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THE INFLUENCE OF THE BIOLOGICALLY ACTIVE ADDITIVE (BAA) “THE REINDEER MOSS” UPON THE BIOCHEMICAL INDICES OF BLOOD

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Resume

We investigated the influence of the BAA “The Reindeer Moss” upon the biochemical indices of blood among the volunteers (n=28) of the indigenous nationality with the initially high level of glucose and cholesterol. It was established that after 3 weeks intake of the medicine among the volunteers the level of glucose, cholesterol and atherogenic coefficient ($K\alpha$) and aspartate aminotransferase (AsAT) significantly decreases, and the quantity of the correlative bonds increases.

Key words: Glucose, cholesterol, “the reindeer moss”, biochemical indices.

Climatic and geographic factors of the high latitudes stipulate the increased loads upon the human organism. The long historic inhabitation under the extreme climatic conditions of the Far North develops the “polar metabolic type” with the complex change of harmonic and metabolic profile of the organism [5,8]. Historically made up protein and lipid character of nutrition of the aboriginals of the North during the last decades switches to the so-called “European” carbohydrate type [9], that leads to the change of metabolism. The consequence of such processes is the increase of frequency of occurrence of dislipidemia among the indigenous people, acclimated to the severe climatic and geographic conditions of Yakutia [4,10]. The inclination from the traditional nutrition is one of the reasons of the growth of pathology, connected with the abnormalities of metabolism, including diabetes mellitus, atherosclerosis of vases among the indigenous population of Yakutia [1,6]. From the whole complex of interconnected pathological factors, which accelerate the development of the coronary heart disease (CHD), according to the data of the literature, one can distinguish compensatory hyperinsulinemia, insulin-resistance, atherogenic dislipidemia, abdominal type of obesity and others. People with the increased fasting glycemia and/or with the disorders of glucose tolerance have the highest risk of the development of not only diabetes mellitus, but also cardiovascular diseases [11].

The search and development of measures, aimed at the prevention of the advance of the metabolic disorders are one of the primary targets of medicine. It is well known, that the use of the preparations from the local raw materials increases the persistence and adaptive potential of an organism, due to the common character of the main physiological and biochemical mechanisms of the adaptation to the action of different stress factors. It was established that the northern biological raw materials differs by the increased content of biologically active substances, which have three-five times high activity in comparison with the analogous kinds from the middle zone of Russia. In literature there is an information that with the increase of the extremeness of the conditions of growing of plants, in the certain interval of intensity of the climatic stress factors the common content in their tissues increases 1,8-2,5 times as much, and above all, the structural diversity of the biologically active substances of the regulatory and protective effects increases more than 3 times as much.

In connection with this, the investigation of the influence of the local biological raw materials upon the biochemical indices of the inhabitants of Yakutia is urgent, as the results of the investigation could develop the measures aimed to prevent the advance of the disorders of carbohydrate and lipid metabolism at early stages already.

The aim of this investigation is the assessment of the influence of the BAA "The Reindeer Moss" upon the blood indices, which reflect the state of the protein, carbohydrate and lipid metabolism among the people of the indigenous nationality with the increased level of glucose and/or cholesterol.

Materials and methods.

The subject of our investigation became 28 volunteers of the indigenous nationality at the age of 31-60 years old, the middle age of whom was $50,2 \pm 2,03$). The main criterion of the inclusion into the examined group was the high level of glucose ($\geq 5,5$ mmole/l) and/or cholesterol ($\geq 6,5$ mmol/l) in serum and their written consent. From the examined group people with oncological diseases, verified diabetes mellitus, exacerbations of the chronic forms of diseases were excluded. In the process of the investigation undesirable phenomena and side effects were not noticed.

Volunteers took the BAA "The Reindeer Moss" by 20-25 drops before meals (in the morning and in the afternoon) every day during three weeks. Venous blood was sampled from the ulnar vein in the morning in the fasting condition before taking the BAA "Reindeer Moss" and on the 21st day of taking the BAA.

The BAA "Reindeer Moss", confirmed by Rospotrebnadzor (The Consumers' Inspectors of the RF) as a biologically active detoxicant, which was presented by the Institute of the Biological Problems of Cryolite-zone of the Siberian Division of the Russian Academy of Science, Yakutsk. (Patent of the RF №2006100978 dated 01.08.2007, priority dated 10.01.2006; Certificate of the State Registration by Rospotrebnadzor of the RF № 77.99.23.3. Y.3522.5.08 dated 04.05.2008; Sanitary-Epidemiological Conclusion № 77.99.03. 003.T.000928.05.08 dated 04.05.2008; TY 9219-002-36971185-08).

The laboratory investigations were carried out at the base of the laboratory of the biochemical mechanisms of adaptation of the Yakutsk Scientific Centre of the Complex Medical Problems of the SD of the RAMS. In the serum the following parameters were considered: AsAt (aspartate aminotransferase), AlAT (alanine aminotransferase), AP (alkaline phosphatase), γ -GT (gamma-glutamyl transferase), LDH (lactate dehydrogenase), creatine kinase, glucose, whole protein, albumins, urea, uric acid, creatinine, whole cholesterol, triglycerides, high density lipoproteins. All biochemical indices were determined at the automatic biochemical analyzer "Cobas mira plus". Low density lipoproteins and middle density lipoproteins and atherogenic coefficient were determined by the common methods.

The statistic processing of the received results was carried out with the help of the programs SPSS 11,5 for Windows. In the tables the blood indices are given as a middle arithmetical value (M) and its mistakes (m). The assessment of the significance of the differences

between the compared groups was carried out by and parametric criterion of t Student. For the determination of the narrowness of the connection between the investigated qualitative signs the correlation analysis of the data was carried out together with computation of the coefficients and rank correlation of Spirman [3].

The results and the discussion.

According to the received data, among the 28 people, which were under our supervision, the middle values of 13 from 18 considered blood indices, reflecting the basal metabolism, were within the limits of the common norms (table 1). The analysis of the received data showed that 30,0% of the observed people had high activity of AlAT, 42,8% had high activity of glucose and 52,3% had high level of cholesterol.

The increase of the activity of AlAT, entailed with the increase of glucose level in blood, can be considered as a sign of dysadaptation. As far as the maintenance of the normal glucose level and whole protein under any critical situation is a sign of absolute adaptation of an organism to the changing external conditions. It is known that one of the functions of AlAt is transformation of proteins into carbohydrates through the glucose-alanin shunt. The normal level of glucose in blood is maintained by the balanced work of three important flows: combustion of substrates with the participation of AsAT, maintenance of the glucose level with the participation of AlAT and increase of transport of amino acids with the participation of γ -GT. It should be noticed that the activity of AsAT exceeded over the normal values among 18%, the activity of γ -GT among 28% of the observed people. De Ritis coefficient (correlation of AsAT/AlAT) of the observed people before taking the "The Reindeer Moss" didn't correspond to the normal values, that is also a sign of dysadaptation of an organism (Table).

The increased level of cholesterol (up to 7,8 mmol/l) in serum among 52,3% of volunteers, taking part in the investigation, stipulated the high middle value of this index and the high middle value of atherogenic coefficient.

Table

Middle values of the biochemical indices in serum of the indigenous inhabitants ($M \pm m$) before and after taking the BAA "The Reindeer Moss"

Biochemical indices	Referent values	Before taking	After taking	$p = \dots$
AlAT, un/l	Before 40	40,6 $\pm$ 8,0	25,5 $\pm$ 5,5	0,003 ^{1,2}
AsAT, un/l	Before 30	34,7 $\pm$ 6,3	33,6 $\pm$ 6,1	
De Ritis coefficient	1,3 -1,5	0,94 $\pm$ 0,08	1,42 $\pm$ 0,42	0,049 ^{1,2}
Gamma-GT, un/l	f. 7-32	39,05 $\pm$ 5,87	35,89 $\pm$ 5,42	
Alkaline phosphatase un/l	Before 258	252,2 $\pm$ 30,6	238,7 $\pm$ 29,5	
Lactate dehydrogenase, un/l	225-450	358,3 $\pm$ 14,1	381,6 $\pm$ 13,9	
Creatine kinase (whole), un/l	<190	156,4 $\pm$ 55,1	129,4 $\pm$ 12,0	
Glucose. Mmol/l	3,3-5,5	5,53 $\pm$	4,72 $\pm$	0,000 ^{1,2}

		0,07	0,10	
Whole protein, g/l	65-85	78,08 ± 0,62	74,69 ± 0,85	0,002 ^{1,2}
Albumin, g/l	34-48	46,5 ± 0,4	46,4 ± 0,76	
Urea, Mmol/l	1,7-8,3	4,61 ± 0,24	5,53 ± 0,35	0,036 ^{1,2}
Uric acid, Mmol/l	f.155- 357; m.268- 488	239,4 ± 18,6	249,4 ± 18,4	
Creatinine, Mmol/l	f.44-80; m.53-97	80,90 ± 2,62	80,2 ± 2,9	
Whole cholesterol, Mmol/l	3,6-6,5	6,62 ± 0,16	6,09 ± 0,19	0,04 ^{1,2}
Triglycerides, Mmol/l	0,5-1,7	1,24 ± 0,16	1,25 ± 0,12	
High density lipoproteins, Mmol/l	0,78-2,2	1,56 ± 0,09	1,71 ± 0,11	
Low density lipoproteins, Mmol/l	1,68-4,53	3,57 ± 0,41	3,73 ± 0,16	
Middle density lipoproteins, Mmol/l	0,8-1,5	0,56 ± 0,07	0,56 ± 0,06	
Atherogenic coefficient	<3	3,48 ± 0,25	2,7 ± 0,27	0,005 ^{1,2}

The relative increase of such indices, as the level of cholesterol and glucose in blood, is, probably, stipulated by the metabolic disorders, characteristic for the age of the observed people, the middle age was $50,2 \pm 9,6$ years old. The portion of people with the combinative rise of glucose and cholesterol made up 23,8%. And the portion of people with the increased atherogenic coefficient made up 61,9% ($K\alpha > 3$).

The correlative analysis of the indices revealed the presence of the large amount of connections between the qualitative signs, such as sex, age, weight, height, body build index, smoking and quantitative signs, such as systolic and diastolic blood pressure, pulse and biochemical blood indices. The content of the whole cholesterol had a direct connection with low density lipoproteins ($r=0,631$; $p=0,002$), high density lipoproteins ($r=0,044$; $p=0,044$) and alanine aminotransferase ($r=0,435$; $p=0,049$). $K\alpha$ (before taking) occurred to be higher among the smokers ($r=0,545$; $p=0,011$) and men ($r=0,518$; $p=0,016$) and people with high weight values ($r=0,53$; $p=0,013$) and high body build indices ($r=0,444$; $p=0,044$). Direct correlative bonds of $K\alpha$ were established with creatine kinase ($r=0,615$; $p=0,003$), triglycerides ($r=0,485$; $p=0,025$), middle density lipoproteins ($r=0,476$; $p=0,029$), uric acid, and the reverse bond with high density lipoproteins ($r=-0,93$; $p=0,000$). It should be noticed that the level of glucose is directly correlated with the body build index (BBI) ($r=0,453$; $p=0,039$).

The everyday intake of the BAA "The Reindeer Moss" during three weeks according to the instruction normalized the indices of the basal metabolism; one could notice the statistically significant decrease of the activity of AlAT ($p=0,003$), the level of glucose ($p=0,000$), whole

cholesterol ($p=0,04$), the value of deRitis coefficients increased up till the norm ($p=0,05$) and the value of $K\alpha$ decreased ($p=0,005$) (table). It should be emphasized, that due to taking the BAA the portion of people with hyperglycemia and hypercholesterolemia (in%) decreased. Thus, after taking "The Reindeer Moss" the portion of people with high content of glucose decreased 2,99 times as less (14,3%), cholesterol – 1,57 times as less (33,3%), $K\alpha$ – 2,6 times as less, and the combinative rise of glucose and cholesterol is 5,06 times rare in comparison with the analogous indices before taking the remedy (picture 1).

The received results (lowering of the level of glucose and cholesterol) are, perhaps, connected with the activity of AlAT, i.e. dysadaptative changes among the observed people were connected with the disorders of the carbohydrate metabolism.

The correlative analysis of the indices after taking "The Reindeer Moss" showed the increase of the amount of bonds between the considered indices. For example, before taking "The Reindeer Moss" the level of glucose was interconnected only with BBI, and after taking "The Reindeer Moss" there appeared the direct correlative bonds with triglycerides ($r=0,568$; $p=0,009$), middle density lipoproteins ($r=0,520$; $p=0,019$), $K\alpha$ ($r=0,540$; $p=0,014$), age ($r=0,452$; $p=0,039$), weight ($r=0,466$; $p=0,033$). It can be proposed that the increase of the amount of the correlative bonds is connected with the transition of metabolism among the observed people to the qualitatively different level, promoted by the chemical content of the BAA [2], its antioxidant and antibacterial action [7], as well as the detoxication of the inner media of an organism (blood, lymphs, intercellular structures).

The raw materials of the BAA "The Reindeer Moss" were the layers of the lichens of *Cladina* genus. The tincture is produced according to the technology of the extraction of carbon dioxide in overcritical condition ($t=32^{\circ}\text{C}$, pressure 75 atmospheres). By the detoxication effect the BAA "The Reindeer Moss" has no analogs due to the original technology of the manufacture. Detoxication effect of the biological additive is reached due to the content of amino- β -oligosaccharide complexions and the antioxidant substances and natural antibiotics. The action of the biological supplement is based on the ability of amino- β -oligosaccharides to firmly bind the cations of heavy metals, toxic aldehydes and ketons, carcinogens, inflammation factors, cinders, excesses of cholesterol, glucose and to exteriorize them from a human organism [2] (picture 2).

Picture 2. The scheme of the structure of the complexes of the lichen amino- β -oligosaccharides with the toxic carbonyl compounds (in the form of Schiff bases) and the cations of heavy metals bound by them.

Thanks to its small sizes and biofile structure, amino- β -oligosaccharides are well absorbed from the intestine into the blood, penetrate through the cellular membranes with the help of its amino-, hydroxyl and other functional groups and bind different endo- and exotoxic compounds. As far as the amino- β -oligosaccharides contain stable β -glycoside bonds, they don't decompose in an organism, and in the way of complexes with the bound toxicants are exteriorized from an organism: when binding the lipid toxicants – through the intestine; when binding water-dissolved toxicants – through kidneys with urine [2,7].

Thus, detoxication and antioxidant properties of the reindeer moss, stipulated by the presence of the biologically active substances, lead to the decrease of the level of glucose and atherogenic fractions of the lipid spectrum of blood. The results received by us testify the fact, that the three weeks intake of the BAA "The Reindeer Moss" promotes the normalization of metabolism: decreases the risen level of glucose, lowering the concentration of the whole protein and increasing the content of high density lipoproteins, normalizes the atherogenic coefficient $K\alpha$ among the investigated volunteers. The rise of de Ritis coefficient up to the norm testifies

about the fact, that the BAA “The Reindeer Moss” has adaptogenic properties. The carried out researches make it possible to make a conclusion that the BAA “The Reindeer Moss” can be recommended for the prophylaxis of the development of cardiovascular diseases and metabolic disorders, connected with hyperglycemia.

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Etiology of pus sepsis instigators of surgical infections

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