DYNAMICS OF NITROGENOUS FRACTIONS OF THE CHYME OF STOMACH AND SMALL INTESTINE AFTER INTRODUCTION OF FOODS INTO VARIOUS PARTS OF THE GASTRO-INTESTINAL TRACT

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In 4-hour experiments on five dogs with Pavlov gastric pouches and fistulas of the stomach and small intestine the dynamics of the nitrogenous fractions of the gastric, duodenal, and jejunal chyme was studied. The amino-nitrogen concentration in the gastric and duodenal chyme after meat feeding was lower than after introduction of meat into the stomach through the fistula. During steady infusion of Aminokrovin (blood hydrolysis products) into the duodenum the total nitrogen concentration of the gastric chyme was as high as after meat feeding, through the entry of endogenous protein with the digestive juices and duodenal regurgitation. After injection of Aminokrovin into the duodenum and jejunum the amino-nitrogen level of the gastric and jejunal chyme was independent of the rate of infusion of the preparation.

KEY WORDS: jejunal feeding; gastric secretion; intestinal secretion; chyme.

In the treatment of peptic ulcer and after operations on the stomach in some cases nutrients are administered by tube into the small intestine [1-5]. Under these conditions, complex changes arise in the secretion of the digestive juices and the processes of hydrolysis of proteins, fats, and carbohydrates within the intestine.

It was decided to study the dynamics of nitrogenous fractions of the chyme of the stomach and small intestine in experiments in which foods were introduced into different parts of the gastro-intestinal tract.

EXPERIMENTAL METHOD

The total nitrogen and amino-nitrogen content was determined in hourly samples of chyme taken from five dogs with Pavlov gastric pouches and with fistulas of the stomach and small intestine. The concentration of hydrochloric acid (in meq/liter) and pepsin (in meq tyrosine/liter) was determined in 15-min samples. The food stimuli used were raw and cooked meat (100 g) and the hydrolyzed blood preparation Aminokrovin (150 ml).

EXPERIMENTAL RESULTS

The secretion of the isolated gastric pouch during meat feeding was considerably greater than after introduction of meat directly into the stomach or steady infusion (50 ml/min) of Aminokrovin into the stomach ($P < 0.05$). Drip infusion of Aminokrovin (3-4 ml/min) into the duodenum did not induce secretion. The dynamics of the nitrogenous fractions of the gastric and duodenal chyme depended on the nature of the food stimulus and the mode of its administration.

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TABLE 1. Amino-Nitrogen Concentration (in mg %) in Gastric and Duodenal Chyme of Dogs after Meat Feeding and Direct Introduction of Meat into Stomach through Fistula

Mode of administration of meat	Gastric chyme				Duodenal chyme			
	Time of administration of meat (in h)							
	1	2	3	4	1	2	3	4
Direct into stomach	133	121	131	142	182	262	295	275
Feeding	59	80	93	104	115	167	197	172
P	<0,001	<0,001	<0,001	<0,001	<0,05	<0,001	<0,001	<0,05

TABLE 2. Total Nitrogen Concentration (in mg %) in Gastric and Duodenal Chyme of Dogs after Meat Feeding and Steady Infusion of 150 ml Aminokrovin into Duodenum

Mode of administration	Gastric chyme				Duodenal chyme			
	Time after administration (in h)							
	1	2	3	4	1	2	3	4
Feeding	210	332	315	280	257	540	541	509
Infusion of Aminokrovin	271	236	168	245	286	226	233	175
P	>0,05	>0,05	<0,001	>0,05	>0,05	<0,001	<0,001	<0,001

TABLE 3. Total Nitrogen and Amino-Nitrogen Concentrations (in mg %) in Duodenal Chyme of Dogs during Drip and Steady Infusion of Aminokrovin into Duodenum

Character of infusion	Total nitrogen				Amino-nitrogen			
	Time after infusion (in h)							
	1	2	3	4	1	2	3	4
Drip	382	350	338	210	352	310	260	165
Steady	286	225	233	175	229	121	122	63
P	<0,001	<0,001	<0,001	>0,05	<0,001	<0,001	<0,001	<0,001

The amino-nitrogen concentration in the gastric and duodenal chyme, for instance, was much higher (Table 1) when the meat was introduced directly into the stomach than when the dogs were fed with the same quantities of meat.

The mean total nitrogen level in the gastric chyme after meat feeding and after steady infusion of Aminokrovin into the duodenum was practically identical (Table 2). Pepsin activity in the gastric juice was the same after steady infusion of Aminokrovin into duodenum as with meat feeding (569 ± 45 and 439 ± 29 meq tyrosine/liter, respectively).

The total nitrogen concentration in the duodenal chyme during steady infusion of Aminokrovin into the duodenum during the first hour was as high as during meat feeding, but during the next 3 hours it fell significantly. Meanwhile, during meat feeding the total nitrogen concentration in the duodenal chyme increased starting from the second hour, when the arrival of chyme with a high protein concentration from the stomach took place.

The mean total nitrogen level in the gastric chyme during steady infusion of Aminokrovin into the duodenum during the first hour was higher than during drip infusion (271 ± 23 and 153 ± 11 mg%, respectively; $P < 0.05$). This could be connected with regurgitation of some of the Aminokrovin into the stomach and the appearance of secretion of gastric juice with considerable pepsin activity in response to the steady infusion (548 meq tyrosine/liter in response to steady and 233 meq tyrosine/liter in response to drip infusion of Aminokrovin; $P < 0.05$). Later, no differences were found in the total nitrogen and amino-nitrogen concentrations.

In the duodenal chyme, the total nitrogen and amino-nitrogen concentrations as a rule were higher during steady than during drip infusion (Table 3); this could be explained by the more prolonged intake of the protein digest in the first case.

In response to injection of Aminokrovin into the jejunum the amino-nitrogen level in the jejunum, the duodenum, and the stomach was independent of the rate of infusion of the digest. The amino-nitrogen concentration in the gastric contents under these circumstances was lower than in the duodenal and jejunal chyme (46 ± 12, 373 ± 24, and 331 ± 8 mg %, respectively). The high level of amino-nitrogen in the duodenum and jejunum could perhaps be connected with the presence of Aminokrovin in them, and also, evidently, with the secretion of pancreatic and intestinal juices. The low amino-nitrogen concentration in the stomach, however, under these conditions was due to the absence of gastric secretion and to duodenal-gastric regurgitation. The amino-nitrogen level in the gastric chyme was higher in response to infusion of Aminokrovin into the duodenum than into the jejunum (191 ± 25 and 46 ± 12 mg %, respectively; $P < 0.001$). This could be connected with the onset, in the first case, of secretion of protein-rich gastric juice and also with reflux of the duodenal contents during steady infusion of Aminokrovin.

In patients on jejunal feeding, with original zero acidity and very little gastric secretion, the amino-nitrogen concentration in the gastric contents was higher than in the presence of normal or increased acidity and secretion. This can be partly explained by regurgitation of the acid contents [5]. A similar relationship was also found in animals in the present experiments. During a high level of gastric secretion in response to meat feeding the amino-nitrogen concentration in the gastric chyme was lower than at a low level of secretion (direct introduction of meat into the stomach), possibly on account of dilution of the gastric contents by the gastric juice secreted. The reason for the higher amino-nitrogen concentration in the duodenal chyme in response to the direct introduction of meat into the stomach was evidently different, for the total nitrogen level was the same despite different methods of administration of meat.

With the low secretory response of the stomach to direct introduction of meat than to feeding, a more favorable environment was conjecturally created in the duodenum for protein hydrolysis. In fact, under these conditions the pH of the duodenal chyme was considerably higher than during meat feeding (7.22 ± 0.12 and 3.32 ± 0.41, respectively; $P < 0.001$). The dependence of the dynamics of nitrogenous fractions in the stomach and small intestine on secretion and on the rate and site of introduction of food stimuli revealed by these experiments must be taken into account in clinical gastro-enterology.

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