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RESEARCH ARTICLE

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Different attention bias patterns in anorexia nervosa restricting and binge/purge types

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Abstract

Patients with anorexia nervosa (AN) have been shown to display both elevated anxiety and attentional biases in threat processing. In this study, we compared threat-related attention patterns of patients with AN restricting type (AN-R; $n = 32$), AN binge/purge type (AN-B/P; $n = 23$), and healthy controls ($n = 19$). A dot-probe task with either eating disorder-related or general and social anxiety-related words was used to measure attention patterns. Severity of eating disorder symptoms, depression, anxiety, and stress were also assessed. Patients with AN-R showed vigilance to both types of threat words, whereas patients with AN-B/P showed avoidance of both threat types. Healthy control participants did not show any attention bias. Attention bias was not associated with any of the demographic, clinical, and psychometric parameters introduced. These findings suggest that there are differential patterns of attention allocation in patients with AN-R and AN-B/P. More research is needed to identify what causes/underlies these differential patterns.

KEYWORDS

anorexia nervosa, attention bias, avoidance, binge, purge

1 | INTRODUCTION

1.1 | Anorexia nervosa and anxiety

Anorexia nervosa (AN) is a severe mental disorder characterized by self-imposed restriction of food intake, low body weight, and disturbed body image (American Psychiatric Association, 2013). It is a life-threatening condition, often associated with a chronic course and unfavourable prognosis (Treasure, Stein, & Maguire, 2015). Two different types of AN may exist, on the basis of the presence (AN binge/purge type [AN-B/P]) or absence (AN restricting type [AN-R]) of binging and accompanying purging behaviours to maintain low weight.

The central role of anxiety and anxiety-related processes in the predisposition and maintenance of AN is well acknowledged (Pallister & Waller, 2008). Patients with AN may have premorbid anxious traits, often dating back to childhood (Kaye, Bulik, Thornton, Barbarich, & Masters, 2004b). Comorbidity of AN and anxiety disorders is high at any stage of the illness (Swinbourne & Touyz, 2007). Lifetime prevalence rates of comorbid anxiety disorders in patients with AN range from 23% to 75%, with the most prevalent forms being generalized anxiety disorder, social phobia, and obsessive–compulsive disorder (Swinbourne & Touyz, 2007). Importantly, anxiety-related comorbidity has a negative effect on the outcome of AN and has been associated with poor treatment adherence and high dropout (Kendall & Sugarman, 1997). These factors make individuals with comorbid AN and anxiety more resistant to treatment and can, therefore, put them at risk of a poorer treatment outcome (Swinbourne &

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Touyz, 2007). Thus, studies focusing on the relations between anxiety symptoms and AN may offer important insight for treatment targets.

1.2 | Attention bias

Enhanced and prioritized processing of potential threats and a rapid response to threat cues facilitate survival. Attention is a key process in such prioritization (Shechner et al., 2012). Threat-related attention bias is a pattern of information processing allocating attentional resources to threat over neutral or other competing cues (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). Automatic allocation of attentional resources to threat-related stimuli might enhance and maintain an individual's anxious state (Mathews & Macleod, 2002), whereas avoidance of minor threats might serve to regulate anxiety (Bar-Haim et al., 2007).

Threat-related attention bias is typical in anxious individuals, likely playing a role in the predisposition to and maintenance of pathological anxiety (Bar-Haim et al., 2007; Eysenck, Mogg, May, Richards, & Mathews, 1991). A recent meta-analysis suggests that the specific nature of the anxiety disorder may influence information-processing priorities, with increased sensitivity for disorder-specific threat contents relative to more general or generic threat contents (Pergamin-Hight, Naim, Bakermans-Kranenburg, van IJzendoorn, & Bar-Haim, 2015).

1.3 | Attention bias in AN

Studies measuring attentional processes in AN vary in measurement procedures, the nature of applied stimuli (e.g., words and images), type of threat contents, and outcome measurements. Despite this methodological variability, research findings indicate the occurrence of elevated attention bias toward body shape, weight, and food stimuli in patients with AN in comparison with healthy controls (Blechert, Ansorge, & Tuschen-Caffier, 2010; Dobson & Dozois, 2004; Giel et al., 2011b; Rieger et al., 1998; Shafran, Lee, Cooper, Palmer, & Fairburn, 2007; Smeets, Roefs, van Furth, & Jansen, 2008). Reviews indicate that vigilance towards both food-related (Brooks, Prince, Stahl, Campbell, & Treasure, 2011) and body-related (Aspen, Darcy, & Lock, 2013) stimuli may be observed in AN patients across a range of tasks.

Considering the high prevalence of social anxiety and generalized anxiety in AN (Cassin & von Ranson, 2005), a few studies also assessed attention bias toward social and general threat-related stimuli in AN. Attention bias toward anxiety-related words over neutral words (Jones-Chesters, Monsell, & Cooper, 1998) and toward rejecting faces over neutral or compassionate facial expressions (Cardi, Matteo, Corfield, & Treasure, 2012) has been found in patients with AN. These findings suggest that attentional biases may have a specific role in the development and/or maintenance of anxiety-related psychopathology in AN (Aspen et al., 2013).

Nonetheless, some studies have not found elevated attention bias in patients with AN (Schober et al., 2014) or even found attentional avoidance (Giel et al., 2011a). Thus, further work is required to examine possible causes for this variation.

Relatedly, some studies (Cassin & von Ranson, 2005; Stein, Lilenfeld, Wildman, & Marcus, 2004; Vitousek & Manke, 1994), although not all, (Kaye, Wierenga, Bailer, Simmons, & Bischoff-Grethe, 2013; Nagata, McConaha, Rao, Sokol, & Kaye, 1997) indicate that patients with AN-B/P show greater anxiety and more severe eating disorder (ED) pathology in comparison with patients with AN-R. Such differences in anxiety proneness between AN patients with restricting and B/P pathologies may potentially be related to underlying differences in content-specific attention biases.

The aim of the present study was to investigate threat-related attentional processes in AN. We hypothesized that (a) patients with both AN-R and AN-B/P would show greater attention bias to threat words (ED related and general and social anxiety related) than healthy controls; (b) patients with AN-B/P would show greater attention bias to both stimuli in comparison with patients with AN-R; and (c) threat-related attentional bias would be positively correlated with the severity of ED pathology, anxiety and distress levels, and negatively correlated with body mass index (BMI).

2 | METHODS

2.1 | Participants

Participants were 55 female patients with AN (32 with AN-R and 23 with AN B/P) hospitalized in either the adolescent or the adult ED inpatient departments at the Sheba Medical Center, Tel Hashomer, Israel. Inclusion criteria were (1) female gender, (2) age between 15–25 years, and (3) a good understanding of Hebrew. Exclusion criteria were lifetime or current psychotic spectrum disorder, bipolar disorder, substance use disorder, organic brain disorder, mental retardation, and any medical illness potentially affecting appetite or weight (e.g., diabetes mellitus or thyroid disorders). The sample included all female patients hospitalized in the two departments between January 1, 2015 to December 31, 2016, fulfilling the aforementioned inclusion and exclusion criteria and agreeing to participate in the study. All

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patients with AN-B/P were diagnosed with AN-R at the onset of their illness and transitioned to the B/P form during the course of their illness but before hospitalization in our facilities.

Nineteen age-matched healthy female volunteers were similarly assessed. Inclusion criteria for control participants were (1) lack of lifetime or current psychiatric or medical disorder potentially affecting appetite or weight (e.g., diabetes mellitus or thyroid disorders), (2) no regular use of medications (defined as continuous use of medications for no longer than two consecutive weeks), (3) a good understanding of Hebrew. The lifetime and current weight of the control participants was above 90% of average body weight, based on the 2,000 sex-specific growth charts from the Centers for Disease Control and Prevention (www.cdc.gov/growthcharts), and was found adequate also for young Israeli people (Goldstein, Haelyon, Krolik, & Sack, 2001). All the control participants reported regular menses since menarche.

The study was approved by the Helsinki Institutional Committee of the Sheba Medical Center and by the Research Ethics Committee of the Academic Tel-Aviv Yafo College. All patients and their parents (in the case of minors under age 18) agreed to participate in the study by signing a written informed consent after receiving an explanation about the aims and procedures of the study.

Adolescent controls were recruited from families and friends of the staff of the Sheba Medical Center through a circular mail sent via the e-mail system of the hospital, inviting them to bring friends and relatives to participate in the study. Adult controls were recruited by posters distributed in several universities in the center of Israel detailing information about the study. All universities were in the catchment area of the Sheba Medical Center.

2.2 | Instruments

2.2.1 | AN diagnosis

Diagnosis of AN was established using the Structured Clinical Interview for DSM-IV Axis I Disorders-Patient edition (SCID-I/P Version 2.0; First, Spitzer, Gibbon, & Williams, 1995). The diagnoses achieved with the SCID-I/P Version 2.0 were adapted for the DSM-5 diagnoses of AN.

Control participants have been interviewed using the 10 general screening criteria of the SCID-I/P Version 2.0, as well as the specific screening items for affective disorders. Each screening item of the SCID-I/P Version 2.0 is rated as either present (positive), questionable, or not present (negative). Only those answering negatively on all SCID-I/P Version 2.0 screening items have been included as controls in the study. For a similar approach, see Cardi et al. (2012) and Stein et al. (2002).

Control participants were further screened for ED-related symptoms using the SCOFF interview (Perry et al., 2002), previously used in Israeli populations (Kaluski, Natamba, Goldsmith, Shimony, & Berry, 2008). Answering positively on two of the five items of the SCOFF was found to have excellent validity in differentiating people with problematic eating-related behaviours from non-ED individuals (Perry et al., 2002). In the present design, we excluded control participants answering positively on any one item of the SCOFF.

Demographic and clinical variables, including age, education level, and duration of illness and of inpatient treatment, were recorded using a demographic questionnaire and from the patients' medical records.

The following questionnaires were completed by all participants:

2.2.2 | Eating Disorder Examination Questionnaire

The Eating Disorders Examination-Questionnaire version 6.0 (EDE-Q; Fairburn & Beglin, 1994) includes 36 items assessing eating-related psychopathology. It includes four scales related to restricting behaviours in the preceding 28 days, that is, Restraint, Concern over Eating, Concern over Weight, and Concern over Shape, as well as a total score comprising of the mean of the four scales. The EDE-Q also includes specific items relating to the occurrence of bingeing behaviours, purging behaviours, and excessive physical activity in the preceding 28 days. The EDE-Q has good high internal consistency (Luce & Crowther, 1999) and moderate to high concurrent and criterion validity (Mond, Hay, Rodgers, Owen, & Beumont, 2004). In this study, we related only to the four restrictive scales.

2.2.3 | Depression Anxiety Stress Scale

The Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995) is a 21-item three-scale self-report measure of depression, anxiety, and stress. Higher scores indicate higher levels of depression, anxiety, and stress. The scale has been validated and found to possess good reliability with Cronbach's α of 0.94 for depression, 0.87 for anxiety, and 0.91 for stress (Antony, Bieling, Cox, Enns, & Swinson, 1998).

2.2.4 | Attention bias assessment: The dot-probe task

Threat-related attention bias has been evaluated using a Hebrew adapted version of the classic word-based dot-probe task (MacLeod, Mathews, & Tata, 1986; Rieger et al., 1998). Figure 1 presents the sequence of events in a dot-probe task trial. The task consists of 160 trials in which

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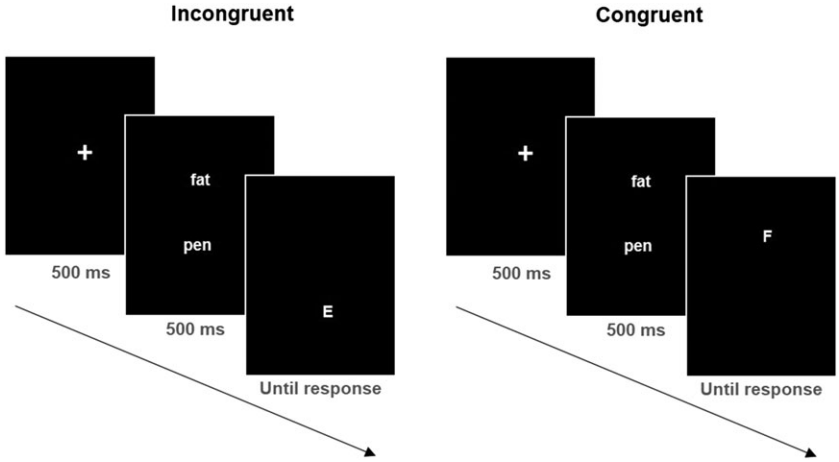

FIGURE 1 Sequence of events in a dot-probe trial. Left panels represent a threat-incongruent trial; right panels, a threat-congruent trial

threat-neutral word pairs are presented in a randomized order. Each trial begins with a central fixation "+" (500 ms), followed by a vertically aligned word pair written in 1-cm-high white block text (500 ms). One word appears directly above, while the other appears directly below the location vacated by the preceding fixation signal. A distance of 3 cm separates the two words. The word pair is then replaced by a target probe appearing in either the threat word (congruent trial) or the neutral word (incongruent trial). Probe type is either the letter *E* or *F*, this being determined randomly on each trial. Participants are required to identify which of the two probe types appears by pressing the corresponding key as quickly as possible without compromising accuracy. The participant's response clears the screen, and the next trial begins 500 ms later. Response latencies to the probe provide a snapshot of attention, with faster responses to probes occurring at the attended location, relative to the unattended location. Threat bias is calculated as the difference between the average response time to targets appearing at neutral word locations and those appearing at threat word locations. Positive bias values represent approach, that is, attention bias toward threat and negative values reflect avoidance, that is, attentional bias away from threat (Bar-Haim et al., 2007). Word valance location, target location, and target type are fully counterbalanced.

The word *stimuli* consisted of one of two sets of 32 threat-neutral word pairs: ED-related threat (e.g., FAT) or general and social threat (e.g., DEAD or GUILT). The general and social set included an equal proportion of social and general anxiety-related words. We related to social and general anxiety threat words to note that the words included are associated with both social and general anxiety. In essence, when these words were used in other studies, they were related to as "general threat word" (e.g., Naim et al., 2014). Still, we decided to use the terminology *general* and *social* in this study, because both anxiety types are considered of importance in patients with AN.

Within each pair, word length and frequency of use in Hebrew were matched. The general and social threat words were taken from Bar-Haim et al. (2010). The ED-related threat words were first rated for emotional valence by 15 independent judges working in the ED departments of the Sheba Medical Center (clinical psychologists, clinical social workers, psychiatrists and dieticians, and all not part of the research team). The ratings were used to select word pairs for which the ED-related threat word was rated as negative, and its neutral counterpart was rated as neutral. Every word pair was presented 5 times in the task, resulting in 160 trials.

2.3 | Procedure

Patients were interviewed independently with the SCID-I/P Version 2.0 by experienced psychiatrists and child and adolescent psychiatrists. DSM-5 (2013) diagnoses were confirmed in clinical team meetings of the two departments. Only those patients for whom there was a unanimous agreement about their AN diagnosis could enter the study. Controls were interviewed with the screening criteria of the SCID-I/P Version 2.0 and the SCOFF by one researcher (T. G. M.), trained with the use of these tools by a senior psychiatrist of the team (D. S.).

Testing for all participants was administered individually in a quiet room during the morning hours between two meals to reduce the influence of food consumption on the results of the study. The dot-probe task was administered by a single researcher (T. G. M.). Each participant was randomly assigned to one of the threat stimuli groups: ED-related threat or general and social threat. The self-rating questionnaires were distributed in random order after the completion of the attention task. Patients' height and weight were measured regularly during the morning hours according to standardized procedures (Tanner, 1994). Height and weight of controls were self-reported.

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The questionnaires and attention task were administered to the ED patients within 2 weeks after hospitalization, when they were considered medically stabilized. The patients were not receiving psychotropic medications at the time of the assessment.

2.4 | Statistical analyses

All trial RTs shorter than 150 or longer than 2,000 ms, trials in which an incorrect response was made and trials in which the response time was two standard deviations of the participant's mean, were excluded from subsequent analyses (<2% of all trials). To explore attention bias as a function of group and word type, a two-way analysis of variance was conducted with 2 (stimuli type; ED-related and general and social threats) × 3 (group; AN-R, AN-B/P, and control) analysis. Tukey's post hoc comparison tests were used to assess between-group contrasts. One-sample *t* test against zero was conducted to examine attention bias in each group. Pearson correlation tests were used to investigate the associations between attention bias and BMI and severity of ED symptoms, anxiety, depression, and stress. Statistical analysis was carried out using SPSS (Version 23).

3 | RESULTS

3.1 | Demographic, clinical, and psychometric variables

Means, standard deviations, and between-group differences for demographic, clinical, and background variables are summarized in Table 1. No group differences were found for age. Both groups with AN had lower BMI and scored higher than the controls on all self-rating scales. Patients with AN-B/P had higher BMI and longer duration of illness and showed greater disturbance than patients with AN-R on the EDE-Q eating concerns, shape concerns and total EDE-Q score (see Table 1).

3.1.1 | Attention bias to threatening words

One-sample *t* test against zero showed the existence of attention bias in patients with both AN-R and AN-B/P. A two-way analysis of variance showed that the main effect of stimulus type and the group-by-stimulus type interaction effects were not significant, $F(1, 72) = 0.08$, $p = .928$ and $F(2, 68) = 0.27$, $p = .762$, respectively. Significant differences in attention bias were found between the two ED groups $F(2,71) = 3.153$, $p < .05$ (see Figure 2). Specifically, patients with AN-R showed approach, that is, attentional bias toward threat, $t(32) = 2$, $p < .05$, (attention bias: ED-related words category, $M = 7.86$ and $SD = 20.49$, and general and social anxiety-related words category, $M = 8.65$ and $SD = 26.08$), whereas patients with AN-B/P showed avoidance, that is, attentional bias away from threat, $t(22) = -1.54$, $p < .05$ (attention bias: ED-related words category, $M = -5.66$ and $SD = 22.02$, and general and social anxiety-related words category, $M = -10.76$ and $SD = 28.25$). The healthy control participants showed no threat-related attention bias, $t(18) = -0.08$, $p > .05$, (attention bias: ED-related words category, $M = -3.54$ and $SD = 23.42$, and general and social anxiety-related words category, $M = 2.33$ and

TABLE 1 Between-group differences in demographic, clinical, and psychometric variables

	AN-R (32)	AN-B/P (23)	CN (19)	$F(2,71)$, p
Age	18.43 (3.37)	18.97 (3.48)	18.48 (3.5)	0.19, $p < .82$
Duration of illness	3.05 (2.86)[a]	5.1 (2.86)[b]	N/A	$F(1,54) = 6.85$, $p < .01$
Hospitalization days	14.81 (10.72)	16.08 (12.31)	N/A	$F(1,54) = 0.16$, $p < .68$
BMI	16.09 (2.35)[a]	17.9 (1.61)[b]	19.9 (1.73)[c]	22.05, $p < .001$
EDE-Q Restriction	4.1 (1.84)[a]	4.82 (1.51)[a]	0.38 (0.47)[b]	52.08, $p < .001$
EDE-Q Eating Concern	3.52 (1.6)[a]	4.33 (0.98)[b]	0.05 (0.09)[c]	75.18, $p < .001$
EDE-Q Weight Concern	4.55 (1.58)[a]	5.27 (1.25)[b]	0.63 (0.81)[c]	73.99, $p < .001$
EDE-Q Shape Concern	4.76 (1.32)[a]	5.47 (0.87)[b]	0.7 (0.77)[c]	119.31, $p < .001$
EDE-Q total	4.23 (1.42)[a]	4.98 (1)[b]	0.44 (0.5)[c]	96.53, $p < .001$
DASS stress	21.71 (11.65)[a]	27.26 (10.76)[a]	3.78 (2.99)[b]	31.79, $p < .001$
DASS depression	21.46 (12.33)[a]	25.04 (11.89)[a]	2.26 (2.37)[b]	27.83, $p < .001$
DASS anxiety	16.84 (12.28)[a]	21.6 (9.17)[a]	1.31 (1.79)[b]	24.97, $p < .001$

Note. AN-B/P = anorexia nervosa binge/purge type; AN-R = anorexia nervosa restricting type; BMI = body mass index; CN = controls; EDE-Q = Eating Disorders Examination Questionnaire version; DASS = Depression Anxiety and Stress Scale; means with different superscripts differ from each other in that row at the $p < .05$ level; means with similar superscripts do not differ from each other in that row.

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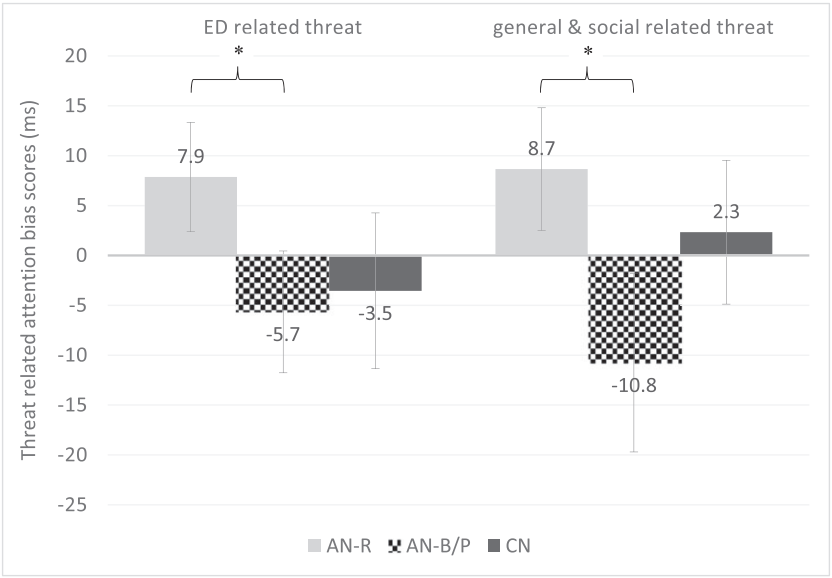

FIGURE 2 Graphic description of the between-group differences in threat bias scores. *Note*. AN-B/P = anorexia nervosa binge and purge type; AN-R = anorexia nervosa restricting type; CN = controls; ED = eating disorder; * = significant differences between AN-R and AN-B/P groups. The number in each bar represents the respective threat bias score (the difference between the average reaction time to targets at neutral word locations and targets at threat-word locations [ms])

SD = 22.79). The difference in attention bias between patients with AN-R and AN-B/P was significant whereas the controls did not differ from either of the ED groups (see Figure 2). No between-group differences were noted in accuracy, $F(2, 71) = 1.191$, $p = .31$, mean accuracy = 94%.

No significant correlations were found between attention bias and the ED-related and comorbid dimensions, BMI, or the patients' duration of illness and inpatient treatment (effect size did not exceed 0.15).

4 | DISCUSSION

The present study sought to improve the understanding of attention bias toward threatening stimuli in AN. Our hypotheses were that patients with AN would show greater vigilance toward both ED-related and general and social anxiety-related threat words than healthy controls and that people with AN B/P would show greater attention bias in comparison to AN-R. Our hypotheses were only partially confirmed, showing greater attention bias to both threat-related words in patients with AN-R against controls. By contrast, patients with AN-B/P did not show elevated vigilance in comparison with controls. Rather, they revealed an opposite pattern with avoidance of both types of threatening stimuli. Control participants did not show any form of attention bias and were not different, in this respect, from the two AN groups.

The findings for patients with AN-R are largely consistent with most (Aspen et al., 2013; Brooks et al., 2011; Cardi et al., 2012; Jones-Chesters et al., 1998), although not all, previous research (Giel et al., 2011a; Schober et al., 2014). Vigilance toward ED threat and general and social threat stimuli may be considered an appropriate behavioural response in the context of the acute stage of the ED. The differences between our findings and those of Giel et al. (2011a) or Schober et al. (2014) may be, perhaps related to methodological considerations such as the utilizing of eye-tracking methodology (Giel et al., 2011a) or the use of different words in the dot-probe task (Schober et al., 2014) in comparison with our study.

The avoidant pattern shown in patients with AN-B/P was unexpected. First, whereas we hypothesized that greater anxiety in these patients would contribute to greater attention bias, we actually found that in contrast to other studies (Cassin & von Ranson, 2005; Vitousek & Manke, 1994), there were no differences in anxiety and stress between the two ED subtypes.

Second, it is possible that attentional avoidance of food stimuli is learned as a coping strategy to overcome the drive to eat, which may be higher in people with binge and purge eating because of impairment in inhibitory control processes. Deficits in inhibitory control such as impulsivity and affective instability are elevated in patients with binge and purge EDs (Cassin & von Ranson, 2005; Kaye, Strober, & Jimerson, 2004a). Indeed, Wu, Hartmann, Skunde, Herzog, and Friederich (2013) found impairments in inhibitory control toward food and eating stimuli in people with bulimia nervosa.

Third, it is possible that those patients who are able to maintain protracted food restriction over time have greater control over their eating-related drives and do not develop avoidance strategies. In this respect, it can be argued that as all of our AN-B/P patients have been diagnosed with AN-R at the onset of their illness, they might have had greater impulsivity and lower control over eating than those maintaining restriction. The association of this assumption with the potential transition from

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vigilance toward threating stimuli to their avoidance must await longitudinal follow-up from the onset of the illness to the transition of the ED from restriction to binge/purge pathology. Such a research might clarify whether all AN patients start with the same attentional style that may later change or, alternatively, whether avoidance at baseline can predict those patients that will develop binge/purge behaviours later on.

In addition, although most research regarding attention bias shows that anxious individuals manifest a bias toward threat, acute stress in some scenarios may lead some anxious individuals to shift their attention away from the threat (Mansell, Clark, Ehlers, & Chen, 1999; Wald et al., 2011). Patients with AN-B/P may represent such a group. This is because their exposure to bingeing, purging, and other impulsive behaviours (Selby et al., 2010; Stein et al., 2004) may have the potential to temporarily reduce mental pain (Orbach, Mikulincer, Sirota, & Gilboa-Schechtman, 2003) and fear of physical pain (Selby et al., 2010) and hence, perhaps also enable the avoidance of threat-related stimuli.

Last, the dot-probe task is limited in differentiating between specific subcomponents of attention (Cisler & Koster, 2010). Hence, it is possible that the attention pattern of AN-B/P patients may be associated with either vigilance or avoidance of threat or with both. If indeed only the avoidance component has been captured by the task, this pattern could reflect the characteristic transition from overcontrol to loss of control in this subtype of AN.

The findings of this study raise the need for future work to investigate the nature of attentional processing of emotional information across a variety of tasks (Rodebaugh et al., 2016) such as psychophysiology, neuroimaging, or eye-tracking (Christiansen, Mansfield, Duckworth, Field, & Jones, 2015; Giel, Friederich, et al., 2011a; Werthmann, Roefs, Nederkoorn, & Jansen, 2013).

4.1 | Limitations

Our results should be interpreted bearing in mind the limitations of the study. First, the number of cases investigated was decided on the basis of available resources, including all participants agreeing to participate in the study during a 2-year period. This resulted in a relatively small sample size and a low statistical power. Second, the small number of participants did not allow us to assess the influence of comorbid psychiatric disorders on attention bias, although we used a self-rating scale for the assessment of depression and anxiety. Third, we did not assess for impulsivity, which may have accounted for between-group differences in attention bias. Fourth, as the sample included only inpatients, our findings cannot not be generalized to outpatients with less severe AN. Fifth, as we have used a cross-sectional design, our findings represent putative associations and do not assess issues of causality. Last, the problems potentially inherent in the lack of reliability when using the dot-probe task (see Rodebaugh et al., 2016) and in measuring response latencies as index of attentional bias may limit the validity of our findings (Christiansen et al., 2015).

4.2 | Clinical implications

Attention bias modification (ABM) training to increase avoidance of unhealthy food may reduce problematic eating behaviours in people with no EDs (Turton, Bruidegom, Cardi, Hirsch, & Treasure, 2016). Similarly, ABM treatment geared toward reducing vigilance to threat-related stimuli has been found suitable in a pilot study of AN patients, mostly diagnosed with the restricting subtype (Cardi et al., 2015). Our results may add to the complexity in the study of ABM, suggesting that training geared toward the reduction of avoidance-related attention bias may be implicated in AN-B/P-type patients, whereas ABM aiming to reduce vigilance may be suitable for patients with AN-R.

4.3 | Future directions

Further longitudinal research in which attention bias is recorded during the progression of the illness from the acute stage to recovery is required to test the hypothetical mechanisms presented in this study, potentially accounting for the transitions from restricting to B/P EDs, as well as for a possible association of attention bias with the outcome of AN.

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