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Research report

Increase in cognitive eating restraint predicts weight loss and change in other anthropometric measurements in overweight/obese premenopausal women ☆

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ABSTRACT

In modern societies characterized by food abundance, dietary restraint may serve as a factor in the successful control of weight or facilitation of weight loss. This secondary analysis of data examined whether changes in cognitive eating restraint (CER) and disinhibition predicted weight loss in a sample of 60 overweight/obese premenopausal women [mean ± SD, age = 35.9 ± 5.8 y; weight = 84.4 ± 13.1 kg; body mass index (BMI) = 31.0 ± 4.3 kg/m^2]. Changes in weight, BMI, waist circumference, hip circumference, waist-to-hip ratio and body fat percentage (BF%) were examined in relation to changes in CER, disinhibition and hunger as measured by the Eating Inventory questionnaire at baseline and week 18 of an 18-week dietary intervention. Multivariate linear regression analysis was used to identify predictors of weight loss and changes in other anthropometric variables from baseline to study completion. Increase in CER was found to be the most robust predictor of reduction in weight ($P < 0.0001$), BMI ($P < 0.0001$), waist circumference ($P < 0.001$), hip circumference ($P < 0.0001$) and BF% ($P < 0.0001$). Effect of increase in CER on change in BMI, hip circumference and BF% was moderated by increase in disinhibition (all $P < 0.05$). Results suggest that strategies that target CER and disinhibition should be emphasized in programs proposed to treat and prevent obesity.

Introduction

The construct of dietary restraint was first proposed by Herman and Mack (1975) to integrate Schachter's concept of externality (Schachter, 1968) and Nisbett's set-point theory (Nisbett, 1972), and to describe the tendency to restrict food intake to control body weight (BW) (Herman & Mack, 1975; Huon, Wootton, & Brown, 1991). In 1975, restraint was perceived as a prelude to the development of counter-regulatory eating associated with excessive intake, bulimic pathology and obesity (Polivy & Herman, 1985; van Strien et al., 2007). Specifically, the restraint theory postulates that attempts to cognitively control food intake may leave dieters vulnerable to loss of control over eating when these cognitive processes are disrupted by disinhibiting factors such as the ingestion of palatable foods, alcohol and depressive mood (Lowe, 1993; Ruderman, 1986; Westenhoefer, Broeckmann, Munch, & Pudel, 1994).

Cognitive eating restraint (CER) is commonly assessed by the Eating Inventory (EI) questionnaire, developed by Stunkard and Messick (1985), which consists of 51 items (36 true-false and 15 multiple-choice questions). The EI measures three psychological constructs, including CER, as well as disinhibition and perceived hunger. Dietary restraint is referred to as the propensity of some individuals to consciously restrict food intake for the purpose of losing or maintaining BW (Stunkard & Messick, 1985), disinhibition as a propensity to overeat due to situational conditions and negative emotional states (Westenhoefer, 1991), and perceived hunger refers to the susceptibility to body signs and symptoms that signal the drive for food (Hays et al., 2002). The validity of the EI with respect to measuring the intent to diet and actual caloric restriction has been well substantiated (Laessle, Tuschl, Kotthaus, & Pirke, 1989; Williamson et al., 2007), and the EI is currently a standard instrument in research that evaluates eating behaviors and obesity.

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Numerous studies have examined dietary restraint to investigate the extent to which differences in restraint were systematically related to caloric intake, body mass index (BMI) and weight change (Finlayson, Cecil, Higgs, Hill, & Hetherington, 2012; Laessle et al., 1989; Leblanc et al., 2012; McLean & Barr, 2003; Tuschl, Laessle, Platte, & Pirke, 1990; Westenhoefer et al., 1994). Available data have shown that women who scored high on dietary restraint did, in fact, restrict food intake (McLean & Barr, 2003), but with varying degrees of success. Under experimental conditions, restrained men and women showed a greater tendency to overeat in response to several disinhibiting factors, including presence of palatable foods, alcohol intake or dysphoric mood (Lowe, 1993; Ruderman, 1986; Westenhoefer et al., 1994). In more naturalistic settings, however, individuals with high eating restraint actually ate less than individuals with low scores, as measured by dietary records (Laessle et al., 1989) and doubly-labeled water (Tuschl, Platte, Laessle, Stichler, & Pirke, 1990).

Several cross-sectional studies have reported a positive association between restraint and BMI (Hill, Weaver, & Blundell, 1991; Janelle & Barr, 1995; Tuschl et al., 1990) and adiposity (Beiseigel & Nickols-Richardson, 2004), while in other studies, these associations have been negative (Foster et al., 1998; Siegel, Yancey, & McCarthy, 2000). Results of prospective studies also have been contradictory. Several investigations of free-living populations have found that self-reported dietary restraint predicted weight gain rather than weight loss (Lowe et al., 2006; Pliner & Saunders, 2008; Stice & Bearman, 2001; Stice, Cameron, Killen, Hayward, & Taylor, 1999). Conversely, intervention trials that assigned subjects to weight-loss-inducing diets have shown that participants with higher levels of restraint had lower attrition rate (Clark, Marcus, Pera, & Niaura, 1994) and experienced greater weight loss (Foster et al., 1998; Karlsson et al., 1994; Lowe, Foster, Kerzhnerman, Swain, & Wadden, 2001; Stice, Presnell, Groesz, & Shaw, 2005; Williamson et al., 2008).

Moreover, results have been further complicated by the fact that restraint has often been associated with disinhibition, which has shown a consistent positive association with BMI (Bellisle et al., 2004; Carmody, Brunner, & St Jeor, 1995; Hays et al., 2002; Lawson et al., 1995) and weight gain (Drapeau et al., 2003; Provencher, Drapeau, Tremblay, Després, & Lemieux, 2003). Inconsistencies across findings could be explained in part by the target populations examined. In free-living individuals not undergoing intervention, increased restraint has been associated with increased disinhibition, while in interventions, disinhibition has been effectively curbed by active dieting (Westenhoefer, Stunkard, & Pudel, 1999).

The purpose of this study was to test the hypothesis that CER was positively associated with weight loss. This study also prospectively evaluated the change in CER, disinhibition and their interaction, as well as hunger, and change in weight and other anthropometric measurements over an 18-week weight-loss intervention in a group of overweight/obese premenopausal women. It was hypothesized that an increase in CER would be positively associated with weight loss [consistent with findings of previous studies (Foster et al., 1998; Karlsson et al., 1994)] and that this effect would be moderated by a change in disinhibition.

Materials and methods

Primary intervention and participants

The current study is a secondary analysis of data obtained from a primary weight-loss trial in which 60 overweight/obese premenopausal women followed a reduced-calorie diet for 18 weeks (Nickols-Richardson, Piehowski, Metzgar, Miller, & Preston, 2014). Participants were instructed to consume 500 fewer kcals per day than required for their energy balance, as determined by the Harris–Benedict equation (Harris & Benedict, 1919). Women were educated on the reduced-calorie diet (50% carbohydrate, 30% fat, 20% protein) and provided with meal planning instructions, based on a food exchange system. Specific food choices were reviewed with participants by a registered dietitian during weekly nutrition education sessions.

The primary study enrolled healthy women, ages 25 to 45 years, with a BMI of 25.0 to 42.9 kg/m^2. Exclusion criteria included: current smoking; depressive symptoms; eating disorders; abnormal metabolic conditions; use of medications affecting metabolism; pregnancy; dysmenorrhea; BW change of >5% in the past six months, and >5 hours of planned physical activity per week. Women were recruited from communities in central Pennsylvania (USA), using published advertisements, electronic notices, posted flyers and word-of-mouth. Each woman provided written informed consent before participating in the primary study. The primary study, including variables examined in this secondary analysis, was approved by the Institutional Review Board for Research Involving Human Subjects at The Pennsylvania State University (University Park, PA, USA).

Measurements and questionnaires

Anthropometric measurements, including height (cm), BW (kg), waist circumference (cm), hip circumference (cm) and body fat percentage (BF%) were obtained by trained staff at baseline and after 18 weeks of intervention, following standard protocols (Piehowski, Preston, Miller, & Nickols-Richardson, 2011). Investigators calculated BMI (kg/m^2) from height and BW measurements and waist-to-hip ratio from waist and hip circumference measurements. Body fat percentage was assessed by dual-energy X-ray absorptiometry (QDR 4500A, Hologic, Inc., Bedford, MA, USA), using standard procedures (Miller et al., 2009).

Caloric intake (kcal/d) was estimated using 4-day food records at baseline and week 18 (Nickols-Richardson et al., 2014). During three non-consecutive weekdays and one weekend day before collection of anthropometric measurements, women recorded all foods and beverages consumed and portion sizes of these items. Food records were coded by one investigator, and caloric intake was estimated using the Food Processor® dietary intake analysis software (version 10.6.0, ESHA Research, Salem, OR, USA). Physical activity (hrs/d) was assessed using the Stanford 7-Day Physical Activity Recall Scale (Sallis et al., 1985) at baseline and week 18 to calculate caloric expenditure (kcal/d) (Piehowski et al., 2011). During the five consecutive weekdays and two weekend days before collection of anthropometric measurements, women recorded the approximate number of hours that they spent in a variety of activities. These activities were classified according to metabolic equivalents (METs), and caloric expenditure was estimated for each activity (1 MET = 1 kcal/kg/hr). The total number of hours of moderate, hard and very hard activities was multiplied by the corresponding MET value, summed and divided by seven to estimate total caloric expenditure per day. Women were instructed to maintain their typical physical activity patterns throughout the 18-week intervention.

At baseline and week 18, participants completed paper-and-pencil versions of the EI. Participants were verbally instructed on how to complete the EI and also were provided with written instructions. Upon completion of the EI, investigators scored responses according to guidelines (Stunkard & Messick, 1985) to calculate CER, disinhibition and hunger scores for each participant. The range of possible scores for the CER, disinhibition and hunger subscales were 0–21, 0–16 and 0–14, respectively.

Statistical analyses

Sixty women completed baseline measurements, 51 of which completed the 18-week intervention. Data were analyzed using the intention-to-treat model, which replaced missing data entries with the last available measurement value. The primary study revealed