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THE INFORMATIVENESS ACTIVITY OF TRANSAMINASES IN DETECTING SIGNS DISTURBANCES OF LIPID METABOLISM

ABSTRACT

The authors report their study on estimation of informativeness of biochemical tests in men living at high latitudes, for revealing signs of disorders of lipid metabolism. We examined the indigenous and non-indigenous residents of Yakutia in age from 22 to 67 years. It was revealed that significant differences of enzyme activity depended on the degree of adaptation to the conditions of high latitudes. Signs of lipid metabolism have been linked to an indicator of the metabolic state of the body (coefficient de Rytis). Thus, it was found that the ratio of activity of transaminases (coefficient de Rytis) can be used for the formation of a group of persons with signs of lipid exchange and timely preventive measures.

Keywords: enzyme activity, coefficient de Rytis, lipid profile, adaptation, high latitudes.

INTRODUCTION

The main reason for the development of various pathologies is the failure of the adaptive mechanisms under organism of inhabitant of Yakutia both in alien and indigenous [9]. Despite the fact that at the indigenous people of Yakutia in the process of centuries of selection has formed a particular, optimal for the harsh conditions of the far North, the genotype of the circulatory system, not predisposing to the development of atherosclerosis and its associated diseases [2,3,8] currently, the pathology of the cardiovascular system occupies one of leading places in structure of mortality of the working age population as among the newcomers and the indigenous people of Yakutia [1,4,5,6,].

One of the most important tasks of clinical and biochemical research is to identify the most informative tests in various pathologies, but, unfortunately, there are currently no organ-specific markers, as the biochemical spectrum of blood serum reflects not only pathological processes, but in General metabolic processes in the body.

On this basis, to assess the functional state of the organism and for the formation of groups of risk associated with the development of cardiovascular pathology among population of Yakutia it is necessary to identify the most informative changes in the spectrum of biochemical parameters of blood serum.

The purpose of the study. Assess the informative value of biochemical tests at men living at high latitudes, for identify signs of disorders of lipid metabolism.

MATERIAL AND METHODS

The sample of 300 inhabitants of Yakutia aged 22 to 67 years (average age was 45,13±0,58). The number of indigenous men, adapted to the conditions of the North, was 126 people, newcomers men, unadapted to the conditions of the North, – 174. Exclusion criteria from the study was exacerbation of chronic diseases, the presence of cancer, infectious and viral diseases, persons with coronary artery disease, heart attack and stroke in anamnesis.

To assess the objective status a survey was conducted on the questionnaire developed in FBGO “Yakut scientific center of complex medical problems”; obtained the informed consent of the respondents to research, at surrender blood. Blood for biochemical studies was taken from the cubital vein in the morning on an empty stomach, 12 hours later after a meal.

The determination of the enzymes activity, total cholesterol (TC), HDL cholesterol (cholesterol high density lipoproteins), triglycerides (TG) was performed by enzymatic method on the automatic biochemical analyzer “Labio” using reagents “Analyticon” (Germany). LDL cholesterol and VLDL cholesterol was calculated by the formula of Friedewald et al. [13].

Statistical data processing was performed using the package of applied statistical programs SPSS Statistics 17.0. Applied standard methods of variation statistics: calculate averages, standard errors, 95% confidence interval. Data in tables are presented as M±m, where M – average, m – error of the average. The significance of differences between means was assessed using the student’s t test and Kolmogorov-Smirnov. The probability of a justice of the null hypothesis was accepted at $p<0.05$. Correlation analysis was performed according to the method of Pearson and Spearman.

THE RESULTS AND DISCUSSION

Adaptation to extreme conditions of high latitudes is associated with stress and complex restructuring of the homeostatic systems of the organism [10,11] and causes structural damage and functional disorders associated with the development of chronic diseases [7]. In men blood biochemical parameters did not differ from normal values, but includes to statistically significant of differences among ethnic groups have (table. 1).

In men, the activity of enzymes involved in oxidative phosphorylation, had a dependence on the degree of adaptation to high latitudes conditions and point to different energy requirements for the adequate functioning of the organism (table.1). So in alien inhabitants of Yakutia in comparison with the natives were statistically significantly high activity of creatine kinase, coupled with the relatively high activity of AST, indicates more intensive receipt of metabolites in the tricarboxylic acid cycle (TCA) and on the functioning of the malate-aspartate mechanism.

Among newcomers men than indigenous significantly higher levels

of creatinine (100,14±79,32 1.48±1,18 mmol/l, respectively, p=0.000), combined with the activity of creatine kinase (CK), possibly associated with the adaptation of the organism to far North conditions (tab. 1). CK is stress dependent enzyme, that is an indicator of utilization of the energy potential of the and adaptability of the organism to new conditions [10].

In alien inhabitants significantly high levels of glucose associated with significantly high levels of triglycerides, total cholesterol, cholesterol of lipoproteins of low and very low densities indicates the activation of lipid metabolism while reducing use of carbohydrates, metabolic sources of energy (table. 1).

In for fittest the residents of Yakutia, a significantly high activity of gamma-glutamyl transferase (γ-GT), lactate dehydrogenase (LDH) and alkaline phosphatase (ALP) was associated with significantly low levels of glucose compared to non-adapted residents. So, γ-GT is involved in the transport of amino acids, and increased blood alkaline phosphatase, ensures not only the dephosphorylation and release of glucose from cells, but also produces considerable amounts of inorganic phosphate that affect bioenergetics in the cell and in the organism as a whole. High activity of LDH ensures an easier dissociation of oxygen and hemoglobin, leading to increased exchanges in all organs and systems. As a result of more rapid and intense the passage of the substrates of metabolic pathways is provided by the high activity of all enzymes. Significantly high activity of lactate dehydrogenase indigenous men compared to newcomers reflects not only the rate of anaerobic glycolysis, but also points to the adaptability of the organism to hypoxia of the indigenous population. The increase in activity of these enzymes in the indigenous population indicates a mobilize switching protein and carbohydrate metabolism.

Under extreme conditions of high latitudes quantitative and qualitative conversion of the enzyme systems due to the mobilization of energy resources and increased energy metabolism as a whole [12] and physiological (not pathological) condition is provided and maintained by many thousands of reactions occurring within cells and in the extracellular environment, i.e. in the metabolic equilibrium of the body.

Normal course of metabolic reactions at the molecular level due to harmonious combination of processes of catabolism and anabolism, and the activity is transaminases indicator of the metabolic is state of the organism is the. The ratio of AST and ALT (de Ritis coefficient) reflects not only the functional state of the liver or the heart, but also an figure of adaptive reactions of the organism [10]. Based on the fact that metabolic balance is achieved in the range of 1.3–1.5, we have formed 3 groups: the first group of de Ritis coefficient corresponded to the norm, in the second group exceeded the norm, and the third was below the norm (table. 2).

As can be seen from table 2 in the groups inhabitants of Yakutia of enzymes activity not had significant differences depending on the de Ritis coefficient. The enzyme activity had significant differences depending on ethnicity. In group with normal value of de Ritis coefficient the ethnic in group significantly differed in the activity of alkaline phosphatase , in the groups with high and low de Ritis coefficient important differences along with the activity alkaline phosphatase was high and LDH, γ-GT, KK, which indicates the intensity of energy metabolism. γ-GT is not only involved in the transport of amino acids, but also is an indicator of and a key enzyme of the antioxidant system – glutathione.

In the table 2 evidence shows that the coefficients atherogenic and de Ritis interrelated. The lower atherogenic coefficient was in group 2, where the de Ritis coefficient exceeded the normal value, and indicating to tension energy processes and the predominance of catabolic reactions in the body. Signs of disorders of lipid metabolism were observed in group 3, where the de Ritis coefficient was below normal values and testified about the depletion of the functional reserves of the organism.

As can be seen from table 2 in alien inhabitants of Yakutia in comparison with the indigenous people in all three groups, levels total cholesterol, triglycerides were high. Significantly high levels of triglycerides, cholesterol and LDL cholesterol in alien inhabitants of Yakutia in comparison with indigenous suggests they are in chronic stress and the body's energy needs are met by lipids.

The relatively low level of HDL cholesterol in the indigenous population than newcomers combined with significantly high levels of cholesterol in VLDL, possibly associated with changes in traditional diets and eating foods rich in carbohydrates.

The activity of enzymes that characterize the metabolic state of the organism, is correlated from atherogenic coefficient (table 3). In table 3, the statistically significant correlation of transaminases with atherogenic coefficient in men of Yakutia suggests that the values of these biochemical indices of the blood serum can reveal persons with signs of disorders of lipid metabolism. Preventive measures to restore metabolic balance is required among individuals with elevated energy costs, as long as «hard» adaptation to high latitudes conditions leads to exhaustion of the functional reserves of the organism, and any violation of

Table 1

Biochemical parameters of blood serum in men of Yakutia

Biochemical parameters	Indigenous (n=126)	Newcomer (n=174)	Reliability (p)
Lactate dehydrogenase, U / L	382, 37±8,38	352,03±5,87	0,000
Gamma-GT, U / L	48,71±3,67	39,30±3,42	0,001
Alkaline phosphatase, U / L	247,53±7,24	169,88±4,31	0,000
Creatine kinase, U/l	128,14±9,86	157,69±8,08	0,001
ALT, U / L	24,17±1,39	21,23±0,96	0,009
AST, U / L	30,12±1,85	31,26±1,29	-
Coefficient de Rytis	1,40±0,05	1,67±0,06	0,035
Triglycerides, mmol / l	0,94±0,04	1,12±0,03	0,000
Cholesterol, mmol / l	5,57±0,10	5,99±0,08	0,001
HDL-C, mmol / l	1,53±0,04	1,48±0,03	-
LDL-C, mmol / l	3,45±0,11	4,01±0,08	0,000
VLDL-C, mmol / l	0,57±0,07	0,51±0,01	0,000
Coeff. atherogenicity	2,96±0,13	3,29±0,09	0,004
Glucose, mmol / l	4,45±0,06	5,10±0,07	0,000

Table 2

Biochemical parameters of blood serum in men depending on the de Ritis coefficient

Biochemical parameters	I group		II group		III group	
	Indigenous (n=35)	Newcomer (n=42)	Indigenous (n=44)	Newcomer (n=76)	Indigenous (n=47)	Newcomer (n=64)
Lactate dehydrogenase, U / L	366,53±15,56	361,54±11,99	399,57±16,92	367,38±9,54*	379,92±11,28	348,76±9,11*
Gamma-GT, U / L	52,80±8,92	51,61±12,36	37,09±5,09	30,69±2,94	56,53±5,25	40,30±3,03*
Alkaline phosphatase, U / L	256,03±13,20	171,11±7,75*	225,88±12,86	188,37±7,43*	259,67±11,34	174,40±6,62*
Creatine kinase, U/l	136,86±22,34	156,34±13,16	137,69±22,37	167,67±16,26*	115,05±7,36	148,53±10,84*
ALT, U / L	24,86±2,88	20,36±1,39	16,23±1,97	14,97±1,02	31,08±1,96	29,03±1,96
AST, U / L	33,91±4,03	28,0±1,90	31,59±3,92	32,90±2,43	25,91±1,42	27,92±1,64
Coefficient de Rytis	1,37±0,01	1,38±0,01	2,0±0,06	2,26±0,07*	0,86±0,03	0,95±0,03*
Triglycerides, mmol / l	1,03±0,09	1,06±0,07	0,83±0,05	0,94±0,04*	0,99±0,07	1,20±0,06*
Cholesterol, mmol / l	5,38±0,21	5,81±0,18	5,52±0,16	5,78±0,12*	5,74±0,17	5,98±0,14
HDL-C, mmol / l	1,49±0,08	1,51±0,05	1,60±0,07	1,66±0,04	1,49±0,08	1,39±0,04
LDL-C, mmol / l	3,17±0,22	3,71±0,18	3,42±0,18	3,71±0,11*	3,68±0,18	3,96±0,14
VLDL-C, mmol / l	0,71±0,18	0,59±0,11*	0,49±0,08	0,42±0,02*	0,56±0,09	0,54±0,03*
Ka	2,93±0,28	2,96±0,13	2,67±0,17	2,61±0,09*	3,25±0,23	3,47±0,16

*- the reliability between indigenous and immigrant inhabitants.

metabolic balance are accompanied by the development of pathology.

CONCLUSION

1. The differences of biochemical parameters in blood serum at ethnic groups depended on the degree of adaptation to high latitudes conditions.

2. The transaminases ratio (de Ritis coefficient) can be used to assess the functional state of the organism and the formation of a group of persons with signs of disorders of lipid metabolism.

Table 3

Correlation between biochemical parameters and atherogenic coefficient

Biochemical parameters	Indigenous		Newcomer	
	Coeff. correlation (r)	Reliability	коэфф. корреляции (r)	достоверность (p)
(p)	Coeff. correlation (r)	Reliability (p)	0,255	0,001
ALT	0,358	0,000	0,255	0,001
AST	0,246	0,005	0,238	0,002

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FEATURES OF BIOPHYSICAL PROPERTIES AND COMPOSITION OF ORAL FLUID IN CHILDREN WITH CONNECTIVE TISSUE DYSPLASIA LIVING IN THE CONDITIONS OF HIGH LATITUDES

ABSTRACT

The complex clinical laboratory research of the children with connective tissue dysplasia (CTD) living in the North conditions has been done. The obtained data confirmed the existence of particular changes in structure and properties of oral fluid which promoted disturbance of structural homogeneity of solid tissues of teeth and decreased their caries resistance. The examined age groups of children showed biophysical properties of oral fluid characterized by the secretion rate reduction, the increase of saliva viscosity, the dominance of II and III types of microcrystallization, the decrease of remineralizing potential of oral fluid. The high-quality changes of common protein decrease concentration in children with a severe DCT form have been noted in children's saliva. Besides, the activity decrease of alkaline phosphatase irrespective of case severity has been revealed. The carried cationic and anionic spectral microanalysis of oral fluid has revealed the decrease in concentration of cations of magnesium and calcium which are important in teeth enamel saturation by mineral components of hydroxyapatite. Magnesium is a coenzyme of protein structures and generally concentrates in the bone tissue, dentine and enamel of teeth. Besides, it participates in formation of normal structure of connective tissue and its deficiency in prenatal development influences on the development of connective tissue dysplasia syndrome. The revealed features of structure and properties of oral fluid can be consider specific regional biological risk factors of the development of pathological processes of organs and tissues of oral cavity in children with DCT living in the North conditions that on the other hand has been confirmed by the obtained data of the high level of teeth caries in the examined age groups of school children and the high intensity level in key age group of 12-year-old children by WHO. In this regard, the complex treatment-and-prophylactic events and rehabilitation of children have to be organized taking into account the revealed biophysical features of properties and composition of oral fluid among school children with DCT living in the Republic of Sakha (Yakutia).

Keywords: dysplasia of connective tissue, organs and tissues of oral cavity, oral fluid, caries of teeth, prophylaxis of dental diseases.