REGULARITY IN APPEARANCE OF THE FUNCTIONAL MOBILITY OF THE HUMAN GUSTATORY RECEPTOR APPARATUS

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In the previous study [2] we described the appearance of functional mobility of the human gustatory receptor apparatus that could be elicited by application of sweet, sour, bitter and salty substances.

After determining this fact we investigated the regularity of appearance of functional mobility and determined its significance in adapting the gustatory apparatus to changing conditions of the environment. Since the organ of taste is connected with, and a part of, the digestive system, we observed the activity of the gustatory receptors of the tongue at various times after ingestion of food.

N.I. Gusev [1] studied the changes in gustatory perception by the method of general stimulation, i.e., rinsing the oral cavity with a solution of the substance to be tested (sweet, sour, bitter and salty).

The author determined the changes in taste perception by noting the changes in threshold concentrations of the test solutions. The conclusion was that sensitivity to sweets is subject to the greater changes and is increased during hunger; the sensitivity to salty substances is also increased, but it is decreased to acid and bitter solutions.

In our investigations the general method of determining the functional mobility of gustatory receptor elements was used [2].

By means of glass tubes with a capillary tip, slightly colored test solutions (with food colors for purposes of fixing the investigated papillae) were placed on the functional units of the gustatory receptor apparatus – (papillae).

Solutions of sugar 80% (threshold 40%), citric acid 4% (threshcld 2%), sodium chloride 35% (threshold 20%) and quinine 2% (threshold 1%) were used.

For investigation four papillae were chosen that showed sensitivity to the gustatory stimulus during the first trial. Application of the capillary tube to each papilla followed a definite order. The test solution was applied at five minute intervals for one hour (12 times).

Four series of investigations were carried out: on an empty stomach, 5-10 minutes after food intake, $1\frac{1}{2}$ and 4 hours later, for a total of 300 tests on six healthy subjects.

The results of these investigations show that the level of functional mobility changes depending on the time elapsed from food intake.

The accompanying table illustrates the dynamics of change in gustatory perception at various intervals after food intake (although only a sugar solution was used, the identical results were obtained on stimulation with solutions of acid, salty and sour substances).

Record of Investigation of Gustatory Perception

Number of the papilla	Number of the experiments											
	1	2	3	4	5	6	7	8	9	10	11	12
	Investigation on empty stomach (9:00)											
I	+	+	+	+	+	+	+	+	+	−	+	+
II	+	+	+	+	+	+	+	+	+	+	+	+
III	+	+	+	+	+	+	+	+	+	+	+	+
IV	+	+	+	+	+	+	+	+	−	+	+	+
	Investigation 5 min. after food intake (12:30)											
I	+	−	+	−	+	+	−	−	−	−	−	+
II	+	+	−	−	−	+	+	+	−	−	−	−
III	+	+	+	−	+	−	+	−	+	+	+	−
IV	+	−	−	+	−	+	−	+	−	−	−	+
	Investigation 1½ hours after food intake (2:30)											
I	+	+	−	+	+	−	−	+	−	−	+	+
II	+	+	+	+	+	+	+	+	+	+	−	−
III	+	+	−	−	−	+	+	+	−	−	+	+
IV	+	−	+	+	−	+	−	+	+	+	−	+
	Investigation 4 hours after food intake (4:00)											
I	+	+	+	+	−	+	+	−	+	+	+	+
II	+	+	+	+	+	+	+	+	−	+	−	+
III	+	+	+	+	+	−	+	+	−	+	−	+
IV	+	+	+	+	+	+	+	+	+	+	−	+

As is seen from the table, sensitivity of the taste buds is most acute on an empty stomach (indicated by +) and this holds true in all investigations (46 positive and 2 negative responses).

Five to ten minutes after food intake a significant inactivation of the papillae is noted (23 positive and 25 negative responses).

An increase in functional activity is noted 1½ hrs. after food intake (32 positive and 16 negative responses).

Results 4 hrs. after food intake approximate those obtained on an empty stomach (40 positive and 8 negative responses).

The following may be said in comparing the results obtained in observing the activity of gustatory receptors at varying intervals after food intake: 1) maximal perception, as expressed in mobilization of an absolute majority of investigated papillae, is noted in the fasting state (10-12 hours following food intake); maximal diminution of perception occurs 5-10 minutes after food intake; 3) some increase in the activity of the papillae is noted in 1½ hrs. after food intake as compared with the results noted in the preceding interval; 4) 4 hrs. after food intake an increase in the acuity of gustatory perception is noted and its level approximates that during a fasting state. These are characteristic physiological dynamics of the mobilization of the human gustatory receptor apparatus found in all healthy subjects studied. This may be taken as a test of the normal physiological function of this organ – its biological state.

The fact that the taste papillae are activated immediately after food intake (filling of the stomach) points to the part played by the interceptor apparatuses of the stomach that apparently stimulate mechanical as well as the chemical excitants.

By comparing the functional mobility of the gustatory receptor apparatus it is possible to form an opinion on the state of the entire digestive apparatus at various intervals after food intake.

Investigation of the functional mobility of the gustatory receptor apparatus may be used in studying conditioned reflex activity in the human body and also the activity of some pharmacological substances that exert their action on the gastro-intestinal tract.

LITERATURE CITED

[1] N. N. Gusev, in book: Investigation on the Problem of Sensitivity, 1940.

[2] N. S. Zaikov, Bull. Expt. Biol. and Medicine, 1955, No. 1, p. 7-10.