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Original Article

Self-reported dietary restraint is associated with elevated levels of salivary cortisol

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Previous studies have found inconsistent relationships between restrained eating, dieting, and cortisol. The present study was designed to clarify the relationship between self-reported restrained eating and cortisol using multiple measures of dietary restraint. Eighty-five college-age women completed the Restraint Scale (RS) and the Cognitive Restraint Scale of the Three Factor Eating Questionnaire (TFEQ-R) and provided a saliva sample for analysis of cortisol. Both measures of restraint were positively associated with elevated levels of salivary cortisol, although the TFEQ-R was more strongly associated than the RS. Restrained eating, characterized by largely unsuccessful efforts to control eating, may lead to elevated cortisol levels.

Dietary restraint is associated with elevated levels of salivary cortisol

Cortisol is secreted by the adrenal glands under situations of physiological and psychological stress. There have been recent reports suggesting that the effects of stress on cortisol may lead directly to the development of abdominal obesity via a disruption of the functioning of the hypothalamic-pituitary-adrenal gland (HPA) axis (Bjorntorp, 1995, 1997; Bjorntorp & Rosmond, 2000). Abdominal obesity is associated with greater health risks than that in peripheral regions and is an independent risk factor for the development of risk factors and morbidity, even when body mass index is not markedly increased (National Heart, Lung, and Blood Institute, 1998).

Restrained eating, which reflects a struggle to maintain control over food intake and weight (Heatherton *et al*., 1988; Lowe, 1993), may in itself be a stressor and thus play a role in this process. However, studies of restrained eaters have found an inconsistent relationship between restrained eating and cortisol. Pirke and colleagues (1990) found no correlation between restrained eating as defined by the Three Factor Eating Questionnaire-Cognitive Restraint scale (TFEQ-R; Stunkard & Messick, 1985) and plasma cortisol, while McLean, Barr and Prior (2001) found that restrained eating as defined by the TFEQ-R was positively correlated with elevated levels of urinary cortisol. Furthermore, previous studies have demonstrated significant decreases, not increases, in cortisol during weight loss, which presumably involves an increase in restraint (Buffenstein, Karklins & Driver, 2000; Hainer *et al*., 1992; Scavo *et al*., 1988).

This study was designed to clarify the relationship between self-reported restrained eating and cortisol. Additionally, because there has been ongoing debate

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over the most appropriate way to measure dietary restraint via self-report (Gorman & Allison 1995; Heatherton *et al*., 1988; Lowe, 1993), this study measured restrained eating using multiple self-report measures.

Method

Participants

A total of 85 female college students were recruited as part of a larger study in an experiment on factors influencing the development of eating disorders. For the present study, all potential participants were screened for eating problems using the Questionnaire on Weight and Eating Patterns-Revised (QEWP-R; Yanovski, 1993) followed by the Interview for the Diagnosis of Eating Disorders-IV (Kutlesic *et al*., 1998) when QEWP-R responses suggested the presence of an eating disorder. Individuals with current eating disorders ($N = 4$) were excluded from the study.

Participants were between 17–49 years old, with a mean age of $19{\cdot}3 \pm 3{\cdot}8$ years and a median age of 18 years. They averaged a height of $64{\cdot}5 \pm 2{\cdot}4$ in.; a mean weight of $139{\cdot}7 \pm 27{\cdot}0$ lbs.; and a mean BMI of $23{\cdot}6 \pm 4{\cdot}4\,kg/m^2$. A total of 45 (52·9%) were Caucasian, 10 (11·8%) were African American, 10 (11·8%) were Hispanic, 6 (8·1%) were Asian, 1 (1·4%) was Asian Indian, and 13 (15·6%) did not indicate their race.

Self-report measures

Restraint Scale

The Restraint Scale (RS; Herman & Polivy, 1980) was the first self-report inventory designed to measure restrained eating. The scale consists of ten questions yielding a total possible score of 35. The RS appears to measure the consequences of chronic unsuccessful dieting such as disinhibited eating and weight fluctuations (Gorman & Allison 1995; Heatherton *et al*., 1988; Laessle *et al*., 1989b; Lowe, 1993). While the RS has been shown to have a two-factor structure (Gorman & Allison, 1995), it has been argued that the total score, not the factor scores, be used (Heatherton *et al*., 1988). In the present study both the total score and factor scores of the RS were analyzed and the results were almost identical. Therefore, only the results of the RS total score are presented.

Three Factor Eating Questionnaire-Cognitive Restraint scale (TFEQ-R)

The TFEQ-R (Stunkard & Messick, 1985) is a 21-item scale that is reported to measure short-term caloric restriction, although individuals scoring high on this scale may not actually be in a hypocaloric state (Gorman & Allison 1995; Heatherton *et al*., 1988; Laessle *et al*., 1989a,b; Lowe, 1993; Tuschl *et al*., 1990).

Restraint has traditionally been treated as a categorical variable in the literature (i.e. high restraint vs. low restraint). Restraint is more accurately conceptualized as a continuous variable, however, with no clear boundary defining "high restrainers" from "low restrainers" (Gorman & Allison, 1995). Categorizing a continuous variable has been shown by numerous authors to have harmful consequences (e.g. Cohen, 1983; Pedhazur & Schmelkin, 1991, pp. 538–540), and several authors have argued specifically against dichotomizing restraint variables (Gorman & Allison, 1995; Stein, 1988). Therefore, we treated both RS score TFEQ-R score as continuous variables in the present study. To be comparable to previous literature, secondary analyses were conducted using both RS score TFEQ-R score as categorical variables as well. When used as a categorical variable, participants are most commonly classified as restrained or non-restrained eaters using a median split (Polivy, Herman & Howard, 1988); this procedure was followed in the present study.

Salivary cortisol

Cortisol is a reliable indicator of HPA axis activity (Kirschbaum & Hellhammer, 1989). Salivary cortisol is significantly correlated with serum and free cortisol (Umeda *et al*., 1981) and is a valid indication of unbound cortisol (Hiramatsu, 1981, Umeda *et al*., 1981; Young *et al*., 1998). The advantage of using salivary samples is that the method of collection is not stress-inducing (Kirschbaum & Hellhammer, 1989), unlike the collection of plasma samples (venipuncture) and urinary samples (the demand of urinating on command). Normal, unstressed salivary cortisol levels are $0{\cdot}50 \pm 0{\cdot}25\,\mu g/dl$ for females not taking estroprigestative drugs and $0{\cdot}48 \pm 0{\cdot}24\,\mu g/dl$ for females taking estroprigestative drugs (Guechot *et al*., 1982). Cortisol samples were analyzed using radioimmunoassay (Hiramatsu, 1981).

Procedure

Because salivary cortisol has been found to a have significant diurnal rhythm (Pruessner *et al*., 1997), participants were scheduled to complete the experiment in the morning. Upon arriving at the laboratory, participants gave informed consent, filled out the RS and TFEQ, and had their height and weight measured. Participants then gave a sample of their saliva for cortisol analysis according to a standardized protocol