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Enzyme Excluding Activities Of Salivary Glands Before And After Unilateral Nefrectomy

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Abstract – The article is devoted to the mechanisms of transformation of saliva properties, depending on the functional state of the kidneys, before and after unilateral nephrectomy. Chronic experiments were performed on dogs with excreted ducts of the parotid, submandibular and sublingual salivary glands according to I.P. Pavlov.

Keywords – Salivary glands, Nefrectomy, Endosecretion, Enzymes, Saliva, Amylase, Lipase, Pepsinogen.

The urgency of the problem. The amount and composition of saliva reflects the quantitative parameters of the internal environment of the body. This is most clearly manifested in its water-electrolyte homeostasis - dehydration of the body reduces salivation and this acts as a signal in the oral phase of thirst [12, 15], largely determines the motivated behavior aimed at eliminating water deficiency. The ratio of electrolytes in saliva is determined by their level in blood plasma [4].

The homeostatic function of the salivary glands is carried out by the excretion of endogenous and exogenous substances from the blood in the saliva and the endosecretion of the products of the activity of the salivary glands into the blood. A-amylase and a number of physiologically active substances synthesized by the salivary glands circulate in the blood [1, 3, 16]. In this respect, the salivary glands differ little from other digestive glands, which are characterized not only by exo, but also by endosecretory activity [20].

In recent years, probeless research methods have been increasingly used to study the functional state of the main digestive glands. One of the groups of these methods takes into account the hydrolytic enzymes of the digestive glands in the blood and urine. This method is based on the fact that the main digestive glands, along with the exosecretion of the bulk of the enzymes they synthesize, some of them are incremented into the blood and lymph [8], from where these enzymes are excreted by the renal and extrarenal pathways, including the salivary glands [9, eleven].

The hydrolytic enzymes that entered the blood and lymph have a rather complex fate, which cannot be reduced only to the excretion of these enzymes by the kidneys. Thus, there are indirect and direct data on the deposition of enzymes of the digestive glands brought by the portal blood flow in the liver [13]. It has also been shown that a number of enzymes are secreted from the blood as part of the secretions of other digestive glands [10, 21, 24] by the type of recreation. But the main way of excretion of incremental enzymes from the body is the kidneys. Moreover, in most studies of the renal release of hydrolases, changes in its parameters are interpreted as a result of a corresponding shift in the functional state of the glands, in which this enzyme is

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synthesized and incremented. This is one of the expressions of underestimation of the role of the actual renal factors in the release of enzymes from the body, that is, it is roughly believed that the incremental amount of the enzyme is excreted by the kidneys without much dependence on the functional state of the latter. At the same time, in recent years, clinical and experimental studies have appeared, which show the dependence of the excretion of enzymes by the kidneys on their functional state, on the level of mobilization of certain mechanisms of urine formation, and the amount of urine output [5, 14].

We were faced with the question of revealing the mechanisms of transformation of the properties of saliva, depending on the functional state of the kidneys, before and after unilateral nephrectomy.

The aim of the study was: to study the mechanisms of transformation of the enzymatic spectrum of saliva and to establish the real contribution of the salivary glands to the enzymatic homeostasis of the body in violation of the excretory function of the kidneys.

Experimental technique and technique. In chronic experiments on dogs, saliva was collected, its volume was taken into account and hydrolytic enzymes were determined in it. In order to study the possibility of their recreational origin, the corresponding hydrolases in the blood were determined in parallel.

Chronic experiments were performed on dogs with excreted ducts of the parotid, submandibular and sublingual salivary glands according to I.P. Pavlov in the following series.

In the first series of chronic experiments on animals, the enzyme-excreting activity of the salivary glands was studied under conditions of their basal and stimulated secretion. The experiments involved dogs with excreted ducts of the salivary glands.

After collecting the basal secretion (5 min), salivation was stimulated by giving the animals meat-rusk powder (10 g), the collection of saliva lasted for 5 minutes from the beginning of salivation. In the course of the experiments, the hydrolases of saliva and blood were taken into account.

In the second series of chronic experiments on animals, the secretion of some enzymes by the salivary glands and their content in the blood after unilateral nephrectomy under conditions of basal and stimulated secretion by food stimuli were studied.

After unilateral nephrectomy, the secretion of enzymes in saliva and their content in the blood were taken into account under conditions of basal secretion and when given three food stimuli. The duration of the experiment is 4 hours. During the experiment, twice (before feeding 2 and 4 hours later) blood was taken from the vein and saliva was collected by stimulating salivation with meat-rusk powder. The content of amylase, lipase and pepsinogen was determined in plasma and saliva.

Discussion of the results obtained. Paired salivary glands of dogs, outside their stimulation by exogenous conditioned and unconditioned stimuli, secrete a small amount of saliva, the volume of which changes periodically. Basal salivation of the parotid, submandibular, and sublingual glands, insignificant in volume, was also noted by us (Table 1). Moreover, the tension of salivation in the parotid gland is approximately 3 times less than in the submandibular and sublingual (the secret of which was collected from their common duct and subsequently these glands will be designated for brevity as mixed).

Table 1. Basal enzyme release (units / min.) And release of enzymes by the salivary glands of dogs when they are fed with meat-rusk powder (average data from experiments on dogs (M m))

Indicators salivations	Basal		P<	Stimulated		P<
	OK	PP		OK	PP	
saliva volume (ml / min.)	0,10±0,003	0,32±0,011	0,001	0,9±0,03	1,2±0,04	0,001
Amylase (x 100)	$\frac{5,7 \pm 1,1}{0,5 \pm 0,1}$	$\frac{2,5 \pm 0,3}{0,8 \pm 0,1}$	$\frac{0,001}{0,001}$	$\frac{0,8 \pm 0,05}{0,6 \pm 0,06}$	$\frac{0,9 \pm 0,05}{1,1 \pm 0,06}$	$\frac{0,1}{0,001}$

Lipase	$\frac{13,1 \pm 0,6}{1,3 \pm 0,04}$	$\frac{14,9 \pm 0,7}{4,6 \pm 0,2}$	$\frac{0,05}{0,001}$	$\frac{2,4 \pm 0,3}{2,2 \pm 0,3}$	$\frac{5,0 \pm 0,5}{6,0 \pm 0,7}$	$\frac{0,001}{0,001}$
Pepsinogen	$\frac{15,1 \pm 1,9}{1,6 \pm 0,3}$	$\frac{29,9 \pm 2,6}{7,1 \pm 0,7}$	$\frac{0,001}{0,001}$	$\frac{14,1 \pm 3,1}{13,0 \pm 3,2}$	$\frac{10,0 \pm 1,9}{12,0 \pm 2,1}$	$\frac{0,1}{0,1}$

Note: * - reliability of the difference.

- numerator, enzyme content units / ml.

- the denominator of the release of enzymes units / min.

- OK parotid salivary gland.

- PP submandibular-hyoid gland.

Basal secretion of enzymes by these glands has significant differences not only due to the volume of salivation, but also the content of the registered enzymes in saliva. Thus, the amylolytic activity of the saliva of the parotid glands was approximately 2 times higher than that of the mixed glands. The lipolytic activity of the basal secretions of these glands had less difference, but nevertheless the saliva of the mixed glands had a slightly higher content of lipase due to the volume of salivation; the secretion of this enzyme was much higher in the mixed glands. Pepsinogen in the basal secretion of the mixed glands was significantly (1.5 times) higher concentration than in the saliva of the parotid gland and its release with the saliva of the latter was approximately 5 times lower than with mixed saliva.

Suppliers of hydrolytic enzymes into the blood from among the digestive glands are called salivary, gastric, pancreas.

glands, liver and small intestine [11, 12].

The content of enzymes in the blood of experimental dogs is not the same. Approximately, amylase and pepsinogen are equally present in the blood, making up, respectively, 16.6 ± 1.1 and 15.7 ± 1 units / ml hour. The lipolytic activity of the blood is three times less than the previous enzymes, and is 5.0 ± 0.3 U / ml hour.

According to many authors dealing with this issue, using different methods of differentiation of P- and S-isoamylases in blood serum [2, 11], the proportion of amylolytic activity of pancreatic α-amylase is 30-40% [23], and according to some data - 13-17 % [24].

Blood lipase is mainly of pancreatic origin. The origin of serumlipase is also associated with the liver [12].

Blood pepsinogen is of gastric origin [6, 7, 8]. Research and clinical interest in blood and urine pepsinogen has sharply increased since the 40-50s of the last century. However, to this day there are frequent publications about which determination of which enzymes of the digestive glands in blood and urine is more informative about the morphofunctional state of the glands-producers of the corresponding enzymes, which methods of their determination are more preferable [2, 14, 15, 19]. The problem of enzyme endosecretion is, of course, relevant for all digestive glands.

We determined the dependence of the content and secretion of enzymes by the salivary glands on their content in the blood during basal salivation (on an empty stomach) and after stimulation of salivation with meat-rusk powder (5 g each).

The results obtained showed that amylolytic activity and its secretion by the salivary glands have a rather high dependence on the amylase content in the blood. The correlation coefficients for the release of amylase by the salivary glands are high and more reliable than for their content in saliva. If we compare the correlative indicators of the parotid, submandibular and sublingual glands, they are approximately the same.

After stimulation of salivation, the correlative dependence of the release of amylase by the salivary glands increases, especially this is more pronounced for the submandibular and sublingual salivary glands. The content and excretion of pepsinogen

by the salivary glands have a higher dependence on its content in the blood. With the stimulation of salivation with meat-rusk powder, the correlation coefficients became higher compared to those on an empty stomach.

There are positive correlation coefficients between the lipase content in the blood and its secretion by the salivary glands. These indicators for the parotid salivary glands are higher than the submandibular and sublingual.

Hence, we can conclude that in the composition of saliva hydrolytic enzymes - amylase, pepsinogen and lipase, are of a recreational nature. The severity of the recreation of enzymes by the salivary glands depends on their functional state; with stimulated salivation, the secretion of enzymes by the salivary glands becomes more dependent on their level in the blood.

The results obtained showed that unilateral nephrectomy affects the content of amylase, pepsinogen and lipase in the blood ambiguously.

After unilateral nephrectomy under conditions of basal secretion in two dogs (Laska, Tarzan), the amylolytic activity and the content of pepsinogen significantly increased. In the third dog (Bobik), they remain at the level of the original values.

Blood lipolytic activity in experimental dogs after unilateral nephrectomy remains unchanged. This means that unilateral nephrectomy not only affects the excretion of enzymes by the kidneys, but also affects the incretion of enzymes by the digestive glands.

After unilateral nephrectomy in experimental animals, the volume of the basal secretion of the salivary glands, in the dog Tarzan - of the parotid gland, Lasky - of the submandibular and sublingual salivary glands, increases. In the Bobik dog, the volume of basal secretion of the salivary glands after unilateral nephrectomy remains at the initial level.

Unilateral nephrectomy on the enzyme spectrum of saliva is ambiguous. In all experimental dogs, after nephrectomy, amylolytic activity and its debit in the saliva of the parotid salivary gland increase. In the submandibular saliva with the sublingual salivary glands, the amylolytic activity and its flow rate, after unilateral nephrectomy, remain at the level of the initial values.

There is a unidirectional change in the amylolytic activity of blood and its secretion by the salivary glands, this once again proves the participation of the salivary glands in maintaining enzymatic homeostasis by incretion and recreation, especially amylase.

Our results of a correlation analysis between the content of amylase in the blood and excretion in saliva showed that the correlation coefficients for the saliva of the parotid gland were always higher than for the saliva of the submandibular and sublingual glands. These results confirmed the literature data [12] that in the composition of the saliva of the parotid, submandibular and sublingual glands, the ratio of S-, P- amylolytic activity is observed in parotid saliva S - 55-67%, P - 33-44%, and in the submandibular and sublingual saliva S - 79%, P - 21%.

Hence, we can conclude that the parotid salivary gland can recruit more pancreatic β-amylases from the blood than the submandibular and sublingual salivary glands.

In all experimental animals after unilateral nephrectomy, the content of pepsinogen in the saliva of all salivary glands tends to increase, but these changes are not significant. In two dogs (Laska and Tarzan) out of three, the release of pepsinogen in the saliva of the submandibular and sublingual salivary glands significantly increased. The correlation coefficients between the blood pepsinogen content and its secretion by the salivary glands were high and positive. This means that there is a direct dependence of the release of pepsinogen by the salivary glands on the level of its content in the blood. These results confirmed the literature data [8, 11] that pepsinogen in saliva is of a recttorial nature; it is secreted from the blood by the salivary glands. Pepsinogen is secreted into the blood by the main cells of the gastric glands.

From the above, we can conclude that unilateral nephrectomy stimulates the increment of pepsinogen by the gastric glands, and, accordingly, enhances its recreation from the blood by the salivary glands.

After unilateral nephrectomy, the basal lipase secretion by the salivary glands remains unchanged. Only in one dog (Tarzan) was an increase in the release of lipase in the saliva of the submandibular and sublingual salivary glands observed. This is most likely the result of increased salivation by these glands.

Correlation analysis showed that there is a direct relationship between the content of lipase in the blood and its secretion by the salivary glands. We consider this as an argument confirming the recreational nature of lipase in saliva.

Summarizing the results of studying the effect of unilateral nephrectomy on the content of blood enzymes and their secretion by the salivary glands, it seems possible to conclude:

1. After unilateral nephrectomy under conditions of basal secretion, the content of amylase and pepsinogen in the blood increases, while its lipolytic activity remains unchanged.

2. Unilateral nephrectomy does not have a significant effect on the blood content of the three considered hydrolases, when animals are given food stimuli that stimulate the digestive glands.

3. After unilateral nephrectomy, with basal salivation, the content and release of amylase by the parotid salivary gland increases, and when incretion is stimulated by food irritants, its release by all three salivary glands increases. The observed unidirectionality of changes in the amylolytic activity of blood and its secretion by the salivary glands once again proves the participation of the salivary glands in maintaining the homeostasis of amylase through its incretion and recreation.

4. Unilateral nephrectomy stimulates the increment of pepsinogen by the gastric glands, and, accordingly, enhances its recreation from the blood, by the salivary glands.

5. After unilateral nephrectomy, the increment of amylase and pepsinogen into the blood increases, while there are unambiguous changes in the release of enzymes from the blood by the salivary glands, aimed at maintaining their homeostasis.

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