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COMPARATIVE ANALYSIS OF BIOCHEMICAL PARAMETERS OF BLOOD IN THE MEN, LIVING IN YAKUTIA RURAL AND URBAN AREAS

ABSTRACT

We surveyed the men of Yakutia indigenous population (n = 150) living in rural and urban areas. The shift of lipid metabolism in the direction of dyslipidemia was observed in men in Central Yakutia, while among urban residents the signs of disadaptation were more marked. The men who lived in the north of Yakutia, there was no deviation from the norm. We revealed the correlation of lipid metabolism index (atherogenic index) with metabolic equilibrium index (De Ritis Ratio) that allows recommending the use of De Ritis Ratio for the formation of groups at risk of cardiovascular pathology and timely implementation of preventive measures.

Keywords: indigenous population of Yakutia, the activity of enzymes, lipids, metabolic equilibrium, De Ritis Ratio.

Recent studies show that in today's socio-economic environment of genetically enshrined mechanisms of energy metabolism in the restructuring of the indigenous population is not enough [2, 4, 8, 9, 11, 14]. Increased metabolism of lipids needed for adaptation to the climate and geographical conditions of the North, with a small amount of replenishment of reserves of the body can lead to pre-pathological changes in the body. Currently functional exhaustion manifested in the increase of cardiovascular diseases among the indigenous population of Yakutia [1, 5, 6]. The role of lipid metabolism in the development of atherosclerotic vascular disease which is a risk factor for cardiovascular diseases, early detection of changes in biochemical parameters involved energy metabolism is important.

Purpose of the study. Detection of maladjustment biochemical parameters of blood in indigenous men depending on place of residence.

MATERIAL AND METHODS

In total we studied 150 indigenous men of Yakutia aged 22 to 70 years (mean age 43.23 ± 1.23 yrs). People living in the northern regions were 55, in Central Yakutia: 68 living in urban area, in rural area - 27. Criteria of exclusion were: exacerbation of chronic diseases, the presence of cancer, infections and viral diseases. In addition, people with coronary artery disease who underwent heart attack and stroke were excluded.

To assess the objective state during survey questionnaire was conducted, developed in FBGNU "Yakult Science Center of complex medical problems"; we obtained informed consent of respondents to be studied, blood test. Blood for biochemical studies was taken from the cubital vein on an empty stomach in the morning, 12 hours after a meal.

Determination of biochemical parameters was carried out by enzymatic method on an automatic biochemical analyzer «Cobas Mira Plus» company «La Roche» (Switzerland) using reagents "Biocon" (Germany). Calculation of LDL cholesterol (low density lipoprotein) and LDL (cholesterol VLDL) was performed according to the formula Friedewald et al. (1972). Atherogenic coefficient was calculated according to the formula proposed by A.N. Klimov (1977): Ca = (cholesterol - HDL cholesterol) / HDL-C.

The study was approved by the decision of the local Ethics Committee of the Yakult Science Center of complex medical problems.

RESULTS AND DISCUSSION

Blood biochemical parameters in men living in rural areas in the north of Yakutia were varied in the range of normal values (Table). The relatively high level of albumin in this group compared with the Central Yakutia residents can be attributed to the increased energy metabolism, as one of the important functions of albumin is him participation in the transport of fatty acids. In addition, albumin is the low molecular anti-

oxidant. In rural men of Central Yakutia above normal values were gamma-GT and alkaline phosphatase. In this group, compared to the northern rural men activity of alkaline phosphatase was significantly higher, creatine kinase, ALT (alanine aminotransferase), AST (aspartate aminotransferase), and creatinine were significantly associated with a lower level of glucose. The high activity of these enzymes may be related to the maintenance and restoration of the total protein level through on the glucose-alanine shunt: the combustion of substrates with the participation of AST, maintaining glucose levels with the participation of ALT and increasing transport of amino acids with the participation of gamma-GT. The increase of alkaline phosphatase in the blood, not only provides the dephosphorylation and glucose output from the cell, but also forms a large amount of inorganic phosphate affecting bioenergy in the cell and the organism as a whole. Significant increase in serum creatinine and creatine kinase, which is part of the CK-system is probably related to a component of ATP and increased the body's need for energy substrates.

The men living in urban areas in Central Yakutia demonstrated high activity of creatine kinase, and a high level of creatinine may be associated with the adaptation of indigenous people to urban conditions, depending on the CPC-system (including creatine, phosphocreatine, creatinine) is the transfer of phosphate energy of mitochondrial ATP in the cell base. Roslyj I.M. et al. consider creatine kinase (CK) completely stress-dependent enzyme, which is a measure of the implemented energy potential of the organism. At rest, creatine kinase can be determined (zero activity), but when any stress, creatine kinase activity is increased to virtually unlimited values [12]. On maladaptive changes in blood biochemical parameters among urban males also indicate that exceed activity ALT and glucoses level.

At high latitudes, energy metabolism switches from carbohydrate to lipid type, i.e., the carbohydrate contribution to the energy exchange is lower a the fat and higher. This is a typical manifestation of adaptive changes in the body, aimed at recycling more energy-intensive materials. Indigenous adapted to climate-geographical high latitudes, increase blood levels of the atherogenic fractions of cholesterol (LDL and VLDL) does not lead to the development of atherosclerotic vascular changes due to the high activity of lipoprotein lipase and hepatic triglyceride lipase, and the balance of atherogenic and antiatherogenic cholesterol fractions (HDL) is preserved[10].

In our study, shift of lipid metabolism in the direction of dyslipidemia was observed in men in Central Yakutia, while in the urban dwellers disadaptative signs were distinct. Men living in the north of Yakutia had no abnormality. Dyslipidemia in men in Central Yakutia indicate failure due to genofenotypically mechanisms of adaptation to extreme environmental factors. Factors of depletion of functional reserves of the body are not only a departure from the traditional way of life and diet, but also social and economic reforms carried out in recent decades. Conducted in Yakutia medical and social research has shown that high levels of trait anxiety among rural residents, primarily was associated with low quality of life [11]. A prolonged state of emotional stress is one of the causes of failure of adaptive reactions of the organism [3, 9].

These significant differences in the activity of enzymes show different intensities of adaptive metabolic processes, depending on the place of residence. One of the indicators of metabolic balance is a de Rytis factor, since the activity of AST and ALT are a simplified common metabolic marker: ALT - the level of anabolism, AST - a level of catabolism [12].

Metabolic balance is achieved within 1.3-1.5. In study conducted by us assigned genetic resistance to the extreme conditions of the North is kept in the northern men. In Central Yakutia low levels of factor de Rytis combined with high atherogenic indicate a depletion of functional reserves of the body and is a sign of disadaptation.

Such biochemical parameters of blood as cholesterol, glucose and total protein are an absolute constant. The sum of two summands - cholesterol and glucose - rigid biological constant and in healthy people it is equal to 10.0 mmol / l. At an energy deficit it is caused reciprocity of these two terms: lowering glucose level leads to higher blood cholesterol level, or vice versa, but at the adaptive condition of the body there is a constant dozen [13].

Just on the north of Yakutia in men the intensity of energy metabolism meets the needs of all functional systems at the moment in these conditions, which is confirmed by biochemical blood parameters: the sum of cholesterol and glucose (10.08 mmol / L), coefficient de Rytis (1.50 ± 0 , 08) and the atherogenic ratio below 3 (2.69 ± 0.18).

The carried out correlation analysis showed that atherogenic factor had a direct link with the place of residence ($r = 0.293$, $p = 0.000$). Direct conjugate relation with coefficient atherogenic had: γ-GT activity ($r = 0,357$, $p = 0.000$), serum uric acid (the low molecular weight antioxidant) ($r = 0,356$, $p = 0.000$) and serum creatinine ($r = 0,228$, $p = 0.016$). Besides atherogenic factor had direct communication with ALT levels ($r = 0.385$, $p = 0.000$) and AST ($r = 0.224$, $p = 0.007$), indirect communication with the coefficient de Rytis ($r = - 0.247$, $p = 0.003$).

CONCLUSION

1. The most pronounced disadaptation changes of blood biochemical parameters were found in urban men who had departed from the traditional way of life and, perhaps, the traditional food.

2. Identified correlation indicator of lipid metabolism disorder (atherogenic index) with an indicator of metabolic equilibrium (coefficient de Rytis) can be recommended to use a coefficient de Rytis to form groups at risk of cardiovascular disease and timely preventive measures.

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Table 1

Biochemical parameters of blood in men, depending on the place of residence

Biochemical parameters	The inhabitants of the northern regions (n=55)	Villagers Central Yakutia (n=68)	Urban residents of Central Yakutia (n=27)
Lactate dehydrogenase, U / L	389,12±18,62	379,12±8,39	419,09±22,12
Gamma-GT, U / L	40,58±3,73	56,57±5,92	44,46±9,42
Alkaline phosphatase, U / L	214,47±11,60	270,40±8,53 *p=0,000	228,78±17,71
Creatine kinase, U/l	109,83±9,56	130,63±9,69 *p=0,015	284,45±52,98 *p=0,000 **p=0,005
ALT, U / L	18,33±1,37	28,45±2,17 *p=0,000	34,63±4,07 *p=0,000
AST, U / L	24,11±1,18	33,91±3,22 *p=0,007	32,30±1,96 *p=0,000
Coefficient de Rytis	1,50±0,08	1,28±0,06 *p=0,032	1,21±0,15 *p=0,015
Triglycerides, mmol / l	0,86±0,06	1,04±0,07 *p=0,038	1,08±0,12
Cholesterol, mmol / l	5,30±0,14	5,79±0,15	6,0±0,25 *p=0,016
HDL-C, mmol / l	1,58±0,07	1,49±0,05	1,48±0,12
LDL-C, mmol / l	3,32±0,12	3,80±0,15 *p=0,044	3,94±0,31
VLDL-C, mmol / l	0,39±0,03	0,48±0,03 *p=0,026	0,68±0,11 *p=0,001 **p=0,024
Coeff. atherogenicity	2,69±0,18	3,17±0,19	3,44±0,32 *p=0,035
Glucose, mmol / l	4,78±0,08	4,24±0,06 *p=0,000	5,65±0,21 *p=0,000 **p=0,000
Creatinine, mmol / l	74,09±2,33	82,04±1,21 *0,001	93,67±3,19 *p=0,000 **p=0,003
Urea, mmol / l	4,88±0,25	5,31±0,14	5,15±0,83
Uric acid, μmol / l	280,23±9,96	309,45±11,51	309,22±22,08
Total protein, g / l	78,29±0,67	78,71±0,47	77,54±1,09
Albumin, g / l	49,66±0,67	48,85±0,49	47,62±0,83

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THE FREQUENCY OF DYSLIPIDEMIA AMONG THE ARCTIC REGION POPULATION OF YAKUTIA

ABSTRACT

Biomedical research of the indigenous Arctic population of the Republic Sakha (Yakutia) for 1994 and 2013 showed reduction in the proportion of people with normal cholesterol level and increase of proportion of the individuals with borderline high and high cholesterol. There has been growth of triglyceride level as well. High cholesterol is not always accompanied by a shift towards the atherogenic changes, in 75% of men and 76% of women increased cholesterol level can be considered as a consequence of the process of adaptation to changing conditions of life. The imbalance in lipid profile was identified also in people with normal cholesterol level, which is indicating the need for a mandatory determination of lipid fractions, regardless of its level. The tension of regulatory mechanisms of metabolism of proteins and carbohydrates, associated with atherogenic changes in lipid profile requires assessment of all risk factors and mandatory correction of the diet.

Keywords: adaptation, indigenous people, lipid metabolism, atherogenic changes.

Violation of adaptation of the indigenous inhabitants of the Arctic observed in recent decades is confirmed by the demographics. The average duration of life of northerners of Russia decreased by 11 to 14 years, mortality has increased in 1.4 times in comparison with industrialized northern countries [20]. In the Republic Sakha (Yakutia) in the Arctic group of regions the coefficient of total mortality of the working-age population by 2012 against 1990 increased in 2.5 times, and it is significantly higher than average republican index. The process of depopulation is associated primarily with high mortality from diseases of the circulatory system (345.7 per 100.000) [8], although until recently the incidence of hypertensive heart disease, coronary disease and obesity among the small peoples of the Russian North has been at a rather low level [2, 13, 21]. The deterioration of population health in the Arctic is associated with the deterioration of the quality of life, when to the natural risk factors, were added difficult socio-economic, health infrastructure and anthropogenic factors [11, 16, 19, 24]. Stress factors, the gradual departure from the traditional lifestyle and change of diet, increased in recent years, could not fail to affect homeostatic body systems, in particular on the regulation of lipid metabolism. The imbalance in lipid profile towards atherogenic is regarded as one of the major risk factors of cardiovascular diseases.

Therefore, the evaluation of lipid metabolism of the indigenous population of the Arctic region in dynamics is relevant in the justification of increasing the efficiency of preventive measures for preservation and strengthening of health, improvement of quality of life of indigenous peoples of the North.

The purpose of the study was to assess the frequency of the atherogenic lipid profile of the indigenous population of Saskylah Anabar district Sakha Republic (Yakutia).

MATERIAL AND METHODS

In the spring season of 1994 in a cross-sectional epidemiological study we examined a random sample of the indigenous population of Saskylah Anabar district Sakha Republic (Yakutia). We surveyed 134 indigenous people (22 men and 109 women). The average age was 38.8±1.19. In April 2013 in the village we surveyed 170 people aged 18 to 75 years (107 women and 63 men). The average age of patients was 46.6±0.77 years (men were at the age 46.3±1.53; women - 46.8 ± 0.90). To identify changes in the level of cholesterol and triglycerides of them we selected a group of 139 individuals in the appropriate age-sex structure as the sampling of 1994 (29 males, 110 females, average age of them 38.8±1.19). All study participants were representatives of indigenous populations: Yakuts, Evens and Evenks.