

# REFLEX REACTION OF THE TASTE RECEPTORS OF THE TONGUE TO DIRECT STIMULATION OF THE GASTRIC RECEPTORS

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In our previous investigations [4, 5] we showed that the activity of the human taste apparatus depends to a great extent on the functional condition of the digestive system, and, in particular, of the stomach. Thus not only do reflexes from the taste receptor apparatus activate secretory and motor mechanisms of the digestive apparatus, but the activity of the organ of taste itself is reflexly regulated by influences of the gastric interoceptors. This result is in line with the facts observed in studying the reflex reorganization of the receptor apparatus of the retina and of the skin by the method of functional mobility [1, 2, 6, 10, 11]. The problem of centrifugal regulation of receptors has also been studied electrophysiologically [11].

In the present work our starting point has been that changes in the level of gustatory sensitivity obtained by introducing food directly into the stomach, without any stimulus to the taste apparatus, would constitute an incontrovertible proof of a reflex influence exerted by the gastric interoceptors on the taste receptor apparatus. For this purpose we made use of patients with cicatricial constriction of the esophagus, in whom a gastric fistula was established.

## METHOD

Observations were made on ten male and female patients aged between 22 and 47 years. All were equipped with a gastric fistula on account of cicatricial constriction of the esophagus (mostly as a result of caustic burns). The injuries had occurred at various times.

We used the method of functional mobility to determine not only change in sensitivity, but also the extent of the possible adaptation by the gustatory organs. We measured sensitivity of various of the lingual papillae (4 fungiform papillae lying in the anterior third of the tongue). Solutions of substances at concentrations above the threshold for taste were introduced through glass capillary tubes onto the papillae to be investigated. Tests of a given solution were repeated twelve times at intervals of two or three minutes for the duration of the study. After each test, the subject washed out his mouth with warm water. Before the test, the tongue was dried with filter paper.

The solutions used were 44.5% sugar, and 26% salt solution.

The taste sensitivity was measured with the stomach empty, and then after 5 - 7 minutes, food was introduced through the fistula, and the determinations repeated; the food usually given was the breakfast, though in some cases meat broth was substituted.

## RESULTS

With the stomach empty, the degree of mobilization of the taste receptors was high, i.e. the taste sensitivity was acute. After food had been taken through the gastric fistula, without any stimulation of the taste receptors, the mobilization level was reduced (Fig. 1). Stimulation of the gastric interoceptors therefore produces a reflex alteration in the taste apparatus.

The taste receptors themselves play a certain part in the change of taste sensitivity after food is taken. In some of our observations, before the food had been introduced into the stomach through the fistula, it was chewed by the subject. In this case, the reduction of taste sensitivity after food had been introduced into the stomach was somewhat greater (Fig. 2).

These observations indicate definitely that the stomach is one of the reflexogenous zones influencing the functional condition of the taste analyzer.

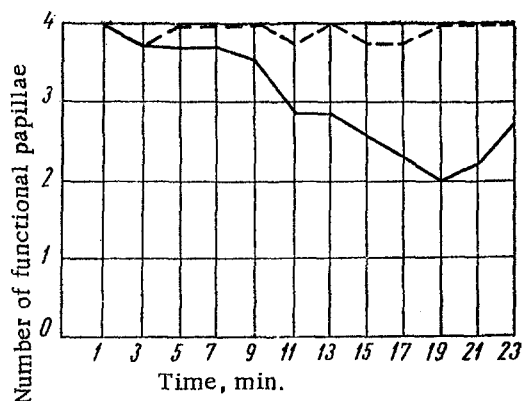


Fig. 1. Change in taste sensitivity after food has been taken through a fistula. Interrupted line—stomach empty; continuous line—after food was taken.

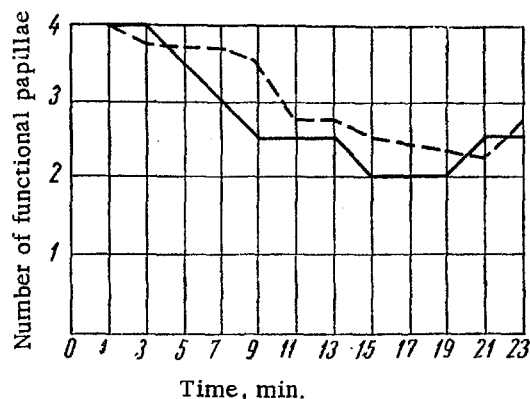


Fig. 2. Change in taste sensitivity after food has been taken through a gastric fistula, after previously chewing food. Interrupted line—food taken through fistula; continuous line—after preliminary chewing.

The reflex from stomach to tongue in the subjects equipped with gastric fistulas was preserved: after the food had reached the stomach, just as in healthy people, the direction of the action was such as to reduce sensitivity, but its amplitude was less than normal, and its latent period somewhat greater. The smaller reduction of taste sensitivity in the patients than in healthy subjects might be due to some disturbance of the digestive system due to the cicatricial constriction of the esophagus. When food is taken into the stomach without involvement of the taste apparatus, the powerful reflex zone of the oral cavity remains unaffected, and there is no emotional satisfaction in taking the food, i.e. one of the components for setting the level of sensitivity of the taste apparatus at its optimum functional level is absent.

We observed some variation in the reaction of the taste receptor apparatus according to the length of the illness. When the condition had lasted 6 - 10 years, the response of the receptor apparatus with the stomach empty was approximately normal. In patients in which the fistula had been established for only 2 - 3 years, taste sensitivity with stomach empty showed the greatest acuity. The organism was not yet adapted to the new conditions.

Different results were obtained on patients with diseases of the digestive system such as gastritis, gastric ulcers, etc. Here we found no alterations in the setting of the taste receptor apparatus after food was taken. The sensitivity with the stomach empty might be very high, but it did not alter after taking food, i.e. the normal change in the control over the receptor apparatus was absent.

The results obtained confirmed our view that like other sense organs, the gustatory organ is adjusted to changes in its environment, partly, though to a small extent, through stimulation of the receptors themselves, but also through impulses reaching it from the central nervous system. The existence of such "reverse" connections enables the sense organ to perceive very fine changes occurring in the medium, and to adjust itself accordingly to them.

In the Pathophysiological Laboratory of the N. V. Sklifosovskii Institute, by observations on patients with cicatricial constriction of the esophagus, the change in taste sensitivity resulting from the condition has been demonstrated electrophysiologically. An electrophysiological method has also been used in the Laboratory of the Physiology and Pathology of the Sense Organs, Institute of Normal and Pathological Physiology, AMN SSSR to show that when

the frog stomach is stimulated there is an alteration in the electrical activity of the lingual nerve [4].

Observations on healthy subjects, on patients with gastric fistulas or with various disorders of the digestive system, and electrophysiological studies on animals have made it possible to study the mechanisms underlying the phenomena we have described here.

#### SUMMARY

In man, signals from the gastric receptors acting through the central nervous system play an important part in regulating the reaction of the gustatory receptor apparatus. A considerable reduction in the sensitivity of taste receptors tested on the tongue was caused by food introduced directly into the stomach through a fistula, so that to by-pass them.

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