

Comparison of Canine Gastric Juice with 0.1 N HCl as Stimulus for External Pancreatic Secretion. (19243)

FRANK P. BROOKS* AND J. EARL THOMAS.

From the Department of Physiology, Jefferson Medical College, Philadelphia.

Unpublished experiments in this laboratory have suggested that commercial preparations of gastric mucus as well as commercial pepsin have a slight stimulating effect on the pancreas when placed in the intestine. The results were inconclusive but seemed worthy of further exploration. Experiments were, therefore, undertaken to determine whether gastric juice, as secreted, contains any pancreatic stimulus other than HCl.

Methods. Three mongrel dogs were used weighing 15 to 25 kg and equipped with gastric and duodenal cannulae as described by Thomas and Crider(1). The pancreatic duct was cannulated through the duodenal fistula as described by Hart and Thomas(2). The gastric juice was obtained from the same or other similarly equipped dogs after the subcutaneous injection of 1.0 mg of histamine base or the intravenous injection of 15 to 20 units of insulin. The juice was filtered through gauze and the free and total acidity determined by titration with 0.1 N sodium hydroxide using Toepfer's Reagent and Phenolphthalein as indicators. Values for free and total acidity were so nearly the same that it was apparent that it would make no significant difference which value was used in estimating the volume of gastric juice equivalent in acid

value to a given volume of HCl. Ten cc of 0.1 N HCl and equivalent amounts of gastric juice in terms of total acidity were compared as stimuli for the pancreas. In each experiment 4 injections of one of the test materials were made at 10-minute intervals, followed by 4 injections of the other. Reversal of the order made no difference in the results. Injections were made through a tube which was passed into the duodenal fistula until its tip lay approximately 6 inches distal to the fistula. The pancreatic juice obtained after the first stimulus with any test solution was discarded. The volume and specific gravity (determined gravimetrically) of each remaining sample of pancreatic juice were recorded.

Results. Table I shows the number of injections of each test solution made and the mean values for volume and specific gravity of the pancreatic juice secreted in response to the specified stimulus. Although the individual volumes varied widely, there is no significant difference in the mean volumes secreted in response to hydrochloric acid, gastric juice secreted in response to insulin and that in response to histamine. The values for specific gravity were less variable and in 2 of the 3

* Public Health Service Research Fellow, National Institutes of Health.

TABLE I. Mean Volume and Specific Gravity of Pancreatic Juice Secreted in Response to .1 N HCl and to Gastric Juice.

Dog	Stimulus	No. of samples	Vol, cc	Specific gravity
1	10 cc .1 N HCl	17	7.3 ± 2.3	1.011 ± .0008
	Histamine gastric juice†	20	8.2 ± 2.9	1.011 ± .0007
	Insulin gastric juice†	5	7 ± .9	1.011 ± .0004
2	10 cc .1 N HCl	23	7.2 ± 3.8	1.012 ± .0008
	Histamine gastric juice†	9	10.9 ± 4.8	1.012 ± .0008
	Insulin gastric juice†	15	7.5 ± 2.2	1.012 ± .001
3	10 cc .1 N HCl	13	3.4 ± 1.1	1.012 ± .003*
	Histamine gastric juice†	13	4.2 ± .8	1.011 ± .0008
	Insulin gastric juice†	17	4.1 ± .9	1.012 ± .003*

* A single determination of specific gravity in each group of 1.021 and 1.024 respectively accounts for the large stand. dev. On both occasions secretion of pancreatic juice eventually ceased and in one instance a mucous plug was actually demonstrated obstructing the cannula.

† Volume of gastric juice used ranged from 6.5 to 12.8 cc.

dogs the mean value is the same for all 3 stimuli. In the third the difference was not significant.

Comment. The specific gravity of pancreatic juice has been used in this laboratory as a measure of the nitrogen output(3) and, by inference, the protein output of the pancreas(4). The latter, in turn, may be taken as an index of the output of enzymes(5-7). Our results indicate that canine gastric juice secreted in response to either histamine or insulin contains no substance other than HCl which modifies either the volume or the nitrogen content of pancreatic juice. Probably the slight stimulating effect of some commercial preparations of substances normally found in gastric juice is due to contaminants.

Conclusion. Canine gastric juice contains

no stimulus for the pancreas other than HCl, which can be revealed by our method of study.

1. Thomas, J. E., and Crider, J. O., *Am. J. Physiol.*, 1940, v131, 349.
2. Hart, W. M. and Thomas, J. E., *Gastroenterology*, 1945, v4, 409.
3. Crider, J. O., and Thomas, J. E., *Am. J. Physiol.*, 1944, v141, 730.
4. Thomas, J. E., *The External Secretion of the Pancreas*, pp34, 149, C. C. Thomas, Springfield, Ill., 1950.
5. Babkin, B. P., and Tichomirov, N. P., *Hoppe Seyler's Z. f. physiol. Chem.*, 1909, v62, 468.
6. Friedman, M. H. F. and Thomas, J. E., *Fed. Proc.*, 1945, v4, 22.
7. Komarov, S. A., Siplet, H., and Shay, H., *Fed. Proc.*, 1950, v9, 72.

Received November 19, 1951. P.S.E.B.M., 1951, v78.

Hypoproteinemia as Protection in Mercuric Chloride Poisoning. (19244)

HOWARD F. MARTIN AND NEWTON H. REID. (Introduced by H. L. White.)

From the Department of Physiology, Washington University School of Medicine, St. Louis.

Certain experimental states apparently protect animals from HgCl_2 toxicity. A hemoglobinuric dog survived 4 mg HgCl_2/kg (1), albuminuric rats survived toxic doses of organic mercurials(2), and hypoproteinemic dogs survived 3 mg HgCl_2/kg (3). A possible mechanism for the latter action is indicated by the present experiments.

Experimental. Two normal dogs fed a 6% protein 10:3:3 crackermeal:sugar:lard diet supplying 75 Cal./kg/day were plasmapheresed daily by replacement of 25% estimated blood volume by an equal volume of a 50% dog erythrocyte suspension in 0.9% NaCl, until plasma protein totaled less than 4.4 g %. With 5 untreated normal dogs as controls, all dogs were given 3 mg HgCl_2/kg intravenously, except one hypoproteinemic dog who received 4 mg/kg. Daily urine Hg^{++} content(4) and clinical signs were noted. To urine samples having less than 0.001 mg Hg^{++}/ml , the lower limit of 3% accuracy for this method, .002 mg HgCl_2 was added per ml. Table I shows probable error limits of

each determination. Surviving (hypoproteinemic) dogs were then put on a stock diet of 1/4 pound raw horse meat daily plus Friskie dog chow *ad lib.*, and 3 additional doses of 3 mg/kg of HgCl_2 were given 1, 2, and 6½ months after the initial dose. Except for omission of urinalysis after the fourth dose, procedure was the same each time.

Results. The 4 control dogs whose plasma protein level exceeded 6.1 g % died 2½ to 4½ days after the HgCl_2 dose. The fifth control dog had 5.8 g % plasma protein and died in 16½ days. Each had anorexia, weakness, emesis, bloody diarrhea, ulcerative stomatitis, initial diuresis, albumin- and hemoglobinuria and, in the 12-hour period before death, hyperventilation with rates up to 240/min., weak and rapid pulse and tetany of facial, neck and shoulder muscles. Dehydration, fatty liver, noncrepitant lungs, hemorrhagic intestinal mucosa, and necrosis and edema of renal cortices were seen at autopsy. No control dog excreted as much as half the HgCl_2 .