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Research report

# Relation of dietary restraint scores to cognitive biases and reward sensitivity☆

Amy L. Ahern [a,c,*], Matt Field [a], Sonja Yokum [b], Cara Bohon [b], Eric Stice [b]

[a] School of Psychology, University of Liverpool, Eleanor Rathbone Building, Bedford Street South, Liverpool L69 7ZA, UK
[b] Oregon Research Institute, 1715 Franklin Boulevard, Eugene, OR 97403, USA
[c] MRC Human Nutrition Research Unit, Elsie Widdowson Laboratory, 120 Fulbourn Road, Cambridge CB1 9NL, UK

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ABSTRACT

This study tested the hypotheses that dietary restraint scores are associated with greater reward sensitivity and cognitive bias for food-related cues, which might result in chronic overeating and efforts to curb this tendency through dietary restriction. Participants ($N = 63$) with high versus low scores on the DEBQ-R did not differ on attentional bias for pictorial food-related cues on a visual probe task, or approach tendencies elicited by food cues, as assessed with a stimulus–response compatibility (SRC) task. Restraint was also unrelated to performance on an operant task that assessed how hard participants would work for snacks, or responding during a taste habituation paradigm. Dietary restraint scores were correlated with self-reported appetitive response to food, sensitivity to reward, and sensitivity to punishment. Results provide limited support for the hypothesis that individuals with elevated dietary restraint scores show greater reward sensitivity and cognitive bias for food stimuli, though it is possible that the null findings on the behavioral task resulted because of an approach-avoidance conflict to food cues in which heightened appetitive responses to food are inhibited by food-related anxiety.



## Relation of dietary restraint scores to cognitive biases and reward sensitivity

Dietary restraint refers to intentional restriction of caloric intake for the purposes of weight loss or weight maintenance (Wilson, 2002). Polivy and Herman (1985) posit that a reliance on cognitive controls over eating leaves individuals vulnerable to binge eating when these controls are disrupted, such as by negative affect. Prospective studies indicate that individuals with elevated scores on dietary restraint scales, relative to those with lower scores, are at increased risk for future onset of binge eating, bulimic pathology, and increases in bulimic symptoms (Field et al., 1999; Johnson & Wardle, 2005; Killen et al., 1996; Neumark-Sztainer et al., 2006; Stice, 2001). Yet, randomized trials indicate that assignment to low-calorie weight loss diets, relative to waitlist control conditions, results in significantly greater decreases in binge eating for obese binge eating women (Goodrick, Poston, Kimball, Reeves, & Foreyt, 1998; Reeves et al., 2001) and overweight women (Klem, Wing, Simkin-Silverman, & Kuller, 1997) and greater decreases in bulimic symptoms for normal weight young women (Groesz & Stice, 2007; Presnell & Stice, 2003) and women with bulimia nervosa (Burton & Stice, 2006). It is vital to clarify the nature of the relation of dietary restriction to bulimic pathology because the two sets of findings have opposed implications: if dieting increases risk for bulimic pathology, prevention trials should seek to eradicate dieting, but if dieting reduces bulimic symptoms, prevention programs should promote effective dieting.

Recent studies that used objective measures of caloric intake indicate that dietary restraint scales [including the TFEQ (Stunkard, 1981) the Restraint Scale (RS; Polivy, Herman, & Warsh, 1978), and Dutch Eating Behaviour Questionnaire (DEBQ-R, van Strien, Frijters, Bergers, & Defares, 1986)] are not a valid measure of actual dietary restriction during single eating episodes, multiple eating episodes, or over 2–12 week observation periods (Martin et al., 2005; Rolls et al., 1997; Stice, Cooper, Schoeller, Tappe, & Lowe, 2007; Stice, Fisher, & Lowe, 2004; Sysko, Walsh, Schebendach, & Wilson, 2005; van Strien, Cleven, & Schippers, 2000), suggesting that it is not dietary restriction that increases binge eating and bulimic pathology, but some other latent construct tapped by dietary restraint scales.

### *Dieters may experience greater reward from food intake*

One possibility is that certain individuals experience relatively greater reward from food intake, which increases the odds that they attempt restraint and the risk for binge eating and bulimic pathology onset. In line with this hypothesis, greater cravings for

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* Corresponding author.
*E-mail address:* Amy.Ahern@mrc-hnr.cam.ac.uk (A.L. Ahern).

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palatable foods have been reported by those with elevated TFEQ restraint scale scores (Gendall, Joyce, Sullivan, & Bulik, 1998), though this relation was not observed in other studies (Fedoroff, Polivy, & Herman, 1997; Rodin, Mancuso, Granger, & Nelbach, 1991; White, Whisenhunt, Williamson, Greenway, & Netemeyer, 2002). Smelling food or thinking about eating food leads to greater caloric intake among and individuals with elevated scores on the TFEQ restraint scale (Rogers & Hill, 1989) and the RS (Fedoroff et al., 1997; Jansen & Van den Hout, 1991). Further salivary response to the sign and fell of food correlates positively with scores on the RS (Klajner, Herman, Polivy, & Chhabra, 1981; LeGoff & Spigelman, 1987; Sahakian, Lean, Robbins, & James, 1981) and TFEQ (Legenbauer, Vögele, & Rüddel, 2004); though null findings have been reported for the RS (Bulik, Lawson, & Carter, 1996; Nederkoorn & Jansen, 2002). Thus, certain findings are consistent with the hypothesis that individuals with elevated dietary restraint scores experience greater reward from food intake.

Experimentally manipulated food deprivation increases the reinforcing value of food (Bulik & Brinded, 1994; Epstein, Bulik, Perkins, Caggiula, & Rodefer, 1991; Epstein, Truesdale, Wojcik, Paluch, & Raynor, 2003; Fulton, Woodside, & Shizgal, 2000). However, the one study that tested whether food is a more potent reinforcer in individuals with elevated dietary restraint scores found no differences between participants with high and low scores on the TFEQ in the reinforcing value of snacks relative to fruits and vegetables (Goldfield & Legg, 2006). This null effect might have emerged because of the small sample size ($N = 30$) or because fruit and vegetables are equally unrewarding for individuals with high and low dietary restraint. Thus, we used a single reinforcer version of the progressive reinforcement schedule paradigm developed by Epstein et al. (1991) to test whether individuals with elevated dietary restraint scores work harder for self-selected snack foods than those with low dietary restraint scores in a larger sample.

It is also possible that individuals with high dietary restraint scores are at greater risk for binge eating and obesity because they experience more hedonic pleasure when consuming food or show weaker reductions in perceived pleasantness after intake of a particular food (allisthesia). Elevated hedonic response to sweet tastes has been found in binge eating, bulimia nervosa (Franko, Wolfe, & Jimerson, 1994; Greeno, Wing, & Schiffman, 2000; Salbe et al., 2004) and obesity, and predicts weight gain over 5 years (Salbe, DelParigi, Pratley, Drewnowski, & Tataranni, 2004). Thus, we tested the hypothesis that individuals with high dietary restraint scores would evidence higher hedonic ratings of the pleasantness of snack foods and would show blunted habituation in pleasantness ratings of a sweet taste presented repeatedly.

### *Biased cognitive processing of food-related stimuli*

We also used a visual probe detection task (MacLeod, Mathews, & Tata, 1986) to test the hypothesis that individuals with elevated dietary restraint scores would show attentional bias towards food cues. Mogg, Bradley, Hyare, and Lee (1998) found that individuals who were experiencing greater hunger directed attention towards food words to a greater extent than individuals who were experiencing less hunger. However, Boon, Vogelzang, and Jansen (2000) found that dietary restraint scores were not related to attentional bias for food related words. One explanation for this pattern of findings is that the effect of dietary restraint scores on attentional bias is not as strong as the effect on hunger, and the effect of dietary restraint scores might emerge with a more ecologically valid task. Thus, we used pictures of real food in a visual probe task designed to measure attention to self-rated appetizing and non-appetizing food cues, compared to control pictures. We hypothesized that participants with high dietary restraint scores would direct attention towards rewarding foods, compared to those with lower scores.

Studies have also used indirect measures to test whether individuals with high versus low dietary restraint scores show greater evidence of a positive emotional response to food stimuli. One study that used two indirect measures, the Affective Priming Paradigm (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) and the Extrinsic Affective Simon Task (EAST; De Houwer, 2003) found no differences in the responses between individuals with high versus low RS scores; both groups showed positive associations with palatable foods relative to unpalatable foods on both paradigms (Roefs, Herman, MacLeod, Smulders, & Jansen, 2005). De Houwer, Crombez, Baeyens, and Hermans (2001) developed the stimulus response compatibility (SRC) task as an indirect measure of approach and avoidance tendencies. Evidence suggests that performance on the SRC Task correlated with the incentive value of stimuli. Field, Mogg and Bradley (2005) found that bias to approach rather than avoid alcohol cues was higher in social drinkers reporting high versus low craving. We developed an SRC Task that examined potential differences in approach tendencies for food cues in participants with high versus low dietary restraint scores. It was predicted that participants with high versus low dietary restraint scores would be faster to make a symbolic approach response to appetizing cues and slower to make a symbolic avoidance response away from them.

### *Sensitivity to reward and punishment profile*

Individuals may experience greater reward from food intake because they are generally more sensitive to reinforcing stimuli. Interestingly, research has found that dietary restraint scores and eating disorder symptoms are both associated with generalized self-reported sensitivity to both reward and punishment (Kane, Loxton, Staiger, & Dawe, 2004; Loxton & Dawe, 2001; Nederkoorn, van Eijs, & Jansen, 2004). Nederkoorn et al. (2004) found that individuals with high versus low RS scores report higher general reward sensitivity as well as sensitivity to punishment on the Behavioral Approach System, Behavioral Inhibition System scale (BIS/BAS; Carver & White, 1994). The current study compared individuals with high versus low dietary restraint scores on the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Molto, & Caseras, 2001), which assesses behavioral approach in the presence of cues to reward (sensitivity to reward) and behavioral inhibition in the presence of cues to punishment (sensitivity to punishment).

### *Aims of the study*

The current study examined food reward sensitivity, and cognitive processing of food-related stimuli, in individuals with high versus low dietary restraint scores. We hypothesized that high versus low dietary restraint participants would report greater appetitive responsiveness to food; show bias to attend to and approach food related stimuli relative to control stimuli; work harder for food; rate the taste of snack foods as more pleasant and show less habituation to a sweet taste. We also predicted that dietary restraint would be associated with generalized sensitivity to reward and punishment.

## Method

### *Participants*

Four hundred and fifty-three female students taking introductory psychology completed a survey that included the restraint scale of the Dutch Eating Behaviour Questionnaire (DEBQ-R, van Strien et al.,