



Individual differences in the relationship between ovarian hormones and emotional eating across the menstrual cycle: A role for personality?

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ABSTRACT

Within-person changes in estradiol and progesterone predict changes in binge eating tendencies across the menstrual cycle. However, all women have menstrual-cycle fluctuations in hormones, but few experience binge eating. Personality traits may be critical individual difference factors that influence who will engage in emotional eating in the presence of a vulnerable hormonal environment. Women ($N = 239$) provided self-reports of emotional eating and saliva samples for hormone measurement for 45 consecutive days. Negative urgency and negative emotionality were measured once and were examined as moderators of hormone–emotional eating associations. Consistent with prior research, within-person changes in the interaction between estradiol and progesterone predicted emotional eating. Neither negative urgency nor negative emotionality interacted with changes in estradiol and progesterone to predict changes in emotional eating. Additional factors, other than the two personality traits examined, may account for individual differences in within-person associations between hormones and emotional eating.

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1. Introduction

Ovarian hormones are one important set of biological factors involved in the etiology of binge eating and eating disorders (Edler, Lipson, & Keel, 2007; Klump, Keel, Racine, et al., 2013; Racine et al., 2012). Longitudinal studies across the menstrual cycle find that binge eating and emotional are highest during menstrual cycle phases characterized by high progesterone (i.e., mid-luteal phase) and lowest during phases described by high estradiol (i.e., ovulatory phase) (Edler et al., 2007; Klump, Keel, Culbert, & Edler, 2008; Klump, Keel, Racine, et al., 2013; Lester, Keel, & Lipson, 2003). Moreover, studies that have directly assayed hormone levels suggest that within-person changes in hormones drive menstrual-cycle fluctuations in binge eating. Pilot work found that binge eating in clinical samples and emotional eating in community samples were predicted by decreases in estradiol and increases in progesterone (Edler et al., 2007; Klump et al., 2008). However, recent research with the largest sample to date suggests that ovarian hormone effects are interactive,

such that emotional eating is highest when progesterone and estradiol are high (Klump, Keel, Racine, et al., 2013). This is consistent with high levels of emotional eating during the mid-luteal phase, a time of high progesterone and relatively high estradiol.

Despite converging evidence demonstrating that ovarian hormones predict binge eating, all normally cycling women have menstrual-cycle changes in estradiol and progesterone, but relatively few engage in dysregulated eating. Individual differences in these relationships clearly exist, and there is a need to examine factors that influence patterns of dysregulated eating across the menstrual cycle in some but not all women in order to develop targeted prevention and interventions for these symptoms.

Personality traits could impact which individuals binge eat in response to a vulnerable hormonal environment, as individual differences in personality predict the development of eating disorder symptoms (Lilenfeld, Wonderlich, Riso, Crosby, & Mitchell, 2006). Impulsivity is perhaps the most important personality trait for binge eating and associated eating disorders. Unlike other traits (e.g., negative emotionality), impulsivity specifically relates to binge eating versus other disordered eating behaviors (e.g., dietary restraint) (Yeomans, Leitch, & Mobini, 2008) and tends to differentiate patients with binge/purge behaviors versus restrictive eating disorders (Claes, Vandereycken, & Vertommen, 2005; Rosval et al., 2006).

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Recently, the multidimensional construct of impulsivity has been decomposed into distinct traits that are differentially related to impulsive behaviors (Smith et al., 2007; Whiteside & Lynam, 2001). One type of impulsivity, negative urgency (i.e., the tendency to act rashly in response to negative affect), appears to be most important for binge eating and associated eating disorders. When examined together with other impulsive traits (i.e., lack of planning, lack of perseverance, sensation seeking), negative urgency consistently emerges as the best predictor of binge eating (Anestis, Smith, Fink, & Joiner, 2009; Fischer & Smith, 2008; Fischer, Smith, & Cyders, 2008). Perhaps most importantly, recent longitudinal work suggests that negative urgency is a prospective risk factor for the development of binge eating (Fischer, Peterson, & McCarthy, in press; Pearson, Combs, Zapolski, & Smith, 2012).

To date, no study has investigated whether personality variables critical for binge eating might moderate within-person associations between ovarian hormones and binge eating phenotypes. Individuals high on negative urgency tend to experience strong impulses and have trouble resisting their impulses (Whiteside & Lynam, 2001). The biological drive to binge eat or to eat in response to emotions as a result of menstrual-cycle changes in ovarian hormones may represent a strong urge that is difficult for these individuals to resist. Thus, we hypothesized that ovarian hormones will be more likely to predict within-person changes in emotional eating in individuals with high versus low levels of negative urgency.

As a control, we investigated whether the personality trait of negative emotionality (i.e., a stable disposition towards experiencing negative affect, negative interpersonal interactions, and withdrawal behaviors; Patrick, Curtin, & Tellegen, 2002) may similarly moderate hormone-emotional eating associations. Negative emotionality has been identified as a risk factor for the development of disordered eating symptoms (Leon, Fulkerson, Perry, & Cudeck, 1993; Leon, Fulkerson, Perry, Keel, & Klump, 1999; Martin et al., 2000) as well as eating disorder diagnoses (Cervera et al., 2003; Killen et al., 1996). Moreover, negative emotionality is correlated with both binge eating and emotional eating in community samples (Heaven, Mulligan, Merrilees, Woods, & Fairouz, 2001; Klump, McGue, & Iacono, 2002). Although both negative emotionality and negative urgency involve negative affect, negative urgency includes the additional component of rash action that is hypothesized to be particularly important for dysregulated eating in response to a risky hormonal milieu. Therefore, examining negative emotionality may help determine whether any moderating effects are specific to negative urgency or are more general and present for other personality traits associated with eating symptomatology.

Finally, consistent with previous research (Klump, Keel, Racine, et al., 2013), we included daily negative affect as a covariate in all models. State levels of negative affect are strong proximal predictors of binge eating/emotional eating (Haedt-Matt et al., submitted for publication; Smyth et al., 2007), and levels of negative affect are thought to vary across the menstrual cycle (Dennerstein & Burrows, 1979; Ivey & Bardwick, 1968). Moreover, high negative affect appears to be associated with stronger relationships between estradiol levels and emotional eating across the menstrual cycle (Hu, Boker, Neale, & Klump, submitted for publication). Thus, we wanted to ensure that trait-level, personality characteristics moderated the direct effects of ovarian hormones on emotional eating, independent of state negative affect.

2. Methods

This study was reviewed and approved by the Michigan State University Institutional Review Board and was carried out in accordance with the APA Code of Ethics.

2.1. Participants

Participants included 239 (132 monozygotic; 107 dizygotic) same-sex female twins between the ages of 16 and 22 years drawn from the

Twin Study of Hormones and Behavior Across the Menstrual Cycle (Klump, Keel, Racine, et al., 2013) within the Michigan State University Twin Registry (MSUTR). MSUTR twins were recruited using birth record methods previously described (Klump & Burt, 2006). Because of the focus on ovarian hormones, a number of exclusion criteria were necessary to capture natural hormonal variation (see Klump, Keel, Racine, et al., 2013 for details). Despite these criteria, participants were demographically representative of the recruitment region (83.3% Caucasian; 15.1% African American; 0.8% Asian/Pacific Islander; 0.8% Native American; <http://www.michigan.gov/mdch>). Moreover, they did not meaningfully differ on levels of impulsivity, negative emotionality, or binge eating when compared to participants from previous MSUTR studies without similar exclusion criteria (average $d = .11$; $ds = .01-.20$).

2.2. Procedures

Participants provided saliva samples and behavioral data for 45 consecutive days. Saliva samples were collected every morning within 30 min of waking (see Klump et al., 2008 for details). Behavioral questionnaires were completed each evening (after 5:00 pm) and included items assessing daily emotional eating and negative affect. The timing of daily data collection was such that ovarian hormone measurements clearly preceded behavioral ratings each day. In addition, three in-person visits occurred at the start of the study, mid-way through data collection (~day 23), and at the end of data collection (~day 45). Each visit included a re-assessment of study eligibility, completion of questionnaires, height/weight measurements, and collection of materials. Questionnaires assessing the personality traits of negative urgency and negative emotionality were administered one time during the first study visit (see below). Between visits, staff called/emailed participants once/week to answer questions and confirm protocol adherence. This was effective at minimizing missing data ($\leq 6\%$) and drop-outs ($< 3\%$) as well as identifying participants who were no longer eligible (e.g., due to pregnancy, $< 3\%$).

2.3. Measures

Sample characteristics for all study measures are presented in Table 1. Although daily, longitudinal data was examined for some variables, we present averages across data collection in order to characterize the sample for comparisons in future studies.

2.3.1. Emotional eating

The Dutch Eating Behavior Questionnaire (DEBQ) Emotional Eating scale (van Strien, Frijters, Bergers, & Defares, 1986) was completed daily and includes thirteen items assessing eating in response to negative affective cues (e.g., “Did you have a desire to eat when you were discouraged?”). Similar to previous research (Klump et al., 2008), instructions for this scale were modified with permission to ask about emotional eating over the current day. Eating in response to negative emotions is thought to be a core feature of binge eating.

Table 1
Sample Characteristics.

Variable	Mean (SD)	Range
Age	18.09 (1.74)	16–22
Negative Urgency	2.03 (0.54)	1–3.67
Negative Emotionality	35.53 (15.32)	13–89
Emotional Eating	0.33 (0.42)	0–3
Estradiol (pg/ml)	3.04 (1.32)	0.95–10.63
Progesterone (pg/ml)	123.85 (62.98)	18.73–368.00
Negative Affect	14.83 (3.50)	10–28
Body mass index (BMI)	24.20 (5.83)	16.71–45.83

Values for emotional eating, estradiol, progesterone, and negative affect are average values across the 45-day data collection period. Values for BMI are average values across the three study visits.

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