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*LETTER TO THE EDITOR*

# BODY WEIGHT REGULATORY MECHANISMS EVIDENCED ON MEAL-TIME RESTRICTIONS

Sir,

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Constancy of adult weight despite variations in food intake and energy expenditure indicates the presence in the body, a weight regulatory mechanism- 'Ponderostat' (1). This was earlier thought to be residing in ventromedial hypothalamus (2). Recently nucleus tractus solitarius is demonstrated to be its locus (3). Since the bodily changes involved in the maintenance of body weight are not delineated as clearly as that involved in thermo regulation, the present investigation was conducted.

Adult male wistar rats (n = 20) housed in individual wire mesh cages, were kept in animal house with natural light/ dark cycles (12 h each) and a temperature of 24 ± 2.0 degrees centigrade. They were given wet food (powder : water = 2:1) and tap water to drink. After a 10 day period of adaptation to cages, food and water intake, the animals were divided into two groups. Group 1 (n = 10) rats continued to be on ad lib food and water and served as controls. For the group 2 (n=10) food was available only for 3 h period (4–7 p.m ) per day, but water was available 24 h. Every day, at 4 p.m. all the animals were weighed, food and water intake measured and fresh supply of food and water was given. The 3 h food and water intake of both groups of rats was measured at 7 p.m After that, food was not given to meal time rats, but was restored ad lib rats. Volume of urine was measured at 4 p.m. everyday.

The food transit time in the gastrointestinal tract was estimated by using modified continuous marker technique (4). The tissue water percent was computed using cadaver desiccation method (5). The stomach volume was estimated by simply measuring the volume of normal saline necessary to fill the lumen of the stomach. The student's 't' test was used for statistical analysis of data and $P<0.05$ was kept as level of significance.

The food and water intake as well as urine output are expressed per 100 gms body weight. The body weight of meal time rats was reduced immediately following initiation of 3 h food schedule. However in a 10 day period of adaptation of schedule, the body weight of meal time rats increased and matched with body weights of *ad lib* controls (Fig. 1). The initial loss in body weight of 3 h food rats followed reduced food intake per day. After 10 day period on meal time restriction the rats increased their food intake from initial meager amount (2.0 ± 0.8) to 8.6± 0/3 gms. However, even this increased intake was less than the daily

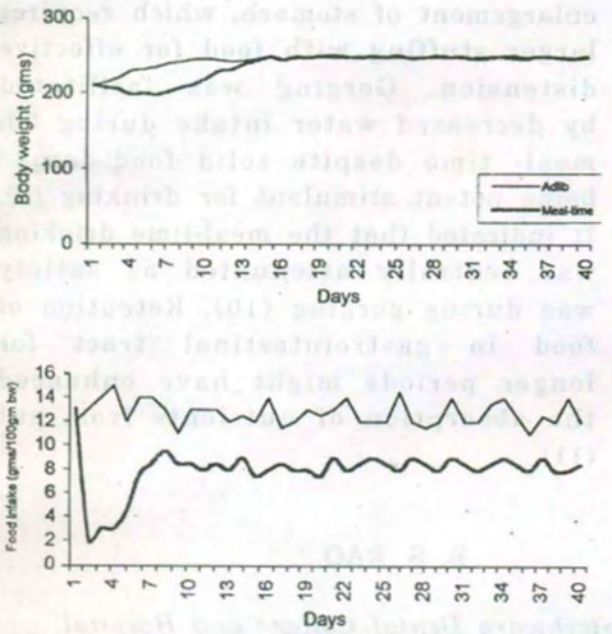


Fig. 1 : Food intake and body weight changes in adlib and meal-time restricted rats.

intake (12.5 ± 0.9) of *ad lib rats*. After adaptation to 3 h meal time, the animals drank proportionately less water (4.1 ± 9 0.3 ml) in 3 h than expected from 3 h solid food intake (8.6 ± 1.3 g) which is shown by reduced 3 h water-to-food (W/F) ratio (0.48). In contrast 24 h W/F ratio of meal time rats (1.3) was similar to 24 h W/F of *ad lib* rats (1.15). The locomotor activity of *ad lib* rats increased (20958 ± 135.8) as compared to *ad lib* rats activity (14289 ± 110.6) in the first 10 day period, following initiation of food schedule. But in the last 10 days, it decreased significantly (P<0.01) in meal-time rats to 9258 ± 48.5. *Ad lib* rats activity in the last 10 day period (14302 ± 121.3) remained unaltered as compared to activity of first 10 day period. The urine output per day of 3 h meal time rats (0.7 ± 0.05 ml) was also decreased as compared to *ad lib* rats urine output (2.3 ± 0.2). However, the food transit time of 3 h meal time rats (59.7 ± 1.3 h) was increased (P<0.01) as compared to transit time in *ad lib* rats (35.8 ± 3.2 h). Computation of tissue water percent showed meal time rats tissue water percent was similar to *ad lib* rats tissue water percent. The 3 h meal time rats stomach volume was 12.8 ± 0.9 ml more than doubled over the volume of the *ad lib* rats stomach (5.2 ± 0.30). Visual examination of gastrointestinal tract of killed rats soon after 3 h meal rats showed that all the consumed food was stored in the stomach and was not found in the oesophagus or duodenum. In contrast, the *ad lib* rats alimentary canal from stomach downward contained food in different stages of digestion.

In this investigation, the 3 h meal time restricted rats were used as models of humans who for one month voluntarily restrict meal intake to nights for religious reasons.

Maintenance of body weight of meal-time rats on low food intake, despite the initial loss of body weight appears as due primarily to consumption of nearly 75% their *ad lib* food intake as well as to reduction of locomotor activity. Earlier studies (6) reported that rats which ingested less than 50% of their normal intake (in an hour and a half) showed excessive activity on running wheels and starved to death ultimately. The reduction in locomotor activity of meal-time rats was unexpected as such a behaviour is found only in severely

food restricted rats (7). Though, decreased energy expenditure via lowered activity of meal-time rats suggests the behavioural adaptation to maintain body weight on low calorie intake whether the meal-time rats actually decreased their energy expenditure is doubtful as epidemiological and whole body calorimetry studies evidenced that energy expenditure per day "gorges" was not different from that of "nibblers" (8).

The meal-time rats appear to have surmounted the problem of satiety by simple enlargement of stomach, which requires larger stuffing with food for effective distension. Gorging was facilitated by decreased water intake during 3 h meal- time despite solid food intake being potent stimulant for drinking (9). It indicated that the meal-time drinking was centrally attenuated as satiety was during gorging (10). Retention of food in gastrointestinal tract for longer periods might have enhanced the absorption of nutrients from gut (11).

B. S. RAO

*Sri Venkateshwara Dental College and Hospital, Uttarahalli, Bangalore – 560 061*

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