SEASONAL CHANGES IN WEIGHT OF THE THYROID GLAND IN ALBINO RATS AND ITS ABILITY TO ACCUMULATE I^{131}

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In the course of one calendar year the authors studied changes in the weight of the thyroid gland of rats and its ability to accumulate I^{131}. On the average the weight of the gland was 8 mg % of the body weight and it varied with the season, being minimal in February and maximal in May. Parallel with these changes in weight, but varying within wider limits, changes occurred in the ability of the thyroid gland to accumulate iodine.

Workers who have studied the ability of the thyroid gland of animals to accumulate I^{131} at different seasons of the year have obtained different values for accumulation of the isotope in control groups (rats), varying within wide limits, viz. from 8 to 60% after 24 h [1, 2, 11, 12]. The weight of the thyroid gland also varies. For example, for albino rats values of between 6 and 15 mg/100 g body weight have been described [7, 8, 11, 13, 14, 16-19]. In our own experiments on rats we have also observed variations both in the percentage of I^{131} incorporated into the thyroid gland and also in the weight of the gland [3].

Seasonal fluctuations in the activity of several endocrine glands are known, e.g., the gonads, pituitary, and hypothalamus [6, 15]. Pantich and Stoshich [10] state that in deer in May and June the adenohypophysis contains chiefly basophils producing gonadotropic and thyrotropic hormones. Because of the close connection between hormone formation in the thyroid gland and metabolism, changes which are observed in different seasons [5, 6], it is to be expected that changes will take place in both the weight and the functional activity of that gland [9].

For these reasons it was decided to investigate the problem by experimenting at different times throughout the year.

TABLE 1. Monthly Changes in Weight of the Thyroid Gland and Degree of I^{131} Accumulation in Albino Rats (M ± m)

Month	Wt. of thyroid gland (mg/100 g body wt)	Accum. of iodine (in %) after 24 h
XII	8,13±0,38	26,00±2,59
I	6,86±0,40	20,45±1,35
II	5,94±0,33	17,20±1,74
III	6,96±0,20	20,00±1,73
IV	9,09±0,28	25,42±1,95
V	10,50±0,26	43,80±2,95
VI	9,72±0,29	40,00±1,82
VII	8,63±0,32	34,70±2,33
IX	7,42±0,22	24,25±2,30
X	7,28±0,25	27,72±1,77
IX	8,08±0,27	27,50±1,89
Mean	8,06±0,12	27,40±0,78

EXPERIMENTAL METHOD

Experiments were carried out on 282 noninbred male albino rats weighing 150-220 g at intervals of 7-10 days in groups consisting of six animals. Altogether there were 45 groups. The rats of each group received an intraperitoneal injection of 1 μCi I^{131} in 1 ml physiological saline. The same activity (1 μCi in 0.05 ml) measured in a Plexiglas mold, of the same shape and size as the rat's neck, was used as the standard. After fixation of the animal in the usual way, under superficial ether anesthesia the radioactivity was measured in vivo with the aid of the scintillation probe of the Vakutronik M-160 apparatus, inserted into a lead collimator. Measurements were made 2, 6, and 24 h after administration of the I^{131} and the level of its accumulation in the thyroid was calculated as a percentage of the activity administered;

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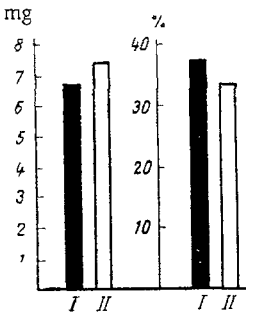

Fig. 1

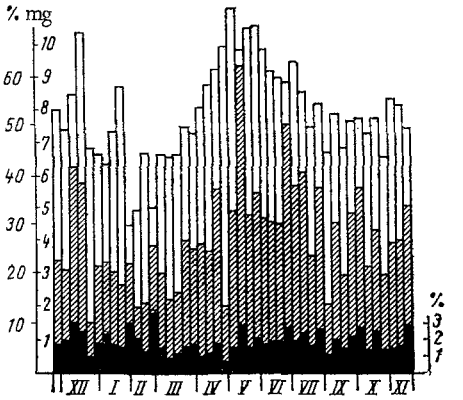

Fig. 2

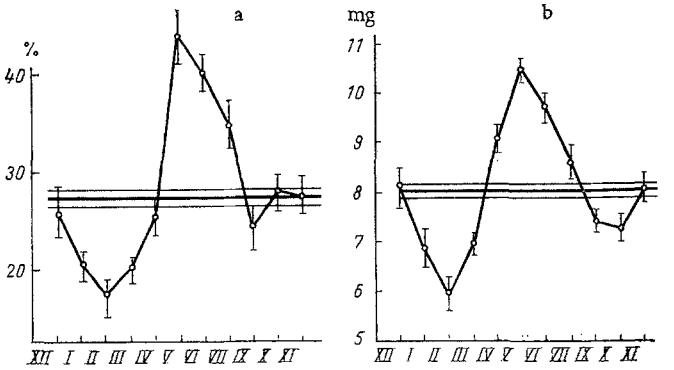

Fig. 3

Fig. 1. Weight of thyroid gland (in mg/100 g body weight) and accumulation of I^{131} (in %) after 24 h in rats weighing 220 g (I) and 156 g (II).

Fig. 2. Weight of thyroid gland (in mg/100 g body weight; unshaded columns), accumulation of I^{131} after 24 h, in % (obliquely shaded), accumulation of I^{131} in %/mg thyroid gland (black columns) from November, 1971 to November, 1972.

Fig. 3. Accumulation of I^{131} in thyroid after 24 h (a) and change in weight of gland per 100 g body weight (b) month by month. Horizontal lines show mean values for the year.

a correction was introduced for the natural radioactive background. The rats were sacrificed by ether anesthesia 24 h later and their thyroid glands were weighed on torsion scales.

To ascertain how differences in the animals' weight are reflected in the experimental results, measurements were carried out on two groups of animals weighing 156 and 220 g respectively. The results of these measurements (weight of the thyroid gland and level of I^{131} accumulation) are given in Fig. 1. Differences in the values for the two groups are not statistically significant. It can accordingly be concluded that a difference in the weight of the animals used in the experiments was not reflected in the results.

Statistical analysis of the data was carried out by the Student–Fisher method.

EXPERIMENTAL RESULTS

The results of the investigations for each of the 45 experimental groups are given in Fig. 2. The weight of the thyroid gland fell, with comparatively small fluctuations, during January, February, and March and rose in April, May, and June, so that it was back at its initial level in July, September, October, and November.

Despite considerable fluctuations in the percentage accumulation of I^{131} in the thyroid during the 24 h after its injection, a tendency was noticed for the accumulation curve to correspond to the weight curve.

This seasonal rhythm can be seen more clearly still from the data in Table 1 and Fig. 2, which show changes in these parameters in the various months by comparison with the mean value for the year.

The weight of the thyroid gland expressed per 100 g body weight fell in January, February, March, September, and October with a minimum in February, while in April, May, June, and July it was above the average for the year, with a maximum in May. The degree of accumulation of radioactivity showed generally speaking the same changes: a decrease in January, February, and March, with a minimum in February and an increase in May, June, and July with a maximum in May.

To ascertain to what extent the difference in accumulation can be explained by changes in the weight of the thyroid gland in the different seasons of the year and to what extent by a change in the functional activity of the gland parenchyma, the percentage of injected activity accumulated by 1 mg thyroid gland tissue was calculated. The results are given in Fig. 2. Clearly the functional activity of the thyroid gland tissue did not show seasonal fluctuations. Seasonal changes in the accumulation of I^{131} can be attributed in general to changes in the weight of the thyroid gland, i.e., to variation in the quantity of functioning tissue.

The weight of the gland changed comparatively little, while the functional differences, i.e., the values for I^{131} accumulation in the thyroid, varied within wide limits. The explanation for this difference should probably be sought in the influence of certain meteorological factors, such as atmospheric pressure, temperature, and so on [4], on this ratio. Irrespective of this fact, seasonal fluctuations caused by differences in the activity of certain endocrine glands (pituitary and hypothalamus) were clearly revealed [6, 15].

According to the results obtained the weight of the thyroid gland in noninbred rats weighing 150-220 g amounted on the average to 0.008% of their body weight with variations between 0.006% in February and 0.0105% in May. The mean accumulation of I^{131} in the gland after 24 h was 27.40 ± 0.78% of the quantity injected. The degree of accumulation was lowest in February (17.20 ± 1.74%) and highest in May (43.80 ± 2.95%). If the results obtained by different workers are to be compared, the season during which their experiments were performed must be taken into account.

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