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Research report

Attentional bias to food cues in youth with loss of control eating ☆

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ABSTRACT

Emerging data indicate that adults with binge eating may exhibit an attentional bias toward highly palatable foods, which may promote obesogenic eating patterns and excess weight gain. However, it is unknown to what extent youth with loss of control (LOC) eating display a similar bias. We therefore studied 76 youth (14.5 ± 2.3 years; 86.8% female; BMI-z 1.7 ± .73) with (n = 47) and without (n = 29) reported LOC eating. Following a breakfast to reduce hunger, youth participated in a computerized visual probe task of sustained attention that assessed reaction time to pairs of pictures consisting of high palatable foods, low palatable foods, and neutral household objects. Although sustained attentional bias did not differ by LOC eating presence and was unrelated to body weight, a two-way interaction between BMI-z and LOC eating was observed (p = .01), such that only among youth with LOC eating, attentional bias toward high palatable foods versus neutral objects was positively associated with BMI-z. These findings suggest that LOC eating and body weight interact in their association with attentional bias to highly palatable foods cues, and may partially explain the mixed literature linking attentional bias to food cues with excess body weight.

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Introduction

One factor promoting obesity may be an attentional bias to food cues that leads to excess energy intake. An attentional bias to food cues is a biased processing of food-related stimuli, which may result from a heightened salience of food cues in the environment (Berridge, 2009; Nijs & Franken, 2012). In line with incentive-sensitization theory (Robinson & Berridge, 1993), the repeated exposure of a rewarding stimulus produces an exacerbated reward response in susceptible individuals. As a result, increased salience and strong motivational properties are established for the stimulus (Robinson & Berridge, 1993). As the incentive salience of palatable food cues increases, seeking out and consuming palatable foods becomes an important goal, exceeding homeostatic feeding drives (Berridge, 2009). It has been proposed that an attentional bias to palatable food cues represents a vulnerability to overeat in the current obesogenic food environment, consequently promoting or maintaining obesity (Braet & Crombez, 2003; Castellanos et al., 2009; Nijs & Franken, 2012; Nijs, Muris, Euser, & Franken, 2010).

Some (Werthmann et al., 2011), but not all (Graham, Hoover, Ceballos, & Komogortsev, 2011; Loeber et al., 2012), data suggest that overweight and obese adults demonstrate an approach–avoidance pattern to palatable food cues, indicated by increased automatic orientation to palatable food cues followed by decreased sustained attention. This pattern may reflect the competing influences of enhanced salience of food stimuli and attempts to

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control behavioral responses through avoidance (Nijs & Franken, 2012). Inconsistent results in overweight samples may be due to the heterogeneous etiology of obesity, highlighting the importance of identifying specific phenotypes within individuals prone to obesity (Field, Camargo, & Ogino, 2013). Indeed, data in adults suggest that attentional bias to food cues is associated with state characteristics such as hunger level and negative affect (Hepworth, Mogg, Brignell, & Bradley, 2010; Loeber, Grosshans, Herpertz, Kiefer, & Herpertz, 2013; Nijs et al., 2010; Tapper, Pothos, & Lawrence, 2010), as well as stable traits such as an increased tendency toward external eating and food-specific cravings, impulsivity, and reward drive (Brignell, Griffiths, Bradley, & Mogg, 2009; Hou et al., 2011; Newman, O'Connor, & Conner, 2008; Tapper et al., 2010; Werthmann, Roefs, Nederkoorn, & Jansen, 2013). Notably, many of these characteristics are reported by adults with binge eating disorder (BED; Filbey, Myers, & Dewitt, 2012; Pinaquy, Chabrol, Simon, Louvet, & Barbe, 2002; Schag, Schönleber, Teufel, Zipfel, & Giel, 2013; Schag et al., 2013), which is robustly associated with obesity (Blomquist et al., 2011; Yanovski, 2003a).

Several studies have examined the cognitive processing of food cues in adults with BED (Balodis et al., 2013; Chamberlain et al., 2012; Mobbs, Iglesias, Golay, & Van der Linden, 2011; Schmitz, Naumann, Trentowska, & Svaldi, 2014; Svaldi et al., 2014; Svaldi, Tuschen-Caffier, Peyk, & Blechert, 2010). One study directly examined attentional bias to food cues using electroencephalography (EEG) recordings in overweight individuals with BED compared to healthy controls (Svaldi et al., 2010). Differences emerged when viewing high palatable food only; women with BED demonstrated an EEG response pattern which suggested that palatable food stimuli consumed greater attentional resources (Svaldi et al., 2010). However, these findings were potentially confounded because BMI was not accounted for in the analyses (Svaldi et al., 2010). A second study examined attentional bias to food cues using two cognitive tasks (a clarification task and a spatial cueing paradigm) in adults with BED compared to a weight-matched control group (Schmitz et al., 2014). Results suggested that individuals with BED demonstrated an increased automatic orientation bias toward food cues compared to the control group; however, both groups demonstrated a bias in sustained attention toward food cues (Schmitz et al., 2014). These two studies provide preliminary evidence that adults with BED have differential attentional bias to food cues compared to adults without the disorder.

There are limited data on attentional biases and obesity in youth. One study in adolescents found that attentional bias to food cues, as measured by neural activity in reward and attentional processing regions during an fMRI scan, was not only positively correlated with BMI cross-sectionally, but also predicted increased BMI percentile gain one year later (Yokum, Ng, & Stice, 2011). However, no known study has directly examined the relationship of attentional bias to food cues and obesity in youth using a visual probe task. While a variety of attention bias paradigms exist, many are indirect measures, such as the modified Stroop task. Instead, the visual probe task is advantageous because varying the stimulus duration allows for the differentiation between automatic orientation and sustained attention (Field & Cox, 2008). Additionally, we opted for this paradigm because many attention bias modification interventions are adaptations of the visual probe task (e.g. Boutelle, Kuckertz, Carlson, & Amir, 2014; Eldar et al., 2012).

While children typically do not meet full criteria for BED, reports of episodes of loss of control (LOC) eating are common, particularly among those prone to excess weight (Shomaker, Tanofsky-Kraff, & Yanovski, 2011; Tanofsky-Kraff, Marcus, Yanovski, & Yanovski, 2008). For youth, the subjective experience of LOC may be a more salient indicator than episode size when describing aberrant eating (Goldschmidt et al., 2008; Shomaker et al., 2010). The presence of LOC eating places youth at high risk for excessive weight and fat gain (Tanofsky-Kraff et al., 2006, 2009) and the development of partial or full-syndrome BED (Hilbert, Hartmann, Czaja, & Schoebi, 2013; Sonneville et al., 2013; Tanofsky-Kraff et al., 2011). Notably, youth with LOC eating appear to have an increased preference for highly palatable foods. Data collected from self-report measures (Theim et al., 2007) and in the laboratory (Tanofsky-Kraff et al., 2009) indicate that youth with reported LOC eating consume more snack- and dessert-type foods, as well as more energy from carbohydrates and less from protein compared to youth without LOC eating (Tanofsky-Kraff et al., 2009; Theim et al., 2007). These data support the notion that youth with LOC eating may be particularly susceptible to attentional bias toward palatable food cues, which may promote the obesogenic eating patterns that distinguish the LOC phenotype. Examining attention biases among youth with LOC eating may provide novel information about the role of attention biases in developmental risk models for eating disorders.

Individual differences in behavioral phenotypes promoting obesity (Field et al., 2013) may account for the heterogeneity of findings regarding attentional biases and weight status. Indeed, it is possible that the relationship between attentional biases to food cues and weight status may vary as a function of LOC eating or BED presence. Individuals with LOC eating or BED, who have been shown to be more impulsive and sensitive to the rewarding properties of palatable foods relative to weight-matched controls (Filbey et al., 2012; Schag et al., 2013), may experience greater difficulties with diverting attention from foods regardless of their goals. Such sustained attention toward palatable foods may be associated with exacerbated cravings (Kemps & Tiggemann, 2009) that trigger LOC episodes and frequent overconsumption, which may promote excessive weight gain and obesity. By contrast, it is possible that overweight youth without LOC eating exhibit the approach–avoidance bias pattern, as they may possess improved attentional control capacity in the face of palatable food cues relative to those with LOC eating. However, these hypotheses require empirical evaluation.

Therefore, we examined biases in sustained attention toward high palatable foods using a visual probe task in youth with and without reported LOC eating. We hypothesized that children with LOC eating would display a greater sustained attentional bias toward palatable foods compared to youth without LOC eating. Additionally, given the prior literature in overweight adults (e.g. Castellanos et al., 2009; Werthmann et al., 2011), we explored whether BMI-z and LOC eating interacted in their relationship to attentional bias to highly palatable foods. In order to determine whether findings were specific to high palatable foods, we also examined biases in sustained attention toward low palatable foods; however, we hypothesized that there would be relevant differences between youth with and without LOC eating on high palatable foods only.

Materials and methods

Participants and recruitment

Participants were a convenience sample of children and adolescents, aged 8–17 years, recruited through multiple methods: advertisements in local newspapers, referrals from physicians' offices, mailings to local area parents, flyers posted at the National Institutes of Health (NIH) and the Uniformed Services University of the Health Sciences (USUHS) in Bethesda, Maryland, and local public facilities, with permission. Flyers were also distributed through local elementary, middle, and high school parent listservs. Participants were drawn from three separate studies. Two were non-intervention studies. The first, carried out at the NIH, examined eating behaviors in adolescent boys and girls (13–17 years) with and without reported LOC eating of all weight strata (ClinicalTrials.gov ID: NCT00631644). The second non-intervention study took place at