

Effects of meal frequency on energy expenditure and body weight in adult rats

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There is a conflicting literature on the effects of varying the number of meals into which a fixed intake of energy is divided, and no evidence from measurement as to the effect on energy expenditure. We have used the automated high-precision calorimeter described by Tobin & Hervey (1985) in conjunction with Hervey, Sivapalan & Tobin's (1986) intragastric feeding system to measure energy expenditure in matched animals that were fed varied, precisely controlled meal schedules.

The four calorimeter cages maintained at 22 °C, contained matched pairs of 4-month-old hybrid male WAG/C × PVG/C rats. A nutritionally complete liquid diet was used, which provided 10% of the energy as protein, 30% as fat and 60% as carbohydrate. Metabolizable energy intake was measured by bomb calorimetry of diet and excreta. The diet was given ad libitum for four weeks before the experiment. Gastric cannulae were implanted under pentobarbitone sodium, (3 mg/100 g b.wt., i.p.), anaesthesia on day -10. Infusion started on day -5; the amount given was progressively increased to equal voluntary intake by day 0, when ad libitum food was removed. During days 0–15 the rats were given 11 meals per day in a pattern similar to normal feeding. During days 15–30 one group continued to receive 11 meals per day; one received the same amount in four equal meals at 01.00, 07.00, 13.00 and 19.00 h; one two meals at 01.00 and 13.00 h; and one a single meal at 01.00 h. The entire experiment has been performed twice, with similar results.

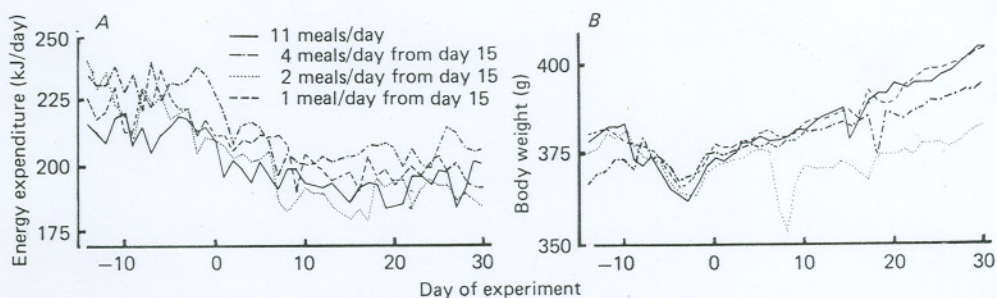


Fig. 1. Energy expenditure (A) and body weight (B).

Fig. 1 shows the energy expenditure and body weight of the four groups over preparatory and experimental periods. Intragastric feeding led to a reduction in energy expenditure by about 25 kJ/d and a small consequential increase in the rate of weight gain, which was countered by reducing the energy infused by 25 kJ/d. The weight loss in the 2-meal group on day 8 was due to a failure of the feeding system.

Energy expenditure and body weight were not perceptibly affected by the number of meals into which a constant energy intake was divided. Respiratory quotient was affected within the day, but the ratio calculated over the day was unchanged.

REFERENCES

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