



Attentional bias to unhealthy food in individuals with severe obesity and binge eating



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ABSTRACT

Attentional bias is an implicit cognition relevant to development and maintenance of obesity, but little is known of how binge eating modulates attentional bias in severe obesity. This study investigated attentional bias towards unhealthy foods at different stages of attentional processing in a clinical sample, comparing obese patients (Body Mass Index, BMI > 35 kg/m²) with and without binge eating behaviors. Participants were separated into two groups according to their score on the Binge Eating Scale (BES): no binge eating (NB; score ≤ 17; n = 23) and binge eating (BE; score > 17; n = 19). Participants performed a computerized visual probe task designed to evaluate attentional bias in different stages of attentional process; matching pairs of unhealthy food and matching non-food pictures concealed a target for 100, 500 or 2000 ms. Reduced reaction times to targets following food-related images are indicative of attentional bias towards food images. BE group exhibited a greater bias towards food than NB. Both groups showed positive attentional bias to food in the initial orientation stage (100 ms), whereas bias was close to zero in the maintenance of attention stage (2000 ms), suggesting ambivalent approach-avoidance responses to food stimuli. Only the BE group showed a bias towards food images when displayed for 500 ms, indicating disengaging from food-related stimuli was faster in NB group. Although both groups were ambivalent about attending to food cues, slower attentional disengagement from unhealthy food might be a cognitive marker of binge eating behavior in severe obesity.

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Interventions designed to modify health-harming behaviors such as smoking or overeating are often based on making decision more rational (Marteau, Hollands, & Fletcher, 2013). Changing lifestyles, pharmacological intervention or bariatric surgery are the current weight loss strategies (Kushner, 2014). Bariatric surgery is considered the most effective long-term treatment for severe obesity for individuals with severe or moderate obesity complicated by comorbid conditions that is not responsive to non-surgical approaches (Buchwald et al., 2004; Fandiño, Benchimol, Coutinho, & Appolinário, 2004). Understanding subtypes of obesity might help to understand better its causes and to provide adequate prevention and treatment (Field, Camargo, & Ogino, 2013).

Main behavioral treatment strategies for obesity do not address implicit automatic processes. Automatic, implicit behavioral

processes are not necessarily consistent with current explicit goals such as quitting smoking or maintaining a weight-reducing diet (Marteau, Hollands, & Fletcher, 2013), but may play an important role in future cognitive-behavioral interventions (Beck & Haigh, 2014; Wiers & Stacy, 2006). Research on implicit cognition underlying automatized actions such as binge eating can help to refine subtypes of obesity and developing effective behavioral change strategies.

Implicit cognition such as attentional bias may be relevant to development and maintenance of obesity. Attentional bias is a tendency to focus attention on one particular class of stimuli – in this case food-related stimuli – because such stimuli are highly motivationally relevant (Jansen, Houben, & Roefs, 2015; Williams, Mathews, & MacLeod, 1996). Attentional bias can be assessed directly using eye tracking (Popien, Frayn, Kristin & Sears, 2015; Schag et al., 2013) or indirectly using computerized tasks (Rooske, Hine, & Thorsteinsson, 2008; Wiers & Stacy, 2006). Interventions

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that influence implicit cognitive processes such as attentional retraining suggest innovative strategies to improve treatment of obesity (Jansen et al., 2015; Stacy & Wiers, 2010).

There is a consensus that an attentional bias towards food is common in the obese population (Castellanos et al., 2009; Nijs & Franken, 2012; Nijs, Muris, Euser, & Franken, 2010; Werthmann et al., 2011). Attentional bias towards food words in a Stroop task was associated with an increase in body mass index (BMI) over time (Calitri, Pothos, Tapper, Brunstrom, & Rogers, 2010). On the other hand, decreased BMI after bariatric surgery was accompanied by reduced attentional bias towards food-related stimuli at a 6-month follow-up (Giel et al., 2013). Obese individuals have an ambivalence towards food, which manifests as an attraction to food-related stimuli during the initial orienting stage of attentional processing and avoidance of food-related stimuli or a reduction in bias towards them when attention has to be maintained (Jansen et al., 2015; Nijs & Franken, 2012; Nijs et al., 2010; Werthmann et al., 2011).

This approach-avoidance or motivational ambivalence (Nijs & Franken, 2012) has been found by Werthmann et al. (2011) who measured attention using eye tracking and a visual probe task with a Stimulus Onset Asynchrony (SOA) of 2000 ms and the study of Nijs et al. (2010), which used the P300 evoked potential and a visual probe task with SOA of 100 ms and 500 ms. The ambivalent approach-avoidance response to stimuli seems to arise with stimuli that are associated with both positive and negative reinforcement (Breiner, Stritzke, & Lang, 1999). This ambivalence was observed in failed dieters (Veenstra, de Jong, Koster, & Roefs, 2010), people 'addicted' to chocolate (Cartwright & Stritzke, 2008), abstinent alcoholics (Vollstädt-Klein, Loeber, Von der Goltz, Mann, & Kiefer, 2009) and abstinent smokers (Peuker & Bizarro, 2013), which suggests that it is a typical response to desired but prohibited stimuli (Breiner et al., 1999; Nijs & Franken, 2012).

Methodological differences among various studies may account for differences in observed attentional bias to food in individuals with obesity (Loeber et al., 2011; Mobbs, Iglesias, Golay, & Van der Linden, 2011; Nijs & Franken, 2012). Task sensitivity might be affected by the type of stimuli used (e.g. words or pictures), task parameters such as stimulus duration (Nijs & Franken, 2012), participants' hedonic mindset (Jansen, Houben & Roefs, 2015) or being on a weight-reducing diet. Perhaps only a subset of individuals with obesity are susceptible to external stimuli to eat and this may influence performance on behavioral tasks that assess attentional bias to food. Also, highly palatable foods may have higher reinforcement value to those most susceptible to obesity (Field, Camargo & Ogino, 2013).

Overweight or moderate obese individuals with binge eating have increased attentional bias to food (Popien, Frayn, Kristin & Sears, 2015; Svaldi, Tuschen-Caffier, Peyk, & Blechert, 2010b; Schag et al., 2013; Schmitza, Naumannb, Trentowskab, & Svaldi, 2014) compared to normal-weight controls. Binge eating disorder (BED) is one of the most common psychiatric disorders among obese individuals (Apollinario, 2004; Costa et al., 2009; Dobrow, Kamenetz, & Devlin, 2002; Zanella et al., 2002). BED is characterized by episodes of binge eating, which occur at least once a week for three months and are associated with lack of behavioral control and an absence of compensatory behaviors; binges are accompanied by feelings of disgust, guilt, and regret (American Psychiatric Association, 2013).

Among obese individuals, those with BED form a distinct subgroup with a greater level of functional impairment (Wilfley, Wilson, & Agras, 2003). This subgroup shows behavioral and cognitive abnormalities in evaluation of rewards and losses, executive functions, attentional bias towards food, and impulsivity (Balodis et al., 2013; Danner, Ouwehand, van Haastert, Hornsveld, & De Ridder, 2012; Geliebter et al., 2006; Mobbs et al., 2011; Svaldi

et al., 2010b). Having BED is considered a negative prognostic factor for bariatric surgery; it is associated with smaller weight reductions (Macias Leal, 2003; Niego, Kofman, Weiss, & Geliebter, 2007; Sallet, Collis, Pisani, & Sallet, 2005, p. 289; Sallet et al., 2007), or regaining of weight after a maintenance period. (Hsu et al., 1998; Niego et al., 2007; Pekkarinen, Koskela, Huikuri, & Mustajoki, 1994). Little is known about the influence of binge eating on attentional bias to food in individuals with severe obesity.

Binge eating and obesity have been independently associated with attentional bias to food stimuli. For instance, individuals who were in treatment for eating disorders including binge eating disorder showed reduced attentional bias towards food-related stimuli (Shafran, Lee Cooper, Palmer, & Fairburn, 2008). On the other hand, overweight or moderate obese individuals with binge eating have increased attentional bias to food (Popien, Frayn, Kristin & Sears, 2015; Svaldi et al., 2010b; Schag et al., 2013; Schmitza et al., 2014) compared to normal-weight controls. Among obese individuals, those with binge eating disorder tended to gaze longer at food stimuli as observed using eye tracking (Schag et al., 2013).

There is a clinical relevance to study attentional bias in orienting and maintained attention in subgroups of patients with severe obesity. Specifically, attentional bias to food is likely to be a cognitive marker of binge eating in severe obesity. The aim of this study was to compare attentional bias towards unhealthy food in obese patients with or without binge eating behaviors indicative of BED at different stages of attentional processing. Our hypothesis was that binge-eating behavior would increase the bias towards food in severely obese patients, especially in the maintenance stage of attention.

1. Material and methods

1.1. Participants

The participants were 44 adults, aged 18 and above. They were recruited from a waiting list for bariatric surgery at a public hospital in Brazil. The majority of participants was female ($n = 40$) and white ($n = 31$). Participants were aged from 26 to 68 years-old ($M = 47$ years; $SD = 11.7$). The inclusion criteria were presence of obesity grade II or III (BMI, above 35 kg/m²; World Health Organization, 2008) and normal or corrected-to-normal vision. The mean BMI was 48.05 kg/m² and most of the sample ($n = 41$) were classified as having grade III obesity (BMI, above 40 kg/m²; World Health Organization, 2008).

The sample was characterized by low educational attainment, a high unemployment rate, and a low average monthly income compared with the general population of Brazil. The majority of the sample ($n = 30$) had completed Elementary School; just over half the sample ($n = 23$) was working at the time of data collection (unemployment rate in Brazil by the time of data collection was 7%, IBGE). The majority of the sample ($n = 36$) had a monthly income of between one and five times the minimum wage. Only 15 participants reported that they took physical exercise but 33 were dieting.

Participants were separated into two groups according to their score on the Binge Eating Scale (BES). These groups are characterized by no binge eating (NB; score ≤ 17 ; $n = 23$) and binge eating (BE; score > 17 ; $n = 19$). BE group ($n = 19$) had scored between 18 and 36 points on the BES ($M = 24.7$; $SD = 5.6$; $Mdn = 23$). NB group ($n = 25$) scored between 2 and 17 ($M = 10.9$; $SD = 4.6$; $Mdn = 11$). The mean age of the BE group was 45 years ($SD = 9.62$) and the mean age of the NB group was 49.5 years ($SD = 12.92$).

1.2. Instruments

Binge Eating Scale (BES). The instrument consists of 16 items

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