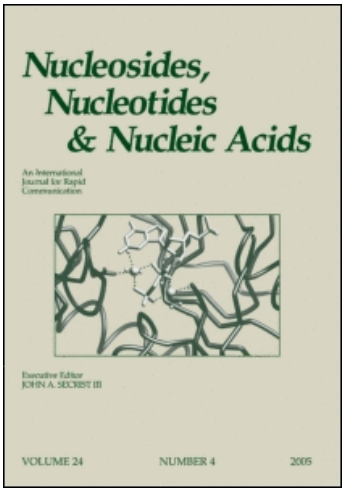

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Strong Changes in Lipoproteins and Autoantibodies of Blood Serum of the Tundra Nency Population as a Result of Environmental Radiation on the Territory they Inhabit

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ABSTRACT

As a result of large-scale nuclear tests on the Novaya Zemlya test site (1955–62) the Tundra Nentsy population of Yamal-Nentsy autonomous region (YNAR) fell under the constant influence of incorporated radioactive isotopes (^{137}Cs and ^{90}Sr). Therefore, it is very important to analyze a possible spectrum of diseases of Tundra Nentsy population.

Key Words: Lipoproteins; Hyperlipidemia; Hypolipidemia; Radioactive isotopes; Serum blood; Atherosclerosis; Autoimmune diseases.

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Table 1. Concentrations of cholesterol, triglycerides and all lipid components (triglycerides, cholesterol ester, free cholesterol, phospholipids and apolipoproteins) in different fractions of LPs for healthy donors (control) and for patients with CA, MS and SLE.

			Coronary athero-sclerosis (n = 63)		Multiple sclerosis (n = 102)		Systemic lupus erythematosus (n = 23)	
No.	LP fractions	Control (n = 120) av. value mg/dl	Av. value mg/dl	Diff. of the values, %	Av. value mg/dl	Diff. of the values, %	Av. value mg/dl	Diff. of the values, %
Cholesterol								
1	HDL_3	19,6 ± 3,0	8,3 ± 2,0	**− 57,6**	11,7 ± 2,1	**− 40,4**	8,8 ± 3,9	**− 55,1**
2	HDL_2	46,7 ± 3,7	23,8 ± 5,9	**− 49**	34,1 ± 4,1	**− 26,9**	25,8 ± 7,1	**− 44,8**
3	HDL	66,2 ± 4,1	32,1 ± 3,7	**− 51,5**	45,8 ± 4,7	**− 30,8**	34,6 ± 7,8	**− 47,2**
4	LDL_{1-3}	68,1 ± 5,0	122,2 ± 10,3	**79,4**	96,0 ± 5,7	**41**	101,8 ± 13,4	**49,5**
5	IDL	23,3 ± 3,3	38,4 ± 5,3	**64,8**	17,2 ± 3,1	− 26,1	21,0 ± 7,7	− 9,9
6	LDL	91,5 ± 5,1	160,6 ± 10,6	**75,5**	113,2 ± 6,9	23,7	122,8 ± 13,9	**34,2**
7	$VLDL_{3-5}$	12,8 ± 1,6	27,8 ± 6,8	**117,2**	11,5 ± 2,7	− 10,2	8,9 ± 3,2	− 30,5
8	$VLDL_{1-2}$	1,2 ± 0,1	2,6 ± 0,6	**116,6**	1,1 ± 0,2	− 8,3	1,2 ± 0,4	0
9	VLDL	14,0 ± 1,6	30,3 ± 7,2	**116,4**	12,6 ± 2,8	− 10,4	10,1 ± 3,4	− 27,9
10	All LPs	171,7 ± 6,8	223,1 ± 9,6	**30**	171,6 ± 10,9	− 0,1	167,5 ± 17,6	− 2,4
Triglycerides								
11	HDL_3	7,4 ± 1,2	3,1 ± 0,6	**− 58,1**	4,3 ± 0,8	**− 41,4**	3,3 ± 1,5	**− 55,4**
12	HDL_2	17,8 ± 1,5	8,9 ± 1,3	**− 50**	12,8 ± 1,6	**− 28,1**	9,6 ± 2,7	**− 46,1**

13	HDL	25,2 ± 1,6	12,0 ± 1,4	**– 52**	17,2 ± 1,6	**– 31,3**	12,9 ± 3,0	**– 48,8**
14	LDL_{1-3}	30,9 ± 2,4	57,8 ± 5,7	**87**	43,9 ± 3,2	**42,1**	54,1 ± 10,2	**75,1**
15	IDL	31,1 ± 4,5	51,2 ± 7,0	**64,4**	22,9 ± 4,2	**– 26,3**	27,9 ± 10,2	– 10,3
16	LDL	62,0 ± 3,9	109,0 ± 7,6	**75,8**	66,8 ± 4,9	7,8	82,0 ± 13,1	**32,3**
17	$VLDL_{3-5}$	33,5 ± 3,7	71,7 ± 16,4	**114**	30,3 ± 6,5	– 9	24,5 ± 7,9	– 26,9
18	$VLDL_{1-2}$	11,2 ± 1,1	23,6 ± 4,3	**110,7**	10,2 ± 1,7	– 9,3	11,3 ± 3,3	0,9
19	VLDL	44,6 ± 4,4	95,3 ± 19,3	**113,7**	40,5 ± 7,8	– 9,2	35,8 ± 10,1	– 19,7
20	All LPs	131,9 ± 6,9	216,3 ± 19,4	**64**	124,5 ± 11,0	– 5,6	130,7 ± 20,5	– 0,9
The sum of all lipid components of LPs								
21	HDL_3	208,0 ± 29,5	88,6 ± 15,0	**– 57,4**	127,8 ± 22,4	**– 38,6**	95,0 ± 40,2	**– 54,3**
22	HDL_2	327,6 ± 29,1	154,9 ± 23,6	**– 52,7**	225,0 ± 29,7	**– 33,1**	166,4 ± 47,9	**– 49,2**
23	HDL	536,4 ± 36,6	243,5 ± 25,9	**– 54,6**	352,7 ± 37,3	**– 34,2**	261,4 ± 56,9	**– 51,3**
24	LDL_{1-3}	227,1 ± 15,9	406,6 ± 34,8	**79**	320,0 ± 18,7	**40,9**	354,5 ± 46,8	**56,1**
25	IDL	100,8 ± 14,4	165,9 ± 22,8	**64,6**	74,3 ± 13,5	– 26,3	90,5 ± 33,1	– 10,2
26	LDL	327,8 ± 17,7	572,5 ± 37,9	**74,6**	394,3 ± 24,3	**20,3**	445,0 ± 51,3	**35,8**
27	$VLDL_{3-5}$	74,4 ± 8,6	160,3 ± 37,8	**115,4**	67,2 ± 15,0	– 8,9	53,2 ± 18,1	– 28,5
28	$VLDL_{1-2}$	15,5 ± 1,5	33,1 ± 5,9	**113,5**	14,1 ± 2,3	– 9,1	15,7 ± 4,7	1,3
29	VLDL	89,9 ± 9,5	193,4 ± 42,1	**115,1**	81,2 ± 16,7	– 9,9	68,9 ± 21,0	– 23,4
30	All LPs	954,2 ± 43,1	1009,3 ± 48	5,8	828,2 ± 60,3	**– 13,2**	775,3 ± 88,1	**– 18,7**

Notes: LP—lipoprotein, HDL—high density LPs, LDL—low density LPs, IDL—intermediate density LPs, VLDL—very low density LPs. Bold type—differ from healthy donors (control) with statistical confidence (interval of confidence $P > 0.95$).

INTRODUCTION

As a result of multiple nuclear explosions on the Novaya Zemlya test ground in 1955–62, the Tundra Nentsy population of YNAR fell under constant the influence of radioactive isotopes (^{137}Cs and ^{90}Sr) incorporated in the body. The partially reduced species that are produced as intermediates through exposure to ionizing radiation, including $O_2^{\cdot -}$, H_2O_2, and $OH^{\cdot}$, are potent oxidants attacking different cellular components. Cytogenetic analysis of the Tundra Nentsy population reveals the elevated overall percentage of chromosomal aberrations in the population, and ring and dicentric chromosomes as markers of radiation-induced damage.[1] We have analyzed health in the YNAR aboriginal population using new approaches for analysis of LPs in human blood plasma or sera and auto-antibodies.

MATERIALS AND METHODS

Concentrations of all main fractions and subfractions of lipoproteins (LP, 30 parameters) in human were measured using small-angle X-ray scattering and a general mathematical model to describe LP composition in human blood.[2] Levels of antibodies to DNA and kardiolipin were measured by kits for immune-fermentative analysis (Sigma). Estimation of autoimmune complexes spectrum was made by precipitation in 7% polyethylene glycol, coloration by sudan black and electrophoresis in 0,8% agarous gel.

RESULTS AND DISCUSSION

First we have compared 30 LP parameters in the plasma of healthy donors and patients with coronary atherosclerosis (CA), multiple sclerosis (MS), and systemic lupus erythematosus (SLE), respectively (Table 1). Patients with disorders leading to CA are characterized by increased concentrations of different LP fractions and subfractions (hyperlipidemia) and the observed difference of 29 of 30 parameters was found to be statistically significant as compared with healthy donors (Table 1). In contrast to CA patients, both SLE and MS patients were characterized by decreased concentration most of LPs fractions. The difference 16 of 30 analyzed parameters was found to be statistically significant (Table 1). Interestingly, 9 from 30 parameters (number 1–3, 11–13, 21–23) were decreased as for CA patients, so as for patients

Table 2. Percent of donors, falling into different categories, according statistical analysis of LP parameters.

According to	Percent of donors, falling into a category, according to LP parameters		
	Control	CA, MS, SLE	Undescribed pathologies
9 parameters	11,0 ± 1,5%	66,9 ± 10,3%	22,1 ± 9,3%
6 parameters	11,6 ± 0,6%	55,0 ± 7,2%	33,4 ± 7,5%

with SLE and MS, while 6 from 30 parameters (number 4, 6, 14, 16, 24, 26) were increased. All the data obtained showed that analysis of fine spectrum of human blood LPs permit to distinguish healthy donors and humans with different pathologies.

In order to estimate possible deviations from healthy donors of Tundra Nentsy population we have analyzed 30 parameters characterizing LPs of 374 YNAR natives. According to statistical analysis of 9 and 6 parameters occurring unilaterally for all diseases analyzed, 61,0% of donors of tundra aboriginal population demonstrate indexes, which characterized disorders leading to CA, MS, SLE and other related pathologies (Table 2). The trend of deviations in LP parameters for 27.8% of the natives is not seen in analyzed diseases, but is different as compared with norm (Table 2). Taken together, only ~10% of the donors are normal, while the indices for ~90% of the test subjects fall into the range of different pathologies (3–8% incidence in normal population, according to epidemiological studies).

Among the YNAR donors, ~37% contain anti-DNA Abs at increased concentrations as compared with the control group of healthy donors. Anti-DNA Abs concentration in ~6.4% of the donors is comparable with that for SLE patients during exacerbation of disease. In addition, ≈30% of donors are characterized by abnormally high concentration of Abs to lipids (typical phospholipids syndrome). Moreover, abnormal autoimmune complexes are contained in blood of ~90% YNAR natives. Thus, as a result of chronic intrinsic exposure to low doses of radiation, health in the YNAR aboriginal population is far from the norm.

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REFERENCES

1. Osipova, P.L.; Posukh, O.L.; Ponamoreva, A.V.; Matveeva, V.G. The tundra Nentsy: health and environmental radiation on the territory they inhabit. In *Geochemistry of the Eath's Surface*; Armannson, Ed.; Balkema: Rotterdam, 1999; 215–218.
2. Tuzikov, F.V.; Tuzikova, N.A.; Galimov, R.V.; Panin, L.E.; Nevinsky, G.A. A general model to describe the structure and dynamic balance between different human serum lipoproteins and its practical application. Med. Sci. Monit. **2002**, *8*, MT79–MT88.

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