

EFFECT OF HIGH TEMPERATURE ON ENZYME ACTIVITY OF THE SMALL INTESTINE IN THYROIDECTOMIZED RATS

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Changes in the activity of certain intestinal enzymes (invertase, monoglyceride lipase, dipeptidase, and alkaline phosphatase) were compared in thyroidectomized rats and rats undergoing a mock operation, when both were kept at a high ambient temperature for 2 h (40°C; relative humidity 30-40%). Exposure to heat led to changes in the spectrum of enzyme activity of the mucous membrane of the small intestine in both groups of rats. However, the severity and direction of the changes depended on the presence of the thyroid gland.

KEY WORDS: Hyperthermia; enzymes of small intestine of mucous membrane; thyroidectomy.

Previous investigations showed that a short exposure to a high ambient temperature leads to marked changes in the spectrum of enzyme activity in the mucous membrane of the small intestine [1, 2, 6]. The response of different organs and systems to exposure to heat is known to be largely determined by functional state of the thyroid gland.

TABLE 1. Effect of Thyroidectomy on Enzyme Activity (in μ moles/g/min) in Mucous Membrane of Small Intestine after Exposure to a High Ambient Temperature ($M \pm m$)

Enzyme	Group of rats	Not exposed to high ambient temp. (n = 7)	After exposure to high temperature		
			4 h (n = 7)	24 h (n = 7)	48 h (n = 7)
Invertase	Mock operation	13,8 \pm 0,7	11,0 \pm 0,7	11,4 \pm 0,5	11,3 \pm 0,4
	Thyroidectomy	7,8 \pm 0,2	9,3 \pm 0,4	7,4 \pm 0,5	10,4 \pm 0,7
Monoglyceride-lipase	Mock operation	4,5 \pm 0,2	5,7 \pm 0,1	4,1 \pm 0,2	2,8 \pm 0,1
	Thyroidectomy	3,4 \pm 0,3	4,1 \pm 0,3	4,1 \pm 0,3	3,7 \pm 0,2
Dipeptidase	Mock operation	7,0 \pm 0,3	13,4 \pm 0,8	12,6 \pm 0,8	8,8 \pm 0,4
	Thyroidectomy	12,8 \pm 0,5	7,7 \pm 0,4	9,8 \pm 0,5	10,0 \pm 0,3
Alkaline phosphatase	Mock operation	3,7 \pm 0,3	2,6 \pm 0,2	3,0 \pm 0,1	4,0 \pm 0,1
	Thyroidectomy	4,7 \pm 0,2	3,1 \pm 0,2	2,4 \pm 0,3	2,6 \pm 0,05
	P		<0,02	<0,01	<0,02

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In the investigation described below the character of the change in activity of several intestinal enzymes was compared in animals undergoing thyroidectomy and a mock operation and exposed to a high ambient temperature.

EXPERIMENTAL METHOD

Altogether 56 male albino rats weighing 120-140 g were used. Total thyroidectomy was performed on 28 rats under ether anesthesia. The remaining animals underwent a mock operation. One week after the operation 21 rats of each group were exposed for 2 h to a high ambient temperature (40°C; relative humidity 30-40%). The remaining rats were used as the control. The completeness of thyroidectomy was verified at autopsy. The animals of both groups were kept on a mixed diet and were given unrestricted access to food and water. The animals were killed 4, 24, and 48 h after exposure to heat. Invertase [3], monoglyceride-lipase [5], dipeptidase [4], and alkaline phosphatase [7] activity was determined in homogenates of the mucous membrane of the small intestine made up in Ringer's solution (pH 7.4) in the proportion of 1 ml to 100 mg weight of tissue. Activity of the enzymes was expressed in micromoles of hydrolysis product of the substrate formed per minute per gram weight of mucous membrane.

EXPERIMENTAL RESULTS

In the thyroidectomized rats kept at an ordinary temperature, the invertase and monoglyceride-lipase activity was lower, but the dipeptidase and alkaline phosphatase activity higher than in animals undergoing the mock operation (Table 1).

After exposure of the animals to a high temperature the activity of individual enzymes in the intestinal mucous membrane changed appreciably both in animals undergoing the mock operation and in the thyroidectomized rats. However, the changes observed in the two groups of animals were different. In the animals undergoing the mock operation, for instance, the invertase activity was sharply reduced and it remained low throughout the experiment. Meanwhile, in the thyroidectomized rats, exposure to heat led to an increase in the activity of this enzyme 4 and 48 h after exposure. The monoglyceride-lipase activity of animals undergoing the mock operation was sharply reduced 48 h after exposure to heat, whereas in the thyroidectomized rats it was unchanged throughout the experiment. Exposure of the animals undergoing the mock operation to heat caused a sharp increase in the dipeptidase activity of the mucous membrane, whereas in the thyroidectomized rats this activity fell considerably. The alkaline phosphatase activity in the rats undergoing the mock operation fell during the first hour after exposure to heat but was restored to normal after 48 h. In the thyroidectomized animals, on the other hand, it remained low throughout the experiment.

During exposure of animals to a high ambient temperature substantial changes thus took place in the enzyme activity of the mucous membrane of the small intestine in both groups of rats. However, the degree and direction of the changes observed depended on the presence or absence of the thyroid gland.

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