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Levels of Low Molecular Antioxidants in the Indigenous and Non- Indigenous Population of Yakutia

Z.N.Krivoshapkina, G.E.Mironova, E.I.Semenova, L.D.Olesova, A.I.Jakovleva

ABSTRACT

Two groups of the population were under study: the first group included indigenous people, adapted to the high latitudes, the second – the non- indigenous, not adapted to local conditions. In the non- indigenous compared with the indigenous people low molecular antioxidant levels were significantly higher and combined with significantly high levels of lipid metabolism. About strengthening the energy metabolism in the Yakutia non- indigenous population, related to adaptation to northern conditions, significantly high levels of glucose, creatinine, and high creatine kinase compared with the indigenous people, showed. Correlation analysis revealed a statistically significant direct relationship between levels of uric acid and the northern experience in the non- indigenous people.

Keywords: albumin, urea, uric acid, lipids, adaptation, North.

INTRODUCTION

Accommodation in high latitudes associated with higher energy costs is associated with adaptation, in which inevitably the intensity of cellular respiration, enzyme activity and the quantity of reactive oxygen species - initiators and followers of lipid peroxidation chains increase. The normal concentration of active oxygen species and lipid peroxidation products are small, as their excess inactivated AO system. With high speed and course of active oxygen species amplification of lipid peroxidation accumulate toxic substances that do not have time to be inactivated by the AO system, which leads to cell death or dysfunction of the development and pathological conditions.

Antioxidant system of the organism is represented as well as macromolecular antioxidants and antioxidants (superoxide dismutase, glutathione peroxidase, glutathione reductase, catalase) as the low molecular weight antioxidants.

The aim of our research was to study levels of low molecular weight antioxidants in the serum of indigenous and non-indigenous inhabitants of Yakutia.

MATERIAL AND METHODS

1262 residents of Yakutia in age from 18 to 72 years were surveyed. Indigenous people of Yakutia was 631 people (mean age 45,02 ± 3,54 years), the alien population - 631 (mean age 43,67 ± 2,61 years). Women was 778, men - 484. Yakutia Residents were divided into two groups: the first group included persons adapted to the North, to which the attributed indigenous people - Yakuts, Evens, Evenki, the second - person unadapted to northern conditions, newly arrived residents (Russian). The studies were conducted in the winter. Biochemical studies were conducted on automatic biochemical analyzer «Cobas Mira Plus» utilizing commercial reagents «Biocon» (Germany).

Statistical processing of data was performed using statistical software application package SPSS for Windows 17.0. Standard methods of variation statistics calculation of mean values, standard errors , 95% confidence interval. Data in tables are presented as M ± m, where M - average , m - error of the mean. The significance of differences between mean values was assessed using Student's t test and Kolmogorov-Smirnov. Probability of the null hypothesis accepted at $p < 0,05$. Correlation analysis was performed by the method of Pearson and Spearman.

Results and discussions. Comparative analysis in serum of blood concentrations low-molecular antioxidants of Yakutia residents showed their dependence of ethnicity. As seen from Table 1, the levels low molecular weight antioxidants,which include albumin, urea, uric acid, varying in within normal values were higher in statistically significantly alien inhabitants.

Albumin, the major protein of blood is one of the endogenous antioxidants. Antiradical and antiperoxidant properties are due albumin the presence of thiol groups which represent important

the extracellular antioxidants.

Antioxidant effect of urea associated with the stabilization of of membranes and modification of enzymes, thereby reducing the number of iron centers of lipid peroxidation.

Uric acid is able to inhibit the O_{2}-, OH-radicals, $ONOO^{-}$, heme oxidants and amino groups at the expense of bind metal ions of variable valence, forming stable complexes. Due to the high content of uric acid in blood serum it accounts for from 35 to 65% protection against oxidation of lipoproteins, 10 - 15% the inhibition hydroxyl radical and singlet-oxygen.

A statistically significant increase in serum low-molecular antioxidants in alien inhabitants of Yakutia was beset with a significantly higher total cholesterol, atherogenic cholesterol fractions and A statistically significant increase in serum low-molecular antioxidants

in alien inhabitants of Yakutia was beset with a significantly higher total cholesterol, atherogenic cholesterol fractions and low value antiatherogenic cholesterol fractions than with indigenous peoples (Table 2).Exceeding the normal factor values atherogenicity alien inhabitants indicates an increase in circulation the modified LDL which exposed peroxidation of lipids.

To strengthen energy metabolism alien inhabitants related with adaptation to northern conditions indicate statistically significant high activity of creatine kinase (115,04 ± 3,09 U / L) compared with the indigenous people (103,46 ± 4,59, p = 0.001) . In addition, the alien population of Yakutia than with indigenous peoples was high serum creatinine (90,99 ± 0,98 mmol / l) compared with indigenous peoples (74,47 ± 1,26 mmol/l, p = 0.000).

With the intensification energy metabolism could explain the increased levels of albumin in alien inhabitants, as one of the important functions of albumin is its part in the transport of fatty acids. Follows also be noted that glucose levels in serum alien inhabitants have been significantly higher (4,96 ± 0,04 mmol/l, p = 0.000) compared to natives (4,62 ± 0,04 mmol/l).

Increase in blood low molecular weight antioxidants is an indicator of suppression antioxidants of enzymatic unit the radical protection of cells, as under conditions of oxidative stress defense enzyme has a less effective action compared to protective effect low molecular weight antioxidants.

However, the excessive education free radical oxidation may be depleted a pool of and nonenzymatic antioxidants, which, acting as free radical scavenger, are transformed into inactive dimer and other forms. In Yakutia, observed that decrease of low molecular weight antioxidants is due to exogenous substances - vitamins with antioxidant activity - ascorbic acid, vitamin E and A, that is most noticeable among the rural population.

Described in Tables 3 are statistically significant correlations with the levels of low molecular weight antioxidants lipid metabolism in non-adapted inhabitants of Yakutia, and detected a statistically significant direct relationship between levels of uric acid in the northern experience indicates that the biochemical parameters of blood serum reflect the adaptive metabolic processes.

The conclusion. Statistically significant high levels of low molecular weight antioxidants increase of atherogenic cholesterol fractions and reduced antiatherogenic cholesterol fractions, and also the activity creatine kinase, adjoint with increase in blood creatinine and glucose in Yakutia alien inhabitants as compared with indigenous peoples indicate that they had showing signs depletion of the reserve capacity of the organism.

Since in the northern conditions endogenous antioxidants can not cope with the increasing concentrations of lipid peroxidation products, it is necessary to ensure the delivery of antioxidant vitamins from outside.

Table 1

The levels low molecular weight of antioxidants, depending on ethnicity

Biochemical parameters	Native population (n=631)	Non-native population (n=631)	Veracity (p)
Albumin, g / l	47,44±0,22	50,26±0,17	0,000
Urea, mmol / l	4,76±0,07	5,21±0,07	0,000
Uric acid, μmol / l	281,84±3,93	319,09±4,23	0,000

Table 2

Serum lipid profiledepending on the ethnicity

Biochemical parameters	Native population (n=631)	Non-native population (n=631)	Veracity (p)
Cholesterol, mmol / l	5,54±0,04	6,19±0,05	0,000
Triglycerides, mmol / l	1,07±0,02	1,27±0,04	0,000
HDL-C, mmol / l	1,59±0,02	1,48±0,02	0,009
LDL-C, mmol / l	3,46±0,04	4,08±0,05	0,009
VLDL-C, mmol / l	0,49±0,01	0,56±0,01	0,009
Coeff. atherogenicity	2,81±0,05	3,48±0,07	0,009

Table 3

Correlations between biochemical parameters and the low molecular weight with antioxidants in alien inhabitants

Biochemical parameters	Albumin		Uric acid		Urea	
	Coeff. correlation (r)	Veracity (p)	Coeff. correlation (r)	Veracity (p)	Coeff. correlation (r)	Veracity (p)
Northern length of service	-	-	0,208	0,001	-	-
Triglycerides, mmol / l	-	-	0,392	0,000	0,171	0,000
Cholesterol, mmol / l	-	-	-	-	0,270	0,000
HDL-C, mmol / l	0,091	0,05	-0,254	0,000	-	-
LDL-C, mmol / l	-	-	-	-	-0,137	0,001
VLDL-C, mmol / l	-	-	0,362	0,000	-	-
Coeff. atherogenicity	-	-	0,329	0,000	-	-
Creatine kinase, U/l	0,147	0,002	-	-	-	-

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Autors:

Krivoshapkina Zoja Nikolaevna – candidate of biological sciences, the senior researcher of biochemical mechanisms of adaptation FSBI «Yakut Scientific Center complex medical problems» of SB RAMS; 677019, g. Jakutsk, Sergeljahskoe shosse, 4; zoyakriv@mail.ru.

Mironova Galina Egorovna – doctor of biological science, professor, Head of laboratory of FSBI «Yakut Scientific Center complex medical problems» of SB RAMS, professor of the Department of Natural Sciences Institute FSAEI HVE «North-Eastern Federal University» named after M.K.Ammosov; mirogalin@mail.ru.

Semjonova Evgenija Ivanovna – candidate of biological sciences, the junior researcher; kunsuntar@mail.ru.

Olesova Ljubov' Dygynovna – candidate of biological sciences, the senior researcher; oles59@mail.ru.

Jakovleva Aleksandra Ivanovna – the junior researcher.