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## **OLIGOETHERS INFLUENCE ON WARM-BLOODED ANIMAL'S IONIC METABOLISM UNDER SUBACUTE EXPERIMENT CONDITIONS**

**Summary.** *It was investigated the subacute effect of the oligoethers L-501-2-100, L-1601-2-50»B» and L-1601-2-50»R» in 1/10 DL50 dose on the ionic metabolism (potassium, sodium, iron, copper, magnesium, zinc, calcium, manganese, phosphorus) in blood serum, liver, testes of the white rats by atomic-absorption method. It was determined increasing ionic contents of magnesium, zinc, copper, iron, phosphorus, manganese, potassium in blood serum and decreasing their levels in the internal organs that shows their withdrawal from organism. Such imbalance in ionic metabolism apparently is linked with structural-metabolic disorders, that are due to the development of the dystrophic and destructive processes. That is evidence of the adaptive mechanisms frustration of the organism homeostatic function provision in which the central nervous system and hypophysis-adrenal system are main.*

**Key words:** *xenobiotics (oligoethers), ionic metabolism, albino rats, toxicological experiment.*

### **1. Introduction**

According to many researchers, quite informative indices in estimate of processes changes occurring in animals and humans under the influence of alien chemicals are the micro- and macro- elements content [3, 6, 8]. Both deficit of metal ions and their surplus content in organism leads to metabolic disorders and may cause the development of pathological states. Their entry into basic biochemical metabolic systems (enzymes, hormones, vitamins, receptors, nucleic acids, ribosomes), determines

their crucial role in providing various physiological and biochemical processes – fertilization, mitotic, maturing, transition from proliferation to a state of rest, amino acid transport across the membrane, nerve impulse currying out, etc. [1,4,7]. In our work we studied the polysystemic characteristic of potential hazard of the new synthesized oligoethers on the basis of the pathophysiological mechanisms disclosure of the structural and metabolic disorders in the organism under subacute toxification. In this case the dynamics of ionic metabolism has a certain scientific and practical interest. Studied oligoethers are used for produce of plastics, foams, thermoplastics, epoxy resins, lacquers, enamels, brake, and hydraulic fluids, etc. [3].

Given the above, **the purpose of the work** was to study the oligoethers influence on the ionic metabolism in the animals organs and tissues in subacute experience.

## II. Problem statement

In the work we used oligoethers with regulated properties: L-501-2-100 (polyoxyethyleneglycol monomethyl ether acetals), L-1601-2-50 «B» (butylallilic ether of polyoxypropilenoxyethyleneglycol), and L-1601-2-50 «R» (polyoxypropilenoxyethylene monobutyl ether acetals). The research program included a subacute experiment on white rats and determination of the content in the organs and tissues of potassium, sodium, iron, copper, zinc, magnesium, calcium, manganese and phosphorus. In experiments there were adult male rats Wistar weighting 0.18-0.20 kg, which every day for 45 days were subjected to oral exposure dose oligoethers in 1/10 DL50, which amounted to 3.46, 3.85 and 5.17 g / kg of animal body weight, respectively, for L-501-2-100, L-1601-2-50 «B» and L-1601-2-50 «R». The substances in the form of aqueous solutions were introduced intragastrically using a metal probe daily in the morning on an empty stomach. The control group received the appropriate volume of drinking water. It was created by three experimental and one control group of 10 rats in each group. The animals were kept in stationary vivarium conditions at a constant temperature and natural lighting. Slaughtering rats was carried out the decapitation with a pre-anesthetic by the thiopental sodium. Performing procedures with experimental animals was carried out in accordance with the principles of bioethics and the «European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes» (Strasbourg, 1986). Ionic metabolism was studied by atomic absorption method [2]. For analysis the organs and tissues preliminary were limed and extracted by E.A. Лойко [5] and Г.О. Бабенко [2]. The resulting extract was applied to the device, and ion content was determined and the results compared with the reference samples.

## Statistical analysis

Analysis were performed using SPSS statistical software (SPSS for Windows Ver.11.5). Results of different groups were compared using descriptive statistics (mean±SD).  $P \leq 0.05$  was considered statistically significant.

### III. Results

In researches we revealed that oligoethers at a dose of 1/10 DL50 in **serum** lead to increased levels of potassium ions, calcium, magnesium, copper, zinc, iron, phosphorus, manganese and to decreased sodium concentration (Table 1).

**Table 1. Dynamics of metal ions content in rats blood serum under subacute oligoethers exposure dose in 1/10 DL50**

Indices	Monitoring Group, M±m			
	control	L – 501-2-100	L – 1601-2-50 «B»	L – 1601-2-50 «R»
Potassium (mmol / L)	3,53±0,42	6,24±0,57*	6,15±0,35*	6,43±0,53*
Sodium (mmol / L)	140,4±5,76	120,3±4,80*	115,6±5,10*	110,4±3,75*
Calcium (mmol / L)	2,43±0,17	3,46±0,28*	3,54±0,39*	3,70±0,48*
Magnesium (mmol / L)	1,10±0,16	2,27±0,19*	2,43±0,25*	2,56±0,33*
Copper (umol / L)	16,8±1,44	27,8±1,32*	26,5±1,47*	29,66±1,74*
Zinc (umol / L)	17,35±1,67	31,43±2,55*	33,18±1,76*	30,54±2,10*
Iron (umol / L)	18,44±1,52	42,56±3,17*	44,62±3,80*	39,74±2,75*
Phosphorus (mmol / L)	1,77±0,19	3,45±0,37*	3,62±0,29*	4,15±0,32*
Manganese (umol / L)	16,35±1,24	28,26±1,94*	31,58±2,63*	34,32±2,76*

Note: \* – reliable differences with control,  $p < 0.05$ .

Thus, the potassium level increased to – 76.77 %; 74.22 % and 82.16 %, calcium – 42.39 %; 45.68 % and 52.27 %, magnesium – 106.37 %; 120.91 % and 132.73 %, copper – 65.48 %; 57.74 % and 76.55 %, zinc – 81.16 %, 91.24 % and 76.03 %, iron – 130.81 %; 141.98 % and 115.51 %, phosphorus – 94.92 %; 104.52 % and 134.47 %, manganese – 72.85 %, 93.15 % and 109.91 %, against a background of the lowering sodium levels on 14.31 %; 17.66 % and 21.36 %, respectively, under L-501-2-100, L-1601-2-50 «B» and L-1601-2-50 «R» effects as compared with the control group.

Ionic metabolism in **liver** showed a reduction of potassium, sodium, magnesium, zinc, copper, iron, phosphorus, manganese levels and raising calcium concentration (Table 2).

**Table 2. Dynamics of metal ions content in the rats liver under subacute oligoethers exposure dose in 1/10 DL50**

Indices	Monitoring Group, M±m			
	Control	L – 501-2-100	L – 1601-2-50 «B»	L – 1601-2-50 «R»
Potassium (mg/100 g tissue)	8,45±0,32	5,13±0,36*	4,96±0,42*	5,28±0,47*
Sodium (mg/100 g tissue)	8,73±0,46	6,17±0,32*	6,54±0,53*	6,24±0,46*
Calcium (mg/100 g tissue)	3,26±0,25	5,82±0,49*	6,10±0,55*	6,63±0,57*

Magnesium (mg/100 g tissue)	6,70±0,38	4,16±0,35*	3,84±0,31*	4,05±0,24*
Copper (mg/100 g tissue)	9,84±0,57	7,15±0,63*	6,52±0,49*	6,22±0,38*
Zinc (mg/100 g tissue)	0,88±0,07	0,65±0,04*	0,60±0,05*	0,53±0,04*
Iron (mg/100 g tissue)	1,28±0,09	0,82±0,03*	0,74±0,05*	0,66±0,06*
Phosphorus (mg/100 g tissue)	4,15±0,24	2,63±0,18*	2,56±0,22*	2,17±0,17*
Manganese (mg/100 g tissue)	5,22±0,46	3,10±0,27*	2,84±0,33	2,56±0,22*

Note: \* – reliable differences with control,  $p < 0.05$ .

As compared to the control group the level of potassium in the liver decreased on 39.29 %; 41.30 % and 37.51 %, sodium – 29.32 %; 25.08% and 28.52 %, magnesium – 37.01 %; 42.68 % and 39.55 %, zinc – 27.33 %; 33.74 % and 36.78 %, copper – 26.13 %; 31.81 % and 39.77 %, iron – 35.93 %; 42.18 % and 48.43 %, phosphorus – 36.62 %; 38.71 % and 47.71 %, manganese – 40.61 %; 45.59 % and 50.95 %, calcium levels increased on 78.53 %; 87.12 % and 103.38 %, respectively, under the L-501-2-100, L-1601-2-50, «B» and L-1601-2-50 «R» influence compared with the data of the reference group.

Study of the ionic metabolism in the **testes** revealed a decrease in potassium content on 16.58 %; 19.51 % and 24.39 %, sodium – 23.97 %; 25.54 % and 33.65 %, magnesium – 17.95 %; 20.17 % and 22.36 %, zinc – 62 %; 60.34 % and 63.79 %, copper – 20.92 %; 21.79 % and 41.02 %, iron – 48.03 %; 43.30 % and 50 % phosphorus – 48.79 %; 52.78 % and 56.49 %, manganese – 27.35 %; 31.18 % and 16.23 % and increase in the calcium content on 38.26 %; 33.34 % and 40.09 %, respectively, under the influence of L-501-2-100, L- 1601-2-50 «B» and L-1601-2-50 «R» (see Table 3).

**Table 3. Dynamics of metal ions content in the testes of rats in subacute oligoethers exposure in dose 1/10 DL50**

Indices	Monitoring Group, M±m			
	Control	L – 501-2-100	L – 1601-2-50 «B»	L – 1601-2-50 «R»
Potassium (mg/100 g tissue)	4,10±0,23	3,42±0,18*	3,30±0,20*	3,10±0,26*
Sodium (mg/100 g tissue)	8,26±0,35	6,28±0,43*	6,15±0,34*	5,48±0,42*
Calcium (mg/100 g tissue)	1,83±0,12	2,53±0,16*	2,44±0,21*	2,58±0,27*
Magnesium (mg/100 g tissue)	6,35±0,38	5,21±0,26*	5,05±0,18*	4,93±0,36*
Copper (mg/100 g tissue)	5,80±0,27	2,16±0,18*	2,30±0,22 *	2,10±0,14*
Zinc (mg/100 g tissue)	0,88±0,06	0,57±0,04*	0,61±0,03*	0,46±0,04*
Iron (mg/100 g tissue)	2,54±0,26	1,32±0,14*	1,44±0,16*	1,27±0,13*
Phosphorus (mg/100 g tissue)	8,62±0,69	4,23±0,28*	4,07±0,32*	3,75±0,24*
Manganese (mg/100 g tissue)	5,74±0,46	4,17±0,23*	3,95±0,18*	3,66±0,22*

Note: \* – reliable differences with control,  $p < 0.05$ .

Studies show that oligoethers generally increase the content of metal ions in the blood serum, whereas in the viscera are in most cases much lower studied ions levels.

Summarizing the obtained results about ionic metabolism in organs and tissues of animals exposed subacute oligoethers effect at a dose of 1/10 DL50, it can be said that the potassium concentration in the serum was increased and decreased in the liver and testes. Decreased levels of sodium in the blood serum, liver, and testes give an idea about the development of the natriuresis. The calcium content was increased in the serum, liver and testes. The magnesium, zinc, copper, iron, phosphorus, manganese levels were increased in serum and decreased in liver, testes. Such dynamics of metal ions can indicate on their removal from the body [3,6].

It is known that the regulation of micro-and makroelementic metabolism in the body is carried out both the nervous system and the endocrine glands. The most authors consider that the main regulatory mechanism in ionic metabolism is the pituitary- gland- adrenal cortex system, its functional state its strongly connected with the central nervous system activity. Just these systems are the most susceptible to changes under conditions of the pathological states formation [6-8]. In this connection, we can assert that an imbalance of metal ions in different organs and tissues under oligoethers toxification is connected with disorder of the cooperative interaction of the CNS and the pituitary-adrenal system.

#### **IV. Conclusions**

Installed ionic metabolism in the experimental animals organism under subacute oligoethers exposure can be associated with structural and metabolic disorders caused by the development of dystrophic and destructive processes. The metal ions come out of the cells, intracellular structural and functional units and income into the extracellular space and the bloodstream. Under these conditions, we should expect violations of tissue respiration and oxidative phosphorylation, hypoxical processes development, as well as disorders of power and metabolic synthesis, indicating on the failure of the adaptable and protective mechanisms of the organism homeostatic function, in which the leading role belongs to the central nervous system and the pituitary-adrenal system.

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