



Lifestyle intervention has a beneficial effect on eating behavior and long-term weight loss in obese adults



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ABSTRACT

Objective: To investigate the change in eating behavior and the factors related with the change among successful dieters (maintained a weight loss of $\geq 5\%$ of original weight).

Methods: Obese adult subjects (21 male, 55 female) were randomized into three-year lifestyle intervention ($n = 59$) and control groups ($n = 17$). Eating behavior (cognitive restraint of eating, uncontrolled eating and emotional eating) was evaluated by the TFEQ-18 and motivation to lose weight and tolerance to problems by a separate questionnaire. Weight, height and body mass index were measured.

Results: Weight decreased more in the intervention group than in the control group (5.0% vs 0.6%, $p = 0.027$). Cognitive restraint increased twice as much in the intervention group compared to the control group (16.0 vs. 7.0, $p = 0.044$). The increment in cognitive restraint was positively associated with weight loss and high baseline motivation and tolerance to problems. Cognitive restraint increased in both successful ($n = 27$) and unsuccessful dieters ($n = 32$), but only the successful dieters were able to decrease uncontrolled eating in the long term.

Conclusions: Our results showed that intensive lifestyle counseling improved cognitive restraint which was associated with enhanced weight loss among obese adults. Successful dieters also showed a long-term improvement of uncontrolled eating. Eating behavior should be evaluated and followed before and during lifestyle interventions in order to support the change, e.g. by finding methods to control eating at risk situations and strengthening motivation and tolerance to problems.

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1. Introduction

Obesity is a global concern for which long-term prevention and treatment solutions are being sought. Although many studies have been conducted to reveal the most effective treatment regimen for weight loss and maintenance, the optimal treatment protocol is still unknown. Several behavioral treatment protocols have been suggested to promote healthier eating habits and increase physical activity (Lang & Froelicher, 2006). Interventions including both nutritional counseling and physical activity have been shown to be most

effective in generating weight loss and maintenance with a favorable change in eating behavior (Andrade et al., 2010; Dombrowski, Knittle, Avenell, Araújo-Soares, & Sniehotka, 2014; Rejeski, Mihalko, Ambrosius, Bearon, & McClelland, 2011).

Certain traits of eating behavior have been associated with successful weight loss and long-term weight maintenance. Higher cognitive restraint of eating enhances the maintenance of weight loss in overweight subjects (Andrade et al., 2010; Keränen, Strengell, Savolainen, & Laitinen, 2011; Keränen et al., 2009; Svendsen et al., 2008; Westerterp-Plantenga, Kempen, & Saris, 1998), while uncontrolled eating and binge eating predict less weight loss and emerge as unsatisfactory traits for successful weight maintenance (Keränen et al., 2009; Pacanowski, Senso, Oriogun, Crain, & Sherwood, 2014; Svendsen et al., 2008; Westerterp-Plantenga et al., 1998). Emotional eating has also been inversely associated with maintenance of weight loss (Andrade et al., 2010; Keränen et al., 2009; Neve, Morgan, & Collins, 2012). The cognitive restraint of eating has been shown to increase and uncontrolled eating to decrease more among overweight successful

Abbreviations: BMI, Body mass index; TFEQ-18, The Three-Factor Eating Questionnaire-18; TFEQ-51, The original Three-Factor Eating Questionnaire.

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dieters compared to those who fail in weight loss and maintenance (Karhunen et al., 2012; Keränen et al., 2009; Neve et al., 2012). In general population, higher body mass index and other adiposity factors have been associated with increased cognitive restraint (de Lauzon et al., 2004).

Although the importance of eating behavior on weight control is already acknowledged, there are still relatively few studies concerning the change in eating behavior during long-term lifestyle interventions aiming at weight loss or maintenance. A positive effect on cognitive restraint and emotional eating was shown in overweight women after a behavior change intervention aiming exercise and eating patterns which are known to predict successful weight management (Teixeira et al., 2010). The change in eating behavior seems not to be dependent on whether intensive or short-term counseling has been employed (Keränen et al., 2009). Yet, there is only limited knowledge on other factors, such as motivational and self-confidence factors that are associated with the change in eating behavior and may thus be possible important prerequisites to it. Instead, motivation has been shown to predict successful changes in dietary and exercise behavior and weight loss has been associated with belief in one's ability to change behavior (Stubbs & Lavin, 2013).

The aim of this randomized controlled trial was to evaluate the effect of a lifestyle intervention on the change in eating behavior, especially cognitive restraint of eating, uncontrolled eating, and emotional eating. Another aim was to study the effect of the trial on the success in weight management. Furthermore, the aim was to reveal the motivational and self-confidence factors associated with the change in eating behavior. We hypothesized that lifestyle intervention has beneficial effects on eating behavior, especially in those with success in long-term weight management.

2. Material and methods

2.1. Study design and participants

The study was a randomized controlled intervention (Fig. 1). It consisted of a 9-month weight loss program followed by a 27-month weight maintenance period. The total duration of the follow-up was thus 36 months. Volunteer participants were recruited by newspaper advertising, which attracted 489 responses. The inclusion criteria were body mass index (BMI) (weight (kg)/square of height (m)) more than 30 kg/m² and age between 18 and 65 years. The exclusion criteria were pregnancy or lactation, inability to take part in exercise or intensive counseling, drugs affecting heart rate, or current treatment for obesity at another clinic or group.

One hundred and twenty subjects (26 males and 94 females) were randomly chosen among all the eligible volunteers ($n = 397$). They were randomly allocated into an intervention group ($n = 90$) and a control group ($n = 30$). Altogether 76 (63%) participants (21 males, 55 females) completed the study and participated in the final measurements including the filled TFEQ-18 questionnaire, composing the study population of this study.

The procedures of the study were in accordance with the Declaration of Helsinki. The protocol was approved by the Ethics Committee of the Northern Ostrobothnia Hospital District. All participants gave an informed and written consent.

2.2. Questionnaires

The subjects filled in a questionnaire enquiring about health, lifestyle, education and smoking. All questionnaires were filled in at baseline and at 9, 24 and 36 months.

2.2.1. Eating behavior

Eating behavior was evaluated using the Three-Factor Eating Questionnaire-18 (TFEQ-18) (Karlsson, Persson, Sjöström, & Sullivan,

2000), which is a shorter version of the original 51-item Three-Factor Eating Questionnaire (TFEQ-51) (Stunkard & Messick, 1985). The TFEQ-18 has been validated in different populations, also within obese subjects (Angle et al., 2009; de Lauzon et al., 2004; Karlsson et al., 2000). The questionnaire consists of three factors: cognitive restraint of eating, uncontrolled eating, and emotional eating. Cognitive restraint means regulating food intake because of weight maintenance (Karlsson et al., 2000). Uncontrolled eating refers to difficulty to regulate eating. Emotional eating means a tendency to eat more than needed because of e.g. negative mood states.

2.2.2. Motivation and self-confidence

The study participants were asked to report their motivation to lose weight in the study questionnaire by the question: "How motivated are you to lose weight on this occasion compared to previous efforts?". Confidence in oneself to achieve goals was assessed by the question: "How sure are you that you have enough strength to achieve your goal?". Tolerance to problems was assessed by the question: "How much do you believe you could tolerate problems because of losing weight considering your present life situation, e.g. work-related stress?". All of them were evaluated on 5-point scales, ranging from 1 (*not at all*) to 5 (*very much/very sure*).

2.3. Measurements

All measurements were performed at baseline and at 9, 24 and 36 months. Body weight was measured to the nearest 0.1 kg using a calibrated scale (SOEHNLE S20, Soehnle waagen, Germany). The subjects wore light indoor clothes without shoes during the measurement. Change in weight was calculated as relative change in percentage. Height was measured at the beginning of the trial to the nearest 0.1 cm using a right-angle ruler placed on the head against a tape measure secured to the wall. BMI was calculated at each visit by dividing the weight (in kilograms) by the height squared (in meters).

2.4. Intervention

The intervention and control groups were treated according to the Finnish Current Care Guideline for Obesity (2002). The lifestyle intervention consisted of a 9-month weight loss period followed by 27-month weight maintenance period. During the first year the intervention group was given individual weight maintenance counseling three times by a nutritionist and eleven times by a qualified nurse. During the second year the intervention group met the nurse four times and during the third year two times. The counseling included themes such as healthy diet, risk situations in weight management and physical activity. Eating behavior was taken into account in the counseling by questionnaires, exercises and diaries about supporting permanent change in eating behavior to achieve successful weight loss management. The subjects in the control group met a qualified nurse once at the beginning and also received a booklet concerning the principles of weight management.

2.5. Statistical analyses

Statistical analyses were done in per protocol treated patients. The significance of the differences in change in eating behavior and body weight between the groups during the trial and extended follow-up was analyzed by linear mixed model analysis. In post hoc tests Bonferroni correction was used for p-values. Total change in weight and eating behavior between the groups was examined using independent samples t-test. The same analyses were performed between the successful and unsuccessful dieters in the intervention group. Maintaining weight loss of at least 5% of original body weight at 36 months was determined as the criterion for success.

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