HUNGER DURING TOTAL STARVATION

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INTERMITTENT fasts have long been suggested for the treatment of obesity (Folin and Denis 1915). Lately, this method has been more widely used following the reports by Bloom (1959) and by Duncan et al. (1962) that patients felt less hungry during total starvation than on conventional low-calorie diets. Although other workers have commented upon the absence of hunger during total starvation (Ashley and Whyte 1961, Drenick et al. 1964, Hollifield et al. 1964, van Riet et al. 1964, Schwarz et al. 1966) all previous assessments of hunger have been based on clinical impressions alone and no objective measurements of hunger intensity have been attempted during the different forms of dietary treatment. We have determined, objectively, whether or not hunger was diminished when obese patients were treated by total starvation.

Patients and Methods

9 obese patients admitted to the medical wards of this hospital for dietary treatment were investigated. They comprised 7 women and 2 men, who ages ranged from 17 to 55 years and whose pre-treatment weights ranged from 182 to 364 lb. (83–165 kg.). All had previously agreed to undergo total starvation as a treatment for their obesity. Each patient spent at least four days in the ward on a diet of 1000 cal. before starting the starvation regimen, and returned to the same diet after fourteen days of total starvation. The preparation and supervision of the diets was undertaken by the dietetic department. During starvation, liquids were allowed to a maximum of 2000 ml. daily in the form of water or specially prepared fruit or vegetable extracts containing no calories, and all patients received 2-g. supplements of sodium chloride and vitamins daily.

Patients were weighed at a similar time each day, and daily urine specimens were tested for ketones ('Acetest', Ames). Blood-urea and serum-electrolytes were estimated before and during the period of starvation. The intensity of hunger was assessed twice a day (at 10 A.M. and 5 P.M.) on the basis of answers to the following questions:

1. Do you feel hungry now?
2. Do you feel empty now?
3. Have you felt hungry since you last completed a similar form?
4. Could you eat a full meal now?
5. Could you eat a light snack now?
6. Could you eat anything at all now?
7. Do you feel well?

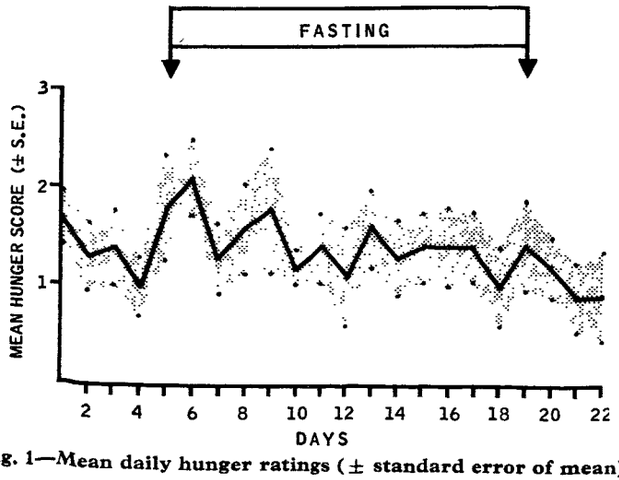

Fig. 1—Mean daily hunger ratings (± standard error of mean).

If patients answered "no" to question 7, they were asked in what way they did not feel well.

The degree of hunger present on each occasion was given a numerical rating according to the following scale: "yes" to questions 1, 2, and 4 (score 3); "yes" to questions 1, 2, and 5 and "no" to question 4 (score 2); "no" to questions 1 and 2 and "yes" to questions 5 or 6 (score 1); or "no" to questions 1, 2, 4, 5, and 6 (score 0).

A score of 3 suggested considerable hunger, the patient indicating that he could eat a full meal; a score of 2 suggested moderate hunger; a score of 1 indicated slight hunger; and patients who scored 0 were not considered to be hungry at all.

The mean score for each day in hospital was calculated for all patients. From this data it was possible to compare the hunger ratings obtained during the period of starvation with those obtained whilst on a 1000-cal. diet.

Results

The mean daily hunger scores of the 9 patients, together with the standard errors of the means are shown in fig. 1. Hunger tended to increase on the first day of the fast, but subsequently the hunger scores were similar to those obtained before starvation. There was no decrease in the mean hunger scores during the fast. But, there was a definite fall in the mean hunger score on returning to a diet of 1000 cals.

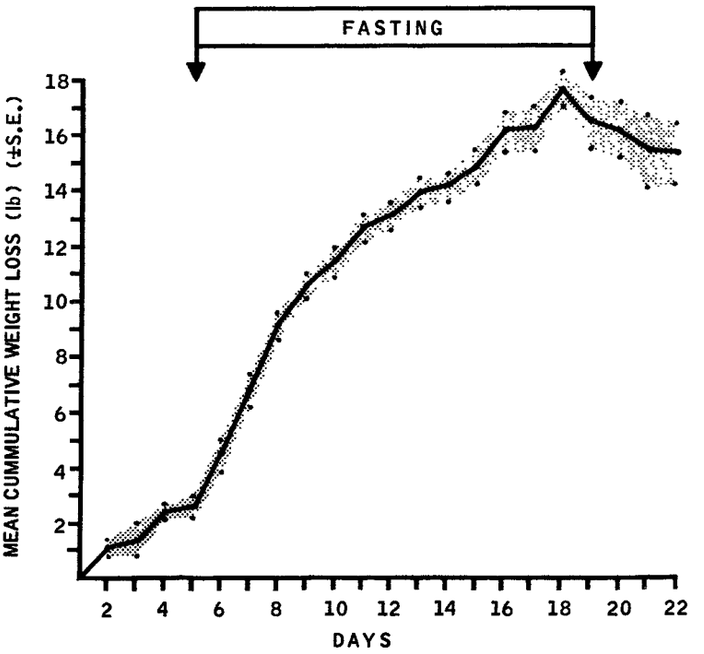

Fig. 2—Mean cumulative weight loss (± standard error of mean).

The daily cumulative weight loss is illustrated in fig. 2. There was a striking negative calorie balance during the period of study. All patients had ketonuria within two days of beginning the fast and this persisted until a diet of 1000 cal. was reintroduced.

All patients remained well during the period of starvation apart from an occasional complaint of postural dizziness. The serum-electrolytes showed no notable changes, although the blood-urea fell in all cases, the level decreasing from a mean value of 32·8 mg. per 100 ml. (range 23–59) to 17·8 mg. per 100 ml. (range 12–29) by the second week of starvation.

Discussion

Our results, based on an objective assessment of hunger, do not support previous claims that hunger diminishes during starvation. There was no significant difference between the mean "hunger score" during the period of starvation and the preceding period on a diet of 1000 cal.

Furthermore, there was no consistent fall in the mean hunger score during the fourteen days that starvation continued. Hunger increased on the first day of starvation, but returned to pre-starvation levels by the second day. In contrast, the mean hunger intensity did fall when the patients ended their fast and resumed a 1000 cal. diet, and this diminution of hunger persisted for at least three days.

The rate of weight loss observed in our patients was very similar to that found by Blondheim et al. (1965) during starvation treatment. In addition, ketonuria developed within two days of beginning starvation and persisted throughout the whole fast. These observations would suggest that the patients did stick to the starvation regimen and were not indulging in any surreptitious eating.

One explanation of the previously reported impression that hunger was diminished during starvation (Bloom 1959, Duncan et al. 1962) may be found in the change we observed in the degree of hunger during the first two days of starvation. On the first day hunger increased to its maximum and thereafter fell back rapidly to pre-starvation levels. It is this relative fall that may have given rise to the impression of a decrease in hunger during starvation.

The present study confirms previous observations by Hollifield et al. (1964) of a reduction in hunger and increased satiety following a period of starvation and the resumption of a low-calorie diet. They demonstrated that adaptive changes occur in enzymatic activity during starvation and have suggested that such changes may be responsible for a temporary reduction in hunger. How long this post-starvation period of diminished hunger lasts is not known with certainty, but in our patients it persisted for at least three days.

Total starvation achieves a considerable reduction of weight in obese patients. But intermittent periods of fasting do not necessarily result in greater weight loss than does continued adherence to a diet of 800–1000 cal. (Blondheim et al. 1965), and the present study shows no difference in the degree of hunger during these two forms of treatment. Total starvation may therefore have fewer advantages than has hitherto been suggested.

Before any conclusions can be made about the effect of diets on hunger, it is clearly necessary that quantitative assessments of hunger are first obtained.

Summary

A questionary has been used to make a quantitative assessment of the intensity of hunger recorded by 9 obese patients on a regimen of total starvation. Hunger scores were computed on a 4-point scale but there was no evidence that hunger diminished during starvation.

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REFERENCES

Ashley, B. C. E., Whyte, H. M. (1961) *Astralas. Ann. Med.* **10**, 92.
Blondheim, S. H., Kaufman, N. A., Stein, M. (1965) *Lancet*, i, 250.
Bloom, W. L. (1959) *Metabolism*, **8**, 214.
Duncan, G. G., Jensen, W. K., Fraser, R. I., Cristofori, F. G. (1962) *J. Am. med. Ass.* **181**, 309.
Folin, O., Denis, W., (1915) *J. biol. Chem.* **21**, 183.
Drenick, E. J., Swendseid, N. E., Blahd, W. H., Tuttle, S. G. (1964) *J. Am. med. Ass.* **187**, 140.
Hollifield, G., Owen, J. A., Lindsay, R. W., Parson, W. (1964) *South. med. J.* **57**, 1012.
Schwarz, F., van Riet, H. G., Schopman, W. (1966) *Metabolism*, **15**, 194.
van Riet, H. G., Schwarz, F., der Kinderen, P. J. (1964) *ibid.* **13**, 291.

EXCRETION OF PREGNANETRIOL IN A CASE OF HYDATIDIFORM MOLE ASSOCIATED WITH OVARIAN THECA LUTEIN CYSTS

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ALTHOUGH the urinary excretion of pregnanediol and œstriol is increased greatly during normal pregnancy (Loraine and Bell 1966) the excretion of pregnanetriol is only slightly elevated (Herrman and Silverman 1957, Ronan et al. 1960, Harkness and Love 1966).

In cases of hydatidiform mole, excretion of pregnanediol and œstriol has been reported (Russell et al. 1957, Frandsen and Stakemann 1964, Macnaughton 1965). In some cases the values fell within the normal ranges for pregnancy, but usually they were low, although greater than those seen in non-pregnant women. Pregnanetriol excretion in hydatidiform mole has not, to our knowledge, been described.

We report here the abnormally high excretion of pregnanetriol (characterised as 5β-pregnane-3α:17α:20α-triol) in a patient with a hydatidiform mole with associated massive theca lutein ovarian cysts. Serial assays of urinary pregnanetriol, pregnanediol, and œstrogens suggest that major portions of these metabolites were derived from ovarian precursors.

Case-report

A woman aged 27 (para 2) was admitted to hospital three months after her last normal menstrual period with a persistent slight vaginal blood-loss and a uterus larger than expected from the period of gestation. Hydatidiform mole was diagnosed on the basis of gonadotrophin excretion and aortography.

Evacuation of the uterus by oxytocin infusion was planned but the patient had a collapse of unknown ætiology associated with chest pain, extreme tachycardia, and dyspnœa. Trophoblastic pulmonary embolism was feared but electrocardiographic examination and chest X-ray gave no support for this. In the circumstances, however, it was considered prudent to evacuate the mole by abdominal hysterotomy. A hydatidiform mole weighing 700 g. was removed. This showed no microscopic evidence of malignancy. At operation the ovaries were observed

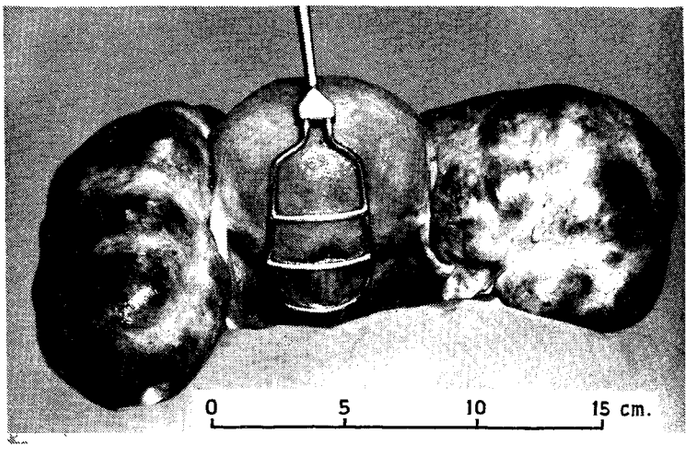

Fig. 1—Massive theca lutein cysts photographed at hysterotomy.