



Interpersonal stressors predict ghrelin and leptin levels in women



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Summary

Objective: Stressful events enhance risk for weight gain and adiposity. Ghrelin and leptin, two hormones that are implicated in appetite regulation, may link stressful events to weight gain; a number of rodent studies suggest that stressors increase ghrelin production. The present study investigated the links among daily stressors, ghrelin and leptin, and dietary intake in humans. **Method:** Women ($n = 50$) completed three study appointments that were scheduled at least 2 weeks apart. At each visit, women arrived fasting and ate a standardized breakfast and lunch. Blood samples were collected 45 min after each meal. Women completed a self-report version of the Daily Inventory of Stressful Events (DISE) at each appointment. Two composites were created from the DISE data, reflecting the number of stressors that did and did not involve interpersonal tension.

Results: Women who experienced more stressors involving interpersonal tension had higher ghrelin and lower leptin levels than those who experienced fewer interpersonal stressors. Furthermore, women who experienced more interpersonal stressors had a diet that was higher in

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calories, fat, carbohydrates, protein, sugar, sodium, and fiber, and marginally higher in cholesterol, vegetables (but not fruits), vitamin A, and vitamin C. Stressors that did not involve interpersonal tension were unrelated to ghrelin and leptin levels or any of the dietary components examined.

Conclusions: These data suggest that ghrelin and leptin may link daily interpersonal stressors to weight gain and obesity.

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1. Introduction

Obesity contributes to a host of medical problems, including Type 2 diabetes, cardiovascular disease, and premature mortality, and is thus a major public health concern (Billington et al., 2000). Stressful events enhance risk for weight gain and adiposity (Korkeila et al., 1998; Solomon et al., 2011; Wardle et al., 2011). For example, a recent meta-analysis concluded that people who experienced more stressors gained more body fat over time than those who experienced fewer stressors (Wardle et al., 2011). However, the relationship between stressful events and weight gain is not without controversy; almost three quarters of the studies examined in the meta-analysis reported no relationship between stressful events and weight gain, whereas others demonstrated that people who experience more stressors eat less and lose weight (Torres and Nowson, 2007; Wardle et al., 2011). Accordingly, there may be contextual factors that influence the links among stressful events, eating behavior, and weight gain (see Torres and Nowson, 2007 for a related argument).

One possibility is that interpersonal stressors, such as marital disagreements, are qualitatively different from other types of stressors and thus have differential effects on appetite and eating behavior. The desire for social connection is a strong impetus behind human behavior (Leary and Cox, 2008; Maslow, 1968). The importance of the need to belong is not surprising given the significance of group living for humans' survival throughout their evolutionary past; humans were most likely to thrive when they were part of a network of people who were invested in their welfare and who looked out for their well-being (Tooby and Cosmides, 1996). Over time, this ultimately led to a fundamental need to form close and caring bonds with other people (Baumeister and Leary, 1995). Because the need for social connection is central to human nature, the failure to fulfill this need should be detrimental to mental and physical health. Moreover, the disruption of social bonds may be a uniquely potent form of stress that affects a person's appetite and eating behavior. For example, experiencing interpersonal stress should motivate people to attempt to restore their sense of social connection (Pickett and Gardner, 2005). Recent research demonstrated that eating comfort food caused people to spontaneously think about their relationships, and simply thinking about comfort food decreased loneliness (Troisi and Gabriel, 2011). Accordingly, feeling hungry and eating in response to interpersonal stressors may allow people to feel socially reconnected, suggesting a distinctive role for interpersonal stressors in eating behavior and obesity.

Ghrelin and leptin, two hormones that are implicated in appetite regulation, may link interpersonally stressful events to eating behavior and weight gain. Although a person's eating behavior is multiply determined, ghrelin and leptin provide two internal eating-related signals. Ghrelin, an appetite-stimulating hormone, is one factor that promotes food consumption (Klok et al., 2007). For example, ghrelin reliably rises before a meal and declines after eating (Cummings et al., 2001), and pre-meal rises are related to increased feelings of hunger (Cummings et al., 2004). One innovative study demonstrated that people felt hungrier and consumed more food when they received a ghrelin injection compared with saline (Wren et al., 2001). Leptin, an appetite-suppressing hormone, rises following a meal and suppresses food intake in cooperation with other peptides (Klok et al., 2007). Furthermore, fat cells are a primary source of leptin, which is elevated among overweight people (Considine et al., 1996). Consistent with its satiety-related effects, leptin-deficient medical patients who received leptin treatment were less hungry and lost considerable weight (Licinio et al., 2004).

A number of rodent studies suggest that stressors increase ghrelin and reduce leptin production. For example, a tail pinch stressor elevated ghrelin gene expression in mice (Asakawa et al., 2001). Both chronic social defeat and continuous restraint stress increased plasma ghrelin production among mice (Chuang et al., 2011; Lutter et al., 2008; Ochi et al., 2008). Rats had higher plasma ghrelin levels after a water avoidance stressor compared with pre-stress levels (Kristensson et al., 2006). Furthermore, mice that experienced chronic social defeat stress and rats that experienced chronic restraint stress had lower leptin levels compared with no-stress controls (Chuang et al., 2010; De Oliveira et al. (2014)).

The rodent literature provides a useful framework for beginning to unpack the links among stressors, ghrelin, and leptin. However, humans are an ultra-social species who evolved specific cognitive skills for interpreting the social world (Herrmann et al., 2007; Pagel, 2012). Accordingly, research with human participants provides a way to delineate the importance of interpersonal versus other types of stressors. Accordingly, the goal of the current study was to fill this gap in the human literature by investigating the links among daily interpersonal and non-interpersonal stressors, ghrelin, and leptin.

2. The current study

We addressed the question of whether women who experienced more stressors involving interpersonal tension would

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