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Combined Effect of Soil Chemical Pollutants and Polyphenyls After Their Penetration with Drinking Water into Organism of Warm-Blooded Animals

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Abstract

The study is devoted to investigation of combined effect of soil chemical pollutants and polyphenyls for warm-blooded animals after their penetration into organism with drinking water (in natural correlation for soils being under investigation). Under experiments on rat males, it was concluded that availability of certain spectrum of xenobiotics penetrated from polluted soil with drinking water, causes general toxic effect on organism of warm-blooded animals. The greatest display of xenobiotic influence is gonadotoxic effect, which is characterized by a number of morphological and functional symptoms.

Introduction

The goal of given investigation was to study chronic toxicity of soil chemical pollutants and polyphenyls for warm-blooded animals after its penetration into organism with drinking water (in natural correlation for tested soils).

Generally, toxicity of polychlorinated biphenyls and their derivatives has been studied rather widely, some views of World Health Organization are devoted to this subject^{1,2)}. As a special question, it has been described the influence of these substances on reproductive function³⁻⁵⁾. However, experiments for study of reproductive toxicity describe mainly influence of xenobiotics on maternal organism and progeny, remaining out the study of their influence on male's gonads. That is why one of the purpose was the study of effect of polychlorinated biphenyls in combination with some other soil pollutants for male's sexual glands.

Experimental Methods

The object of the study was polluted soil from the site near "Condensator" plant (Serpukhov town, Moscow Region, Russia). To prepare water extract of the soil, it has

been taken from polluted site, cleared of roots, sifted through sieve with cells of 1 mm diameter and flooded with distilled water in proportion 1:1. After thorough mixing the soil suspension was settled for 20 hours at ordinary temperature and then filtered through paper filter. During two months the water extract of soil was given as for drinking to three groups of rat males, 6 rats in each group, in dilution 1:1, 1:5 and 1:25, the control group of animals has been given tap water.

After the experiment was completed the material from animals has been taken for laboratory examinations.

Peripheral blood for hematological analysis was taken out by cutting rat's tail tip. Blood for biochemical examinations was taken out from inguinal vein under ether anaesthesia. All values were determined with unificative methods accepted for clinical examinations.

For histological examination the specimens of heart, lungs, spleen, liver, kidneys, adrenal glands, small and large intestine and testes have been taken. The specimens of internal organs were placed into 10% solution of neutral formalin for fixation. Sections with thickness 4-5 μm were cut from paraffined specimens and stained with hematoxylin and eosin. Microscopy was performed under microscope "Opton".

Results and Discussion

Under results of chemical analysis the contents of soil extract was the following: TCB - 1 mg/l; cuprum (Cu) - 1,54 mg/l; zink (Zn) - 4,6 mg/l; lead (Pb) - 0,4 mg/l. It is of vital importance that contents of TCB was 10 times more than liminal concentration accepted under general sanitary standard of harmfulness, and the content of lead was four times more than MPC (maximum permissible concentration) for drinking water.

Maximum daily dose of TCB injected to rats was 19,6 μm , total during the experiment - about 1 mg per animal. It was not observed any symptoms of intoxication during the experiment.

After the experiment, under examination of peripheral blood, it has been revealed statistically reliable reduction of total leukocyte quantity (leukopenia) with simultaneous increasing a percentage of eosinophiles and relating to stab leukocytes at rats which were injected with soil extract in dilution 1:1 (Tabl.1). In this case leukopenia may be considered as a signal of lowering general resistance.

Table 1

Hematologic indices of rat blood under tentative investigation of general toxic effect of soil extract (s.e.)

Indices, in units	Control	Indices after administration of soil extract with dilutions:		
		1:1	1:5	1:25
Leukocytes, ths/mm ³	13,3±0,7	9,4±1,0*	13,3±0,4	14,2±1,3
Eosinophiles, %	3,0±0,9	5,83±0,5*	3,83±1,0	2,2±0,1
Relating to stab neutrophiles, %	0,67±0,4	2,83±0,4*	2,8±0,9	0,8±0,5

Note: * reliable difference from the control.

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It was noted statistically reliable increasing alanine aminotransferase activity for all experimental animals, and besides, increasing aspartate aminotransferase activity for rats which have been injected with soil extract in dilution 1:1 (Table 2), it testifies to toxic effect of xenobiotics, containing in soil extract, on hepatocytes.

Table 2

Biochemical indices of rat serum under tentative investigation of general toxic effect of soil extract (s.e.)

Indices, in units	Dilution of soil extract			
	Control	1:1	1:5	1:25
Alanine aminotransferase, U/l	5,8±0,7	15,3±2,3*	7,8±0,4*	8,6±1,1*
Aspartate aminotransferase, U/l	7,2±0,7	13,9±2,1*	7,8±1,4	7,5±0,9

Note: * reliable difference from the control

Under morphological examination, pathological changes have been revealed only in testes. These changes have shown clear dose relation. For males injected with soil extract in dilution 1:5 it was observed increasing lumen of spermatoc cords at the expense of destruction of a layer of spermatocyte of the second order as well as dystrophia of spermatocytes of the first order and spermatogones. For males injected with soil extract in dilution 1:1 only spermatogones were intacted partly. These symptoms are the result of atrophia process caused by xenobiotics being in the soil extract. In both cases the spermatogenesis was stopped. For males injected with soil extract in dilution 1:25 gonadotoxic effect was not discovered.

So, the availability of certain spectrum of xenobiotics, intaken through drinking water from polluted soil, leads to toxic effect to warm-blooded animals.

The most impressive manifestation of studied xenobiotics is gonadotoxic effect which is characterized with a number of morphological and functional symptoms.

Forming prospects of further investigations, it is planned to continue the study of gonadotoxic effect in order to estimate the consequences of xenobiotic intoxication for progeny in the first and following generations.

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