

# CONCENTRATION OF THIOCYANIDES AND AMMONIA IN THE BLOOD OF SOME LABORATORY ANIMALS

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Cyano-compounds are widely used in many branches of modern industry and agriculture. In recent years these substances have become particularly important in the manufacture of certain types of synthetic plastics, rubbers, and fibers. However, the large-scale introduction of these compounds into industry has been preceded by investigations of their toxicity and their conversions in the body, conducted on laboratory animals.

The complex biochemical conversions of certain cyano-compounds in the body can be reduced ultimately to the possible formation of cyanides (by the liberation of HCN in the body), of thiocyanides (by combination with sulfur), and of ammonia. The accumulation of these products in the body when animals are poisoned with cyano-compounds can be established if their concentration in the intact animals is known.

It is well known that no cyanides are present in normal human and animal blood, but thiocyanides and ammonia are present in various biological substrates of man and laboratory animals in normal conditions. However, there is no information in the literature regarding the normal concentration of thiocyanides and ammonia in the blood of laboratory animals such as mice and rats, so extensively used in research and on which most toxicologic tests are carried out.

The object of the present investigation was to determine the concentration of thiocyanides and ammonia in the blood of intact mice and rats.

## EXPERIMENTAL METHOD AND RESULTS

The serum thiocyanide concentration was determined by the method described by S. D. Balakhovskii and I. S. Balakhovskii [1]. This is a photocolorimetric method based on the development of a color reaction between iron nitrate and thiocyanides.

The investigation was conducted on adult albino rats and mice of both sexes. Blood was taken from the rats with a special glass capillary tube from the sinus of the eye and from the mice by decapitation. To obtain the 1 ml of serum required for the analysis, about 3 ml of blood was needed. This volume can be obtained from the sinus of the eye of 1 rat and by decapitation from 3 mice. Each series of experiments was conducted on 15 rats and 45 mice. The experimental results were compared by parametric statistical analysis. The following symbols were used:  $\bar{x}$ —arithmetical mean,  $S\bar{x}$ —standard error of the arithmetical mean,  $\bar{n}$ —number of experiments,  $P$ —significance of the difference between the mean values (probability of the opposite result). The results obtained are given in Table 1.

TABLE 1. Concentration of Thiocyanides in Blood Serum of Rats and Mice (in mg %)

Animals	Males			Females		
	$n$	$\bar{x}$	$S\bar{x}$	$n$	$\bar{x}$	$S\bar{x}$
Mice	15	2,53	0,067	15	2,62	0,100
Rats	15	2,84	0,075	15	2,52	0,067

TABLE 2. Concentration of Ammonia in the Blood of Rats and Mice (in mg %)

Animals	Males			Females		
	$n$	$\bar{x}$	$S\bar{x}$	$n$	$\bar{x}$	$S\bar{x}$
Mice	15	0,075	0,009	15	0,058	0,006
Rats	15	0,074	0,004	15	0,050	0,009

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It is clear from Table 1 that the content of thiocyanide was about equal in the blood serum of the mice and rats. The comparison showed that the blood of the male rats contained more thiocyanide than that of the females (difference statistically significant,  $0.01 > P > 0.002$ ).

Conway's method of determination of ammonia, a diffusion method based on the absorption of ammonia in special Conway dishes by acid and its estimation of acidometric titration, is very widely used for finding the ammonia concentration in the blood [3]. However, experiments undertaken by the authors have shown that Seligson's microdiffusion method of determination of ammonia in the blood is more sensitive and accurate. This method is based on the color reaction between ammonia and Nessler's reagent, and it is capable of detecting up to 98% of the ammonia contained in the blood [4, 5].

The investigation was carried out on albino rats and mice from which 1 ml of blood was taken for analysis (from the sinus of the eye in the case of the rats, and by decapitation of 1 animal in the case of the mice).

The results obtained with 30 rats and 30 mice are given in Table 2.

This table shows that the ammonia concentration in the blood of the mice and rats was approximately the same. The investigation also showed that more ammonia is present normally in the blood of male rats than of females (difference statistically significant,  $0.05 > P > 0.02$ ). The results obtained are close to the values for the normal ammonia concentration in the blood of other laboratory animals (0.035 mg% for rabbits, 0.07 mg% for dogs) [2].

The values for the concentrations of thiosulfides and ammonia in the blood of intact mice and rats can thus be used for experimental investigation of the toxicity and in vivo conversions of certain industrial poisons, and especially of compounds containing the CN group.

#### LITERATURE CITED

1. S. D. Balakhovskii and I. S. Balakhovskii, Methods of Chemical Analysis of the Blood [in Russian], Moscow (1953), p. 690.
2. N. N. Pushkina, Biochemical Methods of Investigation [in Russian], Moscow (1963), p. 343.
3. E. J. Conway, Biochem. J., 29 (1935), p. 2755.
4. D. Seligson and U. Seligson, J. Lab. clin. Med., 38 (1951), p. 324.
5. D. Seligson and K. Hirahara, J. Lab. clin. Med., 49 (1957), p. 962.