THE EFFECT OF STIMULATION OF THE HYPOTHALAMUS ON THE SECRETORY
FUNCTION OF THE STOMACH IN LONG-TERM EXPERIMENT

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The number of references to the effect of hypothalamic stimulation on the secretory function of the stomach is very small. Such investigations have been carried out by J. Beattie [2] who found in short-term experiments on cats under barbiturate anesthesia that faradic stimulation of the lateral wall of the hypophy- 
sial infundibulum elicited secretion of gastric juice. T. Heslop [3] has shown that stimulation of the anterior hypothalamus in cats and dogs increases the secretion of gastric juice with a rise in acidity and higher con-
tent of free HCl. Similar changes in gastric secretion have been observed on stimulation of the vagus. Stim-
ulation of the posterior part of the hypothalamus increased the amount of mucus secreted, and, in the presence
of acid gastric juice, diminished its acidity. Similar reactions were observed on stimulation of the splanchnic
nerve.

D. Sheehan [5] also found that stimulation of the posterior and especially of the lateral part of the hypo-
thalamus led to considerable increase in the secretion of gastric mucus, accompanied by a series of sympathetic
effects; this suggests the possibility of the existence of a sympathetic center in the hypothalamus.

There is much less data available on the increase of gastric juice acidity on stimulation of the anterior
crcretion in short-term experiments on monkeys under cyclopropane anesthesia. Stimulation of the
anterior part of the hypothalamus gave an HCl secretion curve similar to that obtained on stimulation of the
vagus. Bilateral vagotomy abolished completely the effect of anterior hypothalamic stimulation and diminished
the reactions of stimulation of the posterior hypothalamus. Preliminary extirpation of the adrenals abolished
entirely the effect of stimulation of the posterior hypothalamus without altering the results of stimulation of
the anterior hypothalamus. When vagotomy and adrenal extirpation were combined, stimulation of both parts
of the hypothalamus proved ineffective. On the basis of these results the authors have postulated a theory of
the existence of two different pathways mediating the action of the hypothalamus on HCl secretion by the
stomach: the first originates in the anterior hypothalamus and reaches the stomach by way of the vagus, the
second pathway begins in the posterior hypothalamus and is mediated by the pituitary-adrenal system.

Literature data show that the hypothalamus plays an important role in the regulation of the secretory
function of the stomach. However, this subject has been relatively little studied and the data obtained are
contradictory. The majority of investigations have been carried out in short-term experiments.

The present work is concerned with the study of the effect of hypothalamic stimulation on the secretory
function of the fasting stomach under new experimental conditions.

EXPERIMENTAL METHOD

Our experiments were performed under long-term conditions on dogs with fistulas of the fundal part
of the stomach (Basov’s method). The animals were subjected to experiments on the 6th-7th postoperative day.
The dogs were kept fasting for 18-20 hours prior to experiment, and were allowed to rest for a day after the experiment. Gastric juice was collected in a measuring cylinder with subsequent determination of total acidity and of digestive power according to Mett over a period of 24 hours. Gastric juice was collected every 5, 10, 15 and 30 minutes depending on the aim of the experiment. Free HCl and total acid content were determined by titration with 0.1 N solution of NaOH, using dimethylamidoazobenzene (0.5% alcoholic solution) and phenolphthalein (1% alcoholic solution) as indicators. Determinations were made on 1 to 10 ml gastric juice. Acidity of the latter was expressed in the number of milliliters of alkali calculated on 100 ml gastric juice.

Following careful investigation of the secretory function of the stomach and accumulation of sufficient data, the animals were subjected to the operation necessary for application of 4-polar electrodes to the hypothalamus. The technique of application of multipolar electrodes to the hypothalamus for long-term experiments on dogs involving approach to the hypothalamus from the base of the brain has been developed in collaboration with P. G. Bogach and described in previous reports [1, 2]. Hypothalamic stimulation was achieved by means of electric current from a sound generator of "GZ-1" type.

EXPERIMENTAL RESULTS

Secretory function of the stomach was investigated in 5 dogs, of which one served as control. Following formation of the gastric fistula the gastric content was regularly examined. It was possible to collect from 2 to 10 ml gastric contents, usually opalescent mucus, from each dog over a period of 4-5 hours. Free HCl was absent, total acidity was within the range 15-25, digestive power 0. No change in gastric secretion was observed following the procedure of application of 4-polar electrodes to the hypothalamus.

![Fig. 1. Change in the gastric secretion following single stimulation of the anterior hypothalamus with electric current (frequency 60 cps, amplitude 14, duration of stimulation 1 minute). 1) Total acidity in Ewald numbers; 2) free HCl; columns show amount of gastric juice in milliliters for every 5 minutes; figures below digestive power in millimeters of protein bar for 24 hours (Mett). Experiment No. 18, December 12, 1955, on dog Dzhuk.](image-url)