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The effects of anhedonia and depression on hedonic responses

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ABSTRACT

Anhedonia is one of the key symptoms of major depression. The present study examined whether depressive symptoms and trait anhedonia are associated with deficits in anticipated, experienced, or recalled pleasure and satisfaction (hedonic responses, HR). Sixty-one college students tasted chocolate samples in the lab. Participants' anticipated, experienced, and recalled HR were obtained prior to the task, during the task, and 1 day later, respectively. Anticipatory anhedonia, but not consummatory anhedonia or depression, predicted anticipated HR. In contrast, participants' levels of anticipatory and consummatory anhedonia and depression were not predictive of their experienced and recalled HRs. Depressed individuals showed lower tendency to overpredict their HRs to the task relative to nondepressed individuals. We conclude that clinical reports of anhedonia and depression in a college student population primarily reflect low levels of anticipation of reward, and tendency to accurately estimate their enjoyment of future rewards. If replicated, these results may have important implications for assessing and managing anhedonia associated with depression in clinical settings.

1. Introduction

Anhedonia, or reduced ability to experience interest and pleasure in response to pleasurable activities, reflects a stable individual difference as well as a transitory state associated with a number of psychological disorders, and particularly with major depression (Loas, 1996). Anhedonia is one of the two essential features of major depression as defined by the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) (American Psychiatric Association, 1994), and one of the best indicators of the presence of this disorder (Brody et al., 1998). More than two-thirds of all individuals with major depression endorse this symptom (Buchwald and Rudick-Davis, 1993). Severity of anhedonia is positively correlated with severity of depressive symptoms among depressed and nondepressed individuals (Allen et al., 1999; Kaviani et al., 2004; Mathews and Barch, 2006). Despite this consistent pattern of association, few studies have compared the effects of anhedonia and depressive symptoms on hedonic responses (HR, defined as pleasure and interest in response to potentially rewarding stimuli).

Theories of depression and anhedonia suggest that anhedonic and/or depressed individuals display an experiential hedonic deficit (Meehl, 1975; Beck et al., 1979; Loas, 1996). Studies offer some support for this assumption, and show that depression and anhedonia are similarly associated with dampened HRs. Relative to nondepressed individuals, individuals with heightened levels of depression show diminished HR to pleasant imagery (Sloan et al., 1997; Allen et al., 1999), and films (Rottenberg et al., 2002; Renneberg et al., 2005). Similarly, individuals with heightened levels of anhedonia show diminished HR to pleasant words (Mathews and Barch, 2006), imagery (Fiorito and Simons, 1994), pictures (Fitzgibbons and Simons, 1992; Ferguson and Katkin, 1996), and films (Kaviani et al., 2004, but also see Berenbaum et al., 1987).

Many of these studies relied on complex and/or representational pleasant stimuli (e.g., films). These types of stimuli rely on individuals' ability to attend to them, appraise them or imagine enjoying them. In contrast, a few studies that examined responses to sensory stimuli, such as pleasant tastes, did not show a consistent pattern of association between depression, anhedonia, and HRs. Although some studies show that depression and anhedonia are associated with a reduction in ability to enjoy pleasant tastes (Amsterdam et al., 1987; Berlin et al., 1998), other studies do not replicate this pattern (Berenbaum and Oltmanns, 1992; Germans and Kring, 2000). It is possible that reports of depression and anhedonia are associated with deficits in appraisal, or ability to anticipate or imagine potentially rewarding stimuli, rather than deficits in sensory pleasure. In their daily lives, individuals with depression and anhedonia are likely to encounter both representational (e.g., reading), and sensory sources of pleasure (e.g., eating); thus, it is important to investigate the effects of depression and anhedonia on each.

In addition, it is important to make clear distinctions between deficits in anticipated (i.e., anticipating that an activity would be pleasurable), experienced (i.e., actually enjoying an activity), and recalled (i.e., remembering experienced pleasure after a delay) HRs. These types of responses are known to be distinct from each other at physiological, behavioral, and experiential levels (Klein, 1984; Berridge and Robinson, 1998; Barbano and Cador, 2007; Gard et al., 2007; also see

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Robinson and Clore, 2002). Clinical disorders may affect the association between these responses (Herbener et al., 2007). Both depression (Bradley et al., 1995; Sanz, 1996; MacLeod and Salaminiou, 2001) and anhedonia (Simons et al., 1982; but see Germans and Kring, 2000) are associated with deficits in anticipation and/or recall of pleasant experiences. Thus, it is important to examine whether depression, anhedonia, or their interaction affect anticipation, experience, and recall of HRs.

Finally, most previous studies focused on either depression or anhedonia, but not both. Thus, we do not know whether the effects of depression on HRs are accounted for by anhedonia, or vice versa. Only one study has demonstrated that depression did not account for anhedonia's association with dampened HRs (Mathews and Barch, 2006). This finding requires replication. None of the previous studies examined whether symptoms of depression and anhedonia interact in their effect on hedonic response. The present study builds on the extant literature by examining the contributions of anhedonia, depression, and their interaction to HR.

Based on previous research (Mathews and Barch, 2006), and on the fact that measures of anhedonia assess reported deficits in HR more systematically than measures of depression, we hypothesized that anhedonia will affect HR more than depression. Based on previous literature on anticipatory deficits associated with anhedonia (Gard et al., 2007), we hypothesized that anhedonia will affect anticipated HRs more than experienced HRs. In addition, based on previous literature on the effects of depression on anticipation and recall of positive emotional states (MacLeod and Salaminiou, 2001; Beck, 2002; Mennin and Miranda, 2007), we hypothesized that depressed individuals will show less intense positive biases in anticipating and remembering their HRs than nondepressed individuals. To test these hypotheses, we asked participants with different levels of reported depression and anhedonia to rate how much they may enjoy tasting chocolates, to actually taste chocolates, and to recall how enjoyable this task was 1 day after leaving the laboratory.

2. Methods

2.1. Participants

Sixty-one college students from a small liberal arts college participated in the study. Participants were recruited through flyers and the psychology subject pool. They were invited to participate in a study on mood and taste perception. Participants were reimbursed $8 or assigned course credits for their time. In order to include participants who experienced depression and anhedonia, advertisements encouraged individuals who "felt blue and were no longer interested in things" as well as individuals without these symptoms to participate. Participants reporting symptoms of depression and higher levels of anhedonia were oversampled from the population of eligible individuals to ensure adequate distribution of depressive symptoms and anhedonia in this sample. Participants were between the ages of 18 and 24 ($M = 19.44$; S.D. = 1.42). Women comprised three-quarters of the sample (46; 75.4%).[1] The sample included European American (46, 75.4%), as well as Asian American, Hispanic, and biracial individuals. Two participants reported taking antidepressants. Current smokers and dieters were excluded from the study because these factors can affect taste perception and willingness to taste chocolates.

2.2. Measures

2.2.1. Severity of depressive symptoms

To assess severity of depression, participants completed the Beck Depression Inventory (BDI, Beck et al., 1979). About half (31, 50.8%) of the participants were asymptomatic (BDI scores 0-9), with remaining participants reporting mild–moderate (BDI scores 10–18; 22, 36.1%) and moderate–severe (BDI scores 19–28; 8, 13.1%) levels of depressive symptoms. The scale had adequate internal consistency ($\alpha = 0.89$). Because BDI scores were not normally distributed (*Shapiro–Wilk* $W(60) = 0.95$, $P < 0.01$), we divided the participants into two groups based on a median split of the BDI scores (nondepressed, BDI: 0–9; depressed, BDI: 10–28).

Participants also filled out the Diagnostic Inventory for Depression (DID; Zimmerman et al., 2004), a self-report scale that has been shown to have adequate reliability and agreement with structured diagnostic interviews. We divided participants into three groups based on their DID scores: nondepressed (reporting 0–1 DSM-IV symptoms of major depressive episode (MDE), 43%), subsyndromal symptoms of depression (reporting 2–4 DSM-IV symptoms of major depressive episode (MDE) accompanied by significant impairment, 41%), and depressed (reporting 5–8 DSM-IV symptoms of MDE, including depressed mood, anhedonia or both, and accompanied by significant impairment, 16%). There was a significant association between depression status as determined by the BDI and the DID, χ^2 (2, $N = 61$) = 25.96, $P < 0.001$. These measures demonstrate that participants' reports of depressive symptoms ranged from asymptomatic to clinically significant, thus allowing us to examine the relationship between severity of depressive symptoms and pleasurable responses in this sample. Each measure included two items that captured clinical reports of anhedonia: (1) reported loss of pleasure, and (2) loss of interest.

2.2.2. Anhedonia

The 18-item Temporal Experience of Pleasure Scale (TEPS, Gard et al., 2006) was used to measure reports of anticipatory and consummatory experiences of pleasure. The TEPS has high concurrent validity with other measures of anhedonia. It is based on two scales, a 10-item anticipatory pleasure scale ($\alpha = 0.76$) and an eight-item consummatory ($\alpha = 0.64$) pleasure scale. Lower scores on these scales indicate higher levels of anhedonia.

2.2.3. Reported intensity of HR

Participants provided three reports of their HR: anticipated, experienced, and recalled. For anticipated HR, participants reported their anticipated pleasure in response to six potential study tasks that included chocolate tasting as well as other hypothetical tasks (e.g., solving puzzles). This information was assessed during a brief interview with the experimenter. For experienced HR, participants reported their response to each food sample using rating sheets listing seven taste terms. For recalled HR, participants reported the intensity of their experience in the lab the day before. They indicated how intensely they experienced eight positive and negative emotions during the chocolate-tasting task. Participants used the same nine-point rating scale (0 = "not at all"; 8 = "extremely") when rating intensity of anticipated, experienced, and recalled HRs. For each report, averages of participants' reports of pleasure and satisfaction were calculated as a measure of HR ($\alpha = 0.81$ for anticipated response; αs ranging from 0.78 to 0.91 for experienced HRs across chocolate samples; and $\alpha = 0.76$ for recalled HR). The remaining questionnaire terms were used as fillers. Averages of experienced HRs were calculated for the five chocolate samples.

2.3. Procedure

Measures of anhedonia and depression were filled out by participants prior to the study as part of the prescreening packet. Chocolate-tasting task was selected because a pilot questionnaire has revealed that tasting chocolate is one of the most commonly listed sources of sensory pleasure for this population. The task was piloted in the lab and was associated with significant increases in reported pleasure and satisfaction.

Upon arrival to the laboratory, participants gave written informed consent, and completed a measure of anticipated HR. After that, participants were presented with seven numerically labeled food samples. Five samples of chocolate (first, third, fourth, fifth, and seventh samples) were small pieces of different brands of milk chocolate, presented in a fixed order. Participants also tasted and rated two samples of bland food (a matzo cracker, second sample, and a rice cake, sixth sample). The participants were asked to savor each sample in their mouths and evaluate it using a rating sheet. They were instructed to eat only a bit of the small sample in order to get sufficient taste without reaching satiety, and drank some water between samples to cleanse their palates.

The next day, participants received an e-mail asking them to rate the intensity of their experience in the lab the day before (recalled HR). Upon receiving a response to the follow-up e-mail, the experimenter fully debriefed the participants.

In order to examine the extent to which participants were biased in anticipating and recalling their experienced HRs, we calculated anticipatory and recall bias scores. Anticipatory bias score was calculated by subtracting levels of experienced HR from levels of anticipated HR. Recall bias score was calculated by subtracting levels of experienced HR from levels of recalled HR.

3. Results

3.1. Task effectiveness

To examine whether the chocolate-tasting task was effective in eliciting HRs, we conducted a repeated-measures analysis of variance (ANOVA) (Food sample [bland foods, chocolate]). Participants' HRs were higher for samples of chocolates than for samples of bland foods, $F(1,60) = 129.14$, $P < 0.01$, indicating that the task elicited pleasure and satisfaction, as intended.

3.2. Anticipatory and recalled HRs differ from experienced HRs

To examine whether participants' levels of anticipatory, experienced, and recalled HRs differed from each other, we conducted a repeated-

[1] Preliminary analyses included gender as an additional between-subject factor. Women reported higher levels of HRs than men, multivariate $F(1,59) = 5.86$, $P < 0.05$. Because gender did not interact with type of reports, depression or anhedonia, we collapsed across gender in subsequent analyses.