

ABSTRACTS

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Experimental Studies in Gastric Physiology in Man. A Study of Pyloric Control. The Roles of Acid and Alkali. S., G. and O., Vol. LVIII, No. 6, June, 1934, pp. 935-955.

The authors state that gastric motility may be considered to be the result of three components: gastric peristalsis, gastric tonus, and the state of the pylorus. They consider briefly the first two of those components, and present experimental data, which, after analysis, cause the third component to emerge as the most important factor in gastric emptying.

All studies were made on human subjects by means of roentgen examinations. Cases were selected to represent the entire range of gastric acid secretory response from achlorhydria to hyperchlorhydria. All psychic factors were eliminated; no drugs were used. The examinations were carried out during the evening hours. The subjects were allowed to eat the usual lunch at noon, and at 3 P. M. two slices of dry toast and a cup of tea without cream were ingested. Nothing more was taken until 8 P. M. when the studies were begun.

The mouth test meal consisted of 250 c.c. of luke-warm tap water containing two ounces of barium sulphate. The gastric emptying time for each subject was determined under standard conditions, and rechecked. Very little variation in the emptying time in the same individual under standard conditions was found. All test substances used were added to the water and barium meal. The emptying time for the water and barium meal established, new studies were made in which hydrochloric acid (0.09 to 0.53 per cent) or sodium bicarbonate (1 and 5 per cent) solutions were used. Observations and records were made during the first five minutes, and at intervals of 15, 30, 60, 90 and 120 minutes after ingestion, or at such time when complete emptying had occurred, or a constant residue had been obtained.

In another group of subjects the effect of the direct application of these substances to the duodenal mucosa was made. In these subjects gastric motility with duodenal intubation had been determined. No change in gastric motility attributable to the presence of the tube was found. The test agent was slowly instilled into the duodenum while simultaneously the water and barium meal was taken.

Summary of Experimental Data

Group I. Weak Acid (0.09 to 0.23 per cent taken by mouth).

A. In three subjects who showed normal gastric acidity this agent produced a short delay in gastric emptying in one, no change in the second, while in the third subject there was a slight acceleration in gastric motility.

B. In seven subjects with hyperacidity there was no change in five, one showed a slight delay, another a small increase.

C. Six subjects with achlorhydria showed a marked delay varying from 50 to 150 per cent.

Group II. Strong Acid (0.24 to 0.53 per cent) taken by mouth.

In this group a marked motor delay was found in all instances regardless of the Ewald secretory response. The hyperacidity group showed least relative delay.

Group III. Sodium Bicarbonate (1 per cent) taken by mouth.

A. Three subjects with normal gastric acidity showed a definite decrease in the time of gastric emptying.

B. Seven subjects with hyperacidity gave the same response as the normal subjects, but showed relatively a greater decrease.

C. Six subjects with achlorhydria showed no variation from their emptying time as determined with the water and barium alone.

Group IV. Sodium Bicarbonate (5 per cent) taken by mouth.

A. In three subjects with normal acidity there was no change in two, while in one there was a definite delay.

B. In seven subjects with hyperacidity six showed a decrease in emptying time while no change was noted in one.

C. In six subjects with achlorhydria a definite motor retardation was produced.

In every meal ingested by an achlorhydric there was an immediate filling of the duodenal cap, while in the normals and hyperchlorhydrics this was not always found. In the achlorhydric there is never any acid material in the duodenum to cause pyloric closure, while in the others there may be some acid material in the fasting stomach and duodenum causing the contraction of the pylorus. The reaction of the material on the duodenal mucosa, just distal to the cap, controls the state of the pylorus. In the achlorhydric there was an uninterrupted passage of the bland meal from the stomach, while the weak acid meal upon reaching the duodenum caused closure of the

pylorus and marked delay in emptying. In those subjects with normal acidity or hyperacidity no such marked delay was found. The author suggests the possibility that the neutralizing mechanism in the stomach and duodenum of the achlorhydric may be less efficient than in the normal or the hyperchlorhydric.

The weak alkaline meal caused increased motility in the normals and hyperchlorhydrics by neutralizing the acid present, while in the achlorhydrics it caused no change. The 5 per cent sodium bicarbonate meal causes delay in gastric emptying in the achlorhydric by virtue of its hypertonicity, which initiates the duodeno-pyloric reflex.

One fact stands out clearly from these data: Without a consideration of the gastric secretory response of the experimental subject no logical or consistent interpretation of the results would be possible.

The Effect of Duodenal Instillations upon Gastric Emptying.

In achlorhydrics the instillation of 1 per cent sodium bicarbonate solution into the duodenum had no effect on gastric emptying, while in normals and hyperchlorhydrics it caused a more rapid emptying. In all cases the instillation of 5 per cent sodium bicarbonate solution caused considerable delay in gastric emptying.

The hydrochloric acid (0.12 per cent) instilled into the duodenum of an achlorhydric caused marked delay in gastric emptying. In hyperchlorhydrics the delay was only slight. In all groups there was very marked delay in gastric emptying when 0.25 per cent hydrochloric acid solution was instilled into the duodenum.

In the experience of the author gastric peristalsis is an unimportant factor in gastric emptying. In achlorhydrics the stomach was seen to empty readily without visible peristalsis, while in other cases very vigorous peristalsis failed to empty the stomach as long as pylorospasm lasted. Peristalsis is probably unrelated to pyloric opening.

If the gastric contents in passing over the duodenal mucosa do not set up the duodeno-pyloric reflex, gastric tonus is the most important factor in gastric emptying. It exerts a constant positive force which empties the stomach promptly if the pylorus is relaxed.

In conclusion, the authors emphasize that without due consideration of the individual gastric secretory response no proper evaluation of the experimental data could be made. They liken the stomach unto a dumb waiter ever ready to deliver through its door, the pylorus, anything reaching it. The duodenum they liken unto a selective connoisseur, who promptly closes the door if the stomach contents are not acceptable. The pylorus thus is a door but emphatically not an autonomous one.

An analysis of a large amount of pertinent literature, and a large bibliography are given.

Seven figures and eight tables accompany the article.

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The Digestion of Beef Proteins in the Human Stomach. Jour. of Clin. Invest., 13:193-207 (March), 1934.

In most previous studies of the digestibility of foods, workers have usually contented themselves with measurements of the emptying time of the stomach. However, in the present study the author followed the amount of digestion by determining at a given time after ingestion, the extent to which the protein had been hydrolyzed in the stomach into the various fractions.

Three types or classes of patient were used: (1) "normal" patients (those without gastro-intestinal disease), (2) achlorhydric individuals without pernicious anemia, and (3) achlorhydric individuals with pernicious anemia.

Following very complete and accurate and controlled determination, the author draws these conclusions: That considerable peptic hydrolysis of meat can occur in the stomach in a relatively short time; that there is a wide variation in the extent of this hydrolysis in the normal individual; that pernicious anemia patients accomplish little or no gastric digestion of meat; that achlorhydric cases without pernicious anemia have a small amount of gastric digestion; and that in his experiments the pepsin secretion and acid secretion appear to parallel each other in amounts.

As the author states, these conclusions are based on observations on a meat diet alone and may be different for a mixed dietary, yet this study may well serve as a start for further study of the function of the stomach in normal individuals and in those suffering from some gastro-intestinal pathology.

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