

EFFECT OF ADMINISTRATION OF AN EXCESS  
OF THYROID TO THE MOTHER ON TISSUE  
TRANSAMINASE ACTIVITY IN NEWBORN PUPPIES

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Oral administration of thyroid to dogs in the first third of pregnancy led to reduced activity of aspartate and alanine aminotransferases in some tissues including the cerebral cortex in their newborn puppies.

Thyroid hormones, if present in excess in the mother during pregnancy, can give rise to irreversible metabolic disturbances in the fetus, frequently leading to its death [1-6]. Considerable attention has been paid to the study of relations between the thyroid hormones and enzyme systems.

The object of the present investigation was to determine the effect of an excess of thyroid hormones in the mother on transamination processes in the fetuses.

EXPERIMENTAL METHOD

Newborn puppies from dogs kept on an ordinary laboratory diet constituted the control group (15 animals), and puppies whose mothers received thyroid by mouth during the first third of pregnancy (1-1.5 g/kg body weight) constituted the experimental group (20 animals).

Activity of aspartate and alanine aminotransferases (AST and ALT), catalyzing transamination between ketoglutarate, aspartate, and alanine, was determined.

The activity of the enzymes was determined by the method of Reitman and Frankel in Veselovskaya and Starshov's modification [7].

The results of investigation of the activity of the enzymes AST and ALT were expressed in conventional units, each corresponding to 1 mg pyruvate formed during the period of incubation per gram of dry tissue or per 100 ml serum. The tissues taken for investigation were from various parts of the brain (cerebral cortex, head of the caudate nucleus, thalamus, hippocampus, hypothalamus) and also from the spinal cord, pituitary and thyroid glands, liver, and blood serum.

The state of thyroid function in the newborn puppies and their mothers was estimated from the concentrations of protein-bound (PBI) and butanol-extractable (BEI) iodine in the blood plasma. PBI was determined by Barker's method in Stepanov's modification [8], and BEI by the method of Kontaxis and Pickering [9].

EXPERIMENTAL RESULTS

Although the experimental newborn puppies differed only a little in weight from the controls, the weight of their thyroid glands were reduced by 1.3 times. The values of PBI and BEI for the blood plasma were slightly reduced, evidently because of the excess of thyroid hormones in the maternal blood stream.

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TABLE 1. Content of PBI and BEI (in  $\mu\text{g}\%$ ) in Blood Plasma of Mothers and Newborn Puppies

Test object	PBI		BEI	
	$M \pm m$	$P$	$M \pm m$	$P$
Mothers				
before administration of thyroid . .	$3,88 \pm 0,43$	—	$0,97 \pm 0,11$	—
20 days after administration . . . .	$29,0 \pm 8,7$	0,02	$11,3 \pm 2,5$	0,003
day after parturition . . . . .	$3,44 \pm 0,85$	0,9	$1,5 \pm 0$	0,84
Puppies				
control . . . . .	$2,37 \pm 0,47$	—	$1 \pm 0$	—
experimental . . . . .	$1,6 \pm 0,42$	0,26	$0,7 \pm 0,16$	0,5

TABLE 2. Transaminase Activity (in conventional units) of New-born Puppies ( $M \pm m$ )

Tissues studied	Experiment	Control	$P$	Experiment	Control	$P$
Cerebral cortex	$45,9 \pm 2,22$	$54,2 \pm 1,98$	-0,01	$1,8 \pm 0,54$	$5,4 \pm 0,39$	0,001
Head of caudate nucleus . . . . .	$51,5 \pm 2,66$	$54,0 \pm 1,7$	0,1	$1,5 \pm 0,48$	$5,4 \pm 0,32$	0,001
Thalamus . . . . .	$66,2 \pm 2,69$	$66,7 \pm 2,76$	0,1	$1,8 \pm 0,53$	$5,9 \pm 0,17$	0,001
Hippocampus . . . . .	$52,4 \pm 2,38$	$58,0 \pm 2,78$	0,05	$2,8 \pm 0,5$	$5,7 \pm 0,38$	0,001
Spinal cord . . . . .	$76,1 \pm 2,3$	$78,8 \pm 3,18$	0,1	$18,8 \pm 1,7$	$18,1 \pm 0,79$	0,1
Pituitary . . . . .	$34,7 \pm 2,5$	$37,7 \pm 2,3$	0,1	$0,7 \pm 0,1$	$2,1 \pm 0,18$	0,001
Hypothalamus . . . . .	$69,7 \pm 0,66$	$72,1 \pm 2,4$	0,1	$2,5 \pm 0,55$	$6,2 \pm 0,49$	0,001
Thyroid gland . . . . .	$41,1 \pm 1,86$	$48,6 \pm 3,26$	-0,05	$2,1 \pm 0,49$	$5,3 \pm 0,34$	0,001
Liver . . . . .	$27,7 \pm 1,51$	$55,5 \pm 2,5$	0,001	$43,8 \pm 1,86$	$75,3 \pm 3,3$	0,001
Blood serum . . . . .	$9,1 \pm 0,32$	$8,2 \pm 0,45$	-0,05	$3,4 \pm 0,32$	$4,0 \pm 0,32$	0,1

Atrophy of the thyroid glands in fetuses was observed by Lashene and Stalioraitite [10] after administration of thyroxine to guinea pigs during the last 30 days of pregnancy.

In the mothers receiving thyroid during the first third of pregnancy, by the end of administration of the preparation the PBI content was increased by 7.5 times, and the BEI content by 11.6 times compared with the control pregnant dogs (Table 1).

Determination of the same indices on the day after parturition showed that they were within normal limits (Table 1). Administration of thyroid to the mother during the first third of pregnancy led to a decrease in ALT activity in the newborn puppies in all tissues investigated except the spinal cord and blood serum. It should be noted that in some experiments to ALT activity whatever could be found. AST activity, on the other hand, was significantly reduced only in the cerebral cortex, liver, and thyroid gland, and in the other tissues there was only a tendency for it to decrease. The indices of AST activity in the blood serum were very slightly increased (Table 2).

The results showing a decrease in AST and, in particular, ALT activity are in agreement with those obtained by other workers who found that an excess of thyroid has an adverse effect on organ and tissue metabolism [11-15].

Despite the already low activity of transamination of amino acids in embryonic tissues [16, 17], under the influence of an excess of thyroid in the mother during pregnancy it was inhibited even more.

The differences between the activity of the two transaminases studied revealed by these experiments may be due to different factors. First, an excess of thyroid in the mother may inhibit the functional development of the fetal thyroid, leading to a disturbance of metabolism. Second, functional insufficiency of the neonatal thyroid is also associated with metabolic disturbances. In particular, the disturbances found can be assumed to be accompanied by an insufficiency of the coenzyme containing derivatives of vitamin B<sub>6</sub>, a component of the transaminases studied.

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