



The influence of variations in eating disorder-related symptoms on processing of emotional faces in a non-clinical female sample: An eye-tracking study



Emma Sharpe^a, Deborah J. Wallis^{a,*}, Nathan Ridout^b

^a Loughborough University Centre for Eating Disorders, School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough LE11 3TU, UK

^b Department of Psychology, School of Life and Health Sciences, Aston University, Birmingham B4 7ET, UK

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ABSTRACT

This study aimed to: (i) determine if the attention bias towards angry faces reported in eating disorders generalises to a non-clinical sample varying in eating disorder-related symptoms; (ii) examine if the bias occurs during initial orientation or later strategic processing; and (iii) confirm previous findings of impaired facial emotion recognition in non-clinical disordered eating. Fifty-two females viewed a series of face-pairs (happy or angry paired with neutral) whilst their attentional deployment was continuously monitored using an eye-tracker. They subsequently identified the emotion portrayed in a separate series of faces. The highest ($n=18$) and lowest scorers ($n=17$) on the Eating Disorders Inventory (EDI) were compared on the attention and facial emotion recognition tasks. Those with relatively high scores exhibited impaired facial emotion recognition, confirming previous findings in similar non-clinical samples. They also displayed biased attention away from emotional faces during later strategic processing, which is consistent with previously observed impairments in clinical samples. These differences were related to drive-for-thinness. Although we found no evidence of a bias towards angry faces, it is plausible that the observed impairments in emotion recognition and avoidance of emotional faces could disrupt social functioning and act as a risk factor for the development of eating disorders.

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1. Introduction

Eating disorders such as anorexia nervosa (AN) and bulimia nervosa (BN) are associated with deficits in social and emotional functioning. For example, there is a body of evidence demonstrating that patients with eating disorders exhibit impaired facial emotion recognition in comparison to healthy controls (Jänsch et al., 2009; Kucharska-Pietura et al., 2004; Pollatos et al., 2008). This deficit is also evident when participants are restricted to viewing just the eyes (Harrison et al., 2010a,b; Russell et al., 2009). Furthermore, similar impairments have been observed in non-clinical participants who could be considered 'at risk' of developing eating disorders (Jones et al., 2009; Ridout et al., 2010, 2012). However, it should be noted that other studies have found no evidence of impaired facial emotion recognition in patients with eating disorders. For example, Cardi et al. (2015) reported that, in

comparison to healthy controls, patients with AN and BN were not impaired in their ability to recognise emotion from video clips. Furthermore, Brewer et al. (2015) reported that emotion recognition deficits in a group of patients with eating disorders (AN and BN) were related to concomitant alexithymia and not eating disorder symptomology. Nevertheless, a recent meta-analysis conducted by Caglar-Nazalia et al. (2014) did show evidence of impaired emotion recognition in patients with eating disorders, although this was a small effect size and became non-significant once the moderator variables of group and task type were accounted for in meta-regression. Taken together there is evidence of impaired facial emotion recognition in participants with disordered eating although the stability of this deficit may depend on the type of sample examined and emotion recognition task employed.

In addition to deficits in facial emotion recognition, there is evidence that patients with eating disorders display attentional biases for socially relevant stimuli. For example, McManus et al. (1996) found evidence of biased attention towards emotional words, particularly those connoting threat. Harrison et al. (2010a) reported that this bias generalised to faces. They found that,

* Correspondence to: Present address: School of Applied Social Sciences, Hawthorn Building, De Montfort University, Leicester LE1 9BH, UK.

E-mail addresses: E.Sharpe@lboro.ac.uk (E. Sharpe),

Debbie.Wallis@dmu.ac.uk (D.J. Wallis), n.ridout@aston.ac.uk (N. Ridout).

compared with healthy controls, patients with eating disorders experienced greater interference from angry faces on a face-variant of the Stroop task. This finding has subsequently been replicated (Kanakam et al., 2013) and has been found to persist in recovered patients (Harrison et al., 2010b). Similarly, Cardi et al. (2012) utilised a dot-probe task and reported that patients with eating disorders exhibited an initial orientation bias towards rejecting faces, subsequent problems in disengaging their attention from these faces, and a tendency to avoid attending to accepting faces. Harrison et al. (2010b) has suggested that biased attention for angry faces might be a possible trait vulnerability factor for eating disorders. However, despite this evidence, there is also a growing body of work showing that individuals with eating disorders have a tendency to avoid attending to emotional faces (e.g. Davies et al., 2011; Rhind et al., 2014). For example, Cardi et al. (2015) reported that patients with AN and BN looked away from video clips of emotional expressions of happiness, sadness and anger significantly more often than did healthy controls. They concluded that this tendency could contribute to the deficits in social and emotional functioning that have been observed in patients with eating disorders.

It has yet to be established if biased attention towards angry faces generalises to those with non-clinical levels of disordered eating. Traditionally, research designed to identify cognitive impairments in eating disorders has focused on investigating clinical populations, which has made it particularly difficult to separate the causal and maintaining factors implicated in disordered eating (Stice, 2002). Therefore, a focus on non-clinical levels of eating disorder-related symptoms within the general population may help to distinguish between the factors implicated in the development of eating-related psychopathology and those which maintain the disorder. Overall, work examining individuals without a clinical diagnosis might prove valuable in elucidating the nature of symptom development and progression. It is known that those in the early stages of eating disorder development are the most likely to respond to treatment (Gordon, 2000). Therefore, identifying the factors involved in the development of disordered eating at the non-clinical stage may help to inform early intervention strategies.

To date, the majority of work assessing attentional bias in participants with disordered eating has tended to use variants of either the Stroop or dot probe tasks. However, as noted by Giel et al. (2011), these methods lack the appropriate temporal resolution to clearly delineate the nature of attentional biases. Greater response latencies on these tasks might reflect a bias towards a stimulus (orientation) or problems moving attention away from it (disengagement). Orientation is thought to be an automatic process that occurs early in the temporal processing of a stimulus, whereas disengagement is thought to be a later, strategically controlled, process. Studies using the dot-probe task utilise different presentation times to try and distinguish between these two processes. However, this task only provides a 'snap shot' of the location of attention at a given moment in time, which is a notable limitation as the time chosen for this sampling can influence the direction of bias observed (Cooper and Langton, 2006). Eye-tracking technology enables the continuous measurement of eye-movements using a high temporal resolution, thus it is able to overcome the limitations of previous studies. Eye-tracking has been used successfully to investigate the processing of salient cues in different participant groups (Caivo et al., 2007; Mogg et al., 2003; Nummenmaa et al., 2006). Notably, it has been used successfully to investigate attentional biases to food- and body-related cues in participants with eating disorders (Giel et al., 2011) and nonclinical participants with relatively high scores on measures of disordered eating (Gao et al., 2011; Hewig et al., 2008). With this in mind, the current study utilised eye-tracking in order

to establish if healthy participants who could be considered 'at risk' of developing an eating disorder would exhibit biased attention towards angry faces. A further aim was to determine if the bias related to initial orientation or prolonged engagement (delayed disengagement). We also aimed to confirm previous findings (Jones et al., 2009; Ridout et al., 2010, 2012) of impaired facial emotion recognition in healthy participants with relatively high levels of eating disorder-related symptoms.

In the present study, healthy participants with relatively high or low scores on the eating disorder-related subscales of the Eating Disorders Inventory (EDI; Garner, 1991) were presented with pairs of faces (angry-neutral or happy-neutral) and asked to inspect them under free viewing conditions (as in Giel et al. (2011)). Eye-movements were continuously monitored using an eye-tracker. Following this task participants were presented with a separate series of faces and asked to identify the emotion portrayed (eye movements were not collected during this task). Given previous findings of an attention bias to angry faces in patients with eating disorders (Harrison et al., 2010a,b), it was hypothesised that individuals with relatively high EDI scores would demonstrate a greater tendency to initially fixate on the angry faces than would low EDI scorers. It is also expected that those with higher EDI scores would spend longer during these initial fixations looking at the angry faces than would low scorers. Both of these findings would suggest biased orienting to these threatening stimuli. It was also expected that those with relatively high EDI scores would have difficulties disengaging from angry faces (i.e. longer total gaze duration times on the angry faces) than would low EDI scorers, which would suggest a problem in disengaging attention from threat. On the facial emotion recognition task, it was expected that those with relatively high EDI scores would correctly identify fewer emotional expressions than would the low EDI scorers, and this deficit would be particularly evident for negative emotions. In the analysis of the continuous data (with the total sample), it was predicted that the percentage and duration of initial fixations on angry expressions and the total gaze duration on angry faces would be positively related to scores on the EDI subscales of drive-for-thinness, body dissatisfaction and bulimia. Finally, it was expected that the percentage of expressions correctly recognised would be negatively related to scores on the EDI subscales, particularly drive for thinness.

2. Method

2.1. Participants

Fifty two female volunteers¹ aged between 18 and 29 (mean age=22.13, SD=2.48) took part in the study. A tertile split was conducted on the participants' scores on the eating disorder-related subscales of the Eating Disorders Inventory (EDI; Garner, 1991). The highest scoring (n=18) and lowest scoring participants (n=17) were included in a group analysis of the face processing data.² The mean age of the high EDI group was 21.17 (SD=2.15) and of the low EDI group was 21.65 (SD=2.98). Further details of the two groups can be found in Table 1. All 52 participants were included in the continuous analysis of the data. This study was approved by the research ethics committee of Loughborough University.

¹ All participants reported no history of an eating disorder. However, the EDI scores of two participants were within the range of EDI scores observed in patients with AN (Garner, 1991), which suggests they could potentially meet the diagnostic criteria for AN. This was considered during the analysis of face processing data (see footnote 4).

² Power calculations using G*Power revealed that a total sample of 34 participants is sufficient to detect a large effect size in the critical two-way analyses. However, the study may be underpowered to detect a medium effect size. Furthermore, a sample of 50 participants was identified as appropriate to reliably detect medium effect sizes using multiple regression with up to five predictors.

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