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Concentration of Corticosterone in Adrenal Glands of Thyroidectomized Rats During Development

In addition to changes in the adrenal secretory activity throughout the day, changes have also been described during development (8). On the other hand, the results of studies on the relationship between the thyroid an dthe adrenal glands, previously discussed (3, 4), are very controversial, for while some authors state that in the majority of experimental animals and man, adrenal gland activity is dependent on thyroid hormones, increasing with high doses and decreasing with low ones (6), other authors do not find this relationship, and say that thyroxine does not increase the steroid production *in vitro,* but inhibits the ACTH-induced steroidogenesis (1), to produce a decrease in the 11-β hydroxilase and transhydrogenase adrenal activity (5).

In view of this controversy, this study was designed to examine the influence of thyroid hormones on corticosterone secretion in rats, the main circulating corticosteroid, and the alteration produced in the corticosterone pattern during development.

Male rats, selected after birth, were kept under the same dietary and environmental conditions. A group of rats were surgically thyroidectomized at the end of their fourth week of life. The parathyroids were reimplanted. To ensure complete thyroid tissue ablation, each animal received 250 μCi of ^{131}I 48 hours after thyroidectomy.

Groups of rats, thyroidectomized and euthyroid, were sacrificed at two week intervals representing, successively, the 4th, 6th, 8th and 10th weeks of development. For each animal, sacrifice and adrenal resection was at 12 a.m., following anaesthesia with sodium pentobarbitone (Nembutal, Abbot Lab.). The adrenal glands were rapidly removed, dissected free from fat, and transferred to a flask with saline solution at 0 °C.

After fatty tissue removal, three glands were homogenized together in a Potter-Elvehjein homogenizer with a teflon pestle, using 3 ml saline solution at 0 °C. The homogenate was centrifuged at 2500 *g* for 15 min and the precipitate was discarded.

Corticosterone was determined by a modification of the GRAEF and STAUDINGER method (2): the amount contained in 1 ml of adrenal homogenate was extracted following its agitation with 6 ml of dichloromethane for 2 min; the aqueous phase was discarded and the organic solution was washed successively with 1 ml of 1 M sodium hydroxide, 1 ml of 0.1 M acetic acid and finally, 2.5 ml of distilled water. The dichloromethane solution was then dried with sodium sulphate and, after centrifuging for 10 min at 2000 *g*,

Table I. *Adrenal and body weights with their weight ratios and adrenal corticosterone of control and thyroidectomized rats during development.*
Mean values ± SEM are given. Unpaired t-test was used. Number of animals, in parentheses.

Week	Group	Adrenal wt. (mg)	Body wt. (g)	wt. (× 100) Adrenal/Body	(μg/100 mg wet. tissue) Corticosterone
4th (9)	C	9.1 ± 0.5	37.0 ± 1.1	20.4 ± 1.6	0.74 ± 0.13
6th (8)	C	13.9 ± 0.6	127.5 ± 7.9	10.6 ± 0.6	1.54 ± 0.49
	Tx	8.9 ± 0.5*	95.3 ± 7.2*	9.6 ± 0.9	0.17 ± 0.05*
8th (8)	C	15.4 ± 0.5	189.4 ± 10.4	7.8 ± 0.4	0.25 ± 0.03*
	Tx	10.1 ± 0.7*	124.0 ± 6.3*	7.7 ± 0.4	0.14 ± 0.04*
10th (8)	C	18.8 ± 1.3	245.0 ± 10.6	7.2 ± 0.3	0.59 ± 0.17
	Tx	11.5 ± 0.6*	151.5 ± 6.2*	7.6 ± 0.4	0.17 ± 0.03*

* Differences during development and * differences between both groups ($p < 0.05$).

5 ml were then transferred to a glass test tube and mixed with 2 ml of fluorescent reagent (concentrated sulphuric acid and ethanol, 3:1 v/v), for 1 min. The fluorescence intensity in each sample was determined using an excitation wave length of 475 nm and an emission wave length of 525 nm. The corticosterone standard was treated following the same procedure.

The effects of the circadian rhythm changes and the environmental conditions were eliminated by keeping the animals in identical conditions and by carrying out the extractions from the glands at the same time of day.

Table I shows the marked fall in body and adrenal weights in the thyroidectomized animals in contrast with the increase of these parameters during the development of the euthyroid animals. However, no significant difference was noted in the adrenal weight/body weight ratios of both experimental groups.

The concentration of adrenal corticosterone in euthyroid and thyroidectomized animals during development is also shown in table I. In euthyroid animals, the adrenal corticosterone content was found to be significantly lower at the eighth week of life. This fall coincides with the onset of puberty in the male rat (8), a period associated with important enzymic and hormonal changes. Although there were no significant differences in the adrenal corticosterone contents of the thyroidectomized rats, their evolutary profile was found to be altered, in comparison with euthyroid animals. After thyroidectomy the concentration of adrenal corticosterone falls significantly, in contrast to the increase observed in previous studies of serum aldosterone concentration (4). This could be due to the fact that in aldosterone secretion ACTH plays a subordinate role to other factors, such as the renin-angiotensin system (RAS) or to serum potassium concentration, whereas in corticosterone secretion ACTH is the dominant factor. Consequently the contributary influence that the thyroid hormones have on the ACTH (7) and in turn on the secretion of corticosterone should be considered.

These results confirm both the relationship between adrenal hypofunction and hypoactivity of the thyroid, as far as fascicular steroids are concerned; and in addition, the thyroid hormones influence on corticosterone patterns during development.

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Key words: D-Galactose transport, Phloretin, Theophylline.

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