# EFFECTS OF BODY WEIGHT ON TASTE OF MALE AND FEMALE RATS

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**Summary :** Single-choice taste (solution and mixed-diet) tests revealed that *ad lib* fed male rats with increasing body weight showed increased intake on sweet taste as compared to intake of identically aged *ad lib* fed female rats with static body weight. On meal-time (3 hr) and meal-size (50% diet) restrictions though rats of either sex increased on intake of sweet taste, the increment shown by female was higher and it was correlated with their greater % loss in bw. Hence it appears that the basis for sweet taste preference is the mismatch between actual and target body weight irrespective of sex of animal.

**Key words :** taste sexual dimorphism body weight

## INTRODUCTION

The earlier studies showing that female rat increases its intake over male intake on sweet (3, 13) and salt (6) taste was explained as due primarily to a stimulatory action of ovarian hormones on female taste mechanisms (16). However, the female sweet taste preference and the mechanism involved in it are not well established. For instance there is evidence that ovariectomy does not alter sweet saccharin intake of rats (15), which contradicts the idea of stimulatory effect of ovarian hormones on sweet taste. Further it is known that the taste is not important for the intake regulation of the free feeding, energy-surfeit adult animal (14). How is it then that *ad lib* fed adult female shows sweet taste preference? Is it due to cyclic changes in the female hormones (14)? Perhaps the female gustatory responses are related more directly to body weight (bw) changes in estrous cycle rather than to hormonal changes. This is indicated by the recent studies (9, 10) showing that the state of bw influences the taste responses. It is well known that the bw of adult male rat is higher than the bw of female rat of identical age and hence it is possible that the gustatory responses of male and female rats are related to their bw. Hence the present investigation of gustatory responses of male and female rats in relation to their bw.

## MATERIAL AND METHOD

Adult wistar rats (120 days of age) of either sex were caged individually and kept

in the animal house illuminated in accordance with diurnal light-dark changes. Initially all the rats were fed *ad lib* for 10 day-petiod after which they were divided into three groups, each group consisting of 6 males and 6 females of identical age. One group (Gr I) continued on *ad lib* feeding. The rest of the rats (Gr II and Gr III) were adapted to 3 hr (9 am – 12 noon) food schedule for 120 day period when their bw was similar to bw of *ad lib* fed (Gr I) rats. Then, while Gr II rats were continued on 3 hr food, the Gr III was kept on 50% diet. The 50% diet was computed for individual rats on the basis of their stabilised intake on 3 hr food schedule. Water was available *ad lib* to the three groups excepting for 1 hr during solution tests.

After Gr III rats were adapted to 50% diet for 30 days (Gr I and Gr II were adapted to their respective diet schedules for more than 4 months) the intake responses to glucose, sucrose and saccharin were obtained. The test solutions of 13.5% glucose and 0.2% saccharin were prepared in tap water, and the 1 hr single bottle tests were administered in the morning (8–9 am) before the food and water were replenished for the day. The mixed diets used (10% surcose-mixed and 0.1% saccharin-mixed) were prepared in the similar way as the stock diet by mixing 3 parts (by weight) of warm water with 7 parts of stock powder, excepting for dissolving the sweet substances in warm water prior to its addition to stock powder. The test diets were given according to the feeding time schedules for Gr I and Gr II rats. Between any two test diet days a 3 day rest period with stock diet was interposed. The daily calorie (cal) intake on stock, sucrose-mixed and saccharin-mixed diet are computed. Further the water intake and bw are also measured every day.

The cal intake (on stock and mixed diets) and *ml* intake on test solutions are expressed as mean$\pm$SE (*ml* or cal)/100 *gm* bw. The student's 't' test is used for statistical analysis and a P value $<0.05$ is taken as an indication of significant difference.

## RESULTS

When the 3 month old rats were acquired the bw of males (230.8$\pm$4.5 *gm*) was higher than the bw of females (182.5$\pm$3.2 *gm*) The bw of male rats showed a steady increase as compared to female, bw which evidenced cyclic variations ($\pm$2.5%) around an approximately asymptotic bw. On adaptation to 3 hr food schedule for 150 days, the male bw was similar to the *ad lib* fed male bw, whereas the female bw on 3 hr food was decreased by 12.5% as compared to *ad lib* fed female bw (Table I). On 30–day adaptation to 50% diet the female bw was reduced by 26.9% whereas the male bw was reduced by 21.3% as compared to their respective control *ad lib* fed male bw and female bw. However, the male *ad lib* cal intake (per 100 *gm*, bw) was less than the cal intake (per 100 *gm*, bw) of female rats as shown in Table II. But on 3 hr food schedule, female intake

was significantly reduced, whereas the male intake was slightly decreased as compared to their respective intake on *ad lib* feeding. Though no mealtime restriction was imposed on 50% diet group rats, they usually ingested food in the first 2 hrs of its rpesentation.

The solution tests showed (Table I) that on saccharin taste the *ad lib* male intake was significantly increased over the female intake, though on glucose the male intake was similar to female intake. On adaptation to 3 hr food, the male rats, with no loss in bw showed increase in glucose intake but not in saccharin as compared to respective intake of *ad lib* rats. In contrast the female rats on 3 hr food showed significant increase both in glucose and in saccharin intake. On restriction of meal size (50% diet) both male and female rats showed increase in glucose as well as in saccharin intake. However, the increase shown by male rats was higher than the increase shown by female rats intake. The mixed-diet tests (Table II) confirmed the results of solution tests. On addition of sweet taste the *ad lib* male cal intake increased significantly over cal intake

TABLE I : Effects of bw loss on sweet solution intake of male and female rats.

| | Group | Sex | % loss in bw (mean±SE) | ml intake (mean±SE)/100 gm bw | |
|---|---|---|---|---|---|
| | | | | Glucose | Saccharin |
| I | *ad lib* | Male | 0.0 | 3.2±0.2 | 3.4±0.2 |
| | | Female | 0.0 | 3.6±0.3 | 2.6±0.2 |
| II | 3 hr food | Male | 0.0 | 4.3±0.2* | 4.2±0 2 |
| | | Female | 12.5±1.2 | 5.3±0.3* | 4.7±0.3* |
| III | 50% food | Male | 21.3±1.9 | 8.1±0.5* | 9.9±0.6* |
| | | Female | 26.9±2.1 | 9.7±0.8* | 13.8±0.6* |

*Significant ($P<0.05$) increase over Gr I (*ad lib*) intake.

TABLE II : Effects of sweet taste on Cal intake of *ad lib* (Gr I) and 3 hr food (Gr II) male and female rats.

| | Cal intake (mean±SE)/100 gm bw | | | |
|---|---|---|---|---|
| | Gr I | | Gr II | |
| Diet | Male | Female | Male | Female |
| Stock | 16.1±0.4 | 20.3±1.1 | 15.5±0.6 | 15.8±0.9 |
| Sucrose (10.0%) | 19.6±1.3* | 22.3±1.3 | 20.5±1.1* | 23.4±1.0* |
| Saccharin (0.1%) | 19 7±1.2* | 21.9±0.8 | 19.2±0 5* | 20.4±0.9* |

*Statistically significant change ($P<0.05$) as compared to intake on stock diet.

on stock diet whereas the female cal intake on sweet diets was similar to cal intake on stock diet. But on 3 hr food schedule both male and female rats increased their cal intake on sucrose diet and on saccharin diet significantly over their respective intake on stock diet, the increase in female intake being slightly higher.

## DISCUSSION

The results of the present investigation showing sweet taste preference of *ad lib* male rats and the absence of such preference in *ad lib* female intake, contradict the conclusions of earlier investigators (13, 15). This disparity in the results may be due to the differences in the strains of rats used and more importantly in the methods employed. The male albino rats used here showed bw growth at 7–8 months of age. The female did not show such increase though normal estrous-cycle induced bw variations were evident. As per the methods in the early investigations, 24 hr, two-choice tests were administered when the food was also available. Such multiple-choice long-term exposure tests are known (1, 8) to indicate "discrimination" based on post-absorptive (eg. blood glucose, plasma osmolarity) consequences. In contrast the 1 hr, single-choice tests used in the present investigation are known to measure "preferences" perhaps not influenced by post-absorptive factors (2) and hence a better method for perference measurement. Further some earlier investigators (15) used rats adapted to disrupted diurnal light-dark rhythms which is known to increase sweet taste responses (11) and so their taste responses may not be entirely due to sex hormones. However, a fairly recent investigation (5) of adlib female taste responses to brief (1 hr) exposure, two-bottle tests one containing 13.5 glucose or 0.2% saccharin and the other tap water showed female rat preference for calorie-bound sweetness (i.e., glucose) over calorically inert sweet taste (i.e., saccharin) thus confirming the present observations. In addition the increased male intake on sweet taste shown in the present investigation is reminiscent of earlier evidences of sweet preference by calorically starved animals (4, 12). Like the starved animals, the 7–8 months old *ad lib* males (but not the females) of this investigation had bw which was less than the genetically determined bw as indicated by their increasing growth in bw. This idea that bw reduction is correlated with sweet taste preference is further substantiated by intake of both male and female rats on restricted meal-time and meal-size (Table I). The female % bw reduction was higher than that shown in males on similar food intake restricions which could be due to the estrous cycle (14). Whatever might be the reason for bw reduction, the greater % loss in bw was always correlated with a greater increase on sweet taste. But the sweet taste preference of meal-time restricted male rats appears to deviate from the low bw – sweet taste preference relation. The meal-time restricted male rat showed higher intake on sweet taste as compared to the *ad lib* male intake though its bw was identical to the bw of *ad lib* fed control. This anomaly is probably the resultant of shifting of "set point" for bw to higher than normal level on meal-time restriction (7) thus causing a mismatch between actual and target bw.

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