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## Influence of negative affect on choice behavior in individuals with binge eating pathology

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### ABSTRACT

Research suggests that individuals with binge eating pathology (e.g., bulimia nervosa (BN) and binge eating disorders (BED)) have decision making impairments and particularly act impulsively in response to negative affect. The aim of this study was to examine the influence of negative affect on choice behavior in women with BN and BED. Ninety women (59 with BN or BED and 31 healthy controls) watched a sad or control film fragment and were subsequently asked to complete a choice behavior task (as measured by a variation of the Bechara Gambling Task (BGT)). Results showed that negative affect influenced choice behavior differently in healthy controls and in women with BN and BED after punishment (but not after reward). In the context of increased negative affect, punishment was associated with more disadvantageous choice behavior in both BN and BED women but not in healthy controls, while the effect was the exact opposite in both groups after a decrease in negative affect. Levels of sadness were not found to influence choice behavior after reward in either groups. These findings suggest that emotional states may have a direct impact on choice behavior of individuals with binge eating pathology and are not only related to pathological behavior itself.

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### 1. Introduction

There is consistent evidence that negative affect is an antecedent of binge eating in both bulimia nervosa (BN) and binge eating disorders (BED) (Smyth et al., 2007; Hilbert and Tuschen-Caffier, 2007; Whiteside et al., 2007). It has been suggested that bingeing may serve as an attempt to reduce this affect (Smyth et al., 2007; Deaver et al., 2003). Furthermore, the instantaneous alleviation of negative feelings experienced after bingeing may be experienced as rewarding, and so can serve to reinforce this behavior (Smyth et al., 2007; Hilbert and Tuschen-Caffier, 2007; Hayaki, 2009).

Negative affect has previously been associated with an impulsive nature in individuals with eating disorders (Danner et al., 2012; Fischer et al., 2008). For example, a positive relation was found between bulimic behaviors and the tendency to act impulsively in

response to negative affect (Fischer et al., 2003; Fischer et al., 2008). Impulsivity as well as sensitivity for reward and punishment are typical personality characteristics of individuals with both BN and BED (Fischer et al., 2003; Nasser et al., 2004; Schienle et al., 2009). Reward sensitivity is even thought to partly underlie the impulsive nature of these individuals and may play a role in the initiation of binge cravings and the desire to binge since tension often precedes the bingeing. As a result of this, the binge causes an immediate gratification (Brogan et al., 2010; Dawe and Loxton, 2004). The impulsive personality of these individuals, is not only expressed in pathological eating behavior, but also in other maladaptive behaviors associated with impulsivity such as substance abuse and impulse control problems (Hudson et al., 2007; Pearlstein, 2002).

Being sensitive to reward as well as impulsivity has been associated with decision making in the general population (Franken and Muris, 2005). According to Franken and colleagues (2008) impairments in adaptive choice behavior may be related to impulsive personality characteristics. In their study, highly impulsive participants displayed deficits in decision making performance in comparison to participants low in impulsivity. They further showed that high impulsivity was related to weaknesses

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in learning of reward and punishment associations, which in turn resulted in a decreased ability to alter choice behavior. This indicates that having an impulsive personality makes it more difficult to ignore the immediate reward and learn from punishment in order to make different choices based on long-term positive outcomes.

Furthermore, negative affect, in the form of affective liability as well as direct experience of negative affect, has been linked to disadvantageous decision making (Jollant et al., 2007; de Vries et al., 2008). In fact, a recent study has shown that the tendency to act impulsively in response to negative affect is related to all kinds of problematic behaviors and in specific to disadvantageous decision making (Billieux et al., 2010).

Seeing the impulsive nature of individuals who display binge eating behaviors and their generally high levels of negative affect, it logically follows that these individuals are likely to show impaired decision making ability. Indeed, recent research has demonstrated impaired decision making in individuals with binge eating pathology, both in BN and in BED (Boeka and Lokken, 2006; Brand et al., 2007; Davis et al., 2010; Danner et al., 2011). As expected, choice behavior of these individuals typically appears to be based on short-term rewards, thereby ignoring long-term consequences (Danner et al., 2011; Liao et al., 2009). However, as yet it remains unclear in what way the direct experience of negative affect influences choice behavior in women with BN and BED.

The current study set out to examine how negative affect influences choice behavior in women with binge eating pathology, and to compare such outcomes with the behavior of healthy control women with normal weight. Two separate groups were studied, namely women with BN and with BED, since it has been suggested that purging behavior may be even more related to impulsivity than binge eating behavior (Hoffman et al., 2012) and purging behavior is only seen in individuals with BN and not with BED. Additionally, we decided to include healthy weight, and not to include obese women without eating pathology as a comparison group for BED participants because this group is known to experience decision making problems comparable to individuals with eating disorders (Davis et al., 2010; Danner et al., 2011) and are also characterized by impulsivity and reward sensitivity (Guerrieri et al., 2008; Franken and Muris, 2005).

To test choice behavior in the context of punishment and reward, we used an adapted version of BGT (Bechara Gambling Task; Bechara et al., 1994; Mueller, 2009), in which participants received either a reward (winning money) or a punishment (loss of money) after each choice. Unlike the BGT, reward and punishment are never given simultaneously thereby allowing us to fully explore choice behavior in response to reward vs. punishment.

In sum, this study aims to test the following hypotheses. First, women with binge eating pathology (both BN and BED) display poorer decision making than control women. Second, this effect is amplified after the experience of negative affect. Finally, we aimed to explore similarities and difference in women with BN and BED.

## 2. Methods

### 2.1. Participants and design

Ninety-five women participated in the study: 30 women with a diagnosis of BN or EDNOS with a BN indication and 31 women with a diagnosis of EDNOS subtype BED. These women were recruited from two specialized clinics for eating disorders and from individual therapists in The Netherlands, and they were all in treatment for their eating disorder. Their diagnoses were determined according to DSM-IV criteria as ascertained by eating disorder experts (all medical doctors). Thirty-four healthy controls, women without eating disorders diagnoses, were recruited at Utrecht University and within the community. Prior to participation, they were screened by telephone using the Mini International Neuropsychiatric Interview (MINI), an abbreviated psychiatric structured interview (see also van

Vliet and de Beurs, 2007) to preclude any psychiatric disorder (anxiety disorder, substance abuse) and in particular all eating disorders. In addition, Eating Disorders Diagnostic Scale diagnosis scores (see Section 2.2.3) were calculated after their participation to exclude healthy controls who showed sub- or full-threshold eating disorders.

Participants were excluded if they were on antidepressant medication. Three healthy control women (reporting binge episodes on the EDSS) and two BED women (on antidepressant medication) were excluded, resulting in the inclusion of 90 women in the analyses.

The study had a factorial design with two factors: emotion condition (negative vs. control) and group (BN, BED, healthy control). Demographic information of the participants was assessed with a self-report questionnaire asking their age, weight and height (to calculate Body Mass Index (BMI) in kg/m<sup>2</sup>), as well as the highest level of education completed (participants were asked to report their highest completed level of education on a scale from one, primary school, to seven, university degree). Demographic information was compared between the groups. BED women were older than BN and control women, while BN and control women did not differ in age (BN  $M=25.37$ ,  $S.D.=3.16$ , BED  $M=38.48$ ,  $S.D.=10.68$ , and control women  $M=30.19$ ,  $S.D.=14.50$ ); moreover, as expected a similar effect was found for BMI: BED women had a higher BMI ( $M=37.46$  kg/m<sup>2</sup>,  $S.D.=5.10$ ) than BN women ( $M=23.44$  kg/m<sup>2</sup>,  $S.D.=3.29$ ) and control women ( $M=21.83$  kg/m<sup>2</sup>,  $S.D.=2.30$ ), while the latter two groups did not differ. BED women completed on average a lower level of education ( $M=4.93$ ,  $S.D.=1.51$ ) than control women ( $M=6.00$ ,  $S.D.=0.97$ ), and BN women did not differ from either group ( $M=5.47$ ,  $S.D.=1.36$ ).

### 2.2. Measures and materials

The study consisted of an emotion induction, choice task and several questionnaires to assess relevant clinical and personality traits.

#### 2.2.1. Emotion induction

To evoke negative emotions, a film fragment (2:51 min) was used from the movie "The Champ". This film fragment is known to elicit sadness (Gross and Levenson, 1997) and has been proven successful in inducing sadness in eating disordered individuals (Dingemans et al., 2009; Zonneville-Bender, 2002). In the control condition, a control film fragment was used as a control stimulus comparable in duration (3:32 min). The fragment concerned a weather report that has previously been rated as affectively neutral and as not changing the current emotional state (Evers and de Ridder, 2008; Schaefer et al., 2006).

To examine the effect of the emotion induction on the actual experience of sadness, sadness experience was measured prior to and after the film fragment following a procedure outlined by Gross and Levenson (1997). This procedure requires participants to rate the extent to which they are experiencing sadness at that moment, by using seven-point Likert scales ranging from zero "not at all" to six "very strongly".

Analyses were conducted with the difference scores in sadness before and after the film fragments. It was necessary to calculate the difference scores in sadness due to two reasons. First, the groups differed in overall level of sadness (see Section 3.2) particularly with the BN and BED groups higher on sadness both at baseline and after the emotion induction compared to healthy controls. Second, we were interested in testing whether an increase in negative affect influences choice behavior. Difference scores were calculated by subtracting sadness on T0 from sadness on T1.

#### 2.2.2. Choice task

The choice task was based on the Bechara Gambling task (BGT) which is an electronic version of the Iowa Gambling Task that is available for free (Bechara et al., 1994; Mueller, 2009; van den Bos et al., 2006). In this task, participants had to choose cards from different decks and with every choice, participants won or lost money. Differing from the BGT (where on the punishment trials participants won and lost money simultaneously with the net result of losing money) participants either won **or** lost money so that decision behavior in response to reward and punishment can be systematically examined. The magnitude of the losses was kept similar to the magnitude of the losses in the BGT. In order to determine decision making ability the number of cards chosen from each of the decks were counted.

Participants were instructed to win as much money as possible by choosing cards from the different decks as the money participants could win or lose differs in each deck. Starting with a €0 of (virtual) money, participants were told to choose one card at a time from one of four decks (A, B, C, D) until a stop sign appeared on the screen. Immediately after every choice (100 in total), participants learned whether they had won money (i.e. reward) or whether they had lost money (i.e. punishment). The rewards of decks A and B were larger (100) than the rewards of decks C and D (50). Punishments varied in each deck and were unpredictable for the participants. Punishment from decks A and C was frequent, but rather low in magnitude, while punishment was less frequent but high in magnitude in decks B and D. In the long run, decks A and B were the disadvantageous decks (net loss -7500 and -3500 respectively in case all 100 cards are chosen from the same deck), and decks C and D were the advantageous decks (net win 225 and 2300 respectively in case all 100 cards are chosen from the

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