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Absence of evidence is no evidence for absence of the phenomenon

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Energy intake restriction induces a reduction of energy expenditure. A classical example is the so-called Minnesota experiment (1). Normal-weight men received a baseline weight maintenance diet of 14.6 MJ/d (3490 kcal/d) for 12 wk, followed by 24 wk semistarvation with an intake of 6.6 MJ/d (1580 kcal/d). Body weight decreased during semistarvation from a mean value of 69.4 kg to a new plateau of 52.6 kg. Thus, subjects adjusted their energy expenditure to reach a situation of energy balance after 24 wk at 45% of the ad libitum value of energy intake (1). Energy savings were a consequence of a reduction of maintenance metabolism through the loss of active-tissue mass and a reduction of tissue metabolism, a reduction of diet-induced energy expenditure because of the lowered amount of food to be processed, and a reduction of activity-induced energy expenditure through the lowering cost of moving a lower body weight and a reduction of body movement. In the Minnesota experiment, 3.7 MJ/d (885 kcal/d) of the 8.0-MJ/d (1910-kcal/d) reduction of energy expenditure was explained by adaptive thermogenesis, 0.9 MJ/d (215 kcal/d) through reduced tissue metabolism, and 2.8 MJ/d (670 kcal/d) through reduction of body movement (1). In this issue of *The American Journal of Clinical Nutrition*, Martins et al. (2) try to determine adaptive changes in maintenance metabolism of overweight women with measurements at baseline, after weight loss, and at 1 and 2 y follow-up. They also studied weight regain at follow-up in relation to adaptive thermogenesis. The general conclusion of the study is reflected in the title: metabolic adaptation is not a major barrier to weight loss maintenance.

Martins et al. (2) performed a retrospective analysis of 2 studies using similar designs, getting women with a BMI (in kg/m^2) between 27 and 30 to achieve a $\geq$10-kg weight loss, as well as resulting in a BMI $<$ 25. In 1 study, a mean weight loss of 12.8 kg was reached over 25 wk by providing meals with an energy content of 3.35 MJ/d (800 kcal/d) (3). In the other study, an average weight loss of 12.2 kg was reached over 21 wk by providing the same meals in combination with aerobic, resistance, or no exercise training (4). The results of the 2 studies, used for the retrospective analysis of weight loss and energy expenditure, clearly show a main barrier to weight loss. Subjects likely ate more than the 3.35 MJ/d (800 kcal/d) provided with the meals. Daily energy expenditure, as measured in the first study with doubly labeled water at baseline and after weight loss, showed a nonsignificant change from 9.07 $\pm$ 1.62 to 8.60 $\pm$ 1.47 MJ/d (2168 $\pm$ 390 to 2055 $\pm$ 350 kcal/d) (3). Thus, with a mean energy expenditure of (9.07 + 8.60)/2 = 8.84 MJ/d [(2168 + 2055)/2 = 2112 kcal/d], the 3.35-MJ/d (800-kcal/d) diet induced a 5.5-MJ/d (1312-kcal/d) energy deficit. Cumulated over 25 wk, the energy deficit was 5.5 MJ/d (1312 kcal/d) times 175 d equals 962.5 MJ (229 Mcal) or 32 kg body weight loss, assuming an energy equivalent of 30 MJ/kg (7 Mcal/kg) weight loss. The actual weight loss was, with an observed mean value of 12.8 kg (3), less than half of the calculated 32 kg. Thus, subjects must have consumed at least twice the amount of food provided. In addition, it is surprising in the second study that there was no difference in weight loss between the groups receiving the same 3.35-MJ/d (800-kcal/d) diet with or without exercise training (4). Apparently, exercise training did not induce a larger energy deficit in the groups on the diet with exercise training, or was compensated by additional energy intake.

The significant metabolic adaptation after weight loss of -0.23 ± 0.45 MJ/d (-54 ± 105 kcal/d), observed by Martins et al. (2), confirmed that metabolic adaptation was not absent but was judged as minor in relation to weight loss and weight maintenance after weight loss. However, Hill et al. (5) estimated that a reduction of energy intake of $\sim$0.5 MJ/d (100–150 kcal/d) would be required to prevent positive energy balance in most of the adult population. The observed reduction of energy expenditure with 0.23 MJ/d (54 kcal/d) by Martins et al. (2) is equivalent to 84 MJ/y (20 Mcal/y) or an annual body weight gain of nearly 3 kg when intake does not change, which is not a minor amount when compared with the 6.3-kg weight difference between baseline and follow-up at 1 y after weight loss (2).

Recent evidence showed a positive relation between energy balance and weight loss–induced adaptive thermogenesis (6). Subjects consuming a high-protein diet during weight maintenance after weight loss showed no difference between measured and predicted resting energy expenditure, whereas resting energy expenditure was lower than predicted in subjects receiving a medium-protein diet. A high-protein diet counteracted adaptive thermogenesis and induced a negative energy balance during long-term weight loss maintenance.

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The absence of evidence for a relation between metabolic adaptation and weight regain after weight loss does not imply evidence for absence of metabolic adaptation as a barrier to weight loss maintenance (2). Important determinants of weight maintenance in women after diet-induced weight reduction are cognitive restraint and disinhibition, 2 parameters of eating behavior for successful weight maintenance (7). Cognitive restraint is the magnitude of control of amount of food intake and food choice, whereas disinhibition is inhibition of restraint, or breaking the self-imposed diet (8). As aforementioned, dietary compliance during weight loss was low in the studies analyzed by Martins et al. (2), a common phenomenon in most weight loss studies where subjects are not confined as in the study described by Keys et al. (1). After weight loss, over the 2-y follow-up of weight maintenance, participants were encouraged to attend dietary education classes aimed at weight maintenance. Then, dietary compliance possibly overrides any effect of metabolic adaptation on weight maintenance.

In conclusion, Martins et al. (2) confirmed that weight loss resulted in metabolic adaptation. Weight regain at follow-up after weight loss was not related to the observed metabolic adaptation. The main barrier to weight loss, and contributor to subsequent weight regain after weight loss, was not an adaptive reduction in energy expenditure but likely excessive energy intake. In the weight-loss phase, energy intake was more than twice the amount of food provided. During follow-up after weight loss, there was no further food provisioning with further loss of control of energy intake, the main determinant of energy balance.

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