EFFECT OF SEVERITY OF THYROTOXICOSIS IN RABBITS ON CHANGES IN BLOOD PROTEIN FRACTIONS AND NITROGEN METABOLISM INDICES

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EXPERIMENTAL METHOD

Experimental thyrotoxicosis was induced in male rabbits weighing 2.5-3.5 kg by feeding them with thyroid tablets in an increasing dose (from 0.4 to 1.2 dry thyroid daily) in accordance with an assigned scheme.

The indices of nitrogen metabolism in the blood were determined before administration of thyroid to the rabbits, 14-15 days after administration of thyroid when the body weight of the experimental animals had fallen by 15-20% of its initial value (this state was conventionally regarded as one of moderately severe thyrotoxicosis), and 28-30 days after administration of thyroid, when the body weight of the experimental animals had fallen by 25-40%, corresponding to a severe form of thyrotoxicosis.

Blood was taken from the marginal vein of the ear of all the rabbits at these times for investigation of the following indices: serum protein fractions, protein and nonprotein nitrogen, urea nitrogen, and amino acid nitrogen. The protein and nonprotein nitrogen were determined by the classical Kjeldahl method, urea nitrogen by the authors' modification of Rashkovan's method [1], amino acid nitrogen by the method of Pope and Stivens [2], and the serum protein fractions by electrophoresis on paper. The numerical results were subjected to statistical analysis.

EXPERIMENTAL RESULTS

The results given in Table 1 show that during development of thyrotoxicosis essential changes took place in several indices of nitrogen metabolism in the rabbits. The total nitrogen of the blood changed only slightly during development of thyrotoxicosis, but important changes occurred in the serumprotein fractions, consisting of a decrease of the albumin and increase of the α_1-globulin fraction, and in the severe forms of thyrotoxicosis an increase in the α_2- and γ-globulin fractions.

As Table 2 shows, the nonprotein nitrogen concentration in the blood of the experimental animals rose gradually from 38.5 to 59 mg% on the 14th-15th day and to 61.1 mg% on the 28th-30th day of development of thyrotoxicosis. The increase in nonprotein nitrogen concentration was accompanied by an increase in the coefficient of proteolysis to nearly twice its initial level.

Experimental thyrotoxicosis thus stimulated catabolic processes in protein metabolism and caused disturbance of protein synthesis in the liver.

Changes in the urea nitrogen concentration in the blood showed a different relationship to the severity of thyrotoxicosis. On the 14th-15th day of development of thyrotoxicosis, for instance, the urea nitrogen concentration in the blood of the experimental animals rose from 10.1 to 20.1 mg%. On the 28th-30th day, i.e., when a severe form of thyrotoxicosis had developed, the urea nitrogen concentration in the blood of the experimental animals showed a smaller increase (to 17.1 mg%), although at this period of development of thyrotoxicosis the nonprotein nitrogen level had increased still further. This effect was evidently related to depression of the urea-forming function of the liver.

It may be concluded from these results that, despite the increase in blood urea in thyrotoxicosis, the process of urea formation in the liver may be disturbed. The experimental results described above indicate the occurrence of profound disturbances of nitrogen metabolism in hyperthyroidism.

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TABLE 1. Changes in Total Protein Content and Protein Fractions in Blood Serum of Rabbits with Thyrotoxicosis Due to Thyroid Administration (M ± m)

Experimental conditions	No. of rabbits	Total protein (in per cent)	Protein fractions (in percent)				
			albumin	globulin			
				α_1	α_2	β	γ
Control	30	6,74±0,17	56,35±0,78	6,84±0,43	7,57±0,41	10,57±0,9	18,62±1,2
Thyrotoxicosis (body weight reduced by 15-20%)	18	6,17±0,22 $P>0,05$	47,5±1,6 $P>0,001$	10,31±1,28 $P>0,02$	6,98±0,7 $P>0,5$	12,92±1,01 $P>0,1$	22,29±1,7 $P>0,2$
Thyrotoxicosis (body weight reduced by 25-40%)	20	6,34±0,2 $P>0,5$	46,6±1,7 $P>0,001$	9,08±1,04 $P>0,05$	9,84±0,8 $P>0,02$	11,49±0,9 $P>0,5$	22,99±1,3 $P>0,05$

TABLE 2. Changes in Blood Indices of Nitrogen Metabolism in Rabbits with Thyrotoxicosis Due to Thyroid Administration (M ± m)

Experimental conditions	No. of rabbits	Total nitrogen (in g%)	Principal comp. of nonprotein nitrogen (mg %)			Coefficient of proteolysis	Coefficient of urea formation (in percent)
			urea nitrogen	amino acid nitrogen	residual nitrogen		
Control	14	2,51±0,04	10,1±0,22	6,64±0,25	28,42±0,17	1,54±0,031	27,9±2,8
Thyrotoxicosis (body weight reduced by 15-20%)	14	2,59±0,09 $P>0,5$	20,1±1,4 $P>0,001$	7,2±0,9 $P>0,5$	38,9±2,5 $P>0,02$	2,3±0,12 $P>0,001$	34,1±2,6 $P>0,1$
Thyrotoxicosis (body weight reduced by 25-40%)	14	2,50±0,06 $P>0,5$	17,0±1 $P>0,001$	9,29±0,8 $P>0,01$	52,1±2,40 $P>0,001$	2,73±0,16 $P>0,001$	24,7±1,29 $P>0,5$

LITERATURE CITED

1. S. G. Gasanov, Lab. Delo, No. 12, 3 (1962).
2. C. L. Pope and M. F. Stivens, Biochem. J., 33, 1070 (1939).