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Effects of Bias Modification Training in Binge Eating Disorder

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Food-related attentional biases have been identified as maintaining factors in binge eating disorder (BED) as they can trigger a binge episode. Bias modification training may reduce symptoms, as it has been shown to be successful in other appetitive disorders. The aim of this study was to assess and modify food-related biases in BED. It was tested whether biases could be increased and decreased by means of a modified dot-probe paradigm, how long such bias modification persisted, and whether this affected subjective food craving. Participants were randomly assigned to a bias enhancement (attend to food stimulus) group or to a bias reduction (avoid food stimulus) group. Food-related attentional bias was found to be successfully reduced in the bias-reduction group, and effects persisted briefly. Additionally, subjective craving for food was influenced by the intervention, and possible mechanisms are discussed. Given these promising initial results, future research should investigate boundary conditions of the experimental intervention to understand how it could complement treatment of BED.

Keywords: binge eating disorder; attentional bias; bias modification; dot-probe paradigm

F.S. and J.S. jointly conceived and designed the experiment, conducted the study, analyzed the data, and wrote the manuscript.

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MOST COGNITIVE THEORIES OF BINGE eating disorder (BED) assume a critical contribution of food-related biases. In particular, incentive sensitization theory (Berridge, 2009; Berridge, Ho, Richard, & DiFeliceantonio, 2010; Franken, 2003) posits that the consumption of food items is heavily reinforced by an aberrant reward system. As a consequence, attention toward these food items is increased in the future as they promise reward. This can constitute a vicious cycle, as the biased processing of food cues can trigger craving and approach tendencies. In turn, if inhibitory control fails, the consumption of food items will further increase their attentional salience. In support of this notion, a number of studies have supported the existence of attentional biases in binge eating disorder (Popien, Frayn, von Ranson, & Sears, 2015; Schag et al., 2013; Schmidt, Luthold, Kittel, Tetzlaff, & Hilbert, 2016; Schmitz, Naumann, Biehl, & Svaldi, 2015; Schmitz, Naumann, Trentowska, & Svaldi, 2014; Svaldi, Tuschen-Caffier, Peyk, & Blechert, 2010).

While such food cue reactivity can be easily acquired, the extinction of appetitive responding seems to be more challenging (Jansen, Schyns, Bongers, & van den Akker, 2016). One potential way to escape from the vicious cycle of increased salience and reinforcement is to target attention allocation. Such "attentional bias reduction" or "bias modification" has been successfully applied to a number of disorders in which attentional biases

are considered to be maintenance factors. Originally, bias modification was suggested for anxiety disorders (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002) and research synthesis suggests that bias modification is generally effective in this domain (Beard, Sawyer, & Hofmann, 2012; Hallion & Ruscio, 2011). More recently, bias modification was successfully tested in appetitive disorders such as substance dependence (Field, Munafo, & Franken, 2009), and recent review studies have emphasized the need for increased research on the efficacy of bias modification for appetitive disorders in general (Beard et al., 2012), and for eating disorders in particular (Renwick, Campbell, & Schmidt, 2013).

In most studies, a dot-probe paradigm is applied with manipulated dot-probe contingencies. It is usually observed that participants learn—across multiple trials—to direct their attention to the stimulus category that predicts the location of the dot-probe and to avoid attending to the other stimulus category. Thereby, an attentional bias can be modified. Previous research with substance dependent individuals has shown that attentional biases can be effectively modified within the experimental task (see Field et al., 2009, for a meta analysis). However, meaningful behavioral effects on substance consumption were only observed over multiple sessions of training (Fadardi & Cox, 2009; Field et al., 2009; Schoenmakers et al., 2010). Additionally, findings are inconclusive as to how broad the intervention actually is. Some studies suggest that attentional bias reduction is confined to the stimuli presented in the training session (Field et al., 2009; Schoenmakers, Wiers, Jones, Bruce, & Jansen, 2007), whereas other studies have shown that training effects generalize to novel exemplars of the trained categories not shown in the training phase (Kemps, Tiggemann, Orr, & Grear, 2014, Exp. 1; Schoenmakers et al., 2010).

To date, only a few studies have investigated the experimental modification of attentional biases directed toward food stimuli, and most of these studies were conducted with normal-weight undergraduate students (Kakoschke, Kemps, & Tiggemann, 2014; Kemps, Tiggemann, & Elford, 2015; Kemps, Tiggemann, Orr, et al., 2014; Werthmann, Field, Roefs, Nederkoorn, & Jansen, 2014) and subclinical overweight participants (Boutelle, Kuckertz, Carlson, & Amir, 2014; Kemps, Tiggemann, & Hollitt, 2014). Most of these studies confirmed that attentional biases directed towards food can be reduced by means of bias modification training. Additionally, participants typically reported reduced craving for food or actually consumed less food in a post-intervention taste test (but see Hardman, Rogers, Etchells, Houstoun, & Munafò, 2013, for the absence of a behavioral effect).

Recently, a pilot study ($n = 9$) tested an 8-week bias modification training intervention (three sessions per week) in a group of obese individuals who self-reported binges (Boutelle, Monreal, Strong, & Amir, 2016). Generally, promising results were observed for a number of ecologically meaningful variables, such as a reduction in eating disorder symptoms and a loss of weight. However, participants actually increased their food-related attentional bias across the training period. Given these discrepant trajectories, it appears unlikely that the improvements were a direct causal consequence of a modified bias. However, stimulus devaluation (Chen, Veling, Dijksterhuis, & Holland, 2016), some sort of meta-cognitive processes or changes in self-permission (Werthmann, Roefs, Nederkoorn, & Jansen, 2013) offer a possible explanation of the behavioral changes in daily life. Boutelle et al. (2016) also discuss the large dropout rate that might reflect self-selection and the absence of a control group to rule out placebo effects.

It was the aim of this study to investigate food-related attentional biases as a maintenance mechanism in BED. According to theories of eating disorders (e.g., Berridge, 2009; Franken, 2003), a vicious cycle contributes to the maintenance of eating disorders such as BED (Jansen et al., 2016). The vicious cycle comprises high food salience, food craving, increased risk of a binge episode, the rewarding effects of food consumption, and resulting increases in food-related attentional bias and reward expectations. Consequently, a food-related attentional bias qualifies as a potential target of intervention, and bias reduction could be one possibility to escape from the vicious cycle. In order to test these predictions, we included one group of BED patients in which we sought to reduce a food-related attentional bias by means of a modified dot-probe task. This technique appeared promising, as previous research with analogous samples had demonstrated that bias reduction was possible and was accompanied by reduced craving and food consumption in a subsequent taste test (Kakoschke et al., 2014; Kemps, Tiggemann, Orr, et al., 2014). In our study, we also included a group in which we tested bias enhancement (as done in Hardman et al., 2013). This was motivated by described maintenance and etiological models of binge eating. Specifically, we sought to test if a (temporarily) increased attentional bias (that could be triggered in certain contexts; Jansen et al., 2016) would be accompanied by increased food craving, which, in turn, would increase the risk of a binge episode in real life.

The design of this study comprised a one-session bias modification training for patients with BED,