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Do disinhibited eaters pay increased attention to food cues?

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ABSTRACT

The Three Factors Eating Questionnaire's measure of disinhibited eating is a robust predictor of long-term weight gain. This experiment explored if disinhibited eaters display attentional bias to food cues. Participants (N = 45) completed a visual dot probe task which measured responses to food (energy dense and low energy foods) and neutral cues. Picture pairs were displayed either for a 100 ms or 2000 ms duration. All participants displayed attentional bias for energy dense food items. Indices of attentional bias were largest in disinhibited eaters. Attentional bias in disinhibited eaters appeared to be underpinned by facilitated attention.

1. Introduction

Drug cues acquire higher motivational value through the process of dopaminergic conditioning (Berridge & Robinson, 1998). This associative learning leads to the reward system becoming hypersensitive to drugs and their associated cues (Robinson & Berridge, 2001). A frequently used behavioural measure of neural sensitivity to drug cues is attentional bias. Attentional bias occurs when an individual is quicker at processing personally relevant information compared to neutral information (Macleod, Matthews & Tata, 1986). Attentional bias for drug cues has been consistently documented in smokers, frequent caffeine consumers, drug users and alcoholics (For a review see Field & Cox, 2008). It is thought that attentional bias serves a functional role in maintaining addictive behaviour. Selective attention to drug cues has been shown to underpin approach behaviour and craving (Cox, Klinger & Fadardi, 2015). It is also a robust predictor of relapse (Franken, 2003).

Overeating provides an interesting parallel to addictive behaviour. Much like habitual drug users, obese individuals commonly report experiencing craving and a preoccupation with food (Herman & Polivy, 2008; Jastreboff et al., 2013). The influence that food relevant cues (e.g. sight, smell, taste) have on food intake has also been well documented (for review see Herman & Polivy, 2008). It is plausible that dopaminergic conditioning occurs in individuals who habitually overeat. Attempts to establish if attentional bias for food cues can be a useful predictor of obesity risk has had mixed success. However, there is a growing body of research that demonstrated that obese individuals allocate greater attentional resources to food stimuli compared to their lean counterparts. (Castellanos et al., 2009; Nijs, Franken, & Muris, 2010; Yokum Ng & Stice, 2011; Braet & Crombez, 2003; Graham, Hoover, Ceballos, & Komogortsev, 2011; Kemps, Tiggemann, & Hollitt, 2014; Long, Hinton, & Gillespie, 1994; Nijs, Muris, Euser & Franken, 2010; Werthmann Jansen, & Roefs, 2015).

A recent review of this literature by Doolan, Breslin, Hanna, and Gallagher (2015) proposes that attentional bias to food cues is influenced more by an individual's eating traits than body weight. Research suggests that biased processing of food cues may increase obesity risk. This explanation has been used to explain the paradoxical relationship that exists between body weight and restrained eating patterns. Repeated attempts by restrained eaters to limit their food intake to control body weight, seemingly increases the likelihood that they will become obese (Herman & Polivy, 2008). A number of studies have demonstrated that restrained eaters have high indices of attentional bias to food cues (Hollitt, Kemps, Tiggemann, Smeets & Mills, 2010; Tapper, Pothos, Fadardi, & Ziori, 2008). It can be proposed that attempts to restrict calorie intake made by restrained eaters are thwarted by biased processing of food cues. Higher indices of food processing

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bias have been linked to other eating patterns that are associated with obesity risk; these include external eaters (Brignell, Griffiths, Bradley, & Mogg, 2009; Newman, O'Connor, & Conner, 2008) and high chocolate cravers (Smeets, Roefs, & Jansen, 2009).

To date, there has been no published attempt to document attentional bias in individuals who experience disinhibited eating. This oversight limits the existing literature as the Three Factors Eating Questionnaire's measure of disinhibited eating (TFEQ_D, Stunkard & Messick, 1985) is viewed as one of the most robust predictors of long-term weight gain (Hays & Roberts, 2008). Conceptually the term disinhibition refers to a variety of eating behaviours that can be characterised by a lack of self-regulation (e.g. binge eating, unhealthy food choices, low awareness of satiety) (Lattimore, Fisher& Malinowski, 2011). Research has shown that individuals who score high on measures of trait disinhibition consistently have higher body weights (Boschi, Margiotta, & Falconi, 2001; Provencher, Drapeau, Tremblay, Despre, & Lemieux, 2003), make unhealthy food choices (Contento, Zybert, & Williams, 2005; Lahteenmaki & Tuorila, 1995), are more impulsive (Yeomans, Leitch, & Mobini, 2008) and experience reduced success from weight loss interventions (Bryant, Caudwell, Hopkins, King, & Blundell, 2012). This paper aims to examine if the opportunistic eating pattern displayed by disinhibited eaters is indicative of increased attentional bias to food cues.

The present research examined if individuals who have high levels of disinhibited eating (as measured by the TFEQ, Stunkard & Messick, 1985) paid increased attention to food cues during a visual dot probe task. Two visual stimuli were briefly presented side by side, followed by a dot (probe) where one of the stimuli had been. Some trials involved a food picture and a neutral picture, and others contained two neutral pictures. Participants had to press a button on the side of the display to indicate where the probe had appeared. Response time (RT) was used to calculate attentional bias. Faster RTs on trials where the probe followed in the location of a food picture, compared with trials when it followed one of two neutral stimuli was indicative of increased attention to food stimuli. To explore the impact of motivational value on attentional bias the food pictures consisted of both energy dense and low energy food items (Tapper, Pothos, & Lawrence, 2010). It was predicted that attentional bias would increase for all participants when responding to trials containing foods which are energy dense (due to the cues higher motivational value). However, it is anticipated that this effect will be exacerbated in disinhibited eaters who are typically more responsive to the presence of hedonic food cues (Tapper et al., 2010).

During the visual dot probe task, picture pairs were displayed for either 100 ms or 2000 ms exposures. A matched neutral design was used to allow the reaction time data to be analysed in a way that provides both a traditional measure of attentional bias, but also establishes whether bias reflects facilitated attention to food cues or delayed disengagement (Tapper et al., 2010; Koster, Crombez, Verschuere & Houwer, 2006). If attentional bias for food cues is driven by facilitated attention participants will make quicker responses when the probe replaces a congruent stimulus (probe position replacing food item). Whereas delayed disengagement of attention would result in slower reaction times to incongruent stimuli (probe position replacing neutral items).

2. Method

The sample comprised of forty-five participants who were recruited from the undergraduate population of the University of Swansea. The mean age of participants was 20.5 ± 1.8 years. The sample's mean BMI was within the normal range (23.6 ± 4.8kg/m2). Disinhibition was measured using the disinhibition subscale of the Three Factor Eating Questionnaire (Stunkard and Melleck, 1985). This measure explores an individual's level of uncontrolled eating using 9 items. All potential participants were asked to complete the TFEQ_D; those whose scores placed them in the bottom or top 40% of the sample were invited to complete the visual dot probe task. Participants were grouped in terms of high and low disinhibited eating based on their TFEQ_D scores Recruitment adhered to the following selection criteria; all participants were non-vegan or vegetarian, self-reported that had no history of disordered eating and were not dieting.

Laboratory sessions were scheduled so that they occurred after meal times, all participants ate their habitual breakfast or lunch prior to attendance. This was to ensure that any behavioural differences in task performance were not caused by hunger. On arrival, participants were required to rate their hunger measured using a general mood questionnaire (VAS 0–100) which contained 10 items. Participants were asked to rate their mood (e.g. on a scale of 0–100 how happy are you feeling?) Included in these ratings were questions on hunger and thirst). Participants were then introduced to the visual dot probe task and were informed that they would be required to attend and respond to stimuli in the form of pictures. The test stimuli consisted of 64 pairs of colour pictures. Sixteen pairs were an energy dense food and a household item; sixteen were a low energy food and a household item, and 32 were two household items. All stimuli used in this task had been previously rated in a pilot study as being representative of each of the two categories (Tapper et al., 2008) and none of the household items selected altered the context of the food stimuli (e.g. related to food preparation, cleaning). In addition 10 animal items were used to create practice trials.

Picture pairs were presented for 100 ms and 2000 ms duration across two blocks of 258 trials (128 critical trials, 128 matched neutral trials). Each block contained 4 presentations of each of the experimental or matched neutral picture pairs (e.g. experimental stimulus shown on left, followed by a probe on the left; experimental stimulus on left, followed by a probe on the right; experimental stimulus shown on the right, followed by a probe on the right and experimental stimulus show on right followed by a probe on the left). These presentations were randomised. The probe used in this task was a dot and was displayed until the participant made a response. Participants responded to the probe by identifying which side of the screen the probe had appeared. This was done by pressing one of two response buttons. Reaction time (RT) was measured in Milliseconds (ms). At the end of the computer task, participants were asked again to rate current mood and hunger. Finally, participant's height (cm) and weight (kg) were recorded. An average laboratory session lasted 45 min.

All trials with incorrect responses were excluded from the data analysis. RT for correct choices that were >200 ms and <2000 ms and < two SD longer than the participant's mean RT was analysed. Attentional bias scores were calculated for each participant and picture duration by subtracting the mean RT for probes replacing food items from the mean RT for probes replacing neutral items. Thus positive values would reflect a bias favouring a food stimulus relative to a neutral stimulus.

3. Data analysis

Task Accuracy was compared across the two groups using an x 2 (Stimulus Duration) x 2 (Stimuli Set) X 2 (TFEQ_D) ANOVA. Attentional bias was compared across the two groups using a 2 (Food Type) x 2 (Stimulus Duration) x 2 (TFEQ_D group) ANOVA was conducted. Effect sizes for both ANOVA's were reported are Cohen's d (*d*). The significant interaction between disinhibition group and food type was explored using four planned comparisons of the