EFFECT OF EXOGENOUS THYROXINE ON THE MORPHOLOGY AND ACTIVITY OF THE THYROID GLAND

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The effect of prolonged administration of thyroxine (6–8 μg/100 g body wt/day for 45 days) on the morphology and function of the thyroid gland of rats was studied. As a result of this dose of exogenous thyroxine, the body weight gain in the treated rats was significantly (P < 0.05) higher than in normal rats. The treatment also resulted in histological changes in the thyroid gland characterized by vacuolar degeneration of follicular cells and some depletion of thyroglobulin. The results suggest that the level of circulating thyroxine engendered by the exogenous thyroxine was sufficient to depress thyroid gland activity while ameliorating metabolic activities with a net increase in weight gains.

Thyroxine has been shown to accelerate the basal metabolic rate in mammals. Its use to improve performance and carcass characteristics of animals is fast becoming a common practice. Hatchi et al., stated that if the thyroid activity of an animal can be diagnosed accurately, the administration of the appropriate level of thyroxine may improve animal performances more uniformly. Although it has just been reported that thyroxine treatment results in increased mucosal and serosal transfer of glucose with an accompanied increased glucose metabolism, most of the researches so far conducted on the effects of the thyroid hormones were carried out in the temperate zone. It is now well known that tropical climate influences
the thyroid gland considerably both structurally and functionally. The present work was therefore undertaken to investigate the influence of prolonged thyroxine administration on the weight, morphology and activity of the thyroid gland in adult male rats.

MATERIALS AND METHODS

30 adult male Wistar strain rats weighing between 100–140 g obtained from our departmental animal house, were used for the experiments. Twenty of the rats were used as controls while the remaining ten were the test rats (thyroxine-treated). The control rats were divided into two groups (ten rats in each group). The mean weight of the rats in all the groups was the same (138 g). On the first day, the thyroid glands of the rats in the first control group (Group I rats) were removed under ether anaesthesia and weighed. The second control group (Group II rats) were given rat pellets and water *ad libitum* for a period of 45 days. The test rats (Group III rats) were also provided with rat pellets and constant dose of thyroxine (6-8 μg/100 g body wt/day for 45 days) orally.

On the forty-fifth day, the thyroid glands of the normal and treated rats were surgically removed under ether anaesthesia. The specimens were weighed and fixed in 10% formal saline, after which they were cleared and embedded in paraffin. Sections, 5 μm in thickness were cut from these samples on Leitz rotary microtome, mounted on clean albuminized slides and dried on a hot plate. The sections were stained with Periodic Acid Schiff (PAS).

RESULTS

Table 1 shows that the body weight gain (± S.E) of the treated rats (72.25 ± 4.16g) was significantly (P < 0.05) higher than that recorded for the control rats (63.13 ± 2.09g).

The thyroid gland of the control rats weighed 0.28 ± 0.01g. The weight of the gland in the thyroxine-treated rats was however found to be 0.30 ± 0.02g, and this
value was not significantly different from the value obtained for control rats ($P < 0.05$).

Microscopically, the morphology of the thyroid gland of the control rats (Fig. 1) and that of the thyroxine-treated rats (Fig. 2) were different.

The thyroid follicles of the normal rats were relatively smaller and were filled with colloid of normal consistency. Fig 2 shows that the lobules of the thyroid gland of the thyroxine-treated rats had experienced changes characterized by vacuolar degeneration of columnar follicular cells and depletion of thyroglobulin (D). There was considerable papillary infolding of the follicular epithelium (K).

DISCUSSION

This study revealed that the thyroid gland of the thyroxine-treated rats was not significantly heavier than that of normal rats. Morphological changes characterized by vacuolar degeneration of columnar follicular cells and depletion of thyroglobulin

**Table 1—The weight of the thyroid gland of control and thyroxine-treated rats.**

<table>
<thead>
<tr>
<th>Rat Groups</th>
<th>DAY 0</th>
<th>DAYS 45</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Body weight (g)</td>
<td>Thyroid gland weight (g)</td>
</tr>
<tr>
<td>Untreated and slaughtered on day 0 (Group I) n=10</td>
<td>138.5</td>
<td>0.17</td>
</tr>
<tr>
<td>±4.13</td>
<td>±0.02</td>
<td>±4.13</td>
</tr>
<tr>
<td>Control (Group II) n=10</td>
<td>138.5</td>
<td>—</td>
</tr>
<tr>
<td>±5.75</td>
<td>±2.09</td>
<td>±2.09</td>
</tr>
<tr>
<td>Thyroxine-treated (Group III) n=10</td>
<td>138.5</td>
<td>—</td>
</tr>
<tr>
<td>±5.40</td>
<td>±4.13</td>
<td>±4.13</td>
</tr>
</tbody>
</table>

Values are mean ± S. E.; n=number of animals; *P < 0.05 compared with the value for control.
Fig. 1—Thyroid gland of control rat, stained preparation, Periodic Acid Schiff (PAS) x 400;

Fig. 2—Thyroid gland Thyroxine-treated rat, stained preparation, Periodic Acid Schiff (PAS) x 400, D—areas with depleted thyroglobulin, K—areas experiencing papillary infolding of the follicular epithelium.

were however observed in these thyroid glands. These morphological changes could have been caused by the inactivity of the gland due to exogenous thyroxine administration. Shaw et al. stated that prolonged treatment with exogenous thyroid hormone can suppress endogenous thyroxine secretion to the hypothyroid range. This might be exactly what was happening to the treated rats in this study. This implies that the level of circulating thyroid hormones engendered by the administered amount of thyroxine was sufficient to depress thyroid gland activity, without causing goitre, while ameliorating metabolic activities with a net increase in weight gains of the animals. This shows that small physiological doses of thyroxine can be used for improving the performance of animals in the tropics. It is possible that the enhanced intestinal absorption of food in thyroxine-treated rats recently reported could have accounted for the increase weight gains observed in the treated rats in this study.
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REFERENCES