THE EFFECT OF THYROXINE ON GLAND WEIGHT AND UPTAKE OF RADIOACTIVE PHOSPHORUS BY THE ADRENALS OF THE MOUSE

By

B.-A. Lamberg and C. A. Hernberg

Treatment with thyroxine causes a decrease in incorporation of P³² into some fractions of the thymus (Fraenkel-Conrat & Li, 1949) and also a decrease in the total uptake of P³² (Lamberg & Östling, 1957). In experimental animals, however, thyroxine also causes an increase in the size of the adrenals (Hess & Finerty, 1952; Hoskins, 1916; Money, 1955; Levin & Daughaday, 1955; McGavack, 1951; Pekkarinen et al., 1951). Finally, adrenocortical overactivity is known to result in thymus atrophy (a.o. Dougherty & White, 1945; Selye, 1950; Wells & Kendall, 1940; Money et al., 1950).

Hence, the involution of the thymus after the administration of thyroxine may be either a direct effect of the hormone or mediated through the adrenals.

The purpose of the present work is (a) to demonstrate whether the effect of thyroxine on adrenal weight is paralleled by an increase in the P³² uptake of the gland and (b) to discuss the possible interrelationship of the adrenals and the thymus after treatment with thyroxine.

METHO D

Forty white mice were divided into groups of 10 animals and treated with thyroxine in daily doses of 25, 50, and 150 µg. respectively for 10 days, one group serving as controls. At the end of the period of treatment about 10 µC of P³² diluted to 0.25 ml. was injected subcutaneously. Six hours after injection the animals were decapitated under ether anaesthesia. The adrenals and the thymus were immediately weighed on a torsion balance, spread on aluminum planchets and allowed to dry for 24 hours at room temperature. The radioactivity was then measured with an end-window Geiger-Müller counter and expressed as counts per minute (CPM) per mg. of tissue and also of the whole organ. The method was the same as that used by Lamberg & Östling (1957).
### Table 1.

Uptake of P³² in the thymus and adrenal glands in mice given various doses of thyroxine for 10 days. P³² was given 6 hours before sacrifice.

<table>
<thead>
<tr>
<th>Dose mg./day</th>
<th>Weight mg.</th>
<th>Thymus</th>
<th>Adrenals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CPM/gland</td>
<td>CPM/mg.</td>
</tr>
<tr>
<td>Controls</td>
<td>38.2 ± 3.7</td>
<td>13291 ± 1543</td>
<td>348.3 ± 24.9</td>
</tr>
<tr>
<td>0.025</td>
<td>11.7 ± 1.3*</td>
<td>1671 ± 293*</td>
<td>142.9 ± 12.2*</td>
</tr>
<tr>
<td>0.050</td>
<td>15.6 ± 3.2*</td>
<td>3229 ± 890*</td>
<td>207.7 ± 13.9*</td>
</tr>
<tr>
<td>0.150</td>
<td>8.6 ± 0.7*°</td>
<td>1723 ± 141°</td>
<td>250 ± 10.4°</td>
</tr>
</tbody>
</table>

* = P < 0.001 compared with the controls.
° = P < 0.1 compared with the previous group.
RESULTS

Even a daily dose of 25 μg. thyroxine caused a marked involution of the thymus, the mean weight decreasing from 38.2 mg. to 11.7 mg. (Table 1). The uptake of P\textsuperscript{32} by the whole gland decreased from 13474 CPM to 1741 CPM. Calculated per mg. of organ weight, it decreased from 348 to 142 CPM. The experiments with larger doses of thyroxine showed no significant changes as compared with the series given lower doses.

The changes in the uptake of P\textsuperscript{32} by the adrenals did not increase until higher doses of thyroxine were used i.e. 150 μg. daily. The mean weight, however, increased with 25 μg. thyroxine per day.

To change significantly the P\textsuperscript{32} uptake of the thymus a much lower dose of thyroxine was required than for the adrenals. Changes in weight occurred at the same thyroxine dose level in both organs. There is, however, reason to believe that the P\textsuperscript{32} method is more exact than the weight method (Gemzell, 1948; Reiss & Halkerston, 1949; Nicholls & Rossiter, 1955).

It may be noted that the uptake by the thymus gland, calculated per mg. of tissue, decreases as well as the total uptake. Reports in the literature indicate, however, that although the total uptake decreases as a result of treatment with cortisone the radioactivity calculated per mg. of tissue may increase (Bodlund & Gyllensten, 1954; Venkatamaran et al., 1954). The difference between these reports and the present findings may or may not be significant. It may, however, imply that the mode of action could be different in the case of thyroxine which could exert its effect directly on the thymus without the mediation of the adrenals. When the adrenals are activated during the thyroxine therapy, their effect on the thymus will be added to that of thyroxine.

SUMMARY

White mice were treated with various doses of thyroxine. The consequent involution of the thymus appeared to occur with a lower dose of thyroxine than did the increase in the uptake of P\textsuperscript{32} by the adrenals, thus suggesting that the thyroxine effect on the thymus is a direct one, and not mediated through the adrenals.

REFERENCES