

Carbohydrate Metabolism Changes in Experimental Rats Poisoned with 2,4-D and Polychlorinated Biphenyls

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Abstract. The correlation between carbohydrate metabolism, glucuronide conjugation reactions and glycosaminoglycuronans (GAGs) synthesis impairment was demonstrated in experimental white rats poisoned with 2,4-D and polychlorinated biphenyls (PCB).

Introduction. In conditions of constantly extending contacts of man with chemical substances the feasibility of development acute and chronic poisoning increases. The typical examples of such substances are pesticide 2,4-D and PCB widely used as dielectrics. Biochemical mechanisms of xenobiotics toxic action are investigated insufficiently, especially in the field of their influence on carbohydrate metabolism^{1,2,3,4}). Thus it is necessary to emphasize the connection of glucuronide detoxication reactions and connective tissue glycosaminoglycans synthesis with their general predecessor - UDP-glucuronic acid. The purpose of the present study was aimed at revealing the possible competitive prevalence of these processes with regard to poisoning.

Experimental Methods. The experiments were carried out on white rats of 180-220 g weight. 2,4-D was injected per os in a dose of 40 mg/kg daily during 30 days, which totally made 1200 mg/kg (LD₅₀). An industrial product "Sovtol-10" (mixture of PCB containing 26-31% of 3-chlorobenzol) was injected per os once in a dose of 1500 mg/kg (0.5LD₅₀). Blood glucose and insulin levels were determined; in erythrocytes and in liver the activity of hexokinase (G) and glucoso-6-phosphate dehydrogenase (G6P-DG), the content of ATP, GAGs and glucuronic acids (GA) was estimated.

Results and Discussion. Subchronic injection of 2,4-D decreased G activity in erythrocytes by 27.3%, G6P-DG by 35.1% (table 1) and ATP level - up to 61,8% (fig. 1). Thus glucose level in blood grew by 31.6% and insulin content was decreased by 39.6% (table 2). Similar changes were also noted during acute sovtol poisoning: G and G6P-DG activity in liver was 40.9% and 53.3% decreased correspondingly, and ATP level amounted to 42,5% of standard (fig. 1). In blood glucose concentration increased by 31.6% and insulin content decreased by 39,6% (table 2).

The received data testify marked impairment of energetic metabolism under the influence of toxicants mentioned which causes reduction of macroenergetic connections production.

Table 1.

Changes in Activity Gexokinase and G6P-DG in Rats' Erythrocytes in Subchronic Poisoning by 2,4-D and also in Liver in Acute Sovtol Poisoning

Variant of experiment	Gexokinase activity, nmol gl/h•mg protein	G6P-DG activity, nmol NADP-H / min•mg protein
Erythrocytes		
Control, n=12	20.10±0.49	11.75±1.08
2,4-D (on the 30 th day), n=8)	14.62±0.55*	7.63±1.01*
Sovtol (on the 5 th day), n=8)	7.28±1.22*	5.31±0.84*
Liver		
Control, n=12	259±44*	14.73±2.06*
2,4-D (on the 30 th day), n=8)	174±26*	9.54±1.12*
Sovtol (on the 5 th day), n=8)	153±27*	6.88±1.07*

Note: *- statistically authentic distinctions with regard to control (P<0.05).

Acute sovtol poisoning resulted in GAGs decreasing in organs and GA increase. Thus in brain, lung, liver kidney GAGs concentration diminished correspondingly by 2.3; 1.6; 3.2; 1.5 times comparing with the control. GA content increased accordingly by 1.4; 1.8; 1.5; 1.3 times with regard to control parametres.

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The results of this experiment testify the increased reactions of glucuronide conjugation volume under the influence of sovtol on the background of GAGs reduction in tissue.

Table 2.

Changes in Glucose and Insulin Contents in Rats' Blood in Subchronic 2,4-D and Acute Sovtol Poisoning

Variant of experiment	Glucose content in blood, mmol/l	Insulin content in blood, pmol/l
Control, n=12	5.41±0.45	72.09±7.13
2,4-D (on the 30 th day), n=8)	7.12±0.38*	43.57±5.62*
Sovtol (on the 5 th day), n=8)	7.28±1.22*	51.23±4.27*

Note: *- statistically authentic distinctions with regard to control (P<0.05).

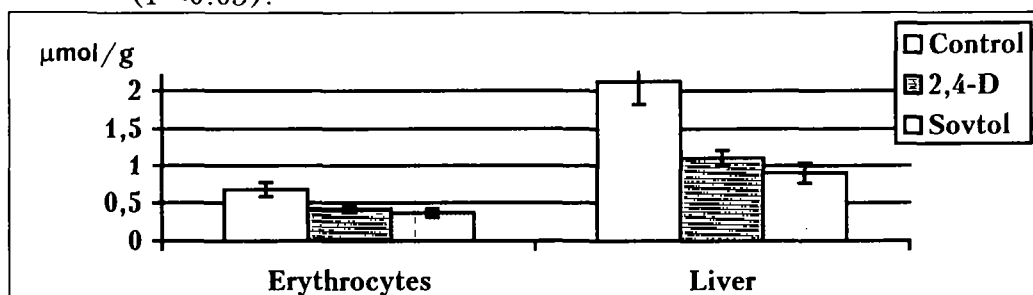


Fig. 1. ATP Concentration in 2,4-D and Sovtol Poisonig.

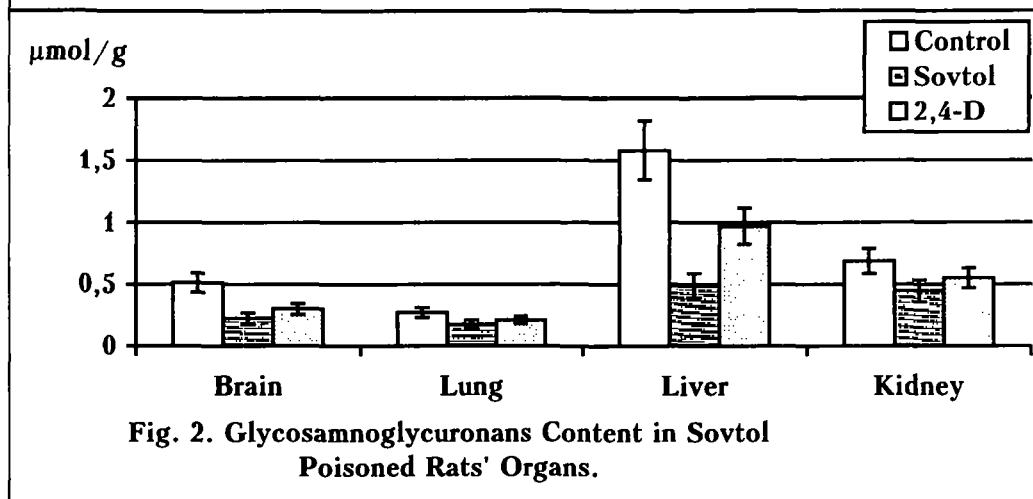
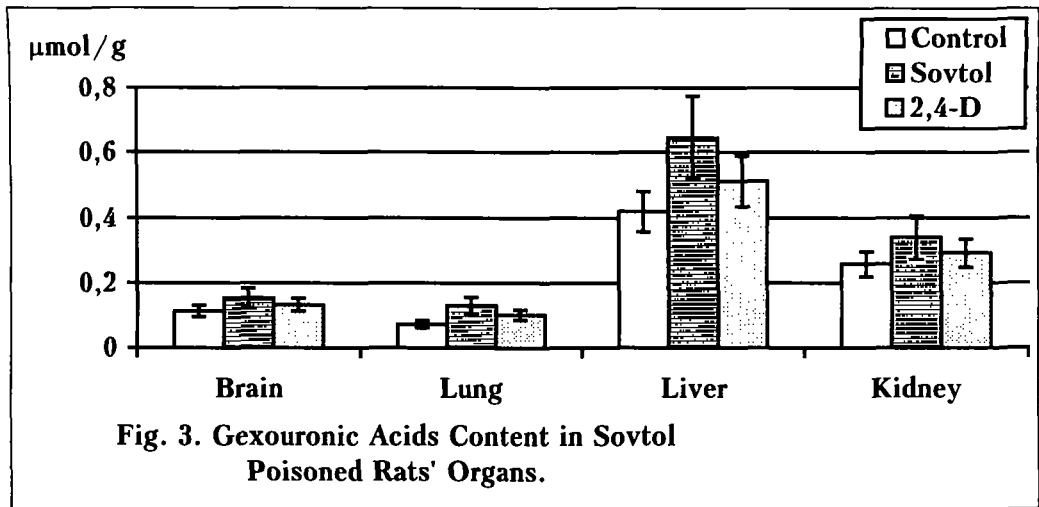


Fig. 2. Glycosamnoglycuronans Content in Sovtol Poisoned Rats' Organs.



Thus 2,4-D and soltol intoxication results in carbohydrate metabolic changes accompanied by infrin of cell energy sytem impairment. The example of acute soltol poisoning revealed glucuronide conjugation reaction volume increase with GAGs level decrease, which is certainly unfavourable for organism, demands futher study and appropriate pharmacological correction.

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