

INTESTINAL SECRETION AND ENZYMIC ACTIVITY OF INTESTINAL JUICE AND BLOOD OF DOGS AFTER RESECTION OF THE SMALL INTESTINE

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Extensive resection (50-75%) of the proximal portion of the small intestine is accompanied by an increase in amylolytic, lipase, and tributryase activity in the solid part and per unit volume in the liquid part of the intestinal juice. Secretion of amylase and tributryase into the intestinal juice in unit time is also increased.

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Complex changes in the body resulting from resection of the small intestine have been insufficiently studied. Most of the few investigations of this problem have been undertaken by Russian workers [2, 5, 7, 9]. Data relating to the effect of extensive resection of the small intestine on enzyme-secretory function of the residual part of the small intestine are of particular interest [1, 6, 11]. Only few combined investigations of enzymes in the intestinal juice and blood have been made after resection of the small intestine. We have previously reported on the amylolytic activity of the blood, intestinal juice, and urine after resection of the small intestine in dogs [3, 4].

In this paper we give the results of an investigation of amylase, lipase, and tributryase in the blood and intestinal juice of 6 dogs after resection of 50-75% of the small intestine in its proximal portion.

EXPERIMENTAL METHOD

Intestinal juice was obtained in response to mechanical stimulation of an isolated loop of intestine by means of a rubber tube. A Thiry-Vella intestinal fistula was formed at the junction between the duodenum and jejunum. The enzyme activity of 1 ml intestinal juice, i.e., the enzyme concentration, and the total activity of the juice collected in 1.5 h (total enzyme activity) were determined. Activity of all enzymes was determined separately in the solid and liquid parts of the intestinal juice. Amylase in the intestinal juice was determined by Wohlgemuth's method with 0.1% starch solution, the blood amylase by modification of the Engel'gardt-Gerchuk and Somogyi methods, and the lipase and tributryase activity of the intestinal juice and blood were determined by a titrometric method [8].

The dogs survived for between 1.5 and 14 months after resection of the small intestine.

EXPERIMENTAL RESULTS

Secretion of the liquid part of the intestinal juice varied in individual dogs from 18.4 ± 0.2 ml to 28.2 ± 7.8 ml, and secretion of the solid part from 0.7 ± 0.2 ml to 0.8 ± 0.3 ml. After extensive intestinal resection the secretion of intestinal juice diminished, on account of a decrease in secretion of its liquid part (in some experiments by 3.7 times). No definite changes were observed in the volume of the solid part of the intestinal juice.

The amylolytic activity of the intestinal juice of the dogs varied from 8 to 32 units/ml, and the total amylolytic activity was 150-370 units. After resection of half of the intestine, the amylase concentration in the intestinal juice was increased by 1.7 times for 8 months, and after resection of three-quarters of the intestine, it was increased by 2.6 times for the first 1.5 months and by 1.4 times during the following months. The amylase content was increased both per unit volume of liquid part of the juice and in the solid part. The

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total amylolytic activity of the intestinal juice was increased in one dog by 2.8 times for 7 months, and in another by 2.1 times for one month. In the other dogs, in which the secretion of intestinal juice was considerably inhibited, its total amylolytic activity was increased only for a short time, or was decreased.

The total content of tributyrase in the healthy dogs reached 47.2 units. After extensive resection of the small intestine the total tributyrase activity of the intestinal juice rose on the average by 23%, on account of an increase in the enzyme content in the solid residue of the juice by 63%. The total content of this enzyme in the greatly reduced volume of the liquid part of the juice fell by 27%, although the concentration of tributyrase in the liquid part of the juice increased by 93%.

Most lipase of the intestinal juice is secreted as a constituent of the liquid part, which contains on the average 5 times more than the solid part. The total content of lipase secreted with the intestinal juice does not exceed 12.6 units. After intestinal resection the lipase concentration in the liquid part of the juice increased by 37% and in the solid part by 55%. However, because of a marked decrease in the volume of juice the total lipase content in it remained unchanged.

The amylolytic activity of the blood of healthy dogs is 11.9 ± 2.2 units. After resection of 55-75% of the small intestine a temporary increase of the blood amylase concentration by 1.2-2 times was observed, but after resection of 50-60% of the small intestine no changes were found in the blood amylase level determined by the Engel'gardt-Gerchuk method, while its determination by Somogyi's method showed a temporary increase in blood amylase even after resection of 60% of the small intestine.

Lipase activity in the blood of healthy dogs varied from 21 ± 2.9 to 66 ± 5.6 units/ml and tributyrase activity from 123 ± 22.5 to 254 ± 5.6 units/ml. Resection of the small intestine had no significant effect on blood lipase and tributyrase activity.

Extensive resection of the small intestine is thus accompanied by an increase in amylolytic, lipase, and tributyrase activity in the solid part, and per unit volume in the liquid part of the intestinal juice. The total quantity of amylase and tributyrase secreted into the intestinal juice in unit time is also increased. Our results are in agreement with those of the morphological investigations of Knudtson and co-workers [10]. The increase in intensity of enzyme secretion in the small intestine may be regarded as a manifestation of compensatory changes in the body deprived of a large part of the intestine. Under these conditions the universal increase in the level of secretion of the liquid part of the intestinal juice may help to promote the liberation of enzymes into the small intestine and to restore normal intestinal digestion.

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