

EFFECT OF THYROXINE ON TASTE HEDONICS IN RAT

SABYASACHI S. SIRCAR* AND SHEILA BHATIA

Department of Physiology,
University College of Medical Sciences,
Shahdara, Delhi - 110 095

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Abstract: 1. The hedonic response to sweetness was tested in 12 thyroxine treated rats using the method of single-bottle brief-exposure to sweet (saccharin) solution.

2. Consumption of the sweet solution was significantly more following administration of thyroxine than during the control period.

3. The 1-hr consumption of saccharin solution appeared to be more sensitive to thyroxine than the 5-minute consumption.

Key words: taste alteration saccharin

INTRODUCTION

The role of the thyroid in modulating the intake of sodium and water is reasonably well established. It has been shown that hypothyroidism reduces the sodium chloride aversion in rats with renal hypertension (1, 2) Bello and Covian (3) also found an increased intake of water and sodium chloride in rats administered thyroxine. While the observation has been attributed to salt craving due to salt and water losses, the present study on the effect of thyroxine on the gustatory responses to sweetness was taken up to determine whether the increased sodium chloride intake could be an isolated aspect of a generalised increase in the gustatory hedonic responses, a possibility which cannot be ruled out in view of the hyperphagia induced by thyroxine.

METHODS

Twelve albino rats weighing between 200 to 300 g were housed in separate cages (32 cm × 20 cm × 14 cm). They were supplied with food (pellets) and water (in graduated cylinders fitted with spouts). Between 8-00 and 9-00 a.m. in each cage, the residual pellets were removed and the water bottle was replaced by a bottle containing 0.2% saccharin solution. After adapting the rats to this daily drill for 15 days, the

experiments were commenced. The rats were injected intraperitoneally with 1 ml per 100 gm body weight of 0.9% saline. The daily intake of food and water were noted in the morning, immediately before subjecting them to the palatability test. During the test, the intake of saccharin solution were noted at 5 minutes and 1 hours on the 1st, 5th and 9th days after the injection; also, water intake for the corresponding period were noted on the 4th, 8th and the 12 day. After 12 days of control sessions, the rats were injected intraperitoneally with 50 µg of L-thyroxine per 100 gm of body weight on 7 consecutive days (4). The food, water and taste solution intake for the next 12 days were again noted: The saccharin solution intake were noted on the 3rd, 7th, 11th 15th, 19th, 23rd 27th, 31st, 35th and 39th day. The intake of water over a corresponding period were noted on the 6th, 10th 14th, 18th, 22nd 26th, 30th, 34th and 38th day. The control and test values were compared using the Student's t-test.

RESULTS

The mean intake of the rats in the control period was 31.23±1.19 gms for laboratory pellets and 38.33±1.76 ml for water. In the test period following thyroxine injections, the mean food intake of the rats

*Corresponding Author

were 36.24 ± 0.87 gms by the 35th day ($P < 0.01$) and 35.10 ± 0.90 gms by the 39th day ($P < 0.05$). The mean water intake increased to 45.51 ± 1.45 ml by the 31st day and 46.14 ± 1.51 ml by the 39th day ($P < 0.01$).

During the control period, the mean 1-hour intake of saccharin solution was 7.57 ± 0.85 ml and the mean 5-minute intake of 3.08 ± 0.43 ml. The corresponding values for water were 3.81 ± 1.86 ml and 1.25 ± 1.06 . Following thyroxine injection, the rats showed a significant increase in the 1-hour consumption of saccharin solution by the 23rd day (11.22 ± 1.14 ml; $P < 0.05$) and by the 39th day, it further increased to 12.90 ± 1.10 ($P < 0.01$). The 5-minute intake became significantly more by the 39th day and was found to be 4.75 ± 0.06 ml ($P < 0.05$). The 1-hour and 5-minute water consumption however showed no significant change over the corresponding period: by the 42nd day it had increased marginally to 3.92 ± 1.08 ml and 1.45 ± 1.06 ml respectively.

DISCUSSION

The gustatory response to sweetness has been studied using 0.2% saccharin solution. Saccharin was preferred to glucose or sucrose owing to its lack of calorific value. As to the determination of onset of the metabolic effects of thyroxine, a behavioral criterion like hyperphagia was preferred to studies of blood chemistry as the painful routine of obtaining frequent blood samples could well affect feeding and gustatory behavior. Hence the interval between thyroxine injection and hyperphagia has been assumed to denote the time required for the hormone to effect its metabolic changes of the required magnitude (5).

In thyroxine treated rats, the expected increase in food intake was significant by the 31st day. The water intake also increases significantly by the 31st day, perhaps due to increased thirst consequent upon increased food ingestion or the enhanced metabolism of hyperthyroidism. It may be noted that Fig. 1 shows 2 conspicuous surges in the food intake, the first of which is transient and not statistically significant and a second, which is sustained and significant. One reason for the first surge in food consumption could be that it was more due to a transient increase in the exploratory behaviour of the rats consequent upon their hyperactivity rather than an increase in hunger *per se*.

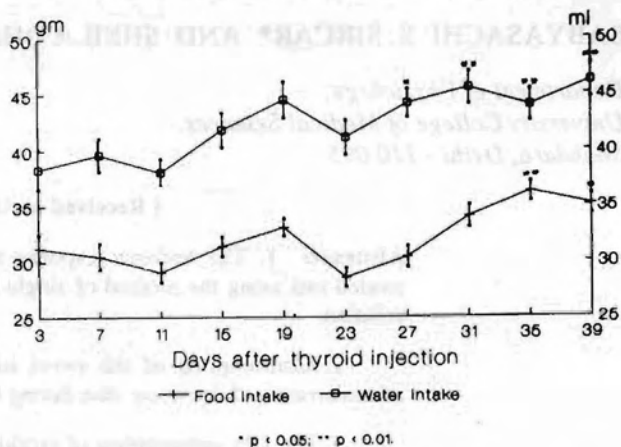


Fig. 1: The mean 23-hr food intake (gm) and water intake (ml) in rats over a period of 39 days after $50 \mu\text{g}$ L-thyroxine injection.

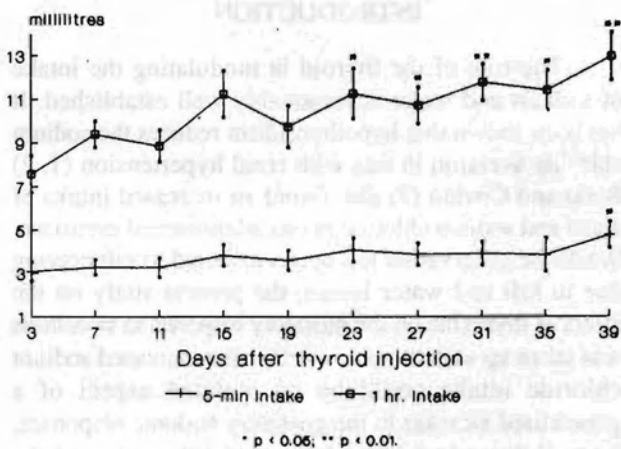


Fig. 2: The mean 5-min and 1-hr intake of 0.2% saccharin solution in rats over a period of 39 days after $50 \mu\text{g}$ L-thyroxine injection.

The significant increase in the 5-minute and 1 hour consumptions of saccharin solution indicates that sweetness is perceived as more pleasant by thyroxine-treated rats. The increase is unlikely to be due to the simultaneous increase in the food and water intake since the brief exposure single stimulus method was designed mainly as a refinement over those involving more prolonged exposure of test solution in order to preclude any possibility of distortion of the results by the changes in food and water intake (6). Such findings when viewed

with the findings of McConnel et al (7) who reported a high frequency of disturbances in taste in hypothyroidism lead to the speculation that alteration in salt preferences may well be a part of the larger gamut of taste alterations in the thyroxine levels in the body.

The 1 hour consumption becomes significantly greater much earlier (by the 23rd day), even before the overall food intake has increased. While the 1 hour consumption is more susceptible to post-ingestional feedbacks than the 5 minute consumption, is more

susceptible to post-ingestional feedback than the 5 minute consumption, in the present study, it appears to be a more sensitive index of taste hedonics. One possibility is that internal state cues modulate (damps down in this case) the post-ingestional feedback. Nevertheless, the observation that saccharin intake is increased in thyroxine treated rats falls well in line with the earlier observation of increased taste responsiveness in the thyroxine treated rats (8) and is consonant with the hypothesis that hunger renders pleasant taste more pleasant and unpleasant taste more unpleasant than usual (9).

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