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0014-4754/84/111285-03$1.50 + 0.20/0

Dietary induced increase of lactase activity in adult rats is independent of adrenals[1]

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Summary. Adult rats fed 10 days a low starch-high fat diet were either adrenalectomized or sham-operated and force-fed the same diet another 5 days; 14 h before sacrifice, some animals were force-fed a sucrose diet. Activity of lactase, sucrase and maltase was increased in adrenalectomized and sham-operated rats.
Keywords. Adrenalectomy; lactase; sucrase; diet; rats.

Lactase activity in adult rat jejunoileum depends on the intake of various carbohydrates including starch and sucrose[2–4]. Recently it has been shown that lactase activity is also influenced by thyroid hormones in adult rats[5–7]. However, possible effects of glucocorticoid hormones on lactase activity have not been investigated. The question arose whether the capability of lactase activity to react to dietary changes is influenced by the adrenal glands. This was explored in the present paper in adrenalectomized rats.

Materials and methods. Female rats of the Sprague-Dawley strain, bred in our own animal colony were weaned at 30 days of age and fed a standard laboratory chow (Lab Blox, Allied Mills, Chicago, IL) until 50 days of age. At that time they were fed a synthetic low starch (5 cal %), high fat (73 cal %) diet[4] for 14 days. After the rats were fed this diet for 10 days, they were either adrenalectomized or sham operated. After the operation, all animals had free access to 0.9% sodium chloride; and to ensure a regular food intake, they were force-fed the low starch diet (diluted to make 3 kcal/ml with water). Force feeding was performed 4 times a day, at 20.00, 1.00, 7.00 and 14.00 h. The amount of the diet was 6 ml, 6 ml, 3 ml and 3 ml, respectively, considering the circadian rhythmicity of the rats' food consumption and providing the daily caloric intake of 26 kcal per 100 g b.wt which corresponds to the ad libitum food intake of rats of this age[8].

Four days after the initiation of force feeding, rats were force-fed either an isocaloric sucrose diet (40 cal % of sucrose, 37 % of fat and 22 % of protein) or the low starch diet at 20.00 (6 ml), 1.00 (6 ml) and 6.00 (3 ml) h. To these diets, identical amounts of mineral and vitamin mixtures were added as pre-

Effect of feeding of sucrose diet on jejunal disaccharidases in sham-operated and adrenalectomized rats

	Low starch sham	Low starch adx	Sucrose sham	Sucrose adx
Number of animals	4	5	4	5
Body weight (g)				
on day −4*	200 ± 22	203 ± 14	203 ± 8	202 ± 3
on day 0	206 ± 19	222 ± 12	208 ± 9	220 ± 3
at sacrifice	208 ± 19	226 ± 11	212 ± 8	228 ± 3
Δ Body weight (g) (during the 5 days)	8.3 ± 2.9[a]	22.8 ± 3.3[b]	9.0 ± 0.7[a]	26.2 ± 1.4[b]
Serum corticosterone (μg/100 ml)	44.4 ± 13.6[a]	1.2 ± 0.3[b]	56.5 ± 3.5[a]	1.1 ± 0.3[b]
Jejunal protein (mg)	177 ± 6	175 ± 14	175 ± 14	170 ± 3
Lactase (μmol/mg prot/h)	0.30 ± 0.05[a]	0.22 ± 0.03[a]	0.63 ± 0.06[b]	0.58 ± 0.06[b]
Lactase (μmol/segment/h)	52 ± 9[a]	39 ± 6[a]	110 ± 12[b]	97 ± 9[b]
Sucrase (μmol/mg prot/h)	0.79 ± 0.10[a]	0.74 ± 0.08[a]	1.79 ± 0.17[b]	2.31 ± 0.13[c]
Maltase (μmol/mg prot/h)	5.77 ± 0.51[a]	4.31 ± 0.39[a]	9.32 ± 0.82[b]	9.85 ± 0.33[b]

* Adrenalectomy was performed on day −4; the feeding of sucrose diets was started on day 0 at 20.00. Rats were sacrificed 14 h later, i.e. 10.00.
[a–c] The values not sharing a common superscript are significantly different from each other by anova ($p < 0.05$).

viously described[4]. Rats were killed by decapitation at 10.00 h, i.e. 14 h after the initiation of the sucrose diet. Serum was obtained for determination of corticosterone by radioimmunoassay (Radioassay Systems Laboratories, Inc., Carson, CA).

The entire small intestine was removed. The duodenum was discarded and the jejunoileum was divided into 3 equal parts along its length. The proximal third of jejunoileum (jejunum) was flushed with ice cold saline and mucosa was scraped, using a microscope slide. Jejunal mucosa was homogenized with 4 volumes of 10 mM potassium phosphate buffer (pH 7.0). Sucrase and maltase activity was assayed according to Dahlqvist[9] and lactase activity according to Koldovský et al.[10]. Protein was determined by the method of Lowry et al.[11].

Results and discussion. All results are summarized in the table. Since starvation can influence the specific activity of lactase[12-14], we considered it important to control the food intake in sham-operated and adrenalectomized rats by force feeding. During the 5-day-period of force feeding, all animals gained body weight. It is noteworthy that in adrenalectomized rats, the body weight gain was significantly higher than in sham-operated rats. The protein content per intestinal segment was practically the same in all 4 groups.

Feeding of the sucrose diet for 14 h led to a marked increase of lactase, sucrase and maltase activity (specific, i.e. per protein and total, i.e. per segment). This result confirms our previous report[15] obtained on animals fed ad libitum.

The same experiment was performed on adrenalectomized rats. The success of adrenalectomy was confirmed by inspection and determinations of serum corticosterone levels. The serum levels of corticosterone of adrenalectomized rats correspond to those reported earlier[16,17]. Since no special precautions were taken to prevent a stress situation during the sacrificing of the animals (by decapitation), the values found in intact animals are approximately 2 times higher than those reported by others[16,17].

Force feeding of the sucrose diet to adrenalectomized rats led to an increase of lactase, sucrase and maltase activities to the levels that were observed in the sham-operated sucrose-fed animals. Therefore, we conclude that activity of the 3 disaccharidases is elevated by an increased intake of dietary carbohydrate without the involvement of adrenals.

Whereas the response of lactase activity to dietary changes has not been reported previously, our results concerning sucrase and maltase activities confirm and solidify the conclusions from published studies of Deren et al.[18]. They showed the increase of the activity of these 2 α-disaccharidases in adrenalectomized rats refed ad libitum sucrose diets after 3 days of starvation. However, Deren et al.[18] did not verify the success of adrenalectomy and did not measure the food intake.

From a developmental point of view, it is of note that whereas precocious increase of sucrase activity in suckling rats induced by dietary sugars is essentially dependent on adrenals[19,20], in adult rats dietary induced increase of sucrase activity is independent of adrenals.

1 Supported by the National Institutes of Health, Department of Health and Human Services, Bethesda, Maryland, USA (AM 27624).

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0014-4754/84/111287-02$1.50 + 0.20/0

Serotonin and 5-hydroxyindoleacetic acid concentrations in individual hypothalamic nuclei and other brain areas of rat

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Summary. Serotonin and 5-hydroxyindoleacetic acid (5-HIAA) were measured in individual nuclei of rat hypothalamus and other brain areas using HPLC with electrochemical detection. 5-HIAA levels were first demonstrated in hypothalamic and some discrete brain areas. The 5-HIAA/5-HT ratio was highest in the n. caudatus putamen, high in the n. ventromedialis and lowest in the n. suprachiasmaticus.

Key words. Rat, brain; brain, rat; hypothalamus, rat; serotonin; 5-hydroxyindoleacetic acid.

The major metabolite of serotonin, 5-hydroxyindoleacetic acid (5-HIAA), provides very good information as to serotonin neuron activities[1]. For determination of serotonin and 5-HIAA in localized regions of rat brain, a method with extremely high sensitivity is required. Radioenzymatic assay is most sensitive for measurement of serotonin[2], but does not allow deter-