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Could Slow Reintroduction of Calories after Weight Loss Prevent Metabolic Adaptation after Weight Loss?

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Introduction

About 66% of the adults in the United States are overweight or obese [1]. Multiple factors are likely to be involved in the development of this epidemic, including increased dietary fat and caloric intake, as well as decreased levels of physical activity. Public health efforts have emphasized the role of preventing weight gain as a means of preventing the complications of obesity such as a number of adverse medical conditions [2], lower quality of life [3] and reduced life expectancy [2]. Obesity is the result of a long term condition of positive energy balance. Energy expenditure is on the output side of the equation while food intake or caloric intake is on the input side of the equation. Total Daily Energy Expenditure (TDEE) exists of three components, Resting Energy Expenditure (REE), the minimum amount of energy spent to maintain bodily functions, which on average is responsible for 60-70% of TDEE [4], the Thermic Effect of Food (TEF), the energy necessary for the absorption and digestion of the food we eat, which takes up about 10% [4,5], and Physical Activity related energy expenditure, which varies largely from day to day depending on the amount of activity performed [6].

Contributing further to the obesity epidemic is the difficulty in maintaining weight loss [7-9] Complex physiological, neuronal and behavioural process seek to restore homeostasis, resulting in a strong drive for weight regain [9,10]. With weight loss, obligatory reductions in total energy expenditure and its individual components occur [9,11]. However, some, though not all, studies have shown that weight loss results in greater reductions in total and resting energy expenditure (REE) than predicted based on decreased body mass, fat mass, and lean mass [11-13]. A low REE has been shown to be a predictor of weight gain over time [14]. It is well known that weight loss results in a decrease of REE, due in part to a decrease in lean body mass, the strongest predictor of REE [15], but also due to a metabolic adaptation to the caloric restriction, resulting in a higher energy efficiency which serves to prevent further weight loss and conserve energy. However, this energy conservation is also responsible for the weight regain after weight loss [16]. Many obesity treatments are therefore focused on limiting the decrease in REE as much as possible whether is by diet, exercise, medication or a combination of the three in order to slow down the process of weight regain. Because of this tendency for weight regain after weight loss due to physiological adaptations, on top of an often unsustainable combination of caloric restriction and exercise that would be required to maintain the lower body weight, the "reverse diet" concept has gained traction. This diet finds its origin in the power lifting world, where physique and power lifting athletes often submit themselves to periods of caloric restriction in the weeks before a competition or a meet in order to reach their desired leanness or weight category.

However, during the period shortly after cessation of the restrictive diet, body mass will quickly return to pre-diet values with a disproportionate gain of fat mass. To avoid this rapid fat gain 'reverse dieting' has become popular. A reverse diet involves "slowly increasing caloric intake in a stepwise fashion… [in order to] restore circulating hormones and metabolic rate… while avoiding rapid fat gain" [5]. In practice, the slow increase in caloric intake of about 2-3% per week is primarily from

adding carbohydrate and fat back into the diet, since those are the macronutrients reduced during dieting for physique competitions, while protein intake is spared [17-19]. In our lab we performed a small pilot study using a convenience sample of 3 male power lifters who were preparing for a competition and were schedule to follow the 'reverse dieting protocol. Energy metabolism and body composition were measured on a weekly basis with the outcome variable being REE per unit Lean Body Mass (kcal/kg LBM). On average the participants lost 6.2kg of body weight over 6 weeks during which energy intake was reduced by 750kcal. REE dropped on average about 80kcal/24h but the ratio with Lean Body Mass did not change and actually had increased by about 1kcal/kg (unpublished data)

Although touched upon in the media, particularly in the power lifting and physique training industry [18,20], to date, no trial has examined the effects of reverse dieting in non-athlete weight-reduced individuals. A search for "reverse diet" returned over 128,000 hits on Google, but only reached 14 hits in PubMed and none were in the context of reverse dieting as described in the popular press. Due to the anecdotal success of reverse dieting, it would be worth examining the concept in weight-reduced adults who are overweight or obese. If the reverse diet strategy proves as efficacious as in athletes, it would increase REE and caloric intake, with minimal weight and fat mass regain. This could enhance weight loss maintenance and/or allow for further weight loss, ultimately helping the overweight and obese population achieve and maintain greater levels of weight loss.

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