CORRELATION OF THE ACETYLCHOLINE – CHOLINESTERASE SYSTEM IN THE BLOOD AND SALIVA DURING EXPERIMENTAL HYPERTHYREOSIS

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In the determination of the functional state of the vegetative nervous system during hyperfunction of the thyroid gland [2,4,7,10,11,14], it is of interest to study the correlation in the acetylcholine–cholinesterase system. Various relationships may be established between acetylcholine and cholinesterase under pathological conditions of the activity of the nervous system [1], reflecting adaptation of the vegetative nervous system to the changed functional state of the organism.

On the basis of the prerequisites outlined, we undertook to study the state of the acetylcholine–cholinesterase system in the blood and saliva during experimental hyperthyreosis.

EXPERIMENTAL PROCEDURE

The investigation was conducted under conditions of a chronic experiment on seven dogs. To obtain saliva, the ducts of the parotid and mixed (submaxillary) salivary glands were taken out according to the Glinskii–Pavlov method. Saliva was obtained in response to the introduction of a standard amount of 0.2% hydrochloric acid solution into the mouth.

The cholinesterase activity was determined according to the method of T. V. Pravdich-Neminskaya [9], the acetylcholine concentration according to the method of M. Corsten [6] in the modification of Kh. S. Khamitov [12]. After a study of the control background, the cholinesterase activity and acetylcholine concentration in the blood and saliva of the dogs, hyperthyreosis was induced by administering thyroidin over a period of 50 days. The dose of thyroidin during the first five days was 0.1 g per kg of weight, and thereafter 0.2 g. After the loading of the animals with thyroidin was ceased, the investigations were continued for a month.

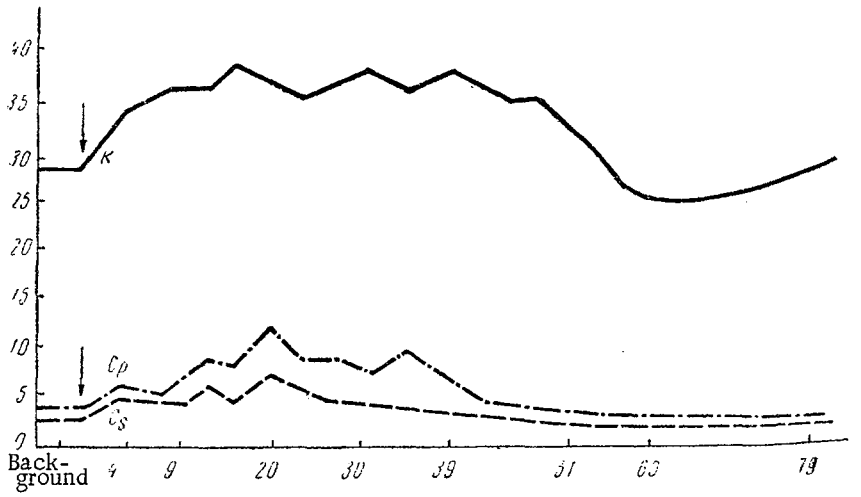
To judge the dynamics of the development of hyperthyreosis, we conducted systematic electrocardiographic investigations, thermometry, and weighing. The duration of the latent period of salivation, total duration of salivation, and gross amount of saliva were investigated.

EXPERIMENTAL RESULTS

The established concentration of acetylcholine in the blood and saliva (see table) corresponds to the data of [13], according to which the acetylcholine level in the blood of the dog is $2 \cdot 10^{-8}$, and in the saliva $1 \cdot 10^{-10}$.

As hyperthyreosis developed, the acetylcholine concentration in the blood of the dogs began to decrease from the 15th day on, and between the 16th and 40th days was $2 \cdot 10^{-10}$. After the administration of thyroidin was stopped, the acetylcholine content in the blood was rapidly normalized ($2 \cdot 10^{-8}$).

The acetylcholine concentration in the saliva of the parotid and submaxillary glands increased during the first days of administration of thyroidin to the animals. On the 20th day of thyroidin loading, it was equal to $2 \cdot 10^{-7}$. Then the acetylcholine content in the saliva of the two glands returned to the original value, in spite of the fact that the dogs continued to receive thyroidin. By the 50th day, the acetylcholine concentration in the saliva was equal to $2 \cdot 10^{-9}$. After the cessation of thyroidin loading, the acetylcholine content returned to the original value ($2 \cdot 10^{-11}$).



Dynamics of variation of the cholinesterase activity in the blood and saliva during hyperthyreosis. Cholinesterase activity: K) in the blood; C_p) in the saliva of the parotid gland; C_s) submaxillary gland. Along X axis, day of experiment; along Y axis, cholinesterase activity (in %).

Initial Acetylcholine and Cholinesterase Concentrations (in %) in Saliva and Blood

Substances studied	Blood	Saliva of parotid gland	Saliva of submaxillary gland
Acetylcholine	$2 \cdot 10^{-8}$	$2 \cdot 10^{-10}$	$2 \cdot 10^{-11}$
Cholinesterase	29,58±0,819	4,08 ± 0.169	3,42±0,141

The cholinesterase activity in the blood and saliva increased from the first days of hyperthyreosis (see figure); in the blood during the first 16 days it was 37.28 ± 1.524% ($P < 0.001$), and on subsequent days it remained at this level. The cholinesterase activity in the saliva of the parotid gland was 6.01 ± 0.344% during the first three days ($P < 0.001$), while in the saliva of the submaxillary gland it was 5.27 ± 0.509% ($P < 0.001$). From the 13th to 39th day of loading of the animals with thyroidin, the cholinesterase activity in the saliva of both glands was equal to 9.28 ± 0.508 and 5.13 ± 0.389%, respectively ($P < 0.001$).

Thyroidin loading led to a sharp increase in the excitability of the nerve centers; the dogs were restless. An intensification of the processes of excitation after the administration of small doses of thyroidin to animals has been demonstrated by a number of authors [1,6,8]. The latent period of salivation was accelerated; the gross amount of saliva per standard volume of hydrochloric acid was substantially increased.

Electrocardiographic investigations revealed the changes in the work of the heart characteristic of thyroidin hyperthyreosis [3]. The frequency of heart contractions reached 190-240 beats per minute; arrhythmia and extrasystole appeared. However, these changes began to be detected in the dogs considerably later (on the 25th to 28th day) than the changes in the acetylcholine-cholinesterase system.

The results obtained indicated that, under conditions of thyroidin loading, the acetylcholine concentration in the blood was lowered, while that in the saliva was increased. This is evidently due to the incorporation of some sort of compensatory mechanisms of a local character, guaranteeing a high acetylcholine level even under conditions of increased cholinesterase activity in the saliva. The latter may be important in increasing its gross amount. The decrease in the acetylcholine level in the blood is probably explained by an increase in the cholinesterase activity, which is confirmed by the suppression of the latter by eserinization [5].

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.
