

Prevalence of lipid metabolism and enzyme activity-related disorders in indigenous and non-indigenous populations of Yakutia

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Annotation. The biomedical study, which included 1,428 representatives of the indigenous and 824 alien populations living in Yakutia, aimed to study the state of the lipid profile and indicators of enzymatic activity. The results showed the presence of disorders that indicate a similar level of threat of atherosclerosis among both indigenous and newcomers. It has been recorded that an increase in cholesterol levels among the indigenous inhabitants of Yakutia is observed upon reaching the age of 40, whereas for those who arrived a decade earlier. The higher the activity of liver enzymes (ALAT, GGT), the lower the level of HDLP-C cholesterol, which can serve as an indicator not only of liver condition, but also of potential risk to the cardiovascular system. The more pronounced activity of liver enzymes in the local population indicates not only a high rate of metabolic processes, but also a widespread depletion of the body's adaptive reserves. This requires further in-depth analysis of the causes and indicates a comprehensive assessment of the health problems of the population of Yakutia associated with an increased risk of atherosclerosis, negative morbidity dynamics and specific biochemical adaptations to a harsh climate. To solve this problem, further research is needed, the development of personalized prevention and treatment strategies, as well as enhanced health monitoring of workers arriving in the Far North.

Key words: lipid profile, enzymes, the Far North, atherosclerosis, indigenous and non-indigenous populations.

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Introduction. Extensive scientific research conducted by Russian scientists since 1970 in the process of developing the northern territories has revealed that extreme climatic and environmental factors have a negative impact on the human body, requiring maximum exertion of the body's resources. These studies have shown the vulnerability of the visiting population to the adverse factors of the northern environment, the complex process of adaptation, and the increased need for a scientific approach to adaptation processes and disease prevention [1, 2, 3, 4].

Modern research details the classical ideas about adaptation to the conditions of the North. Currently, climate change, anthropogenic pollution of the environment as a result of active human economic activity, as well as social and production conditions, changes in lifestyle and diet have led to differences in metabolic processes in the entire population compared to observations made several decades ago. In particular, there is an increase in the prevalence of metabolic syndrome, insulin resistance, and cardiovascular diseases. The prevalence of pathologies among the indigenous population has changed dramatically: from low in the last century to a rapid increase that is comparable to or even exceeds that of

the non-indigenous population today [5, 6, 7]. According to the Federal State Statistics Service, the number of newly diagnosed circulatory system diseases in the Republic of Sakha (Yakutia) has doubled since 2000 [8].

In this regard, research is currently relevant, requiring the assessment of metabolism to create methods that increase the adaptive capabilities of the body in the North, maintain its functional systems aimed at preserving homeostasis, preventing and treating metabolic disorders, improving the diet and physical activity.

Purpose of the study. To assess the frequency of lipid metabolism disorders and enzyme activity among indigenous and non-indigenous residents of Yakutia.

Materials and methods. The data for the study were obtained during medical and biological expeditions, which included a one-time population survey of the population of Yakutia in 2018-2024. A random sample was formed, including 1,428 representatives of the indigenous population (yakuts, evens, and dolgans) and 824 representatives of the non-indigenous population (russians) aged 20 to 85 years. The average age of the participants was as follows: 46 (33; 55) years for the non-indigenous population and 49 (36; 57) years for the indigenous popula-

tion. The study participants were divided into 6 groups based on their ethnicity and age: 1 – 20-29 years old, 2 – 30-39 years old, 3 – 30-39 years old, 4 – 40-49 years old, 5 – 50-59 years old, 6 – 60-69 years old.

The activity of creatine kinase (CK), creatine kinase MB (CK-MB), alanine aminotransferase (ALAT), aspartate aminotransferase (ASAT), alkaline phosphatase (ALP), gamma-glutamyl-transpeptidase (GGT), total cholesterol (TCH), high-density lipoprotein cholesterol (HDLP-C), and triglycerides (TG) was determined using an enzymatic method. The studies were conducted on an automated biochemical analyzer using reagents produced by Analyticon (Germany). The formula proposed by Friedewald et al. (1972) was used to calculate the concentration of low-density lipoprotein cholesterol (LDLP-C) and very-low-density lipoprotein cholesterol (VLDLP-C).

The degree of atherogenicity was assessed using the coefficient developed by A.N. Klimov: $C_a = (\text{total cholesterol} - \text{HDLP-C}) / \text{HDLP-C}$ (Klimov, Nikulcheva, 1999). In addition, the following ratios were calculated: total cholesterol/high-density lipoprotein cholesterol, where a value exceeding 5 indicated an unfavorable profile, and low-density lipoprotein cholesterol/high-density lipopro-

Table 1

Lipidogram in the indigenous and non-indigenous population

Indicators	Groups	M±m	95% CI	Me (Q1; Q3)	P ₁₋₂
TCH, mmol/l	1. Коренные, n=1428	5.24±0.02	5.19-5.29	5.18 (36.00; 57.00)	0.000
	2. Пришлые, n=824	5.68±0.04	5.59-5.76	5.66 (35.00; 54.00)	
TG, mmol /l	Indigenous	0.99±0.01	0.96-1.09	0.88 (4.51; 5.92)	0.000
	The aliens	1.18±0.02	1.13-1.22	1.04 (4.82; 6.54)	
HDLP-C, mmol /l	Indigenous	1.32±0.01	1.29-1.33	1.27 (0.65; 1.21)	0.000
	The aliens	1.38±0.01	1.34-1.42	1.32 (0.74; 1.49)	
LDLP-C, mmol /l	Indigenous	3.47±0.02	3.42-3.52	3.41 (1.06; 1.54)	0.000
	The aliens	3.76±0.03	3.68-3.83	3.68 (1.09; 1.70)	
VLDLP-C, mmol /l	Indigenous	0.45±0.01	0.44-0.46	0.40 (2.81; 4.04)	0.000
	The aliens	0.54±0.01	0.52-0.56	0.47 (3.00; 4.45)	
Predictive indicators					
CA	Indigenous	3.20±0.03	3.14-3.27	3.00 (2.30; 4.00)	0.003
	The aliens	3.36±0.04	3.27-3.46	3.20 (2.38; 4.20)	
TCH HDLP-C	Indigenous	1.24±0.01	1.22-1.27	1.00 (3.30; 5.01)	0.003
	The aliens	1.29±0.01	1.25-1.32	1.00 (3.36; 5.19)	
LDLP-C HDLP-C	Indigenous	2.84±0.02	2.79-2.90	2.70 (2.06; 3.48)	0.019
	The aliens	2.97±0.04	2.88-3.05	2.82 (2.08; 3.64)	

Table 2

Comparative characteristics of the lipid profile depending on age, M±m

	Population	Age groups, years				
		20-29	30-39	40-49	50-59	60-69
TG, mmol / l	Indigenous	0.88±0.03*× n=192	0.94±0.02* n=250	1.02±0.03*× n=266	1.05±0.02*× n=388	1.04±3.87*× n=240
	The aliens	1.08±0.06*+ n=100	1.05±0.04* n=162	1.20±0.04* n=192	1.26±0.03*+ n=274	1.40±0.08*+ n=76
TCH, mmol/l	Indigenous	4.68±0.07*×	5.02±0.05*×	5.28±0.05*×	5.60±3.87*×	5.41±0.06*×
	The aliens	4.88±0.10*+	5.29±0.08*+	5.73±0.08*+	6.20±0.07*+	6.10±0.15*+
LDLP-C, mmol / l	Indigenous	2.99±0.06×	3.30±0.05×	3.53±0.05*×	3.78±0.04*×	3.60±0.05*×
	The aliens	3.12±0.09+	3.39±0.07+	3.79±0.08*+	4.23±0.06*+	4.15±0.12*+
HDLP-C, mmol / l	Indigenous	1.30±0.02	1.26±0.02*	1.30±0.02*	1.32±0.01*	1.32±0.02
	The aliens	1.30±0.04+	1.40±0.03**	1.40±0.03*	1.41±0.02*+	1.21±0.03*
VLDLP-C, mmol / l	Indigenous	0.41±0.01*×	0.44±0.01*	0.47±0.01*×	0.49±0.01*×	0.49±0.01*×
	The aliens	0.51±0.02*+	0.50±0.02*	0.55±0.02*	0.58±0.01*+	0.67±0.04*+
CA	Indigenous	2.76±0.08*×	3.21±0.08*	3.31±0.07*×	3.44±0.06×	3.30±0.08*×
	The aliens	3.06±0.13*+	3.07±0.11*	3.35±0.10*+	3.63±0.08+	4.07±0.15*+
TCH/ HDLP-C	Indigenous	3.75±0.08×	4.17±0.08×	4.33±0.08×	4.46±0.06×	4.34±0.80*×
	The aliens	4.04±0.13+	4.03±1.10	4.39±0.10+	4.65±0.08+	5.08±0.16*+
LDLP-C / HDLP-C	Indigenous	2.44±0.07×	2.78±0.07×	2.94±0.06×	3.02±0.05×	2.88±0.06×
	The aliens	2.62±0.11+	2.64±0.09	2.91±0.08+	3.18±0.07+	3.50±0.13+

Note: the symbol (*) indicates a significant difference in the values of indicators between indigenous and alien groups; the symbol (×) – a significant difference between the first and subsequent indigenous groups; the symbol (+) – a significant difference between the first and subsequent groups of the alien population.

of the mean ($M \pm n$), confidence intervals (CI, 95%), to assess the accuracy of the mean, as well as the median (Me) and percentile values (Q1, Q3). The Student's t-test and the Kolmogorov-Smirnov test were used to compare the means and determine the presence of statistically significant differences. The statistical significance of the differences was determined at a probability level of $p < 0.05$, which corresponds to the generally accepted level.

Results and discussion. The study revealed significant differences in the values of all parameters of the lipid spectrum (Table 1).

In the examined immigrants, the levels of total cholesterol, triglycerides, HDLP-C, LDLP-C, and VLDLP-C were significantly higher than in the indigenous population. The excess was 7.75% for total cholesterol, 16.4% for triglycerides, 35.7% for HDLP-C, 7.72% for LDLP-C, and 16.67% for VLDLP-C. Among the prognostic indices, the C_a is the most sensitive marker. The average value of the C_a was recorded at the upper limit of the reference value. In the non-indigenous population, the C_a was higher than the accepted norm, with an average value of 3.36 ± 0.04 and a median value of 3.20. The other two predictive indicators, such as total cholesterol/high-density lipoprotein cholesterol and low-density lipoprotein cholesterol/high-density lipoprotein cholesterol, which are related to the risk of atherosclerosis, showed results within the established norms. Compared to the indigenous population, the non-indigenous population had high-

Table 3

Prevalence of abnormalities in the lipid profile in the indigenous and the alien populations

Indicators	Indigenous	The aliens
	n / %	n / %
TCH (3,3-5,0 mmol/l)	1428 / 100.0	824 / 100.0
Hyper CH	170 / 11.9	220 / 26.7
TG, (0,5-1,7 mmol/l)	1427 / 100.0	824 / 100.0
Hyper TG	125 / 8.8	139 / 16.9
HDLP-C, (0,78-2,2 mmol/l)	1406 / 100.0	826 / 100.0
Hypo HDLP-C	41 / 2.9	27 / 3.3
LDLP-C, (1,68 – 4, mmol/l)	1408 / 100.0	822 / 100.0
Hyper LDLP-C	132 / 9.4	144 / 17.5
VLDLP-C, (0,8-1,5 ммоль/л)	1402 / 100	817 / 100
Hypo VLDLP-C	1267 / 90.4	676 / 82.7
Ca, (<3)	1410 / 100.0	827 / 100.0
High Ca	644 / 45.7	430 / 52.0
TCH/ HDLP-C, (<5)	1401 / 100.0	821 / 100.0
High TCH/ HDLP-C	371 / 26.5	258 / 25.2
LDLP-C/HDLP-C, (3,2)	1036 / 100.0	553 / 100.0
High LDLP-C/HDLP-C	365 / 26.1	268 / 32.6

er median values of C_a and low-density lipoprotein cholesterol/high-density lipoprotein cholesterol.

A comparative analysis depending on age showed that with age there is a tendency to increase the level of lipidogram parameters (Table 2).

The increase in the level of TCH among the indigenous population is observed in the group from 40-49 years, whereas among newcomers, this trend is observed 10 years earlier, namely from the age of 30.

The highest average level of TCH

Table 4

Correlations of the lipid spectrum and enzyme activity

Parameters	Coefficient and significance	ALAT	GGT	ALP	TG	HDLP-C	VLDLP-C,
GGT (E/L)	Correlation coeff.	0.561**					
	Value. (two-story.)	0.000					
Alp (E/L)	Correlation coeff.	0.254**	0.320**				
	Value. (two-story.)	0.000	0.000				
TG (mmol/l)	Correlation coeff.	0.242**	0.245**	0.103**			
	Value. (two-story.)	0.000	0.000	0.000			
HDLP-C	Correlation coeff.	-0.152**	-0.115**	-0.108**	-0.364**		
	Value. (two-story.)	0.000	0.000	0.000	0.000		
VLDLP-C	Correlation coeff.	0.261**	0.251**	0.103**	0.972**	-0.377**	
	Value. (two-story.)	0.000	0.000	0.000	0.000	0.000	
Ca	Correlation coeff.	0.278**	0.253**	0.154**	0.611**	-0.645**	0.616**
	Value. (two-story.)	0.000	0.000	0.000	0.000	0.000	0.000

**. The correlation is significant at 0.01 (two-way)

Table 5

The level of enzyme activity in indigenous and alien inhabitants

E/L	Groups	N	M±m	95% CI		Me (Q ₁ ; Q ₃)	P ₁₋₂
LDG	1	1421	388.74±1.84	385.13	392.36	389.00 (343.00; 432.00)	0.000
	2	814	359.37±2.77	353.92	364.83	359.00 (314.00; 403.00)	
CK - Nac	1	1419	101.23±1.40	98.47	104.00	89.00 (89.00; 124)	0.005
	2	808	108.68±2.00	104.74	112.62	97.00 (73.00; 135.00)	
CK-MB	1	1046	22.10±0.34	21.43	22.77	20.00 (15.00; 27.00)	
	2	438	24.83±0.57	22.08	24.19	22.00 (17; 31.00)	
ALP	1	1914	255.24±2.30	250.71	259.77	240.00 (197.00; 294.00)	0.000
	2	804	186.16±2.23	181.77	190.55	179.00 (148.00; 214.00)	
GGT	1	1421	35.43±0.56	34.32	36.55	29.00 (20.00; 45.00)	0.000
	2	808	30.38±0.75	28.90	31.85	24.00 (17.00; 38.00)	
ALAT	1	1421	19.04±0.34	18.36	19.72	15.00 (10.00; 23.00)	
	2	808	17.52±0.45	16.62	18.42	14.00 (14.00; 30.80)	
ASAT	1	1421	24.69±0.27	24.16	25.22	23.00 (19.00; 28.00)	
	2	808	24.29±0.41	23.48	25.11	22.00 (18.00; 27.00)	
C the de ritis	1	1421	1.62±0.01	1.58	1.65	1.50 ()	
	2	808	1.59±0.02	1.55	1.64	1.46 ()	

Note: 1 – indigenous population; 2 – alien population.

(6.20±0.07 mmol/l) registered with aliens in the age group of 50-59 years. The TG level in all groups is within the reference range, but in the group of newcomers aged 60-69, the highest TG level, equal to 1.40 mmol/l, is 34% ($p < 0.05$) higher than in the indigenous population.

The aliens have a higher level of HDLP-C compared to the natives. These differences are especially noticeable in the age categories from 30-39, 40-49, 50-59 years ($p=0.000$). However, the aliens (over 60 years old) there is a decrease in the level of HDLP-C. The level of LDLP-C is also higher among the aliens in all age groups, and statistically significant differences from the indicator of indigenous people begin to appear from the age of 40-49 (by 12%, $p < 0.05$).

There is a significant increase in the level of C_a among the aliens, starting from the age of 40-49. This indicator reaches its maximum in the elderly group (4.07±0.15 mmol/l), exceeding the established norms. Two other analyzed markers - TCH/HDLP-C, LDLP-C /HDLP-C - also exceed the reference values in the group of elderly the aliens.

The table of conjugation showed that the aliens are characterized by a higher prevalence of elevated levels of TCH and TG compared with the indigenous population (Table 3).

The differences were 14.8% and 8.1%, respectively. In addition, the aliens were more likely to have increased levels of LDLP-C and VLDLP-C – 17.5% versus 9.5%.

Elevated C_a values were found in a significant part of both groups (45.7% of indigenous and 52.0% of the aliens), and this indicator is more common among the aliens. The TCH/HDLP-C index is less common than elevated C_a , and does not show significant differences between the indigenous (26.5%) and the alien population (25.2%). The ratio of LDLP-C to HDLP-C also indicates an increased risk, and this indicator is recorded more often in the aliens (32.6%) than in the indigenous population (26.1%).

Thus, with age, the lipid profile deteriorates in both indigenous and alien populations. However, for newcomers, these changes begin earlier and are more pronounced. They have an earlier increase in TCH, higher levels of TG, HDLP-cholesterol, LDLP cholesterol, and C_a . Non-indigenous people aged 60-69 have significantly higher C_a than normal. These data indicate an increased risk of developing atherosclerotic diseases in the alien population, especially in older age groups, which is consistent with the literature data [9, 10, 11] and indicates the need for closer attention to their car-

diovascular health under the combined effects of negative climatic factors [6].

A significant part (45.7%) of the indigenous population has a lipid profile disorder. In the work of Sofronova S.I. (2018), LDLP-C hypercholesterolemia in the indigenous population reached more than 70% [12]. The main factors in the development of dyslipidemia among the indigenous population are lifestyle changes, the transition from a traditional diet to a high-carbohydrate diet [13], lack of physical activity, harmful addictions [15], environmental pollution with pollutants, socio-economic factors such as low material well-being, especially in rural areas [4]. The formation of a new type of population metabolism lags behind the pace of dietary changes, which leads to the development of metabolic maladjustment diseases and alimentary-dependent diseases. This led to a general increase in morbidity among the population of the North in all classes of diseases associated with poor nutrition [14].

In addition to lipid metabolism disorders and poor nutrition, lack of physical activity and harmful addictions (tobacco smoking, excessive alcohol consumption) make a significant contribution to the development of cardiovascular diseases in the North [15].

Maintaining the stability of the most

important biochemical parameters, or otherwise humoral homeostasis, including lipid metabolism, is provided by a complex complex of enzymes. Among the most significant among them are: ASAT, ALAT, GGT, ALP, LDH and CK. The main executive mechanisms of this system are the key reactions of transamination. Thus, ASAT is responsible for ensuring the necessary level of bioenergy and heat production, while ALAT ensures the operation of the glucose-alanine shunt.

The Spearman correlation table shows the relationship between the activity of ALAT, GGT, and alkaline phosphatase with the level of TG, HDLP-C, and VLDLP-C (Table 4).

A direct correlation was found between C_a and ALAT ($r=0.278$; $p<0.01$), GGT ($r=0.253$; $p<0.01$), ALP ($r=0.154$; $p<0.01$), as well as a weak negative association between HDLP-C and ALAT ($r = -0.115$; $p<0.01$), GGT ($r = -0.115$; $p<0.01$), alkaline phosphatase (0.108 ; $p<0.01$).

The level of enzyme activity in the blood serum of indigenous and alien residents of Yakutia showed significant differences. Despite the fact that the indicators were within the reference values, this indicates an uneven degree of intensity of adaptive metabolic reactions in the conditions of northern latitudes (see Table 5).

The activity of ALP, LDH and GGT. This is confirmed by both correlation analysis and comparison of median values. A comparison of the enzyme activity data of indigenous and alien inhabitants using conjugation tables showed differences in the activity of LDH ($\chi^2=454.21$; <0.000), CK ($\chi^2=599.065$; <0.000), ALP ($\chi^2=676.154$; <0.000), GGT ($\chi^2=187.440$; $p < 0.014$). The Pearson correlation revealed negative associations between the activity of enzymes of indigenous and alien inhabitants: ALP ($r = -0.435$; $p < 0.01$), LDH ($r = -0.234$; $p < 0.01$), GGT (-0.154 ; $p < 0.01$). The activity of CK is significantly higher among the newcomers than among the indigenous population ($p<0.005$).

Data analysis did not show a significant difference in the average activity level of ALAT and ASAT enzymes, as well as in the ratio of ASAT to ALAT - the de Ritis coefficient between indigenous and non-indigenous people.

The obtained values of C de Ritis in both groups (1.62 ± 0.01 for indigenous and 1.59 ± 0.02 for newcomers) are within the established standard values ($0.91-1.75$).

An assessment of changes in enzymatic activity revealed a significantly increased level of enzymatic activity in the indigenous population. Thus, increased

Table 6
Frequency of enzyme activity deviations in indigenous and non- indigenous population

Indicators	Indigenous		The aliens	
	N	%	N	%
LDG, (225-450 E/L)	1423	100	815	100
Above the norm	286	20,0	83	10,2
CK, (<190 E/L)	1424	100	812	100
Above the norm	123	8,6	72	8,9
CK MB, (<25 E/л)	1048	100	441	100
Above the norm	293	28	152	34,5
ALP, (<258 E/l)	1424	100%	802	100%
Above the norm	612	43%	88	11%
GGT, (W.:7-32; M.:11-50 E/L)	1424	100%	816	100%
Above the norm	495	34,8%	201	24,7%
ALAT, (<30 E/л)	1441	100%	820	100%
Выше нормы	202	14%	78	9,5%
ASAT, (<40 E/L)	1432	100%	815	100%
Above the norm	83	5,8%	48	5,9%
C the de Ritis, st/ un., (3,0)	1422	100%	811	100%
Above the norm	498	35%	270	33,3%
Below the norm	49	3, 4%	26	3,2%

activity of ALP (43%), LDH (35%) and GGT (20%) in the indigenous population was 3, 1.96, 1.4 times more common than in the alien population (Table 6).

The higher activity of enzymes involved in metabolic processes confirms the hypothesis that the indigenous population of the North has a more intensive energy metabolism, which is an adaptation formed as a result of prolonged residence in harsh climatic conditions. [4]. However, the significant activity of ALP and GGT in the blood is an important signal of possible disorders in the hepatobiliary system, since GGT and alkaline phosphatase are markers of cholestasis. The presence of cellular enzymes in the blood indicates cytolysis, that is, cell destruction, and is used to predict the dynamics of the disease and its possible outcome. GGT is an enzyme that ensures the transfer of amino acids into cells. It is one of the detoxification mechanisms of the body.

The main place of its concentration is the liver. It serves as an indicator of intoxication and allergic reactions. The level of GGT activity is directly related to the amount of alcohol consumed. Alkaline phosphatase is present in almost all organs, but its greatest activity is observed in the hepatobiliary zone, so an increase in alkaline phosphatase is most often due to damage to hepatocytes (hepatocellular pathway) or due to disruptions in the

outflow of bile (cholestatic pathway). The hepatocellular mechanism of increased alkaline phosphatase activity dominates in viral and autoimmune hepatitis, as well as in toxic and drug-induced liver damage [16]. This requires further, more detailed studies to determine the exact cause of liver dysfunction.

In the fight against the high morbidity of the population of Yakutia, it is possible to apply the directions of adaptation of the public administration system of the Arctic regions proposed by Provorova A.A. et al. (2024). The approach is differentiated for the indigenous, old-timers and newcomers. For indigenous people, it is the preservation of traditions and medical care in hard-to-reach areas. For the newcomer population, the development of the shift method, personnel selection, medical supervision and counseling of new arrivals, climate-sensitive training, the development of domestic tourism and sanatorium treatment, telemedicine and Arctic medicine [18].

Thus, when analyzing the parameters of the lipid profile in the indigenous and alien populations of Yakutia, it was found that both newcomers and indigenous populations are at increased risk of developing atherosclerosis; dyslipidemia is more pronounced in the alien population; disorders in lipid metabolism in newcomers are noted a decade earlier; with age, the risk of developing atherosclerosis in-

creases in the alien population; the higher the activity of liver enzymes (ALAT, GGT), the lower the HDLP-C level. This is of great clinical importance, since a decrease in HDLP-C is a risk factor for the development of cardiovascular diseases; increased activity of liver enzymes can serve as an indicator not only of liver condition, but also of a potential risk to the cardiovascular system.

When evaluating the activity of ALAT, ASAT, GGT, ALP, and CK enzymes, a more pronounced enzyme activity and a higher percentage of high activity of ALP and GGT were found in the indigenous population compared with the alien population, which indicates not only the different intensity of adaptive metabolic processes in high latitudes, but also the stress of the functional state of the hepatobiliary system. Non-indigenous residents have a slightly more pronounced CK activity, which is probably a marker of increased energy consumption associated with the process of physiological adaptation to the harsh conditions of the northern climate. This mobilization of energy resources is part of a broader process of creating a new level of homeostasis in response to changing environmental conditions.

Conclusion. The data obtained is important for developing adaptation strategies to the harsh conditions of the Far North. An in-depth analysis of the causes of the identified violations is needed and the development of comprehensive measures that take into account the adaptive characteristics of various population groups and the impact of negative environmental factors. A personalized approach to the prevention and treatment of diseases is important, taking into account ethnic and genetic characteristics. Of particular importance is the mandatory comprehensive assessment of the health status of workers arriving from other regions in the Far North.

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DIAGNOSTIC AND TREATMENT METHODS

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Diagnostic challenges and immediate outcomes of surgical treatment of a patient with duodenal non-epithelial tumor

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Abstract. Gastrointestinal stromal tumors (GIST) can be localized in all regions of the gastrointestinal tract. Most often, GIST are localized in the esophagus and stomach, less often in the low intestine. The duodenum accounts for up to 5% of GIST localizations. At the same time, tumors of various histological structures in the duodenum are rare. Often, the tumor develops covertly, manifesting itself only by its complications. The most common of these is bleeding into the duodenum. In the structure of the causes of bleeding from the upper gastrointestinal tract, bleeding from GIST takes up several of percent. The radical method of GIST treatment is a surgical method with mandatory postoperative examination of the prepartate using immunohistochemistry to verify its degree of malignancy and determine further patient management tactics. In clinical practice, difficulties arise in the differential diagnosis of GIST localized in the duodenum and duodenal ulcer. In our clinical case, a 65-year-old man had a long history of peptic ulcer. He was repeatedly treated by a gastroenterologist for exacerbations of duodenal ulcer. Over the past year, he has had several episodes of gastrointestinal bleeding. At the same time, no endoscopic data was obtained for the exacerbation of peptic ulcer disease. The use of such methods as MRI of the abdominal cavity and endoUS allowed the verification of GIST at the preoperative stage. The patient underwent gastric resection with the removal of GIST in the duodenal bulb. A good result of surgical treatment of a non-epithelial duodenal tumor has been shown. If there are clinical manifestations of bleeding from the upper gastrointestinal tract, GIST should be remembered as a possible cause.

Keywords. gastrointestinal stromal tumors, GIST, duodenum, surgical treatment

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Introduction. Gastrointestinal stromal tumors (GISTs) are rare tumors of the gastrointestinal tract [1, 2, 3]. GISTs are characterized by hematogenous metastasis to the liver, peritoneum, less commonly to the lungs, bones, and rarely to the lymph nodes (5%) [1]. Men and women are affected equally often. The median age of patients with GISTs is 55-65 years, rarely in individuals under 40 years of age.

GISTs most often occur in the stomach (60-70%), less commonly in the small intestine (25-35%) and duodenum (5%). They can also be found in the colon and rectum (5%), as well as in the esophagus (1-5%) [1-5]. In 5% of cases, the tumor is not associated with a specific organ. Unfortunately, GISTs are often detected at late stages, as they do not cause specific symptoms and are difficult to diagnose. They are often diagnosed incidentally during an exam-

ination or surgery performed for another reason.

More than half of GIST cases present with urgent complications, the most common of which is gastrointestinal bleeding [4,6,7].

Present our clinical observation. The patient provided written agreement for treatment and publication of his clinical case in a scientific journal. Patient K., 65 years old, was admitted to the surgical department on August 20, 2024, complaining of a feeling of heaviness in the epigastric region immediately after eating, belching, and heartburn. The patient has a long anamnesis of ulcers and has been treated multiple times in various hospitals. Since the beginning of 2024, the patient has been bothered by persistent pain and several episodes of gastrointestinal bleeding, for which he was repeatedly admitted to various surgical hospitals with a diagnosis of duode-

nal ulcer complicated by bleeding. Due to a long history of peptic ulcer disease and several episodes of ulcer bleeding, the patient was diagnosed with a planned surgical procedure for duodenal ulcer disease and referred to University Clinical Hospital. Prior to admission, the patient underwent a series of instrumental examinations as an outpatient.

A gastric X-ray performed on July 25, 2024, revealed a duodenal bulb ulcer with a recess on its contour (Fig. 1).

Magnetic resonance imaging (MRI) of the abdominal organs (July 30, 2024) (Fig. 2) revealed a duodenal tumor with ulceration, no signs of regional lymphadenopathy, and no invasion of surrounding structures (shown by the arrow). This may be consistent with a submucosal tumor (GIST). No focal changes in the parenchymal organs were detected. It is impossible to completely exclude the presence of a penetrating duodenal ulcer.