

INHIBITION OF COMPENSATORY HYPERTROPHY OF THE THYROID GLAND

BY THYROXINE IN RATS OF DIFFERENT AGES

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It was shown in male rats aged 2-2.5, 8-10, and 14-16 months that the inhibitory effect of the same dose (expressed per unit of body weight) of thyroxine on compensatory hypertrophy of the thyroid gland increases with age. It is postulated that the threshold of sensitivity of the hypothalamic-pituitary-thyroid system to homeostatic inhibition decreases with age.

KEY WORDS: *hypothalamic-pituitary-thyroid system; compensatory hypertrophy of the thyroid gland; thyroxine; age dynamics*

It was shown previously that with increasing age in rats the same dose (calculated per unit body weight) of glucocorticoid or estrogen has a steadily diminishing inhibitory action on the corresponding hypothalamic centers [2, 10]. In other words, the view that the threshold of the hypothalamus to inhibition rises with age was confirmed [7, 8].

The object of this investigation was to carry out a similar study on the hypothalamic-pituitary-thyroid system. Enlargement of the lobe of the thyroid gland remaining after unilateral hemithyroidectomy and inhibition of this process by thyroxine (T_4) are known to take place with the participation of the corresponding hypothalamic mechanisms [1, 11, 14].

EXPERIMENTAL METHOD

The right lobe of the thyroid gland was removed under superficial ether anesthesia from male rats aged 2-2.5, 8-10, and 14-16 months and weighed on torsion scales. Thyroxine (T_4 , Reanal, Hungary) was injected intraperitoneally 1-1.5 h after the operation and during the next 3 days. Control animals received physiological saline after the operation. On the 5th day the rats were killed with ether and the residual lobe of the thyroid gland was removed and weighed. The results were assessed from the change in weight of this lobe relative to the weight of the lobe removed at the operation.

EXPERIMENTAL RESULTS AND DISCUSSION

With aging in the rats an increase in the degree of compensatory hypertrophy of the thyroid gland and a tendency toward more marked inhibition of this process by T_4 when given in a dose of 2 μ g/100 g body weight daily was observed (Table 1).

The scatter of the data is evidently attributable to seasonal changes in thyroid gland activity [9]. For instance, the degree of compensatory hypertrophy of the thy-

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TABLE 1. Compensatory Hypertrophy of Thyroid Gland (TG) and Its Inhibition by Thyroxine in Rats of Different Ages (M \pm m)

Age of rats (in months)	Control (physiological saline)			Thyroxine (2 μ g/100 g/day)		
	weight of TG lobe (in mg)	body weight (in g)	change in weight of TG lobe (in %)	weight of TG lobe (in mg)	body weight (in g)	change in weight of TG lobe (in %)
2—2.5	5,2 \pm 0,4	107 \pm 2,5	\pm 20,6 \pm 7	4,7 \pm 0,3	105 \pm 4	\pm 9,3 \pm 7
	6,3 \pm 0,5	119 \pm 3	\pm 12,3 \pm 8	5,1 \pm 0,4	108 \pm 5	\pm 7,0 \pm 7
8—10	8,1 \pm 0,5	222 \pm 8	\pm 33,2 \pm 5	9,3 \pm 0,6	222 \pm 10	\pm 17,5 \pm 8
	10,5 \pm 0,6	230 \pm 7	\pm 28,4 \pm 5	7,4 \pm 0,3	233 \pm 10	\pm 21,8 \pm 8
14—16	9,8 \pm 0,5	290 \pm 12	\pm 40,4 \pm 8	11,0 \pm 0,7	286 \pm 14	\pm 25,5 \pm 5
	13,5 \pm 0,9	300 \pm 16	\pm 36,7 \pm 7	8,3 \pm 0,7	285 \pm 14	\pm 24,5 \pm 6

Note. In numerator of column headed "weight of TG lobe" and "body weight" weight of right lobe of TG and body weight of animals before unilateral thyroidectomy respectively are given; denominator shows weight of left (residual) TG lobe and body weight of rats on 5th day after operation; numerator in column "change in weight of TG lobe" gives absolute, denominator gives relative (i.e., expressed per 100 g body weight) change in weight of residual TG lobe compared with weight of lobe removed at operation.

roid gland was greatest in May-June. The inhibitory effect of T₄ on compensatory hypertrophy of this organ in rats aged 8-10 and 14-16 months was most clearly manifested in experiments carried out from January through May.

Stronger inhibition of compensatory hypertrophy of the thyroid gland with an increase in age of the rats also occurred after other doses of T₄ (1 and 8 μ g/100 g body weight daily).

By contrast with the results of studies of the hypothalamic-pituitary-adrenal and hypothalamic-pituitary-ovarian systems, in the hypothalamic-pituitary-thyroid system no age decrease in sensitivity to the action of the peripheral hormone could be found. The duration of the present investigation was restricted to 5 days, because of data in the literature showing that compensatory hypertrophy of the thyroid gland is sufficiently well marked during that period [6]. The dose of T₄ used (2 μ g/100 g daily) corresponds to information on the level of T₄ production in rats [13, 15].

It can be concluded from these results that the hypothalamic-pituitary threshold to inhibition by thyroxine decreases with age. An increase in the sensitivity of central structures to T₄ has also been observed in rats with destroyed paraventricular nuclei [12] and in animals with induced mammary gland tumors and with transplanted Walker's carcinosarcoma. This lowering of the threshold of inhibition by T₄ with age may evidently lead to inhibition of thyroid function in other states also [3, 5].

Considering the universal role of thyroid hormones in the body [4, 5] and the close interaction between the thyroid gland and other endocrine glands, the existence of reciprocal relations can be postulated between sensitivity of the centers controlling the pituitary-thyroid system and the other systems of hypothalamic regulation to peripheral hormones. This is a problem that requires further study.

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