

# EFFECT OF INTRAGASTRIC PRESSURE ON SECRETION OF THE GASTRIC GLANDS

G. F. Korot'ko and A. M. Musaev

UDC 612.323.014.41

Negative (−30 mm Hg) and positive (10–15 mm Hg) intragastric pressures were created experimentally in dogs, and secretion of the gastric glands was stimulated under these conditions by a conditioned reflex and with carbachol or histamine. Control experiments were carried out in which the intragastric pressure was atmospheric (free escape of secretion).

A decrease in intragastric pressure was found to increase the volume of gastric secretion and pepsinogen production, while a raised pressure reduced these indices and also reduced the secretion of chlorides. Raised and lowered pressures differ in their effects on secretion of the gastric glands stimulated by different methods.

\* \* \*

A relationship between the basal secretion of the gastric glands and the excretion of chlorides and pepsinogen in the gastric juice and urine, on the one hand, and the level of intragastric pressure on the other hand, was described by the writers previously [6].

This paper gives the results of an investigation of stimulated secretion of the gastric glands at an elevated (10–15 mm Hg) and lowered (−30 mm Hg) intragastric pressure.

## EXPERIMENTAL METHOD

Experiments (76) were carried out on dogs with gastric fistulas [2] and with Pavlov and Ugolev isolated gastric pouches [7]. The pressure within the stomach or isolated gastric pouch was measured by means of a special instrument [6] after observations of the basal secretion for 2 h in the main series of experiments. Control experiments were carried out with identical stimulation of secretion, but with secretion flowing freely, i.e., at atmospheric intragastric pressure. Gastric secretion was stimulated by one of

TABLE 1. Conditioned-Reflex Secretion of Gastric Glands with Atmospheric, Lowered, and Raised Intragastric Pressure (percent of basal secretion;  $M \pm t$ )

Index of secretion	Atmospheric pressure		Lowered pressure		Raised pressure	
	1st h	2nd h	1st h	2nd h	1st h	2nd h
Volume of secretion	366,5±47,5	165,2±17,4	488,2±31,9 <sup>1</sup>	210,7±42,2	235,8±28,0	73,9±8,8 <sup>1</sup>
Excretion of chlorides	399,9±65,0	176,5±33,4	481,1±44,3	203,4±48,2	186,8±2,9 <sup>1</sup>	72,2±4,0 <sup>1</sup>
Excretion of pepsinogen	484,1±103,2	267,1±23,9	649,7±32,6 <sup>1</sup>	229,6±42,9 <sup>1</sup>	191,9±19,3 <sup>1</sup>	62,9±9,8 <sup>1</sup>

<sup>1</sup>  $P < 0,05$ .

Department of Normal Physiology, M. I. Kalinin Andizhan Medical Institute. (Presented by Academician V. N. Chernigovskii.) Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 68, No. 10, pp. 22–24, October, 1969. Original article submitted December 17, 1968.

©1970 Consultants Bureau, a division of Plenum Publishing Corporation, 227 West 17th Street, New York, N. Y. 10011. All rights reserved. This article cannot be reproduced for any purpose whatsoever without permission of the publisher. A copy of this article is available from the publisher for \$15.00.

TABLE 2. Changes in Secretory Activity of Gastric Glands Stimulated by Carbachol (A) and Histamine (B), with Raised and Lowered Intra gastric Pressure (in percent of corresponding secretion at atmospheric intra gastric pressure;  $M \pm t$ )

Index of secretion	Series of expts.	Lowered pressure			Raised pressure		
		1st h	2nd h	3rd h	1st h	2nd h	3rd h
Volume of secretion	A	222.0 $\pm$ 4.9 <sup>1</sup>	186.0 $\pm$ 19.0 <sup>1</sup>	161.0 $\pm$ 22.7 <sup>1</sup>	48.0 $\pm$ 4.6 <sup>1</sup>	82.0 $\pm$ 27.1	58.0 $\pm$ 22.0
Excretion of chlorides	B	150.0 $\pm$ 14.0 <sup>1</sup>	300.0 $\pm$ 33.0 <sup>1</sup>	183.0 $\pm$ 20.6 <sup>1</sup>	71.1 $\pm$ 3.3 <sup>1</sup>	59.0 $\pm$ 18.2 <sup>1</sup>	67.4 $\pm$ 19.4
	A	245.0 $\pm$ 8.6 <sup>1</sup>	263.0 $\pm$ 18.6 <sup>1</sup>	246.0 $\pm$ 23.4 <sup>1</sup>	46.0 $\pm$ 2.6 <sup>1</sup>	109.0 $\pm$ 16.9	63.8 $\pm$ 12.0
Total acidity	B	174.0 $\pm$ 14.2 <sup>1</sup>	176.0 $\pm$ 20.1 <sup>1</sup>	90.0 $\pm$ 9.4	79.0 $\pm$ 5.9 <sup>1</sup>	132.0 $\pm$ 43.2	68.0 $\pm$ 4.1 <sup>1</sup>
	A	109.5 $\pm$ 2.4 <sup>1</sup>	109.2 $\pm$ 6.3	102.3 $\pm$ 6.6	93.3 $\pm$ 7.3	95.9 $\pm$ 2.5	99.9 $\pm$ 10.1
Free hydrochloric acid	B	105.5 $\pm$ 4.4	118.2 $\pm$ 10.7	—	95.6 $\pm$ 3.1	108.2 $\pm$ 10.4	—
	A	114.0 $\pm$ 4.5 <sup>1</sup>	111.0 $\pm$ 8.0	114.8 $\pm$ 11.2	93.6 $\pm$ 4.0	92.0 $\pm$ 8.6	98.5 $\pm$ 10.1
Secretion of HCL per hour	B	120.3 $\pm$ 17.2	160.0 $\pm$ 51.0	—	93.4 $\pm$ 4.4	111.3 $\pm$ 20.9	—
	A	245.0 $\pm$ 11.7 <sup>1</sup>	207.0 $\pm$ 16.2 <sup>1</sup>	150.0 $\pm$ 21.5 <sup>1</sup>	77.0 $\pm$ 5.3 <sup>1</sup>	82.0 $\pm$ 26.5	64.0 $\pm$ 21.0
Excretion of pepsinogen	B	213.0 $\pm$ 22.0 <sup>1</sup>	212.0 $\pm$ 29.7 <sup>1</sup>	—	69.0 $\pm$ 6.3 <sup>1</sup>	125.0 $\pm$ 42.0	—
	A	249.0 $\pm$ 24.2 <sup>1</sup>	190.0 $\pm$ 28.4 <sup>1</sup>	204.0 $\pm$ 38.0 <sup>1</sup>	44.0 $\pm$ 6.2 <sup>1</sup>	56.0 $\pm$ 17.6 <sup>1</sup>	68.0 $\pm$ 17.0
	B	183.0 $\pm$ 29.1 <sup>1</sup>	197.0 $\pm$ 20.5 <sup>1</sup>	109.0 $\pm$ 13.3	77.5 $\pm$ 10.7	59.0 $\pm$ 14.3 <sup>1</sup>	50.4 $\pm$ 6.1 <sup>1</sup>

<sup>1</sup>  $P < 0.05$ .

three methods in each series of experiments: by a natural conditioned reflex (showing the dog meat), with carbachol (0.25 mg, subcutaneously), or with histamine (0.5 mg, subcutaneously).

The acidity (titrometrically, followed by calculation of the quantity of HCL secreted per hour), content of chlorides (mercurimetrically [8]) and the content of pepsinogen (by an absorption-colorimetric method [5]), with calculation of the amounts secreted per hour, were determined in the secretion collected at hourly intervals.

## EXPERIMENTAL RESULTS

The experiments showed that when the intragastric pressure was lowered, conditioned-reflex stimulation of the gastric glands is more effective, while if the pressure is raised, the secretory effect is reduced (Table 1). This applies not only to the volume of secretion, but also to the enzyme-secreting activity of the gastric glands.

When the intragastric pressure was raised, secretion stimulated by carbachol was inhibited to a greater degree than that stimulated by histamine (Table 2), but the various indices of secretion were affected differently. For example, the volume of secretion and the secretion of chlorides and enzymes were more clearly reduced; acid secretion was inhibited practically equally whether secretion was stimulated by histamine or by carbachol.

A lowered intragastric pressure also had a more marked effect on carbachol-induced than on histamine-induced secretion. In the first hour the volume of carbachol-induced secretion showed a more marked increase, but during the next hour the volume of histamine-induced secretion increased by a much greater degree (3 times). As regards chloride and enzyme secretion, a lowered intragastric pressure had a more marked effect on secretion stimulated by carbachol than by histamine. Acid secretion under these circumstances was changed practically identically.

The enzyme-secreting activity of the gastric glands was stimulated rather more at a lowered intragastric pressure than it was inhibited by elevation of the intragastric pressure.

The results obtained indicate that the activity of the gastric glands is significantly modified by changes in intragastric pressure, which may occur on a wide scale under normal conditions and in dyskinesias of the stomach [1-3, 9, 11-14].

They also show that during continuous gastric suction, nowadays widely used in clinical diagnostic practice [4, 7, 10], when a lowered (negative) pressure is created in the stomach, the larger volume of secretion is obtained not only through prevention of evacuation of the gastric contents into the intestine, but also through increased secretory activity of the gastric glands under these conditions.

# LITERATURE CITED

1. E. I. Atakhanov, A. M. Kharatyan, and N. V. Sapunova, *Klin. Med.*, No. 4, 77 (1968).
2. E. B. Babskii, A. M. Sorin, A. S. Belousov, et al., *Dokl. Akad. Nauk SSSR*, 158, No. 4, 993 (1964).
3. E. B. Babskii, A. S. Belousov, and B. E. Votchal, *Klin. Med.*, No. 9, 35 (1965).
4. K. A. Garshin, *Vrach. Delo*, No. 8, 127 (1968).
5. G. F. Korot'ko, *Incretion and Excretion of Pepsinogen* [in Russian], Tashkent (1965).
6. G. F. Korot'ko, and A. M. Musaev, *Byull. Eksperim. Biol. i Med.*, No. 5, 17 (1967).
7. O. L. Kotovoi, *Lab. Delo*, No. 7, 401 (1967).
8. L. N. Lapin, and R. Kh. Zamanov, in: *Collected Scientific Transactions of Samarkand Medical Institute* [in Russian], Vol. 9, Tashkent (1956), p. 126.
9. E. M. Matrosova, *Motor Activity of the Stomach and Its Connection with the Secretion of Gastric Juice* [in Russian], Moscow-Leningrad (1964).
10. V. S. Novikov, I. A. Shlykov, and A. P. Okishev, *Lab. Delo*, No. 4, 225 (1966).
11. I. L. Shevchenko, *Vrach. Delo*, No. 8, 127 (1968).
12. I. T. Farrar and J. S. Bernshtein, *Gastroenterology*, 35, 603 (1958).
13. S. H. Lorber and H. Shay, *Gastroenterology*, 27, 478 (1954).
14. H. W. Smith and E. C. Texer, *Am. J. Dig. Dis.*, 2, 318 (1957).