

# EFFECT OF ANGULAR ACCELERATION ON THE SECRETORY AND MOTOR ACTIVITY OF THE HUMAN STOMACH

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The object of our research was to study the effect of angular acceleration on the secretory activity of the gastric glands of human subjects. We have been unable to find any published work on this subject.

## EXPERIMENTAL METHOD

Our experiments were performed on five subjects, aged from 20 to 28, including the author of this paper.

In all, we made 34 observations.

Angular acceleration was achieved by placing the subjects on a centrifuge of radius 3.6 m. The centrifugal force applied varied from 3 to 5 g, acting for 30 seconds in the direction head-seat. The secretory and motor functions of the stomach were observed by means of a double rubber probe, by the method of I.T. Kurtsin. One of the tubes served for collection of gastric juice, and the other for recording motor activity. Stimulation of secretion was achieved by introducing 250 cm<sup>3</sup> of air into the rubber bag. The air was released from the bag after an hour, and it was re-inflated after 15-20 minutes, and the secretory and motor activities of the stomach were followed for another hour. Having determined background conditions of gastric secretion and motility, we waited an hour and then gave the subjects a single spin on the centrifuge.

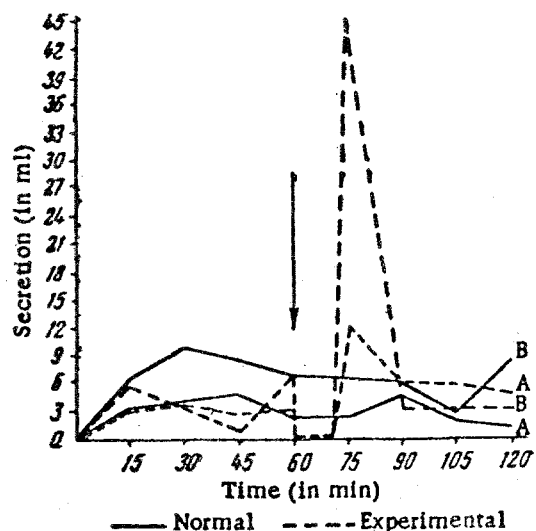


Fig. 1. Effect of a centrifugal force of 3 g, exerted for 30 seconds, on the secretory activity of the gastric glands of two subjects (A and B). Secretion was stimulated by inflating an indwelling rubber bag in the stomach (with 250 cm<sup>3</sup> of air). The continuous line applies to secretion under normal conditions, and the broken line to secretion during centrifugation.

With the object of investigating the neuro-chemical phase of gastric secretion, we performed a number of tests following an Ehrman test meal (300 ml of 5% alcohol). The stomach contents were collected after 25 minutes, and secretion was followed during the subsequent hour. Centrifuging was applied immediately after emptying the stomach. We determined the amount of gastric juice, its free and total acidity, and its peptic activity according to Gross.

## EXPERIMENTAL RESULTS

We found a considerable difference between the background values obtained after distending the stomach by inflation of a rubber bag, and those observed during the application of centrifugal force.

Figure 1 shows the dynamics of secretion of gastric

juice by two subjects, A and B, subjected to a centrifugal force of 3 g for 30 seconds.

As is evident from the figure, secretion was inhibited during centrifugation, down to total suppression over a period of ten minutes. This was followed by a sharp rise in secretion, to a level 3-5 times greater than the normal values.

Concordant results were obtained for all five subjects when we gave an alcohol test meal; a centrifugal force of 3 g caused inhibition of secretion, followed by an abrupt rise.

In most cases, augmented secretion was accompanied by qualitative changes in the composition of the juice: its free and total acidity and its peptic activity rose. When the angular velocity was raised to 4-5 g, absence of secretion was prolonged to 30 minutes, before giving way to the phase of enhanced secretion. We did not, under these conditions, observe any appreciable changes in the periodic contractions of the stomach (Figure 2). After subjection to a centrifugal force of 5 g (Figure 2: B) they differed little from those encountered initially (Figure 2: A).

Repeated exposure to centrifugation (up to eight times for a single subject, at 5-6 day intervals) led to only very slight smoothing out of the abrupt changes in secretion of gastric juice. Even after the eighth consecutive spin the amount of juice secreted was much higher than the background value. Further work is required before the question of adaptation of the secretory activities of the gastric glands can be elucidated.

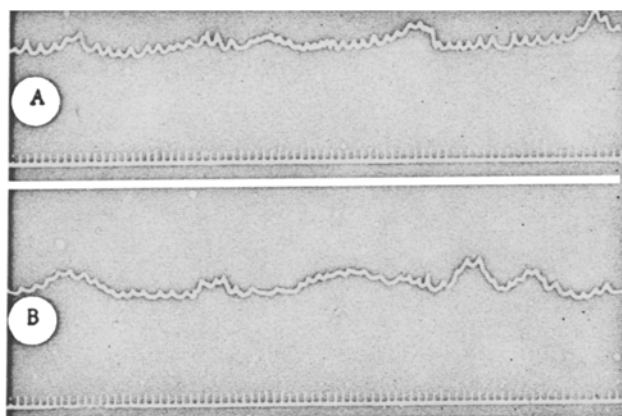


Fig. 2. Periodic contractions of the stomach of an individual (A) before, and (B) after subjection to a centrifugal force of 5 g for a period of 30 seconds. Time marker — three seconds.

It thus appears that centrifugal forces of the order of 3-5 g, acting in a cranio-caudal direction for 30 seconds, cause considerable alterations in the secretion of the gastric glands. Total suppression of gastric secretion takes place during centrifugation, and persists thereafter for 10-30 minutes, being then followed by a phase of sharp increase (up to 3 times the normal background value) in the volume of juice secreted.

#### SUMMARY

During the action of radial accelerations and 10-30 minutes after their discontinuation there was complete absence of gastric secretion which was followed by a period of increased secretion (about three times more than in normal conditions). Upon repeated stimulation, only insignificant normalization of these changes took place. The periodic contractions of the stomach remained unchanged.

#### LITERATURE CITED

[1] I.T. Kurtsin, A New Method for the Functional Diagnosis of Gastric Diseases of the Human [in Russian] (Moscow, 1953).