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EFFECT OF INTRAVENOUS INJECTION OF HETEROLOGOUS SERUM ON GASTRIC SECRETION

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It has been shown by I. P. Razenkov [5] and his co-workers that proteins and other nitrogenous substances are secreted with the gastric juice.

* In Russian.

Similar findings were reported by V. M. Rubel et al. [6], following transfusions into patients of whole blood, serum, or colloidal extenders. The amount of gastric juice rose after transfusions, while its chloride and pepsin contents fell. In most cases the total nitrogen content of the gastric juice rose after transfusions. This increase was due not only to increase in protein and polypeptide nitrogen, but also in nonprotein nitrogen.

It was, in this connection, of interest to ascertain the effect of intravenous injection of heterologous protein on the secretory function of the gastric glands, and to see whether injection of heterologous serum augmented secretion of nitrogenous substances in the gastric juice.

The effect on gastric secretion of injection of heterologous proteins has become of particular interest, in view of the use as blood extenders and parenterally administered nutrients of a number of preparations containing denatured and hydrolyzed heterologous proteins (N. G. Belenky [1], N. A. Fedorov, G. A. Tsinman). Apart from this, the prophylaxis and treatment of a number of infectious diseases are associated with introduction of heterologous proteins into the organism.

EXPERIMENTAL METHODS

Our experiments were performed on 5 dogs, with gastric fistulae: Laska, weight 14.5 kg, a lively dog, eats greedily, rather nervous; Druzhok, 15.5 kg, a quiet dog, does not eat greedily; Tobik, 16.8 kg, lively, eats greedily; Palma, 14.3 kg, active, eats greedily; Bobik, 15 kg, moderately active, eats greedily.

We used sterile bull's serum as the heterologous protein.

Gastric secretion was stimulated by subcutaneous injection of morphine into dogs which had been fasted for 20 hours. The stomach was washed out with warm water before injection of morphine.

It has been shown by A. I. Smirnov and V. F. Shirokov [8] that subcutaneous injection of 0.005-0.01 g of morphine into fasting dogs causes a copious secretion of gastric juice. According to E. G. Lipskaya [3] the chemical composition and pepsin content of this juice is practically identical with that secreted in response to histamine.

The technique adopted in our experiments provided us with considerable amounts of gastric juice, free of food residues. The dosages used were: Laska, Tobik, and Bobik 0.01 g, Druzhok and Palma 0.005 g of morphine hydrochloride.

The gastric juice secreted after injection of morphine was collected at the end of each hour, and was subjected to the following analyses: acidity according to Michaelis, enzymatic activity, from its milk-curdling power, in Pyatnitsky units [4], and nitrogen, by the Kjeldahl method.

After having determined the properties of the gastric juice secreted in response to morphine, we proceeded to inject bull's serum into dogs during the phase of gastric secretion induced by morphine. Two injections were given to each dog; the first of 20 ml, and the second, four days later, of 30 ml.

EXPERIMENTAL RESULTS

The dogs were unaffected by the first injection. After the second injection Laska showed obvious signs of nasal congestion.

The amount of gastric juice secreted (mean hourly figure) by four dogs in response to morphine fell after injection of bull's serum (Figure 1). The total hydrochloric acid content fell for the first four dogs (Figure 2).

The total nitrogen content (Figure 3) of the gastric juice was, for Laska, 14.3 mg per 1 hour portion after morphine alone, 22.2 mg after the first injection of serum, and 4.4 mg after the second. The corresponding values for the other 4 dogs were:

Palma: 12.5, 16.5, and 17.6 mg,
Bobik: 4.4, 11.8, and 17.3 mg,
Tobik: 9.8, 12.8, and 11.5 mg,
Druzhok: 13.7, 10.7, and 11.6 mg, respectively.

The pepsin content of the gastric juice fell, for two dogs, after the first and second injections of bull's serum. The mean pepsin content of a 1 hour portion of gastric juice from Laska was: morphine alone, 52.6,

first serum injection 52.6, 2nd serum injection, 35 units. The corresponding values for Palma were 208.8, 71.7, and 164.9 units. The pepsin content fell only after the first serum injection, with Bobik, the values found being 242.2, 182.4, and 273.8 units. For Tobik, the value was less than the initial one after the second injection (54.3, 71.4, and 46.6 units). The corresponding values for Druzhok were 44.1, 58.2, and 174 units.

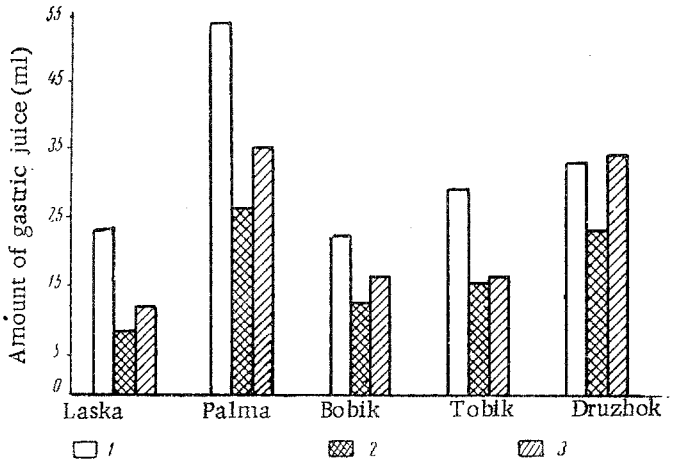

Fig. 1. Amount of gastric juice secreted in 1 hour in response to morphine and serum injections. 1) Morphine; 2) 20 ml of serum; 3) 30 ml of serum.

Our experiments show that intravenous injection of heterologous serum into healthy dogs depresses the secretory function of the gastric glands (the amount of gastric juice falls, as does its hydrochloric acid content and in many cases its enzymatic activity). This disturbance of secretory function of the stomach should, in turn, interfere with the animal's capability of digesting proteins.

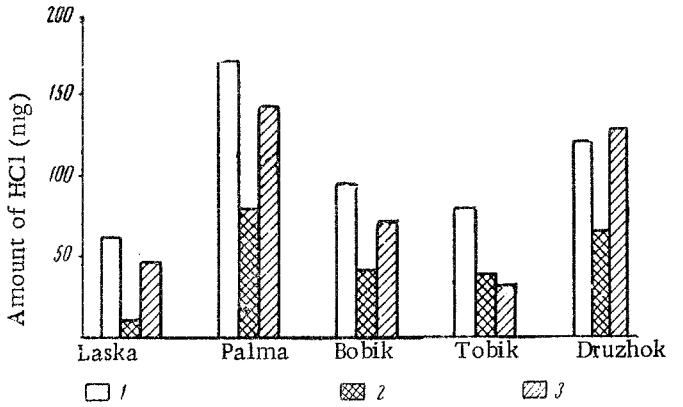

Fig. 2. Amount of hydrochloric acid secreted by dogs in 1 hour in response to morphine and serum injections. 1) Morphine; 2) 20 ml of serum; 3) 30 ml of serum.

The correctness of this supposition is confirmed by N. G. Belenky's findings [2].

He found that intravenous injection of species nonspecific serum into normal dogs in a state of nitrogenous equilibrium was always followed by a rise in the fecal nitrogen content. Considering this finding in conjunction with his earlier ones, N. G. Belenky came to the conclusion that the raised nitrogen content of the feces is ascribable to lowered assimilation of alimentary protein, but not to elimination of the species nonspecific serium proteins via the alimentary tract.

Belenky's view was latter confirmed experimentally. V. M. Rubel, in 1954 [7], working with radioactive isotopes, found that S^{35}-labeled dog plasma proteins administered to dogs were not secreted in the gastric juice.

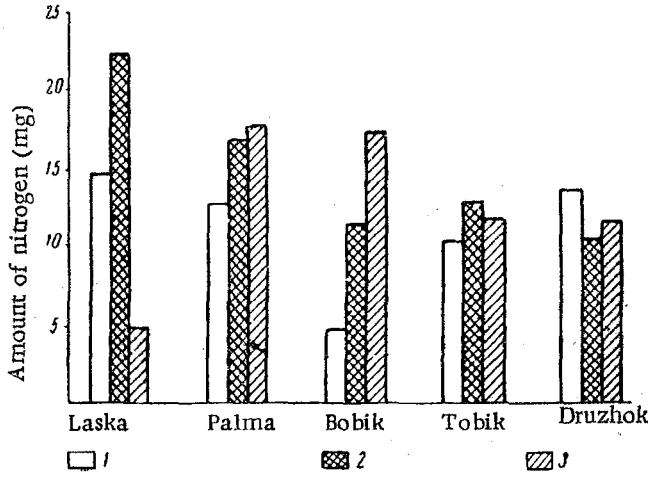

Fig. 3. Amount of nitrogen (mg) in the gastric juice of dogs, secreted over 1 hour after injections of morphine and serum. 1) Morphine; 2) 20 ml of serum; 3) 30 ml of serum.

It follows that the increased fecal nitrogen excretion found in dogs after injection of species nonspecific serum cannot be ascribed to the direct elimination of the serum proteins into the alimentary tract, but should be considered to be a consequence of depressed secretory function of the digestive glands.

To summarize our results, we conclude that the introduction of bull's serum into normal dogs causes a fall in gastric secretion, a fall in the hydrochloric acid content of the gastric juice and (in 6 of 10 experiments) in its pepsin content, and a slight rise in its nitrogen content.

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