

Dietary restraint, anxiety, and the relative reinforcing value of snack food in non-obese women

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Abstract

This study tested the independent and interactive effects of anxiety and dietary restraint on the relative reinforcing value of snack food. Thirty non-obese, female university students were assigned to one of four groups based on median split scores on measures of dietary restraint and state-anxiety: low-restraint/low-anxiety ($n=7$), low-restraint/high-anxiety ($n=7$), high-restraint/low-anxiety ($n=9$), and high-restraint/high-anxiety ($n=7$). Participants were provided the choice to earn points for palatable snack foods or fruits and vegetables using a computerized concurrent schedules choice task. The behavioural cost to gain access to snack foods increased across trials, whereas the cost to gain access to fruits and vegetables was held constant across trials. The relative reinforcing value of palatable snack food in relation to fruits and vegetables was defined as the total amount of points earned for snack food. Two-way analysis of covariance, with hunger and hedonic snack food ratings as covariates, showed that dietary restraint and anxiety had a significant interactive effect on the relative reinforcing value of snack food, indicating that the effect of anxiety on snack food reinforcement is moderated by dietary restraint. Specifically, the high-anxiety/low-restraint women found snack food significantly less reinforcing than low-anxiety/low-restraint women, but no differences emerged between high- and low-anxiety women with high-restraint. Neither restraint nor anxiety had an independent effect on the relative reinforcing value of snack food. These findings indicate that anxiety may have a suppressive effect on the relative reinforcing value of snack food in low-restrained eaters, but not an enhancing effect on snack food reinforcement in high-restrained eaters. Clinical implications of these findings are discussed.

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Food is very rewarding and is a primary reinforcer (Berridge, 1996; Salamone, 1994) but by repeated association of pleasure and hedonic feelings derived from the anticipation and ingestion of palatable food, food adopts secondary reinforcing effects (Del Parigi, Chen, Salbe, Reiman, & Tataranni, 2003). There are individual differences in the relative reinforcing value of food whereby obese individuals find food more reinforcing in relation to non-food

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alternatives compared to non-obese persons (Saelens & Epstein, 1996) and show a stronger preference for highly palatable foods with a high fat/sugar macronutrient content (Drewnowski & Holden-Wiltse, 1992; Drewnowski, Krahn, Demitrack, Nairn, & Gosnell, 1992; Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992). These individual differences in food reinforcement could be one of the underlying factors responsible for the sustained positive energy balance that leads to obesity (Epstein & Saelens, 2000; Saelens & Epstein, 1996).

Food deprivation is a powerful determinant of the reinforcing value of food in humans (Bulik & Brinded, 1994; Epstein, Truesdale, Wojcik, Paluch, & Raynor, 2003; Raynor & Epstein, 2003) and animals (Carr, 1996). Similarly, both acute food deprivation in the laboratory and chronic caloric restriction in the natural environment increase consummatory eating behaviour in animals (Bolles, 1965; DiBattista, 1987; Savory, 1988) and humans (Franklin, Schiele, Brozck, & Keys, 1948; Telch and Agras, 1996; Vohs & Heatherton, 2000). One variable that has not been well studied in relation to the reinforcing value of food is stress or anxiety, despite a broad scope of research examining the effects of stress on eating behavior.

Review of early research revealed that obese persons ate more under stress or when anxious than non-obese individuals, findings that were initially thought to explain the etiology of obesity (Greeno & Wing, 1994). Subsequent research, however, indicated that dietary restraint rather than obesity or weight status was more influential in stress-induced hyperphagia (Greeno & Wing, 1994). More recently, data indicate that the effects of stress/anxiety on food intake in restrained eaters may be more equivocal than previously believed (Gorman & Allison, 1995), findings that may be explained to some degree by differences in methodology, especially differences in measurement of the restraint construct (Gorman & Allison, 1995). Using the Restraint scale developed by Herman and Polivy (1980) to assess dietary restraint in adults, with few exceptions, restrained eaters ate more when anxious or feeling negative affect, while unrestrained eaters ate the same or less (Cools, Schotte, & McNally, 1992; Frost, Goolkasian, Ely & Blanchard, 1982; Heatherton, Herman & Polivy, 1991; Mitchell & Epstein, 1996; Schotte, Cools, & McNally, 1990). Using the restraint scale from the Dutch Eating Behaviour Questionnaire (DEBQ-R) developed by Van Strien, Frijters, Bergers, and Defares (1986), however, effects of stress on eating in restrained eaters have been mixed (Oliver, Wardle & Gibson, 2000; Wardle, Steptoe, Oliver, & Lipsey, 2000). However, when restraint was assessed using the Three-Factor Eating Questionnaire – Restraint scale (TFEQ-R) in adult women, laboratory studies found that food intake was unaffected by stress/anxiety in restrainers, and either remained the same or decreased in non-restrained adult women (Haynes, Lee, & Yeomens, 2003; Lowe & Maycock, 1988; Steere & Cooper, 1993). Similarly, Weinstein, Shide, and Rolls (1997) found a significant positive relationship between change in food consumption under stress and restraint using the Restraint Scale, but the relationship did not reach statistical significance using the TFEQ-R. In trying to reconcile the inconsistent pattern of data, it has been suggested that the Restraint scale actually measures cognitive restraint in addition to dieting status and history of dieting and weight loss (Stunkard & Messick, 1985), thus represents a multidimensional measure of restraint as compared to the unidimensional construct of cognitive restraint measured by the TFEQ-R. This implies that the findings of disinhibited eating during stress may be related to other factors besides the cognitive decision to restrict eating for weight loss or weight maintenance. In fact, Stunkard and Messick (1985) point out that a person who scores high on the cognitive restraint factor (TFEQ-R) would not be overeating, unless that person also scored high on the disinhibition factor of the TFEQ. The low to moderate correlations (which range from $r = .35$ to $.74$) between the Restraint Scale and TFEQ-R provide additional support for the contention that the two measures of restraint cannot be used interchangeably and may account, at least in part, for the discrepant findings (Gorman & Allison, 1995).

Caloric restriction and restriction of certain foods are central components of dietary intervention for obesity, but food deprivation increases the relative reinforcing value of food (Carr, 1996; Epstein et al., 2003; Raynor and Epstein, 2003) and promotes overeating (Lowe, 1993), which may make it more difficult to maintain dietary adherence required for long-term weight loss in obesity intervention. Stress, anxiety and other disinhibiting factors (i.e. alcohol, negative affect, consumption of a forbidden food) may differentially influence the rewarding value of food in restrained and non-restrained eaters. Understanding the factors and conditions that moderate the relative reinforcing value of food may yield information that improves the treatment and prevention of eating disorders and obesity given the evidence that increases in the reinforcing properties of food are associated with increases in food intake (Epstein et al., 2004).

This study was designed to test the single and combined effects of anxiety and dietary restraint on the relative reinforcing value of snack food in a sample of college females. Consistent with the results from the TFEQ-R, we predicted a restraint \times anxiety interaction whereby high-restrainers who felt high-anxiety would find snack food

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