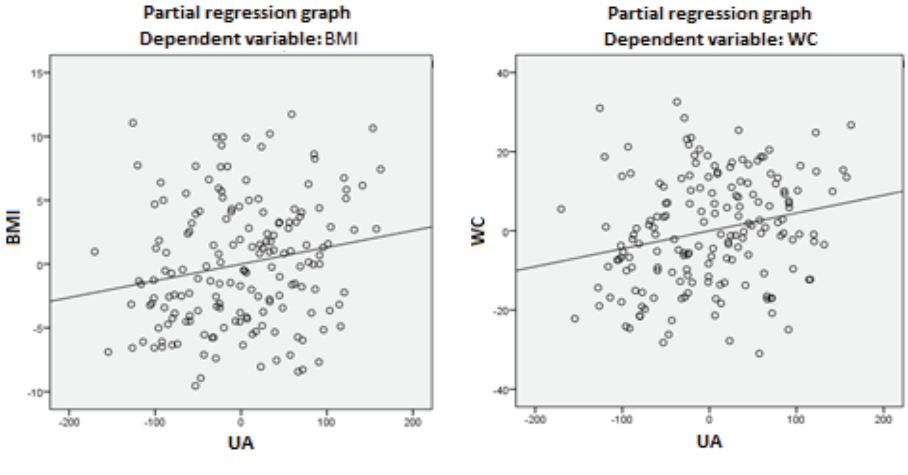

Fig.1. Correlations of uric acid level with BMI and WC (p<0.05)

Correlation analysis of uric acid levels with systolic blood pressure, lipid spectrum and blood glucose by Spearman

parameters		SBP	TC	HDL	LDL	TG	glucose
total	r	0.122	0.387	-0.186	0.330	0.353	0.251
	p	0.107	**0.000**	**0.014**	**0.000**	**0.000**	**0.001**
men	r	-0.086	0.536	-0.404	0.519	0.546	0.158
	p	0.494	**0.000**	**0.001**	**0.000**	**0.000**	0.206
women	r	0.224	0.121	0.118	-0.040	0.232	0.340
	p	**0.020**	0.211	0.224	0.682	**0.016**	**0.000**

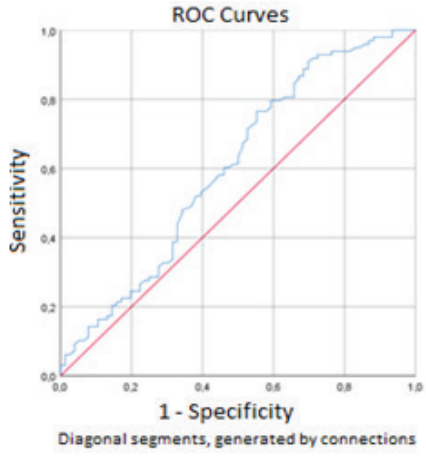

Fig. 2. ROC-curve for predicting UA levels with the development of hypertension

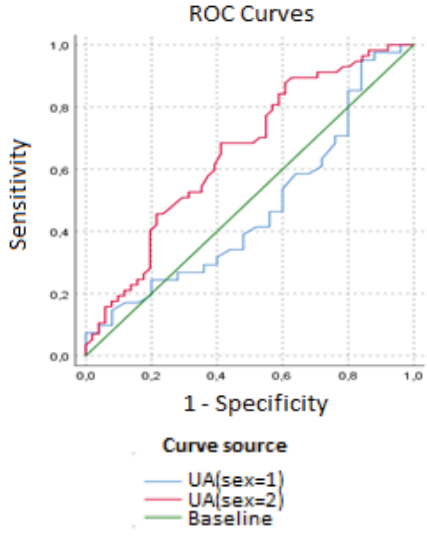

Fig. 3. ROC-curve for predicting UA levels with the development of hypertension depending on sex: 1-male, 2- female

association of UA with coronary atherosclerosis, hypertension, dyslipidemia, described by Romanova A.N., where more associative connections were obtained in non-indigenous residents [6]. For the correlation analysis, we carried out a parallel of the strength and direction of the relationship between the increase in UA level with systolic blood pressure, lipid spectrum in all participants, as well as separately for the male and female population (Table). A correlation with systolic blood pressure was obtained only in women. A direct reliable relationship of the UA level with the parameters of the lipid spectrum, in particular with TC and its atherogenic fractions, and plasma glucose, and a negative significant association with HDL was determined. When analyzing by sex, statistically significant correlations were obtained mainly in men, in women - only with TG levels and blood glucose.

Thus, the relationship between the level of UA with TC and its atherogenic fractions was revealed mainly in the male population, in women - with SBP, TG and blood glucose levels. According to our data, elevated UA levels were an independent risk factor for hyperlipidemia in the male population, hypertriglyceridemia and hyperglycemia in the female. Our data are consistent with the research of foreign and local authors [6,12,14].

The analysis of the presence of HU in hypertensive patients and people without hypertension, as well as sex differences, was carried out. In individuals with hypertension, HU was registered slightly more often (42%) compared with normotonics (31%) ($\chi2=0.757$, $p=0.384$). When comparing by sex among men, regardless of the presence of hypertension or its absence, the incidence of HU had no statistical differences (26.8% and 32%, respectively) ($\chi2=0.202$, $p=0.652$). 31.6% of women with hypertension and 19.6% without it had elevated levels of UA. The incidence of HU in hypertensive women is higher without significant difference ($\chi2=2.008$ $p=0.156$)

In large-scale URRAH studies involving 22,714 people, multivariate Cox regression analysis revealed an independent association of UA concentrations with both total (HR=1.53, 95% CI 1.21-1.93, P<0.001) and cardiovascular mortality (HR=2.08, 95% CI 1.146-2.97; P<0.001) [8]. Taking this into account, in order to identify the prognostic significance of UA values for the risk of hypertension, a significant relationship, we conducted an ROC analysis (Fig.2). The AUC for this model is 0.605±0.044 with satisfactory information value (95% CI: 0.518-0.690), the significance of the model was p=0.019. The cut-off point was 314.5, the sensitivity was 61.2%, and the specificity was 51.2%.

Further, a regression analysis of the association of UA with the risk of hypertension was performed separately for men and women (Fig.3), during which a satisfactory result was obtained only in women (AUC 0.656; [95% CI 0.552-0.760]; p=0.003), with a sensitivity of 68.4% and a specificity of 54.9%.

Thus, the logistic regression showed a less likely prognostic significance of the UA level for the development of hypertension. It can only be considered as a risk factor for hypertension in women. There is a parallel with lipid disorders and hyperglycemia, as well as with both BMI and abdominal obesity.

Conclusion. In conclusion, it should be noted that the frequency of occurrence of HU corresponded to epidemiological studies of ESSE-RF. Our study revealed an association of UA level with BMI, WC, lipid spectrum mainly in men, systolic blood pressure and blood glucose in women. AO was registered equally often in both men and women, regardless of the presence or absence of HU. Logistic regression showed satisfactory information value of the prognostic significance of the level of UA with hypertension only in the female population. Elevated UA levels are an adverse factor affecting the body's metabolism. Determination of its concentration in patients with hypertension by a routine method in primary healthcare is recommended to be introduced according to clinical recommendations for the diagnosis and treatment of hypertension [7, 18]. A recent Consensus on the management of patients with hypertension and high cardiovascular risk indicates a revision of the target levels of UA [4]. However, in our study, the level of UA is not a prognostic risk factor for the development of cardiovascular pathology. Perhaps this is due to the small sample size of the pilot study.

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EVALUATION OF COMPETITIVE ENDURANCE OF AIRBORNE TROOPS PARTICIPATING IN THE ALL-ARMY COMPETITION "AIRBORNE PLATOON" ACCORDING TO THE ANALYSIS OF HEART RATE VARIABILITY

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The article presents the results of a study of the competitive endurance of servicemen of the airborne troops performing at the 3rd stage of the military field training competition "Airborne Platoon". The relevance of the work lies in the fact that a timely assessment of the functional state of military athletes will make it possible to adjust training plans in time and perform more effectively at the competition. The aim of the study was to assess the competitive endurance of military athletes according to heart rate variability data with different military accounting specialties. Based on the data of heart rate variability, the analysis of the state of the regulatory processes of the body was carried out, the assessment of the competitive endurance of the airborne troops before and after performing special tasks in the "Airborne Platoon" military field training competition was carried out. With the help of an orthostatic test, the latent capabilities of the functional systems of the body were evaluated. The body of military personnel serving as driver mechanics is characterized by a pronounced tension of regulatory systems during the orthostatic test, in soldiers of other accounting specialties, the body reacts adequately. It is presented that the physical load during the period of the competition was at the limit of the capabilities of the body of military personnel and almost led to the breakdown of adaptation mechanisms.

Keywords: heart rate variability, military athletes, physical fitness, military field training competition "Airborne Platoon".

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Introduction. For 10 years, complex competitions on military field training of military personnel "Army Games" have been successfully held. One of the most difficult competitions is the "Airborne Platoon".

"Airborne Platoon " is a complex competition of parachute and amphibious assault units, including the performance of physical and combat exercises in a competitive form [4].

The competition consists of 4 stages, which include such disciplines as landing, driving, and using combat vehicles, overcoming obstacles, firing small arms and grenade launchers, terrain orientation, hand-to-hand combat, various marches. These disciplines are held in the form of competitions between teams, which creates, in addition to harmful factors caused by military service (from barometric pressure drop to vibration and motion sickness) [4, 6, 12], psycho-emotional stress affecting the functional state of military athletes [9].

From the above it becomes clear that