ENZYME-SECRETING FUNCTION OF THE INTESTINE IN DOGS,
AS INFLUENCED BY ADRENALECTOMY AND INJECTION OF SOME
STEROID HORMONES

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Translated from Byulleten' Èksperimental'noi Biologii i Meditsiny, Vol. , No.
, pp. 53-58,
Original article submitted July 23, 1960

For a long time there has been evidence to support a close connection between the condition of the adrenal
cortex and the activity of the digestive tract. For instance, the well-known impairment of digestive activity
during Addison's disease provides such evidence.

It is widely held that hormones of the adrenal cortex play an important role in the development of general
adaptive reactions of the organism to strong nonspecific stimulants. In particular, these hormones can protect
the digestive system from the damaging effects of such stimulants. It is also known that hormones of the adrenal
cortex can influence a number of important metabolic processes in tissues. In this connection, their influence on
the enzyme-secreting function of the intestinal mucosa is of special interest. The mucosa rapidly synthesizes
various substances, including highly specific enzymes, and is distinguished under normal conditions by a high rate
of regeneration of the epithelium, which is sloughed off into the intestinal lumen during the process of secretion
[2, 5, 6].

We attempted to study the enzyme-secreting function of the intestine in dogs, as influenced by adrenalecto-
my and by making up hormonal deficiencies with parenteral injection of cortisone and deoxycorticosterone (i.e.,
representatives of the glucocorticoids and mineralocorticoids); and to clarify whether there are any differences
in the effects of these two hormones on the intestine under set conditions.

EXPERIMENTAL METHODS

The experiments were carried out on three dogs, in which two isolated loops were formed, one from the
duodenum and the other from the lower part of the large intestine (by Thiry's method). After the original level
of secretion had been re-established, first one adrenal was removed, and secretion was observed; then, approxi-
mately thirty days after the operation, the second adrenal was removed. Afterwards the dogs were given daily
intramuscular injections of steroid hormones to maintain vitally important functions: first cortisone and deoxy-
corticosterone, then cortisone alone, both hormones again, and finally deoxycorticosterone alone. Each period
consisted of 15-20 days.

We selected the doses of these hormones in preliminary experiments. By trying out increasing quantities
of hormones, we settled on those quantities which produced a good general state of the animals, good utilization
of food, normal motorility, and absence of visible impairment of digestive activity; in other words, we settled on
those quantities of hormones which prevented appearance of clinically expressed symptoms of adrenal insufficiency.
In a period when only one hormone was being injected, the dose of cortisone per kg body weight was 0.41 mg, and the dose of deoxycorticosterone acetate was 0.068 mg. In a period when both hormones were being injected, the dose of cortisone was 0.26 mg, and the dose of deoxycorticosterone was 0.03 mg, per kg.

In external appearance and behavior these dogs did not differ from dogs on which no operations had been performed. Throughout the whole experiment the animals received the usual full amount of food ration. When cortisone alone was being injected, they received in addition 5 g of sodium chloride.

Intestinal secretion in the dogs was studied regularly three times a week. Intestinal juice was collected over the course of five hours during intermittent secretion. The amounts of the fluid and dense fractions were determined quantitatively; then the secretion was homogenized, and the homogenate was analyzed for amounts of the enzymes, enterokinase by the method of G. K. Shlygin [4], alkaline phosphatase by splitting of sodium phenolphthalein phosphate [3], saccharase by splitting of cane-sugar (using a polarimetric method), and peptidase by splitting of peptone, followed by titration of carboxyl groups with 0.2 N potassium hydroxide in a 90% alcohol solution (for further details see [1]).

**EXPERIMENTAL RESULTS**

After removal of one adrenal (without supplementary injection of hormones) the quantity of secretion (in particular, its dense fraction) obtained from isolated loops of the intestine in dogs underwent no significant change.

However, the quantity of some enzymes (computed per unit weight of the secretion) fell noticeably. This was particularly true of enterokinase and saccharase, whose concentrations decreased in some dogs by 40-50%. On the other hand, the content of peptidase (total determination) showed a tendency to increase in some dogs (Figs. 1 and 2).

After removal of the second adrenal, followed by regular injection of cortisone and deoxycorticosterone, changes were observed both in enzyme secretion and in the quantity of intestinal juice (see Fig. 1). The total

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**Fig. 1.** Quantity of secretion obtained from isolated intestinal loops in one hour. a) Total quantity; b) dense fraction. Arrow 1) Removal of one adrenal, arrow 2) removal of both adrenals. 1) Before adrenalectomy; 2) after removal of one adrenal; 3) after removal of both adrenals and with injection of cortisone and deoxycorticosterone; 4) injection of cortisone; 5) injection of deoxycorticosterone; 6) without hormones.