1 INTRODUCTION

The increasing prevalence of obesity has developed into an obesity epidemic where more than half of the population in many countries are overweight or obese. The epidemic has severe medical consequences and implications for the individual as well as society. Global age-standardised mean body mass index (BMI) has increased from 21.9 kg/m² in 1975 to 24.3 kg/m² in 2014 heading towards the acceptance of overweight (BMI≥25 kg/m²) or obesity (BMI≥30 kg/m²) as “the new normal” (1–3). Numerous successful weight loss interventions are recognised (low energy formula diets, very restrictive diets challenging continued adherence, pharmaceutical treatments etc.) (4) and even a modest weight loss of 5-10% of the initial body weight has been shown to have beneficial effects on cardio-metabolic risk factors (5–9). However, the common problem with weight loss programs designed to create a period of negative energy balance is that the achieved weight loss is very difficult to maintain and, therefore, often result in weight regain (4). Thereby, to date, surgical procedures seem to be the most promising treatments to obtain a sustained weight loss (10,11).

Weight loss results in metabolic adaptations triggering innate physiological mechanisms aiming to protect the body from further loss of body mass and to regain the lost weight after a period of starvation when food again becomes available (12,13). During negative energy balance and when reaching energy balance after the weight loss, energy expenditure, both in terms of resting metabolic rate and costs for physical activity, is reduced more than what can be expected from the weight loss per se (14). Thus, the decrease in metabolically active tissue resulting in lower energy needs, will slow down the weight loss and ultimately stop further weight loss. Additionally, the body attempts to counteract the weight loss by increasing the physiological mechanisms stimulating appetite (15–17). As the physiological mechanisms stimulating appetite play an important role in the individual’s ability to control energy intake, these mechanisms highly challenge the maintenance of an achieved weight loss (18) (Figure 1).
Figure 1. Energy balance and body weight regulation assuming that physical activity level remains unchanged. In the stable overweight/obese state, energy intake and energy expenditure are balanced. Decreased energy intake results in a period of negative energy balance resulting in weight loss. However, along with weight loss, energy expenditure is reduced (actual energy expenditure), even more than what can be expected by the loss of body tissues per se (expected energy expenditure). Additionally, alterations in circulating peripheral signalling molecules communicate a state of nutrient deprivation to the brain, resulting in increased appetite. These physiological mechanisms highly challenge body weight management.

Interestingly, the physiological mechanisms related to appetite seem to be reversed after surgically induced weight loss and, thus, decreased appetite is observed during and following a negative energy balance (19–22). This situation may explain why weight loss maintenance is superior after surgically induced weight loss than diet-induced weight loss. Additionally, an increasing number of pharmaceutical treatments for obesity capable of decreasing the appetite are currently being developed as one alternative to surgery. These treatments provide very successful weight losses, but they are only effective during the treatment period, and potential adverse effects from long-term use remain uncertain for many of the treatments (23–25). With the continuously increasing number of individuals needing help for body weight management, it is not feasible to treat the large number of individuals in need of weight reduction surgically or with anti-obesity pharmaceuticals. Therefore, less invasive and less costly concepts are needed for the treatment as well as for the prevention of overweight and obesity.
The big “therapeutic gap” between medical treatments and the traditional weight loss interventions that are available for the majority of individuals who want to achieve a more healthy body weight calls for new dietary-based concepts for body weight management. Dietary-based concepts in which the body’s increased appetite can be satisfied with less energy may be an option to help people manage body weight in order to maintain health and wellbeing throughout life. However, obesity development is very complex and caused by numerous of physiological (genetics, microbiome, resting metabolic rate etc.), psychological (self-esteem, stress, conscious control etc.), social (habits, perceived lack of time, parental control etc.), cultural (nutritional quality of food, food exposure, family etc.) and environmental (food accessibility, safety of unmotorised transport, sedentary employment etc.) factors (26–35). Nonetheless, most of these factors are likely to favour a positive energy balance resulting in weight gain/regain. Thus, appetite reducing treatments can be assumed to be one promising approach in the treatment and prevention of overweight and obesity; nevertheless, there is presently no consensus around whether reduction in appetite is an effective tool for body weight management.