MECHANISM OF DISTURBANCES OF CATECHOLAMINE EXCRETION WITH SALIVA IN RATS WITH ACUTE STARVATION

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Reduced excretion of catecholamines (CA) with the saliva in man is associated with the development of extensive caries and disturbance of adaptation of salivation in individuals wearing artificial dentures [3, 5]. In acute and, in particular, chronic starvation, characterized by a marked decrease in activity of the sympathoadrenal system, degenerative changes in the gastrointestinal tract and organs of the mouth are frequent events [7, 9, 10]. However, it is not yet clear to what extent the excretion of CA with the saliva is modified in starvation, and at what stage this change takes place.

The aim of the present investigation was to study changes in CA excretion with the saliva at different stages of acute starvation, and also to determine to what extent the changes correlate with the CA concentration in salivary gland tissues.

EXPERIMENTAL METHOD

Experiments were carried out on noninbred albino rats weighing 180 ± 5 g. The animals were divided into three groups: satiated (receiving the standard animal house diet), and acutely starved for 24 and 48 h. The investigation was conducted on each group during basal secretion of saliva and secretion induced by pilocarpine (1 mg/kg). Saliva was collected, and the submandibular salivary gland removed for investigation of the CA content under general anesthesia (pentobarbital 40 mg/kg). The CA concentration in the saliva and tissue of the submandibular salivary gland was determined by the standard HPLC method [4] on a "Millichrome" chromatograph, with electrochemical detector. The results were subjected to statistical analysis by Student's t-test.

EXPERIMENTAL RESULTS

As a first step the concentration and excretion of CA with the saliva were determined in satiated and starving rats. It will be clear from Table 1 that after 24 h of acute starvation the concentration and excretion of noradrenalin (NA) and adrenalin in the saliva were significantly reduced. After 48 h, only the reduction of the adrenalin concentration progressed, whereas the concentration and excretion of NA remained virtually unchanged. These results are evidence that activation of secretory activity of the salivary glands in starving animals leads to a selective salivary deficiency mainly of adrenalin — a biogenic amine synthesized in the body predominantly in the chromaffin cells of the adrenals [1, 2].

The next step was to determine changes in the CA concentration in the gland tissue under analogous conditions but during activation of the secretory cycle. Table 2 shows that the submandibular glands of satiated animals have considerable reserves of adrenalin and NA, which undergo substantial mobilization during activation of the secretory activity of the salivary glands. In starving animals, a time-dependent decrease was observed in the content mainly of NA, whereas the adrenalin concentration decreased by a lesser degree, and in the unstimulated salivary gland it remained at about the same level for 1-2 days of acute starvation. Meanwhile, during induced activity of the salivary glands a significant deficit of the concentration of both monoamines could be observed in the gland tissue, the effect being greatest after 48 h of starvation. These data indicate

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TABLE 1. Concentration and Excretion of Catecholamines with Saliva of Rats during Stimulation of Salivation by Pilocarpine (M ± m)

Experimental conditions	Concentration, ng/ml		Excretion, μg/40 min	
	NA	adrenalin	NA	adrenalin
Satiated rats (n = 9)	5,19±0,67	1,44±0,19	1,70±0,26	0,56±0,11
Starvation for 24 h (n = 13)	0,96±0,17*	0,49±0,12*	0,43±0,10*	0,20±0,05*
Starvation for 48 h (n = 7)	0,95±0,20*	0,29±0,06*	0,41±0,07*	0,11±0,01*

Legend. Here and in Table 2: n) number of animals. *$p < 0.05$ compared with satiated animals.

TABLE 2. Concentration of Catecholamines (in ng/g tissue) in Tissue of Rat Submandibular Salivary Gland (M ± m)

Experimental conditions	Without stimulation		Stimulation of salivation by pilocarpine, 40 min	
	NA	adrenalin	NA	adrenalin
Satiated rats	2472,0±238,4 (n=7)	135,4±16,9 (n=7)	2808,2±437,5 (n=12)	118,0±22,7 (n=12)
Starvation for 24 h	2523,9±197,2 (n=17)	99,5±9,6 (n=17)	1800,0±213,7* (n=14)	84,3±8,7 (n=14)
Starvation for 48 h	1901,0±138,0* (n=7)	105,0±6,4 (n=7)	1172,8±69,1* (n=7)	63,2±4,5* (n=7)

that during starvation the supply of CA to the gland tissue from adrenergic nerve endings and also from the blood begins to be limited, but deficiency can be detected only during activation of the secretory activity of the salivary gland. Comparison of the concentration and excretion of CA with the saliva during the secretory cycle in starving animals with the concentrations of these monoamines in gland tissue shows that the fall in the concentration of CA in the saliva runs parallel to the fall in their concentration in gland tissue. During starvation, therefore, CA deficiency in the saliva can evidently contribute to the development of dystrophic changes in the oral cavity, whereas trophic influences on the tissues of this region involve the participation of adrenergic mediators of the saliva [6, 8].

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