Effect of Thyro-Parathyroidectomy and Adrenalectomy on Food Intake In Rats.*† (29745)

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Considerable variation in the feed consumption of normal mature female rats of the Sprague-Dawley-Rolfsmeyer strain has been observed(1). While the mean food consumption was 5.26 g/100 g body weight (bw), individual animals varied from 2.9 to 7.6 g/100 g bw/day.

Lactating rats showed an increase in feed consumption up to the 20th day when they consumed a mean of 14.1 g/100 g bw. They also showed considerable variation about the mean(2). It has been recognized for many years that hypophysectomy decreases food intake(3). The loss of TSH and ACTH in such animals would grossly influence the secretion of thyroxine and the glucocorticoids. It seemed of interest to determine the effect of the removal of these two glands separately and together upon food consumption.

Materials and methods. Adult female Sprague-Dawley-Rolfsmeyer rats weighing from 230 to 270 g were maintained as described previously(1) and mean daily consumption of Purina Lab Chow was determined for a period of 6 days. The animals were then thyro-parathyroidectomized and/or adrenalectomized and allowed at least 3 days to recover. Adrenalectomized rats were maintained with 1% NaCl drinking water at all times.

Prior to the experiment the thyroxine secretion rate (TSR) of each animal was determined by the method previously described (4). The animals were divided into 2 groups and food intake again determined at 2 time intervals.

In Group I replacement therapy with graded levels of thyroxine was instituted 119 days after the operation, and in Group II, after 133 and 189 days. Food intake determination was begun 3 days after thyroxine treatment was started and continued for 6 days.

Results. Group I consisting of 24 animals weighing a mean of 269 g had a mean TSR of 1.22 μg thyroxine/100 g bw. The mean food intake determined 4 to 10 days after the operation declined from 4.6/100 g bw to 4.3/100 g bw, a reduction of 7.2%.

Group II consisting of 25 animals weighing a mean of 232 g had a mean TSR of 1.20 μg thyroxine/100 g bw. Mean food intake determined 10 to 16 days after operation declined from 5.5 g/100 g bw to 4.8 /100 g bw, a reduction of 13.0% (Table I).

Feed consumption of the 22 surviving rats in Group I determined 42 to 48 days after the operation showed a mean of 4.2 g/100 g bw, a reduction of only 6.0%. Feed consumption of Group II determined 56 to 62 days after operation showed a mean of 4.2 g/100 g bw, a reduction of 23.6%. It will be noted that Group II with a higher initial feed intake showed the greater reduction in feed intake after thyroparathyroidectomy.

In spite of the reduction in food intake after the operation, there was a gradual increase in body weight.

Replacement therapy with 0.5 μg thyroxine/100 g bw was instituted 119 days after the operation with Group I. Their mean food intake after thyroxine was administered was 3.3 g/100 g bw compared to a normal food intake of 4.5 g (Table II). Since this group showed food consumption of 4.2 g/100 g bw 48 days after thyroidectomy, it indicates that there was a further decline of 26.56% in food consumption between that time and 119 days which was not influenced by thyroxine (Table I).

Replacement therapy with 1.0 μg thyroxine/100 g bw in Group II 135 days after thyroidectomy may have had a slight replacement value as the food intake was 4.3 g/100 g bw compared to 4.2 g after 62 days of thyroidectomy. However, mean daily in-

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TABLE I. Effect of Thyro-Parathyroidectomy on Food Intake.

Group	Days after thyroidectomy	No. of animals	Normal food intake: Total, g/day	Normal food intake: g/100 g bw/day	Food intake after thyroidectomy: Total, g/day	Food intake after thyroidectomy: g/100 g bw/day	Food intake after thyroidectomy: Reduction, %	Body wt (g): Before	Body wt (g): After	Body wt (g): Increase
I	4 to 10	24	12.30	4.59	11.83	4.26	7.2*	269	275	6
II	10 to 16	25	12.76	5.50	11.84	4.89	13.0‡	232	242	10
I	42 to 48	22	12.01	4.40	12.49	4.23	6.0†	270	299	29
II	56 to 62	24	12.80	5.52	11.30	4.23	23.6‡	232	267	35

* P = .05-.02 † P = .1-.05 ‡ P = <.005

TABLE II. Effect of Thyroxine Replacement Therapy on Food Intake.

Group	No. of animals	Days after thyroidectomy	Thyroxine, μg/100 g bw	Normal food intake/day: Total, g	Normal food intake/day: g/100 g bw	Food intake on thyroxine: Total, g	Food intake on thyroxine: g/100 g bw	Food intake decline, %	Body wt (g): Pretreatment	Body wt (g): Change
I	9	119	.5	12.0	4.48	10.09	3.29	26.56*	305	–5
II	19	135	1.0	12.9	5.54	11.55	4.31	22.20*	276	–8
II	11	189	2.0	12.9	5.38	9.67	3.71	31.04*	272	–3

* P = <.005

take was 1.2 g/day/100 g bw, or 22.20% below that prior to thyroidectomy.

When thyroxine was increased to 2.0 μg/100 g bw/day 189 days after thyroidectomy, the mean daily food intake was further reduced to 3.7 g/100 g bw rather than increased toward the normal level of 5.4 g/100 g bw. If one assumes that the exogenous thyroxine had no beneficial effect, it indicates that 189 days of thyroidectomy depressed mean food consumption 31.04% (Table I and II).

Group III including 26 animals weighing 241 g, showed normal feed intake of 13.1 g/day and 5.4 g/100 g bw. Three days following adrenalectomy, daily feed intake was again determined for a period of 6 days. Mean total intake declined to 8.7 g/day and to 4.0 g/100 g bw, a reduction of 27.12%. Body weight declined a total of 20 g (Table III).

Group IV including 16 animals were first thyroparathyroidectomized and then adrenalectomized. Their mean normal feed intake was 14.2 g/day or 5.8 g/100 g bw. Following removal of the 2 endocrine glands, the mean daily food intake from day 11 to 17 was 9.7 g/day or 3.9 g/100 g bw, a reduction of 30.5%. Body weight declined only 8 g.

Discussion. In a preliminary study of the voluntary food intake of Sprague-Dawley-Rolfsmeyer strain of rats, considerable variation in food intake was noted(1). Considerable variation has been noted also in regard to individual thyroxine secretion rate (5,4), extent of mammary gland growth at the end of pregnancy(6) and intensity of lactation(7,8).

TABLE III. Effect of Adrenalectomy and Thyro-Adrenalectomy on Food Intake.

Group	No. of animals	Gland excised	Body wt (g): Pre-operation	Body wt (g): Post-operation	Normal food intake/day: Total, g	Normal food intake/day: g/100 g bw	Days after operation	Food intake after operation: Total, g	Food intake after operation: g/100 g bw	Food reduction, %
III	26	Adrenal	241	221	13.07	5.42	3- 9	8.74	3.95	–27.12*
IV	16	Thyroid + adrenal	246	238	14.19	5.77	11-17	9.70	3.91	–30.5 *

* P = <.005

While the neural regulation of food intake has been studied extensively(9) there can be little doubt that feed consumption is markedly influenced by a number of hormones and by environments which influence hormone secretions. It is not clear as yet whether the interplay of neural regulation of food intake *via* the hypothalamus and the endocrine influence on food intake may be, in part, related to the same hypothalamic centers which are involved in the control of the release of anterior pituitary hormones.

In the present study it was shown that thyro-parathyroidectomy had a depressing effect upon feed consumption which gradually increased with time after the operation. By 60 days, the decline reached about 24%, whereas after 189 days a decline of 31% was observed, even with replacement therapy.

It will be noted that the rats in Group I were heavier than those in Group II. Their feed consumption under normal conditions was about 20% less per 100 g bw. In both stages of thyroidectomy, their food intake was depressed only slightly in comparison to Group II. The difference between the two groups may be due in part to the lower feed consumption of Group I with less decline after thyroidectomy.

The apparent lack of effect on food consumption of replacement therapy with thyroxine equal to or double the animals thyroxine secretion rate was unexpected. However, the duration of replacement therapy was short. More time may be required for food consumption to increase comparable to the slow decline observed.

In contrast, a very rapid decline in food consumption was observed after adrenalectomy reaching 27% within a period of 9 days. Similarly, the depressing effect of both thyroid- and adrenalectomy on food consumption was of the same magnitude as with adrenalectomy alone (30%). Since the effect of thyroidectomy on food consumption required a considerable time period, it is possible that the full expression of the loss of these two hormones would also require a long period.

In a previous study it was shown that adrenalectomy depressed the thyroxine secretion rate of this strain of female rats 32% (4). The question arose whether the effect of adrenalectomy was due to the absence of the adrenal hormones or to concurrent decrease in food intake. When food restriction of 22% was practiced, thyroxine secretion rate was reduced 13% when estimated within 14 days of initiation of food restriction and 42% after 27 days(10). Thus a major factor depressing thyroxine secretion after adrenalectomy is believed to be due to decreased food intake.

Summary. A study is reported concerning the alteration in voluntary food intake of adult female Sprague-Dawley-Rolfsmeyer rats following thyro-parathyroidectomy and adrenalectomy separately and together. Food consumption declined gradually to 24% at about 60 days following thyroidectomy. After 119 days, graded replacement therapy with thyroxine was initiated. Levels of 0.5, 1.0, and 2.0 μg/100 g body weight failed to stimulate food intake comparable to the control level. Even on 2.0 μg thyroxine after 189 days, food intake was still 31% below normal. After adrenalectomy, food intake was quickly reduced 27%, and after the thyroids were removed, food intake was reduced a total of 30%.

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