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## Research report

Depressed affect and dietary restraint in adolescent boys' and girls' eating in the absence of hunger <sup>☆</sup>

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## ARTICLE INFO

## Article history:

Received 28 August 2014

Received in revised form 8 April 2015

Accepted 26 April 2015

Available online 29 April 2015

## Keywords:

Eating in the absence of hunger

Dietary restraint

Mood

Negative affect

Emotional eating

## ABSTRACT

Data suggest that depressed affect and dietary restraint are related to disinhibited eating patterns in children and adults. Yet, experimental research has not determined to what extent depressed affect acutely affects eating in the absence of physiological hunger (EAH) in adolescents. In the current between-subjects experimental study, we measured EAH in 182 adolescent (13–17 y) girls (65%) and boys as *ad libitum* palatable snack food intake after youth ate to satiety from a buffet meal. Just prior to EAH, participants were randomly assigned to view either a sad or neutral film clip. Dietary restraint was measured with the Eating Disorder Examination. Adolescents who viewed the sad film clip reported small but significant increases in state depressed affect relative to adolescents who viewed the neutral film clip ( $p < .001$ ). Yet, there was no main effect of film condition on EAH ( $p = .26$ ). Instead, dietary restraint predicted greater EAH among girls, but not boys ( $p < .001$ ). These findings provide evidence that adolescent girls' propensity to report restrained eating is associated with their greater disinhibited eating in the laboratory. Additional experimental research, perhaps utilizing a more potent laboratory stressor and manipulating both affective state and dietary restraint, is required to elucidate how state affect may interact with dietary restraint to influence EAH during adolescence.

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## Introduction

Eating in the absence of hunger (EAH) refers to consuming foods in the absence of perceived physiological hunger (Kral & Faith, 2007). Typically measured as intake of palatable snack foods after eating a meal to satiety, EAH is one behavioral manifestation of food disinhibition that may be important for obesity risk (French, Epstein, Jeffery, Blundell, & Wardle, 2012). Increased exposure to large portions of inexpensive, readily available, palatable, and energy-

dense foods in contemporary Western cultures is a well-recognized contributor to positive trends in overeating behaviors that promote a positive energy balance (Hill & Peters, 1998). Indeed, overweight and obese youth (body mass index [BMI, kg/m<sup>2</sup>] ≥85th percentile for age and sex) consume more energy from palatable snack foods in the absence of hunger than youth who are not overweight (Cutting, Fisher, Grimm-Thomas, & Birch, 1999; Fisher & Birch, 2002; Fisher et al., 2007; Hill et al., 2008; Moens & Braet, 2007; Shomaker et al., 2010). Despite widespread access to palatable foods, frequency of EAH varies substantially at the individual level (Kral et al., 2010; Moens & Braet, 2007). Research is needed to understand potentially modifiable factors that explain the significant variation in EAH that persists between individuals.

From a number of theoretical perspectives, depressed affect is hypothesized to play a role in disinhibited eating. Emotion regulation models posit that acute increases in negative affect trigger disinhibited eating episodes as an attempt to alleviate or escape from emotional distress (Hawkins & Clement, 1984; Heatherton & Baumeister, 1991). Indeed, depressive symptoms are positively

<sup>☆</sup> Acknowledgements: NIH Intramural Research Program Grant 1ZIAHD000641 (J. Yanovski) from National Institute of Child Health and Human Development with supplemental funding from the NIH Bench to Bedside Program Y1CH8385858 and the Office of Behavioral and Social Sciences Research; NIH National Research Service Award F32HD056762 and Pathway to Independence Award K99/R00HD069516 (L. Shomaker) from NICHD.

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associated with adolescents' self-reported consumption of sugary foods and percent calories from fat (Fulkerson, Sherwood, Perry, Neumark-Sztainer, & Story, 2004; Kim, Yang, Kim, & Lim, 2013), as well as the onset of disinhibited eating among girls (Skinner, Haines, Austin, & Field, 2012; Stice, Presnell, & Spangler, 2002). Similarly, we have found that adolescents' depressive symptoms were associated with greater observed total energy intake and greater intake of sweet snack foods at a buffet lunch meal, controlling for inter-individual variations in body composition (Mooreville et al., 2014). Data from our laboratory have also illustrated that children's and adolescents' pre-meal state depressed affect was positively correlated with energy intake at a buffet lunch meal, even after adjusting for individual differences in body composition (Ranzenhofer et al., 2013; Vannucci et al., 2012). However, these correlational studies evaluated eating in a fasted or hungry state and the extent to which depressive symptoms and/or state depressed affect influence adolescents' eating in the absence of physiological hunger is unclear. Studies utilizing experimental methods are essential for determining to what extent state depressed mood has an acute effect on disinhibited eating.

Relatively few experimental studies have evaluated the effect of negative state affect, depressive or otherwise, on EAH. Furthermore, existing data are mixed. In several studies of adults, exposure to a laboratory stressor, compared to a neutral control condition, resulted in greater EAH, particularly among overweight participants (Born et al., 2010; Lemmens, Rutters, Born, & Westerterp-Plantenga, 2011; Rutters, Nieuwenhuizen, Lemmens, Born, & Westerterp-Plantenga, 2009). In contrast, among children ages 6–13 y, there was no effect of a negative or neutral mood induction on EAH in the laboratory (Hilbert, Tuschen-Caffier, & Czaja, 2010). The effect of negative affect on EAH in adolescents has not been experimentally evaluated.

Adolescence is an especially salient developmental period to elucidate the potential effects of depressed affect on disinhibited eating patterns. Marked by increases in negative affect, particularly among girls (Flook, 2011; Weinstein, Mermelstein, Hankin, Hedeker, & Flay, 2007), adolescence also is an important time for increases in dietary restraint, which refers to intentions to cut back or reduce an individual's energy intake, regardless of whether a person is successful (Engelsen, 2000). According to theoretical models of restraint, efforts to limit energy intake may increase vulnerability to disinhibited overeating, including eating in the absence of hunger, when self-imposed dietary rules are violated or through heightened responsiveness to environmental food cues, regardless of whether intake is actually limited (Lowe & Levine, 2005; Polivy & Herman, 1985). Consistent with this theoretical framework, one meta-analysis indicates that dietary restraint is a prospective risk factor for the onset of reported disinhibited eating episodes in adolescents (Stice, 2002).

The relationship between dietary restraint and EAH in adolescents is not fully understood. Some laboratory eating studies suggest that the interaction of restraint and negative affect, in both state and more sustained forms, may be relevant for overeating behavior in youth. For instance, adolescents who were high in depressive symptoms and high in dietary restraint consumed the greatest energy from sweet snack foods during a laboratory buffet meal delivered after an overnight fast (Mooreville et al., 2014). Likewise, while change in total energy intake following a laboratory-induced stress (versus a neutral condition) did not differ for children (8–12 y) (Roemmich, Lambiase, Lobarinas, & Balantekin, 2011), there appears to be a significant interaction between restraint and perceived stress (Balantekin & Roemmich, 2012; Roemmich et al., 2011; Roemmich, Wright, & Epstein, 2002). Specifically, children who were high (versus low) in both dietary restraint and perceived state stress experienced the most significant increases in total energy and snacks after a small pre-load (Balantekin & Roemmich, 2012; Roemmich et al.,

2002, 2011). Because these investigations studied youth who were fasted (Mooreville et al., 2014) or moderately hungry (Balantekin & Roemmich, 2012; Roemmich et al., 2002, 2011), it remains unclear to what extent dietary restraint, state negative affect, and depressive symptoms are relevant to EAH in adolescents.

In the current study, we sought to determine the effect of a negative mood induction on EAH in the laboratory among adolescents. We anticipated that adolescents exposed to a depressed state affect induction would consume more palatable snacks in the absence of hunger than adolescents exposed to a neutral affect induction. In addition, we aimed to evaluate the associations of depressive symptoms and dietary restraint with EAH. We expected that both factors would be positively associated with EAH, after accounting for potential demographic and anthropometric confounds such as body composition. Lastly, we evaluated the interactions among sex, depressive symptoms, dietary restraint, and state affect induction. Based upon prior research, we predicted that depressive symptoms and restraint would have a stronger impact on EAH after a depressed state affect (versus neutral) induction, and we also hypothesized that these effects might be more pronounced for girls as compared to boys (Bernier, Kozyrskyj, Benoit, Becker, & Marchessault, 2010; de Lauzon-Guillain et al., 2009; Madowitz et al., 2014; Nguyen-Rodriguez, Unger, & Spruijt-Metz, 2009).

## Methods

### Participants and procedure

Participants were healthy adolescent girls and boys, 13 to 17 y old, recruited to take part in a study of eating behaviors in adolescents (ClinicalTrials.gov ID: NCT00631644). The relationship of depressive symptoms and dietary restraint to buffet lunch-meal eating behavior in a fasted state was previously reported for this sample (Mooreville et al., 2014) but their EAH after depressed or neutral mood induction has not been previously reported. All participants were in good general health, determined by a physical examination and medical history conducted by an endocrinologist or nurse practitioner. Exclusion criteria were a major medical illness, a psychiatric condition likely to impede compliance to study procedures, use of medication affecting appetite or body weight, pregnancy, ongoing weight loss treatment, or reported dislike of more than 50% of foods offered at the laboratory meals. Adolescents provided written assent. Parental guardians gave written consent for participants. During the consent process, families received a complete description of all study procedures. They were informed that the purpose of the study was to better understand eating behaviors in teenagers. Consistent with similar studies in youth (e.g., Goldschmidt, Tanofsky-Kraff, & Wilfley, 2011), all possible risks or discomforts were reviewed, including that adolescents would be asked to watch a brief film clip on a return visit to the laboratory, which could cause some temporary emotional distress that typically does not last long. They were not aware of the specific films, the film content, or the study hypotheses. The Institutional Review Board of the Eunice Kennedy Shriver National Institute of Child Health and Human Development approved the study protocol and all procedures. Participants were financially compensated for their time and inconvenience. Adolescents attended an initial screening appointment at an outpatient pediatric clinic at the National Institutes of Health Clinical Research Center. They returned for a buffet lunch meal appointment on a separate day. For both the screening and buffet lunch meal visits, adolescents were instructed to adhere to a fast after 10:00 pm the night prior to the appointments. Reminder calls were completed 24 hours before participants' scheduled visits. Participants were reminded to begin fasting at 10:00 pm the night prior to their visit. Upon their arrival, compliance to fasting instructions was confirmed by the

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