Emotional ratings of high- and low-calorie food are differentially associated with cognitive restraint and dietary restriction

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A B S T R A C T

Dietary restraint is a robust risk factor for binge eating and eating disorders, which may partially result from increased reward reactivity to food in individuals who attempt to diet. However, research examining the association between dietary restraint and reactivity to food cues is mixed. Mixed findings may reflect distinct relations between food cue reactivity and different dimensions of dietary behavior; attempts to diet (cognitive restraint) may be associated with increased positive evaluations of food, whereas actual reduction in food intake (dietary restriction) may be achieved through decreased reactivity to food cues. The aim of the current study was to examine whether cognitive restraint and dietary restriction, as assessed via subscales on a recently developed multidimensional measure of eating pathology (i.e., Eating Pathology Symptoms Inventory [EPSI]), are differentially associated with emotional evaluations of high- and low-calorie food. Female participants (N = 203) viewed 12 high-calorie (i.e., sweet, savory) and 12 low-calorie (i.e., fruits, vegetables) food images, as well as 36 standard emotional images. Images were rated on the dimensions of valence, arousal, and craving using the Self-Assessment Manikin. Cognitive restraint was correlated with greater pleasure and craving ratings of low-calorie, but not high-calorie, foods. In contrast, dietary restriction was related to reduced pleasure and craving ratings for both high- and low-calorie foods. Findings suggest that cognitive restraint may be associated with a preference for low-calorie foods; whereas dietary restriction may relate to reduced sensitivity to the hedonic and motivational value of food, regardless of caloric content. Results also provide support for the distinction between cognitive restraint and dietary restriction, as assessed via the EPSI.

Dietary restraint, broadly defined as the intention and/or attempts to restrict caloric intake, is one of the strongest risk factors for the development of binge eating and bulimia nervosa (BN). Indeed, a recent review by Stice (2016) reported that dieting predicted BN onset in each of the six longitudinal studies in which it was examined. In addition, dieting increased risk for binge eating and overweight status (i.e., body mass index (BMI) in 85th percentile or above) in adolescent males and females over 5 years (Neumark-Sztainer et al., 2006). According to restraint theory (Herman & Mack, 1975; Polivy & Herman, 1985), restrained eating involves cognitive attempts to avoid eating when hungry, and dieters are susceptible to disinhibited eating when cognitive control is disrupted (e.g., by diet-breaking foods, negative mood, alcohol intake). As such, restraint theory posits that dietary restraint is related to binge eating through failures in top-down cognitive control processes.

There also is evidence that dietary restraint is associated with increased bottom-up reward reactivity to food stimuli, which may help further explain why individuals who attempt to diet are vulnerable to binge eating and weight gain. However, research in this area has produced mixed findings. Some studies report that individuals high on dietary restraint endorse greater trait appetitive responsiveness and craving for food (e.g., Ahern, Field, Yokum, Bohon, & Stice, 2010; Gendall, Joyce, Sullivan, & Bulik, 1998; Meule, Lutz, Vögele, & Kübler, 2012), although null effects have been observed (e.g., Rodin, Mancuso, Granger, & Nelbach, 1991; White, Whisenhunt, Williamson, Greenway, & Netemeyer, 2002). Dietary restraint scores have been shown to positively correlate with salivary reactivity to the presentation of palatable food (e.g., Brunstrom, Yates, & Witcomb, 2004; but see Nederkoorn & Jansen, 2002 for contrasting findings) as well as activation in reward-related brain regions during the receipt, but not anticipation, of food (Burger & Stice, 2011). A meta-analysis reported a small, significant relationship between, restrained eating and attentional...
bias towards food, assessed via the Stroop (Brooks, Prince, Stahl, Campbell, & Treasure, 2011); however, a recent review of additional attention bias tasks concluded that most published studies report no differences in attention bias for food between restrained and unrestrained eaters (Wertheim, Jansen, & Roefs, 2015).

Studies using implicit paradigms have found evidence for both positive and negative automatic associations with food in individuals high on restraint, although many of these studies directly contrast high- and low-calorie food. Indeed, one important study found that participants with high versus low restrained eating demonstrated greater positive attitudes towards palatable food, regardless of caloric content (Houben, Roefs, & Jansen, 2012). Similarly, automatic approach tendencies for high- and low-fat food items were greater in restrained versus unrestrained eaters (Veenstra & de Jong, 2010). However, in contrast to above findings suggesting increased reactivity to high- and low-calorie foods, Ahern et al. (2010) reported that dietary restraint scores were unrelated to performance on attentional bias, food reinforcement, taste habituation, and approach bias tasks in 453 female students.

One important consideration that may help explain previous mixed findings is that dietary restraint is a multidimensional construct, and different dimensions of dietary behavior may be differentially associated with behavioral reactions towards food. Different dietary restraint scales vary on the extent to which they purport to measure “successful” dieting versus dieting that is punctuated by periods of disinhibited eating, and a recent factor analytic study of common dietary restraint measures found three distinguishable factors: calorie counting, weight-focused restraint, and preoccupation with dieting (Hagan, Forbush, & Chen, 2016). Notably, one criticism of virtually all existing measures of dietary restraint is that they do not assess actual caloric restriction. Multiple self-report measures of dietary restraint did not correlate with objectively measured caloric intake in the laboratory or the natural environment (Stice, Fisher, & Lowe, 2004; Stice, Sysko, Roberto, & Allison, 2010), suggesting that dietary restraint scores may be measuring relative dietary restriction (i.e., eating less than one desires) rather than actual reductions in food intake (Stice et al., 2010).

A newly developed multidimensional measure of eating pathology aims to explicitly distinguish between attempts to eat less (cognitive restraint) and actual reduction of food intake (dietary restriction). The Eating Pathology Symptoms Inventory (EPSI; Forbush et al., 2013) includes both a Cognitive Restraint subscale that assesses cognitive efforts to limit or avoid eating, whether or not these efforts are successful, and a Restricting subscale that purports to measure concrete efforts to avoid or reduce food consumption (Forbush, Wildes, & Hunt, 2014). Participants are asked to report on their eating attitudes and behaviors over the past 4 weeks, with subscale scores representing average behavior over this time period. The Cognitive Restraint and Restricting subscales were only moderately correlated in the validation study (r = 0.27) and, of several dietary restraint scales, the EPSI Restricting subscale was the only one to correlate negatively with BMI (Forbush et al., 2013). Thus, the EPSI provides a unique opportunity for examining differential correlates of cognitive restraint and dietary restriction, including emotional responses to food.

Cognitive restraint and dietary restriction may be related to different emotional responses to food, which may help explain previous mixed findings. Specifically, enhanced reward reactivity to food may be linked to cognitive efforts to reduce food intake and associated vulnerability towards binge eating; whereas decreased rewarding reactivity to food may characterize dietary restriction. Data from randomized controlled trials provide indirect support for this hypothesis, as weight loss interventions that require participants to maintain a low-calorie diet (i.e., 1200 calories/day) are related to a decrease, rather than an increase, in bulimic symptoms and BMI (e.g., Groesz & Stice, 2007; Presnell & Stice, 2003). Data from patients with anorexia nervosa (AN), who engage in persistent dietary restriction, provide further support for this potential distinction. Compared to healthy controls, individuals with AN rate food as less pleasurable and more anxiety provoking (see Giel et al., 2011 for a review) and have been found to smile less when viewing food images (Soussignan, Jiang, Rigaud, Royet, & Schaal, 2010). When high- and low-calorie foods have been directly compared, patients with AN have demonstrated both an explicit and an implicit preference for low-versus high-calorie foods, a pattern that is reversed in healthy controls (Cowdrey, Finlayson, & Park, 2013; Veenstra & de Jong, 2011). However, the results of two implicit approach-avoidance bias studies were consistent with an overall loss of incentive value of food, regardless of caloric content (Paslakis et al., 2016; Veenstra & de Jong, 2011). Thus, chronic dietary restriction in the context of AN appears to be associated with reduced reward reactivity to high-calorie foods; whereas emotional evaluations of low-calorie foods are less clear.

The current study aimed to build upon prior research by investigating relationships between cognitive restraint and dietary restriction, measured via the EPSI, and explicit emotional evaluations of high- and low-calorie food. Food images were rated on the dimensions of valence, arousal, and craving using the Self-Assessment Manikin (Bradley & Lang, 1994; Miccoli et al., 2014, 2016). We hypothesized that high cognitive restraint scores would relate to more positive evaluations of high- and low-calorie food, given explicit intentions to diet but associated difficulty reducing caloric intake. We also expected that greater dietary restriction scores would correlate with more negative evaluations of high-calorie food; however, we did not form a hypothesis regarding restriction/low-calorie food associations given evidence for both positive evaluations of low-calorie food as well as negative evaluations of food, regardless of caloric content. Findings from this study are important for clarifying how distinct dimensions of dietary behavior relate to emotional ratings of high- and low-calorie food.

1. Methods

1.1. Participants

Participants were 203 undergraduate women enrolled in an introductory psychology course. Participants ranged in age from 18 to 36 years (M (SD) = 18.84 (1.60) years). The majority of the sample identified as Caucasian (87.6%), with 7.4% identifying as African American, 1.0% as Asian, 2.0% as Native American or Alaskan Indian, and 2.0% as multi-racial. Approximately 10% (19/203) of participants self-reported a history of an eating disorder, including AN only (7/19; 36.8%), BN only (3/19; 15.7%), binge eating disorder only (3/19; 15.7%), or more than one eating disorder (6/19; 31.6%). Participants with an eating disorder history were included to capture the full range of eating behavior, from low to high; excluding these participants did not significantly impact results (average absolute value change in correlation coefficients of interest: 0.02).

1.2. Stimuli and measures

1.2.1. Open Library of Affective Foods (OLAF; Miccoli et al., 2014, 2016)

The OLAF is a set of 96 high-calorie (i.e., sweet, savory) and low-calorie (i.e., fruits, vegetables) food images designed for use in research on emotional processing of food in non-clinical samples.
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