Examining the relationship between selective attentional bias for food- and body-related stimuli and purging behaviour in bulimia nervosa

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Abstract

Previous research exploring cognitive biases in bulimia nervosa suggests that attentional biases occur for both food-related and body-related cues. Individuals with bulimia were compared to non-bulimic controls on an emotional-Stroop task which contained both food-related and body-related cues. Results indicated that bulimics (but not controls) demonstrated a cognitive bias for both food-related and body-related cues. However a discrepancy between the two cue-types was observed with body-related cognitive biases showing the most robust effects and food-related cognitive biases being the most strongly associated with the severity of the disorder. The results may have implications for clinical practice as bulimics with an increased cognitive bias for food-related cues indicated increased bulimic disorder severity.

Keywords: Attentional bias, bulimia nervosa, cognitive bias, purging

Introduction

Cognitive models of eating disorders suggest that there are individual differences which are associated with the maintenance of such conditions (e.g. Vitousek & Hollon, 1990). These include attitudes, beliefs and perceptions of ideal body weight and shape, body dissatisfaction, and over-concern with body image (e.g. Fairburn, Cooper, & Shafran, 2003; Cooper, Anastasiades & Fairburn, 1992). Vitousek and Hollon (1990) have argued that in eating disordered populations schemata associated with these types of categories are maladaptive to the extent of generating systematic errors in the processing of relevant information through processes such as selective attention. Over-concern with body image (e.g., body weight and body shape) is an important diagnostic criteria for both anorexia and bulimia nervosa (American Psychiatric Association, 2013), and is predictive of binge eating and purging (Byrne & McLean, 2002). It has been suggested that body image-related cognition may maintain eating disorder symptoms by distorting how the environment is perceived and how experiences are interpreted by the individual (Blechert, Ansorge & Tuschen-Caffier, 2010; Vitousek & Orimoto, 1993).

Information processing biases and distortions appear to play a central role in the maintenance of eating disorders (see Faunce, 2002; see Dobson & Dozios, 2004; Lee & Shafran, 2004; Johansson, Ghaderi & Andersson, 2005; Smeets, Roefs, van Furth & Jansen, 2008). One approach for understanding the nature of these biases has involved an examination of attentional processes that occur during ongoing behaviour and experience. It has been argued that preferential attention to concern-related stimuli (attentional bias) reflects a biased processing of related experiences (see Mathews & MacLeod, 2005; Fairburn et al, 2003). It has also been argued that with repeated behavioural enactment these concern-related stimuli are detected automatically (without conscious awareness) and result in the desire to undertake both associated and ongoing behaviour (see Field, Munafo & Franken, 2009;

Franken, 2003). Employing a variety of experimental tasks (e.g. modified Stroop, eye tracking technology, flicker induced change blindness, dot probe), attentional biases for concern-related stimuli have been identified in a variety of habitual and compulsive behaviours including alcohol use (e.g. Sharma, Albery & Cook, 2001), cannabis use (e.g. Cane, Sharma & Albery, 2009), smoking (e.g. Attwood, O'Sullivan, Leonards, Macintosh & Munafo, 2008), dieting behaviour (Wilson & Wallis, 2013) and sex-related activity (Fromberger, Jordan, von Herder, Steinkrauss, Nemetschek, Stolpmann, & Muller, 2012), among others.

In the specific realm of eating disorders, research has shown that within a modified Stroop paradigm individuals with eating disorders take longer than control participants to name the ink colour of concern-related words (e.g. food words, body shape words) than matched neutral words (e.g. Ben-Tovim & Walker, 1991; Ben-Tovim, Walker, Fok, & Yap, 1989; Cooper & Todd, 1997; Green, McKenna & de Silva, 1994). There also appear to be variation in cognitive biases between people with anorexia and people with bulimia. People with anorexia typically display a cognitive bias for body/weight-related words whereas people with bulimia demonstrate cognitive biases across a much broader range of stimuli (see meta-analysis by Dobson & Dozois, 2004). This may reflect a generalised deficit in attentional deployment (cf. Mattos, Saboya, Ayrão, Segenreich, Duchesne, & Coutinho, 2004).

Whilst bulimia and anorexia are distinct disorders both are associated with distorted body image. Anorexia typically involves the starving of oneself to achieve the desired body image, whereas bulimia is characterised by the consumption of large quantities of food followed by the act of 'purging' by vomiting or laxative intake. Starvation within anorexics is obviously traumatic and may manifest itself in specific body-related cognitive biases, yet the trauma associated with purging may be directly related to the amount of food that has been

binged upon and may subsequently fluctuate or be dependent upon the quantity of bingeing. That certain activities (e.g. starvation in anorexia and purging in bulimia) are common but domain specific behavioural characteristics, it is also likely that these behavioural characteristics may have cognitive correlates. Whilst it is plausible to assume that people with bulimia may demonstrate a generalised cognitive bias, due to a distorted body-image, as well accompanying behaviours of food bingeing and purging, the frequency with which an individual engages in bingeing and purging behaviour may have implications for the strength of food-related cognitive biases and are analogous with the severity of the condition (Edler, Haedt, & Keel, 2007; Rofey, Corcoran & Tran, 2004). As such this suggestion begs the question of the nature of the relationship between behavioural symptom severity and the operational magnitude of related cognitive biases (see Field, Munafo & Franken, 2009). Previously it has been argued that cognitive biases in attentional preference, and urges to respond in an appetitive manner, results in a 'strengthening' doperminergic response which over time becomes sensitised (e.g. Franken, 2003). This sensitisation creates a saliency in the cues associated with the rewarded behaviour resulting in those cues developing motivational appetitive properties (i.e. providing incentives for continued behavioural enactment) and urge responding (e.g. Robinson and Berridge, 1993). Ultimately the cue becomes the focus of preferential attention, is experienced as 'wanted' and guides future responsive action. A meta-analysis has recently identified that not only do people with eating disorders in general show an attentional preference for food-related cues but that within people with bulimia these stimuli have heightened incentive saliency which is related to an increasing 'need' to consume food and purging of that intake (see Brooks, Prince, Stahl, Campbell & Treasure, 2011). In this sense, it is plausible that for the people with bulimia purging activity (and other indices of symptom severity) may increase in line with increasing attentional preference.

To separate the role of different cognitive biases (those associated with food and those associated with body) in people with bulimia, the current study required such individuals (and controls) to perform a simple modified Stroop task with two word categories: food-related and body-related. To delineate the effect of repeated behavioural patterns on the operation of these biases the frequency of purging within people with bulimia was assessed. Cognitive biases were predicted to differ according to the severity of symptoms. Specifically, it was anticipated that cognitive biases towards food related symptoms would increase in line with symptom severity, but no such association would be observed for body shaped words.

Method

Design.

The experiment used a 3 x 2 factorial design with group (2 levels; people with bulimia and controls) as a between-participants factor and word type (3 levels; food, body and neutral) as a within-participants factor. The key dependent variables were the levels of cognitive bias (expressed as interference scores) and self-reported levels of bingeing / purging. Cognitive bias was measured by the time taken (in milliseconds) to name the ink colours of neutral, food- and body-related words in a modified Stroop task.

Participants

A total of 94 females were initially approached to take part in the study. Of these five decided not to take part in the study and one participant withdrew post consent. As such, the final sample comprised 88 females (mean age = 30.4 years; SD=10.4) of which 45 formed the people with bulimia group (mean age =28.9; SD=10.2) and 43 the control group (mean age = 31.9; SD = 10.6). No differences in age between groups was found, $t(86) = 1.335$; $p = .185$. People with bulimia were recruited through London-based 12-Step fellowships in the community, such as Over-Eaters Anonymous (OA) or Anorexics and Bulimics Anonymous (ABA). As such, attendance at such anonymous fellowships indicates self-definition of

bulimic-type presentation. For ethical reasons it was decided that the use of categorisation measures, such as the Eating Behaviours Inventory or a full clinical interview covering an in-depth description and analysis of related symptomology, could be deemed as being too invasive among anonymous fellowships members. However, whilst such a full diagnostic inventory was not considered appropriate, for inclusion in the final analysis bulimic participants had to volunteer that they had binged and purged on at least three separate occasions within the last 90 days. No participants refused to provide this information and withdraw from the study. Control participants were recruited from an undergraduate population at a London-based University. For inclusion in the control group, participants were required through self-report not to be currently following any specific diet program, nor to have done so for over 90 days. Furthermore, control participants were required to self-report having no current or past history of any eating disorders (no participants declared as such). Participants' data were excluded if they did not meet the eligibility criteria of the group to which they were allocated (no participants data were excluded).

Materials.

Through pilot research, three people with bulimia (who did not participate in the main study but attended Fellowship-based groups) first created word lists and then rated how representative the words were of bulimia-related food words and bulimia-related body words on a Likert scale of 1-5 ("not at all representative" to "completely representative"). Whilst previous work has been conducted using words as stimuli for food- and body-related modified Stroop tasks in eating disordered individuals (see Brooks et al, 2011), the nature of the current cohort comprising participants attending Fellowship groups necessitated the generation of a bespoke set of stimulus words. In other words, the stimuli generated are likely to be most representative of the categories 'food' and 'body' in people attending related Fellowships. The highest ranking words were selected for inclusion in the study. The word

lists were analysed using the Kucera-Francis Psychology Linguistics Database to match words for mean frequency of use. Three words had to be excluded from the study for not matching in frequency with other words. Neutral words were also matched to food and body-related words. Words were presented in category-specific blocks with eight words in each category. Each word was repeated three times in each of the colours red, blue, yellow and green in each category block making a total of 96 trials in each of the three blocks. Food related words were: chocolate, binge, diet, eat, food, sick, junk, sugar; body-related words were: skinny, celebrity, ugly, model, thin, fat, bum, hate; Neutral words were: compass, train, holiday, generator, flowers, aviator, bench, books. The order of the words, and colours, were randomised and presentation of category-specific blocks counterbalanced across groups. Stroop task stimuli were presented using ePrime (Psychology Software Tools Inc., Pittsburgh, Pennsylvania) and conducted on a Toshiba Laptop with a 20" LCD screen. Participants were required to respond to the colour of the word by pressing the appropriately coloured key on a keyboard; accuracy and reaction time was recorded. Interference scores (reflecting cognitive bias) for body-related and food-related words were calculated by subtracting the mean correct reaction time (milliseconds) for the neutral words separately from the mean correct reaction time for body-related words, and the mean correct reaction time for food-related words. In this paradigm, if no cognitive bias is present then interference scores do not differ significantly from zero. Differences in interference scores from 0 indicate a cognitive bias. In this study, this translates to positive scores (significantly above 0) being indicative of increased interference by either food or body-related words. Participants also completed a questionnaire including basic demographic information as well brief details of bulimic behaviour (i.e. the frequency of bingeing/purging and the age when the bingeing/purging first began).

Procedure.

Participants completed the Stroop task in a quiet room. To become familiar with the demands of the task participants completed a set of 48 practice trials in which letter strings (e.g. YYYY, PPPP) were randomly presented in each of the four colours. Participants then entered the testing phase after which individuals in the people with bulimia group were presented with questions associated with purging frequency. Specifically, participants were asked if they had engaged in any bulimic-type behaviour in the past 90 days on more than three separate occasions. This was defined for the participants as a period of binge eating (consuming vast quantities of food in a relatively short time period) followed by purging. Participants were then asked to rate on average how often they behaved in that way ranging from "Never" (scored as 0) to "Many times per day" (scored as 10). Since this non-diagnostic information could have been deemed sensitive in nature participants were reminded of their right to withdraw all data from the study at any point – no requests were made. For the control group, participants were required through self-report to declare not having followed any specific diet program for over 90 days nor to having any current or past history of any eating disorders. These were administered after the Stroop in order to minimise the potential priming effects of the questions.

Results

We initially performed independent-samples t-tests in order to compare interference scores for people with bulimia and controls. The results indicate that people with bulimia (mean = 41.067; sd = 64.374) differed significantly from controls (m = -5.535; sd = 63.915) in terms of food-related interference scores ($t(86) = 3.406$; $p < .001$), and the bulimia group (m = 57.533; sd = 51.167) differed significantly from controls (m = 4.233; sd = 62.618) in terms of body-related interference scores, ($t(86) = 4.381$; $p < .0005$). This suggests that people with bulimia show cognitive biases over controls for food-related and body-related

stimuli. Further, a paired-samples t-test also revealed that people with bulimia have significantly different interference scores for food-related (m = 41.067; sd = 64.374) and body-related words (m = 57.533; sd = 51.167), t(44) = -2.559; p = .014. This result suggests that people with bulimia have an increased cognitive bias for body-related words over food-related words.

One-sample t-tests were then used to examine whether interference scores for each group differed significantly from zero (the score indicative of no attentional bias) for food- and body-related words. Results showed that for the control participants, the interference scores for food-related words (mean = -5.535; sd = 63.915), t (42) = .568; p = .57, and body-related words (m = 4.233; sd = 62.618), t (42) = .443, p =. 66, did not differ significantly from 0. Significant effects were found in the bulimic group for both the food-related (mean = 41.067; sd = 64.37), t (44) = 4.278; p < .001, and the body-related interference scores (mean = 57.533; sd = 51.167), t (44) = 7.54; p <.001). This result suggests a cognitive bias was observed for food-related words and body-related words in the people with bulimia group (see Figure 1).

Fig 1 about here

We were also interested in whether within people with bulimia there was an association between the frequency of reported purging activity and the size of the interference scores generated. Purging frequency was significantly correlated (Pearson's r) with cognitive bias towards food-related words, r (45) = .418; p <. 005), but not with body-related words, r (45) = .081; p = .598). Purging frequency was associated with food-related interference score but not body-related interference.

Discussion

We performed a simple modified-Stroop task on a population of people with bulimia and control (non-bulimic) participants. The Stroop contained food-related, body-related, and neutral words. We used these words to create two cognitive bias interference scores; food-related and body-related. Replicating previous work (see Brooks et al, 2011; see Rofey et al, 2004), results indicated that bulimics and not controls demonstrated both a food-related and a body-related attentional bias. The results also indicated, within people with bulimia, an increased cognitive bias for body-related over food-related words, again replicating previous work (see Brook et al, 2011; see Rofey et al, 2004). Importantly, however, within people with bulimia, purging frequency (which is argued to be indicative of severity of bulimic disorder) was associated with food-related words and not body-related words. Previous research suggests that people with anorexia typically display a cognitive bias for body/weight-related words (Dobson & Dozois, 2004), whereas that people with bulimia have previously been show to demonstrate cognitive biases across a much more broad-range of stimuli (Dobson & Dozois, 2004). The specificity of the cognitive bias in anorexics would suggest the cognitive concern or mechanism in anorexia is related to body shape/size. The results in the current study share similarities to those of Flynn and McNally (1999) who found an increased cognitive bias for body-related cues over food-related cues. However, whereas they only observed a cognitive bias with body-related cues, we also observed a cognitive bias for food-related cues. Our results imply that people in the bulimic state have a distortion of cognitive processes for both food and body cues. This may reflect that, although issues related to body size and shape may be an underlying cause of bulimia, the mechanism for controlling body size and shape is through the traumatic experience of food bingeing and purging (cf. Farber, 1997), whereas, within anorexics the covert avoidance of food-related stimuli may be employed in order to ease the suffering of starvation.

Further, there was a discrepancy observed between food-related and body-related cues in terms of the association with the severity of bulimia disorder. It was only the food-related cues that were associated with our severity measure. This implies that those who engage with purging behaviours more frequently have an increased cognitive bias for food-related stimuli and not body-related stimuli. This may be because people in the bulimic state perceive food-related cues as causing more immediate psychological threat, due to the traumatic nature of regular purging of food (cf. Farber, 1997). In addition, this finding may elude to a potential cognitive mechanism for bulimic behaviour based on the idea that these individuals may show poor awareness of one's internal somatic and affective state (or interoceptive awareness). Previous work has confirmed the relationship between deficits in interoceptive awareness and eating disorders (e.g. Merwin, Zucker, Lacy & Elliott, 2010). The positive relationship between attentional preference for food-related words and purge frequency in the current study may suggest that such stimuli are processed affectively (possibly as threat-related) leading to an affective experience. This affective experience may in of itself produce behaviour designed to remove such arousal, in this instance, purging of food activity. That this effect is selective for food-related stimuli reinforces the idea of a one-to-one correspondence with purging activity. As far as the authors are aware, this is the first such finding of an association with severity of bulimia disorder and cognitive bias. Further experimental work should be undertaken to explore the relationship between cognitive markers such as attentional bias and severity of disorders based on behavioural indices. For instance, changing bulimic behaviour (e.g. purging activity) may be dependent on either encouraging interoceptive awareness and/or altering related attentional preferences through attentional retraining.

The clinical implications of this research are related to diagnosis and assessment. The emotional-Stroop task was sensitive to whether an eating disorder was present or not. The

findings suggest that the diagnosis and assessment of bulimia need not be confined to explicit self-report measures but may benefit from the inclusion of approaches related to processes which are more likely to operate outside of conscious awareness. The discrepancy in the results obtained for the two stimuli types may represent another area for further research, because as food-related biases increase severity of the disorder may also increase. Whilst these implications are important future work should overcome limitations associated with the sample derived from members of anonymous fellowships and replicate in alternative populations (e.g. those in other treatment contexts).

Overall it appears that people with bulimia demonstrate a cognitive bias for both food-related and body-related cues. However, there is an interesting discrepancy in that although body-related cognitive biases appear the most robust, it is food-related cognitive biases that are associated with the severity of the disorder.

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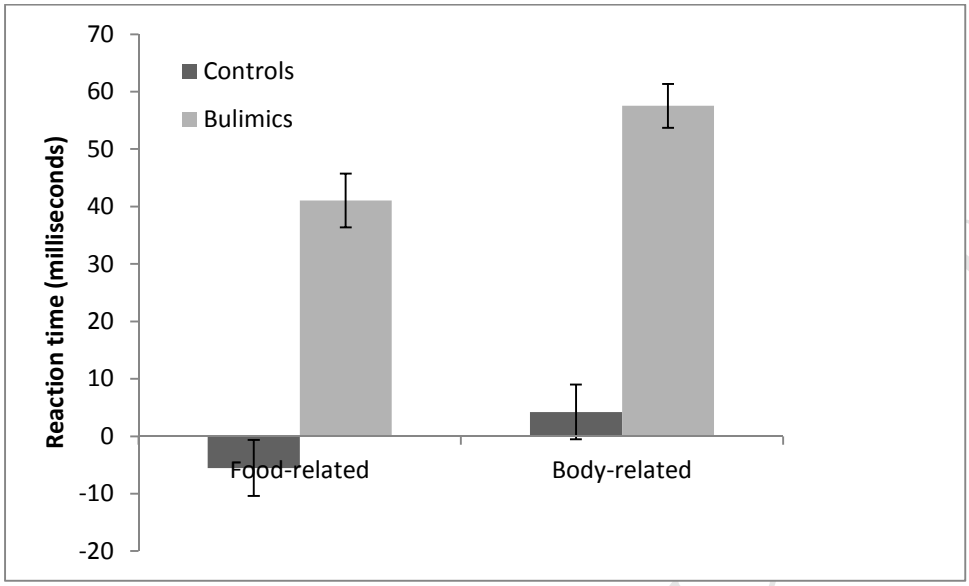

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383 Figure Caption

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385 Figure 1: Mean correct reaction times (milliseconds) for food-related words and body-related

386 words in control and bulimic participants.

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