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Recognition of emotional facial expressions in adolescents with anorexia nervosa and adolescents with major depression

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A B S T R A C T

Anorexia nervosa (AN) has been suggested to be associated with abnormalities in facial emotion recognition. Most prior studies on facial emotion recognition in AN have investigated adult samples, despite the onset of AN being particularly often during adolescence. In addition, few studies have examined whether impairments in facial emotion recognition are specific to AN or might be explained by frequent comorbid conditions that are also associated with deficits in emotion recognition, such as depression. The present study addressed these gaps by investigating recognition of emotional facial expressions in adolescent girls with AN (n = 26) compared to girls with major depression (MD; n = 26) and healthy girls (HC; n = 37). Participants completed one task requiring identification of emotions (happy, sad, afraid, angry, neutral) in faces and two control tasks. Neither of the clinical groups showed impairments. The AN group was more accurate than the HC group in recognising afraid facial expressions and more accurate than the MD group in recognising happy, sad, and afraid expressions. Misclassification analyses identified subtle group differences in the types of errors made. The results suggest that the deficits in facial emotion recognition found in adult AN samples are not present in adolescent patients.

1. Introduction

The ability to correctly perceive and interpret emotional expressions in the faces of others is of major importance for successful communication and interaction (e.g. Keltner and Kring, 1998; Bourke et al., 2010). Impairments or biases in facial emotion recognition have been found to be related to difficulties in social and emotional functioning (e.g. Trentacosta and Fine, 2010; Yoo and Noyes, 2016), to contribute to the development and maintenance of mental disorders (e.g. Hale, 1998; Oldehinkel et al., 2015; Vrijen et al., 2016), and to have a negative impact on treatment outcome (e.g. Geerts and Bouhuys, 1998; Bouhuys et al., 1999; Shiroma et al., 2014).

Anorexia nervosa (AN) is among the mental disorders that have been suggested to be associated with abnormalities in facial emotion recognition in adults (Kret and Ploeger, 2015) as well as adolescents (Collin et al., 2013). These abnormalities might contribute to the difficulties in social and emotional functioning that have been proposed to play a major role in the development and maintenance of the disorder (e.g. Schmidt and Treasure, 2006; Oldershaw et al., 2011). However, studies investigating emotion recognition in adult AN patients have yielded inconsistent results: although meta-analyses point to an impairment in facial emotion recognition in patients with AN (Oldershaw et al., 2011; Caglar-Nazali et al., 2014), some recent studies question this finding as they did not find AN patients to perform inferior to controls (Calvo Sagardoy et al., 2014; Phillipou et al., 2015; Dapelo et al., 2016; Gramaglia et al., 2016; Kucharska et al., 2016).

Adolescence is not only a common time for the onset of AN (Smink et al., 2012) but is also a period in which the ability to recognise facially expressed emotions is still subject to developmental change (e.g. Herba and Phillips, 2004; Thomas et al., 2007; Greimel et al., 2014). Since impairments in emotion recognition may interfere with the normal development of socio-emotional skills, understanding their role in adolescent AN may have important clinical implications for early intervention. Surprisingly, to date only a few studies have investigated facial emotion recognition in adolescent AN patients and their results have been mixed: while Zonnevylle-Bender et al. (2002) found deficits in adolescent AN patients compared to healthy controls (HCs), others found girls with AN to perform similarly (Hatch et al., 2010) or even slightly better (Lulé et al., 2014; Laghi et al., 2015) than HCs. The present study was designed to further investigate facial emotion recognition in adolescent AN patients. In line with most previous studies in adults (see e.g. Oldershaw et al., 2011), we expected to find emotion

Abbreviations: AN, anorexia nervosa; ANOVA, analysis of variance; BDI-II, Beck Depression Inventory-II; BMI, body mass index; CFT-20-R, Culture Fair Test 20 Revision; EDI-2, Eating Disorder Inventory 2; HC, healthy control; IQ, intelligence quotient; MD, major depression; RT, reaction time (for correct answers); SSRI, selective serotonin reuptake inhibitor

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recognition deficits in the AN group compared to the HC group.

Among the reasons that might account for the heterogeneity of results in both the adult and adolescent literature is the way studies deal with frequent comorbid conditions, especially depressive disorders that have been found to affect up to 90% of inpatients with AN (Blinder et al., 2006) with comorbidity rates for major depression (MD) above 30% already in adolescent AN patients (e.g. Bühren et al., 2014). Considering that MD has been suggested to be associated with deficits in facial emotion recognition as well (see e.g. Bourke et al., 2010; Demenescu et al., 2010; Dalili et al., 2015; for reviews and meta analyses), differences between AN patients and controls might not be specific to AN but might at least in part result from elevated depressive symptoms. Some studies on emotion recognition in AN have attempted to control for depressive psychopathology by excluding participants meeting criteria for MD (e.g. Pollatos et al., 2008) or by statistical means (e.g. Kessler et al., 2006; Lulé et al., 2014). Despite being the most straightforward way to address this issue, only one study has directly compared emotion recognition abilities between patients with AN, those with MD, and HCs: Mendlewicz et al. (2005) found no differences between young females with AN and HCs or between patients with AN and MD, while the MD group was less accurate than the HC group in recognising angry facial expressions. In adolescents, one study that included a clinical control group (girls with MD and/or anxiety disorders) found both the AN group and the clinical control group to perform worse than HCs in a free labelling emotion recognition task (although not if response options were given), indicating that emotion recognition difficulties might not be specific to AN (Zonnevylle-Bender et al., 2004).

While the sample in the study by Mendlewicz et al. (2005) comprised both adolescent as well as adult women, to date, no study has directly compared emotion recognition abilities in adolescent girls with AN and those with MD. Therefore, the second aim of this study was to address the question of disorder specificity in adolescent patients by also including a group of girls with MD. We expected the MD group to show emotion recognition deficits compared to HCs as well (as found for adult MD patients: see e.g. Demenescu et al., 2010; Dalili et al., 2015). Moreover, we expected that girls with AN and girls with MD would show specific differences in their ability to recognise facial emotions. In detail, we expected the MD group to perform better than the AN group in the identification of sad facial expressions. This prediction was based on previous studies that found MD patients to show impaired recognition of all emotional expressions but sadness (see Dalili et al., 2015), while studies in AN patients found that emotion recognition deficits were particularly pronounced for sadness (Kucharska-Pietura, 2004; Pollatos et al., 2008). For angry faces, in turn, we expected the MD group to perform worse than the AN group, considering that Mendlewicz et al. (2005) found patients with MD but not patients with AN to perform inferior to controls specifically for angry facial expressions.

We applied three face processing tasks: an emotion discrimination task, a gender discrimination task, and a face-word discrimination task (study design adapted from Rellecke et al., 2012). The emotion discrimination task allowed us not only to investigate overall differences in emotion recognition ability between the three groups, but also whether these differences were specific to certain emotions. Deficits in emotion recognition would be indicated by less correct answers or slower reaction times in this task. The gender discrimination and face-word discrimination tasks served as control conditions: group differences in the gender discrimination task would suggest a deficit in the processing of faces in general (and thus not specific for the emotions expressed by the faces), whereas group differences in the face-word discrimination task would suggest a more general impairment in tasks requiring fast reactions. We did not expect groups to differ in these tasks, however, inclusion of these tasks allowed us to be confident that differences in the emotion discrimination task indicate differences in the processing of emotions in facial expressions and had not arisen due to differences in more general processing domains.

In addition to accuracy rates and reaction times, we also analysed misclassification errors (similar to some recent studies in adolescents with MD: Schepman et al., 2012; Jenness et al., 2015) in order to examine whether groups differed in tendencies to misclassify faces as showing specific emotions. These analyses provide additional information about the nature of biases that may underlie deficits in emotion recognition and that might differ between patient groups even in the absence of differences in overall accuracy and reaction times.

In summary, the present study was designed to investigate facial emotion recognition in adolescent AN patients and to address the question of disorder specificity by also including a group of girls with MD in addition to girls with AN and HCs. We expected that both patient groups would show deficits in comparison to the control group. Moreover, we expected AN and MD patients to show specific differences in their ability to recognise emotions.

2. Methods

The present data on facial emotion recognition were collected within a broader project that also examined the neurophysiological mechanisms underlying face processing in adolescents with AN (Sfärlea et al., 2016).

2.1. Participants

A total of 89 adolescent girls aged 12–18 years were included in the study. The HC group comprised 37 healthy girls, the AN group consisted of 26 girls with AN, and the MD group comprised 26 girls suffering from MD. AN and MD patients were inpatients or outpatients from a University Department of Child and Adolescent Psychiatry in Germany. The HC group was recruited through local advertisements. All included participants had normal or corrected to normal vision. The groups were comparable in terms of age and intelligence but differed, as expected, regarding clinical characteristics (Table 1).

All participants underwent extensive diagnostic assessment before

Table 1
Demographic and clinical characteristics of the study sample.

	HCn = 37M (SD)	**AN**n = 26M (SD)	**MD**n = 26M (SD)	ANOVA results	
Age	15.2 (1.7)	15.2 (1.7)	14.8 (1.7)	$F < 1$	n.s.
IQ	105.3 (10.5)	106.6 (15.0)	110.4 (12.4)	$F_{2,86} = 1.3$	n.s.
BMI	20.1 (2.4)[a]	15.4 (1.2)[b]	21.3 (4.8)[a]	$F_{2,86} = 26.9$	$p < .001$
Age-corrected BMI-percentile	37.9 (23.6)[a]	0.8 (1.2)[b]	47.5 (32.6)[a]	$F_{2,86} = 30.0$	$p < .001$
EDI-2	n.a.	306.4 (46.7)	n.a.		
BDI-II	4.3 (3.7)[a]	23.8 (9.7)[b]	28.1 (13.6)[b]	$F_{2,86} = 59.7$	$p < .001$

HC = healthy control; AN = anorexia nervosa; MD = major depression; IQ = intelligence quotient; BMI = body mass index; EDI-2 = Eating Disorder Inventory 2; BDI-II = Beck Depression Inventory-II; M = mean; SD = standard deviation; group differences were examined by one-way analyses of variance (ANOVAs) and Bonferroni-Holm corrected post-hoc t-tests: [a,b] groups with different superscript letters differed significantly ($p < .001$).