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Running head: Anorexia and emotions

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Abstract

Alexithymia, difficulties in facial emotion recognition, poor socio-relational skills are typical of Anorexia Nervosa (AN). We assessed patients with AN and healthy controls (HCs) with mixed stimuli: questionnaires (Toronto Alexithymia Scale-TAS, Interpersonal Reactivity Index-IRI), photographs (Facial Emotion Identification Test-FEIT) and dynamic images (The Awareness of Social Inference Test-TASIT). TAS and IRI Personal Distress (PD) were higher in AN than HCs. Few or no differences emerged at the FEIT and TASIT, respectively. Despite higher levels of alexithymia, patients with AN seem to properly acknowledge others' emotions while being inhibited in the expression of their own.

Introduction

Impaired emotional functioning and alexithymic traits are core elements of Anorexia Nervosa (AN). (Torres *et al.,* 2015; Courty, Godart, Llalanne, Berthoz, 2015). Patients with AN, compared to healthy controls, show a concrete, reality-based cognitive style and a poor inner emotional and fantasy life. Jenkins & Connor (2012) suggested the phrase "cognitive-affective division" to describe the difficulty shown by patients with Eating Disorders (EDs) when trying to translate what they "think" cognitively into what they "feel" emotionally. Poor skills in emotion regulation (ER), especially when facing negative moods, may lead patients to eating disordered behaviors, which seem to offer a short term comfort or distraction, to the detriment of more adaptive strategies (Skårderud, 2007; Smyth *et al*., 2007; Svaldi, Griepenstroh, Tuschen-Caffiera, Ehringc, 2012). Identification of facial information and emotional expression is a core component of social life and interpersonal communication, and impaired skills in this cognitive processing ability are likely to play a role as regards patients' social functioning deficits, social phobia, social isolation, avoidance and persistent social impairments, even after recovery from AN (Kaye et al., 2004; Nilsson et al., 1999). The current literature suggests that, compared to healthy individuals, people with AN have deficits in emotion regulation across a variety of domains. Difficulties in recognizing facially displayed emotions have been described, although it is not clear whether these are independent from alexithymia (Kessler, Schwarze, Filipic, Traue, von Wietersheim, 2006), and whether they are influenced by comorbid psychopathological conditions, such as depression (Mendlewicz, Linkowski, Bazelmans, Philippot, 2005; Manuel & Wade, 2013; Parling, Mortavazi, Gadheri, 2010). Apart from difficulties in the recognition of facial emotions, especially negative ones (i.e., sadness and fear), people with AN may show impairments in the recognition of emotions in voices, both positive and negative (particularly happiness and sadness) (Kucharska-Pietura, Nikolau, Masiak, Treasure, 2004).

There is a debate as whether there are different patterns of emotional processing deficiencies in different subtypes of EDs, whether emotional regulation and emotional processing difficulties are a

unique hallmark of EDs, and whether these are state- or trait-dependent conditions. Although ER difficulties and social problem solving skills may be impaired in the acute phase of AN, due to the direct effects of starvation on the brain [7, 8], there is evidence that women with AN experience premorbid social difficulties, and that such difficulties persist after recovery [9]. Beadle et al. (2013) found no improvement after weight restoration and suggested that alexithymia and personal distress may be trait features of AN. On the contrary, a better performance in emotional inference in the self and the others has been found in recovered patients than in currently ill ones by Oldershaw and coworkers (2010). Nonetheless, recovered patients compared to healthy controls still showed some slight impairment, particularly in recognizing positive emotions; moreover, patients with AN, both currently ill and recovered, seemed to be actually making greater efforts than healthy controls despite their poorer performance in recognizing emotions. A correlation between ED symptoms and severity and measures of ER impairment has been suggested as well (Svaldi et al. [4]; Racine & Wildes, 2013).

The importance of all these issues depends also on the fact that difficulties identifying feelings may play the role of maintaining factors for AN and impact on prognosis. These factors are likely not disorder-specific for AN (for instance, a possible overlapping between AN and autism spectrum disorders has been suggested), nonetheless in people with AN they may interfere with the healing process (Oldershaw, Hambrook, Tchanturia, Treasure, Schmidt, 2010). For instance, a 3-year longitudinal study (Speranza, Loas, Wallier, Corcos, 2007), found the Difficulty Identifying Feelings factor of the Toronto Alexithymia Scale significantly predicted treatment outcome, independent of depressive symptoms and ED severity.

The aim of our study was to add to the existing literature about these issues, comparing alexithymia, empathy, facial emotion identification and social inference abilities in people with AN and healthy controls (HC). Considering the instruments we used, we also wanted to discriminate whether AN patients were more impaired than controls when assessed about alexithymia, ER skills and social

inference via a pencil-and-paper questionnaire, photographs, or dynamic images depicting emotions and social interactions (see methods).

Method

<u>Participants</u>

We recruited all the patients with a current diagnosis of AN referred to the outpatient and inpatient service for Eating Disorders of the Institute of Psychiatry, Maggiore della Carità Hospital, Novara (Italy), and to a collaborating Psychiatric Clinic (Casa di Cura San Giorgio, Viverone), in a 2-year period (from June 2013 to June 2015), matching the inclusion criteria described hereby. Inclusion criteria for the patients' sample were: 1) current diagnosis of AN according to DSM-IV-TR (American Psychiatric Association, 2000); 2) age >18 years; 3) no comorbid psychosis or drug abuse; 4) availability to give informed written consent to participate in the study. HCs similar for age were recruited among female University students and trainees, their friends and relatives, aged >18 years, with no comorbid psychosis or drug abuse and no current or past Axis I diagnosis. Assessment and diagnosis of patients and HCs were performed by experienced psychiatrists with the aid of the Structured Clinical Interview for DSM-IV-TR (SCID-I) (First, Spitzer, Gibbon & Janet, 2002). The project was approved by the Institutional Review Board of our Institution. Informed consent was obtained.

<u>Materials</u>

HCs were given an appointment and tested in a single session. Patients' assessment with the aid of the SCID-I was performed during the first psychiatric interview; their Body Mass Index (BMI, Kg/m^2) was measured. Patients were then given a second appointment the following week; they were asked to fill the self-administered questionnaires and were assessed with the tests described hereby.

Interpersonal Reactivity Index (IRI) (Penn *et al*., 1994; Giumarra et al., 2015)

The IRI is a 28-item self.administered questionnaire assessing four dimensions of dispositional empathy: Perspective Taking (PT), Fantasy (F), Empathic Concern (EC), and Personal Distress (PD). PT describes the tendency to spontaneously adopt the psychological point of view of others; F measures the tendency to imaginatively transpose oneself into the feelings and actions of fictitious characters in books, movies, and plays. The EC subscale measures other-oriented feelings of sympathy and concern for others in distress. The PD subscale assesses self-oriented anxiety when experiencing others in distress. Cronbach's alphas for the four scales were PT= .54, F= .77, EC= .69 and PD= .50, respectively. High internal consistency and good test–retest reliability and convergent validity were found for the IRI (Davis, 1983).

Toronto Alexithymia Scale (TAS-20) (Bagby, Parker, Taylor, 1994)

Self-administered 20-item scale assessing the three core elements of the construct: Difficulty Identifying Feelings (DIF), Difficulty Describing Feelings (DDF), and Externally Oriented Thinking (EOT). This last factor, EOT, also indirectly assesses (reduced) fantasy and imaginal activity (Taylor, Bagby, Parker, 1997). A score greater than 61 indicates the presence of alexithymia (Bagby, Taylor, Parker, Dickens, 2006). The TAS had good psychometric properties (Cronbach's alpha 0.81; test-retest reliability 0.77).

Facial Emotion Identification Test (*FEIT)* (Kerr & Neale, 1993; Erol, Mete, Sonmez, Unal, 2010)

The FEIT is an interactive computer task containing facial expression stimuli (posed by actors) associated with 6 basic emotions (anger, disgust, fear, happiness, sadness, surprise), and neutral faces. The task includes 55 black and white photos presented on a computer screen for 15 seconds, then immediately replaced by a blank screen. Participants are asked to indicate the emotion seen by pressing a labeled key on the keyboard as soon as they identify it. The software then calculates the number of correct answers for each emotion subset, a total score and reaction times. Cronbach's alphas were as follows: nonclinical controls, alpha = .37; acute-care participants, alpha = .52; and extended-care participants, alpha = .41.

The Awareness of Social Inference Test (TASIT) (Rollins, Flanagan, McDonald, 2002)

The TASIT is divided into three parts. Part 1 - Emotion Evaluation Task – EET : 28 short (15–60 seconds) video clips of social interactions, each featuring one of the six primary emotions (happiness, sadness, anger, surprise, disgust and fear) or neutral affect. Each emotion (including neutral affect) is represented in four different video clips. The participants are required to identify the emotional state of the central protagonist by making a forced choice from seven emotional descriptors presented simultaneously in a paper chart. Part 2 and 3 – Social Inference Minimal and Enriched (SI-M and SI-E) consist of 15 and 16 short (15-60 seconds) videoclips, respectively, including sincere, false and sarcastic dialogues, so that the subject has to infer the real meaning of the message by observing the affective state of the person talking (facial expression, tone of voice), and the environment. Cronbach's alpha for the TASIT is 0.81(Roberts & Penn, 2009).

Both the FEIT and TASIT have already been used together for the assessment of social cognition in schizophrenic patients (Galderisi *et al.*, 2014).

Data analyses

All the analyses were performed using the statistical software STATA MP11 (Stata Corp., 2007). Initial descriptive statistics included frequencies and percentages for categorical variables and the chi-squared test to evaluate the differences in proportions between groups. The continuous variables were reported using the mean and the standard deviation. Normal distribution of data was verified using Shapiro-Wilk test. Mean comparison between groups was carried out using Student's t-test. A two-tailed p value < .05 was considered significant for all analyses.

Results

We enrolled 87 subjects, including 39 patients with AN (44.83% of the whole sample) and 48 HCs (55.17% of the whole sample). The mean age of the whole sample was 32.02 ± 2.26 years; in AN it was 30.59 ± 3.00 and in HCs it was 33.19 ± 3.37. In regards to patients' diagnosis, 27 patients (69.23% of the patients' group) had AN restricting subtype, and 12 AN binge-purging subtype

(30.77%). Mean BMI was 16.3 Kg/m^2 in patients with AN and 21.82 Kg/m^2 in HCs. Differences were found as far as occupational status and schooling are concerned, since most HCs were students and trainees. No difference in marital status emerged. See Table 1 for details.

Table 2 reports the results of the comparison of the two groups as far as the self-administered questionnaires and assessments are concerned. The TAS score was significantly higher in patients with AN than in HCs, and the first scored higher on all TAS subscales, except for EOT. As regards the FEIT, a significantly lower rate of patients with AN proved able to correctly recognize fear and a significantly higher rate of patients with AN correctly recognized disgust, compared to HCs; for the other five emotions (happiness, sadness, neutral, anger, surprise) no significant difference was found between the two groups. The comparison of the AN and HC groups yielded no statistically significant result as far as the TASIT is concerned. The only IRI factor showing a significant difference between the two groups was IRI-PD, and patients with AN scored higher than HCs.

Discussion

TAS

The TAS overall score and TAS-DIF and TAS-DDF scores were significantly higher in AN than HCs. This means that in our sample, as expected, patients with AN showed greater difficulties than HCs identifying feelings, distinguishing them from the bodily sensations of emotion (Skårderud, 2007; Enckell, 2002), and also describing feelings to others. On the contrary, we failed to find a significant difference between AN and HCs as far as EOT is concerned. A high score on TAS-EOT suggests a reduced fantasy and imaginal activity (Taylor *et al.,* 1997). The literature reports mixed results concerning this issue in AN; our results, for instance, are partially in contrast with those by Troop and coworkers (1995) who found that patients with restrictive AN had a poorer fantasy life when compared to controls. On the other hand, our findings seem in line with those by Torres and coworkers (2011), who found patients with AN being able to imagine emotions in hypothetical situations and to identify and label them, despite higher levels of overall alexithymia than HCs.

Moreover, they found that the group of patients with AN felt more intense and internally based negative emotions in comparison with the control group, especially in situations associated with food and weight. They concluded that patients with AN might have preserved meta-emotional abilities, and no global deficit in emotional processing, but rather a specific sensitivity for situations relevant to their AN.

IRI

In our study, the lack of significant differences between patients with AN and HCs in fantasy and imaginal activity suggested by the TAS-EOT is supported also by the IRI-F scale. This describes the tendency to imaginatively transpose oneself into the feelings and actions of fictitious characters in books, movies, and plays, and showed no difference between patients and HCs. Besides this result about the F scale, the assessment of empathy with the IRI failed to highlight differences between patients with AN and HCs also on the scales of PT and EC. These findings are in contrast with an earlier study of alexithymia in AN, which suggested a clinical evidence of empathy disorder in a specific subgroup of patients with AN, with high scores on the TAS (Råstam, Gillberg, Gillberg, Johansson, 1997).

In our study the only subscale of the IRI discriminating between the AN and HCs groups was the IRI-PD, which was higher in patients with AN. The IRI-PD scale assesses self-oriented anxiety when experiencing others in distress and suggests that patients with AN may feel greater discomfort than HCs, or experience more difficulties, when faced with others' 'negative' feelings.

FEIT and TASIT

Concerning the FEIT, differences emerged only as far as fear and disgust recognition are concerned. Patients with AN correctly identified fear in a lower percentage of cases than HCs, but performed better than HCs in the correct identification of disgust. Meaningful comparisons with the existing literature is currently difficult due to mixed results. For instance, Jones and coworkers (Jones, Harmer, Cowen, Cooper, 2008) observed that patients with more severe ED symptoms are usually less precise at recognizing happy and neutral faces when compared to less symptomatic patients.

Severely disordered subjects are also worse at identifying anger, but perform better as far as surprised faces are concerned. Patients presenting more severe conditions tended to mislabel happy faces as neutral and neutral faces as angry or sad, which can also be observed in depressed patients (Leppanen, Milders, Bell, Terriere & Hietanen, 2004).

In patients with AN it has been described the tendency to inhibit their own sadness and anger in interpersonal situations, while reporting high levels of disgust and anger towards themselves and their body. The emotions of sadness and fear have been both linked to body disgust and body dissatisfaction (Fox & Power, 2009). This background may be helpful to understand our finding about patients' difficulties to correctly identify fear, while they recognized disgust better then HCs. Self-disgust might have a central role in the maintenance of EDs and may be used as a means to suppress more ego-dystonic emotions including fear (Fox & Power, 2009).

Last, as far as the TASIT is concerned, no significant difference was found between patients with AN and HCs. The TASIT offers complex stimuli including facial displays of emotions, verbal and non-verbal language, prosody, action and interaction among characters, all within the context of every given scene. Our results seem consistent with those reported in a recent review by Pinar Caglar-Nazali and coworkers (2014) about systems for social processes in people with ED. These Authors found poor evidence for problems with non-facial communication, animacy and action, notwithstanding impaired facial emotion recognition and facial communication, together with increased facial avoidance, alexithymia and poor understanding of mental states.

Consistent with the literature, we have found higher total scores on the TAS , and on the TAS DIF and DDF in patients with AN. Accordingly, we would have expected patients performing worse than HCs on the FEIT and TASIT. However, we found but one only difference between patients and HCs in the IRI scores, and we failed to find relevant differences on patients' ability in properly recognizing and interpreting facial emotions and social interactions from the static and dynamic

stimuli offered by the FEIT and TASIT, respectively. As for the open questions about the possible relationship between alexithymia and difficulties in recognizing facially displayed emotions (Kessler *et al.,* 2006), our results seem to suggest that these two issues are independent, consistent with the preservation of the meta-emotional abilities, despite high levels of alexithymia, described by Torres and coworkers (2010). On the other hand, the TAS scores suggest that patients with AN might have a specific problem concerning their own emotions.

Using an analogy between the central nervous system and a computer, we may consider the mind-brain relationship as the software-hardware one. Ultimately, all software has a physical basis, even if it might be reasonable to think of it as "non-physical" in contrast to hardware, which is undeniably physical. As far as emotion processing in patients with AN is concerned, the results from the three different assessment approaches we used seem to suggest that there might be a software rather than a hardware problem (Fodor, 1981). Of course, further studies in larger samples and including the assessment of emotional avoidance are warranted to support this hypothesis. According to this standpoint, the emotional impairment of patients with AN would not be centered on the emotions themselves, but rather depend on something (inhibition or avoidance) which happens at a later stage, following the proper acknowledgment of others' emotions (Speranza et al., 2005), Hypotheses have been suggested about the possibility that patients may be overwhelmed by over-control and anxious worry (Torres et al., 2011), leading to alexithymia (Troop, Schmidt & Treasure, 1995). Moreover, although experiencing similar levels of negative feelings as controls, patients with AN may tend to avoid negative affect, or may try to regulate it engaging in behaviours such as restrictive eating, purging, and body checking (Corstorphine, 2006; Skårderud & Fonagy, 2011; Schmidt & Treasure, 2006; Espeset et al., 2012). Therefore, an incongruence between expression of negative emotion and inner experience is likely to take place, and patients may inhibit the expression of negative feelings according to the belief that these would have aversive consequences, damage relationships and create or increase conflict (Davies, Swan, Schmidt, Tchanturia, 2012; Ioannou *&* Fox 2009).

<u>Limitations</u>

Some limitations should be underscored; the sample size is small, although not so much if compared to similar studies in the literature. Of course, studies with a larger sample size would be helpful to resolve the conflicting findings of the literature in this field. Moreover, we did not control for the use of psychotropic medication, illness duration or age. As far as educational level is concerned, it should be noted that the control group includes mainly University students and this may represent a bias, although the instruments use for assessments are meant to be culture-independent. Last, albeit it might have integrated our findings, we did not assess experiential avoidance.

Conclusions

Studies of facial expression emotion identification often used static displays of such expressions, namely photographs. Anyway, the network of brain regions decoding these social signals is likely to be much more complex, since facial emotional expressions are highly dynamic signals that encode the emotion message in facial action patterns. The question whether different neural correlates underlie the encoding and decoding of facial expressions of emotion by static or dynamic displays is still unanswered. Suggestions have been made (Kilts et al., 2003) that static displays of facial emotional expression may represent non-canonical stimuli that are processed for emotional content by mental strategies and neural events which are distinct from their more relevant dynamic counterparts. Our assessment was comprehensive, and may offer a thorough perspective on these issues due to the inclusion of different measures and approaches to the investigation of alexithymia, empathy, emotion identification skills and social inference.

From a clinical standpoint, alexithymia, emotional empathy and social inference may play a role as maintaining factors for AN, hence addressing them is not only relevant from a theoretical point of view, but also as far as treatment is concerned (Tchanturia *et al*., 2012). Being aware of poor skills in emotional identification and expression in ED patients is necessary to address such problems

with specific treatment strategies aimed at encouraging identification, labeling and sharing of emotions. Indeed, a shared conclusion of all studies in this field, independent of the results found, is that patients may benefit from an approach aimed at supporting and fostering the identification and expression of feelings, and at developing and improving coping strategies in the area of social interaction and emotion regulation, especially in order to find alternative strategies to emotional inhibition and avoidance.

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Table 1. Descriptive features of the sample.

	Patients with AN % *(N)*	HCs % *(N)*	p
Occupational status			
Employed	48.72 (19)	4.17 (2)	**<0.001**
Unemployed	20.51 (8)	2.08 (1)	
Student	30.77 (12)	93.75 (45)	
Schooling			
Junior high school	20.51 (8)	2.08 (1)	**<0.001**
High school	58.97 (23)	6.25 (3)	
Degree	20.51 (8)	91.67 (44)	
Marital status			
Single	75.00 (36)	79.49 (31)	0.245
Married	25.00 (12)	20.51 (8)	

Table 2. FEIT, TASIT, TAS and IRI scores (mean and range) in Patients with AN and HCs: t-test results.

	Patients with AN (95% CI)	HCs (95% CI)	p
FEIT total	80.41 (77.73 - 83.09)	82.15 (79.02 - 85.28)	0.399
FEIT_happy	82.39 (76.92 - 87.87)	86.21 (80.72 - 91.69)	0.320
FEIT_sad	61.21 (51.34 - 71.08)	73.48 (65.98 - 80.97)	0.054
FEIT_fear	67.24 (58.49 -73.99)	81.82 (75.72 - 88.92)	**0.010**
FEIT_anger	81.63 (76.94 - 86.32)	79.81 (72.74 - 86.87)	0.672
FEIT_surprise	96.06 (93.58 - 98.53)	90.04 (84.31 - 95.77)	0.066
FEIT_disgust	87.18 (81.87 - 92.49)	77.90 (74.95 - 80.85)	**0.028**
FEIT_neutral	90.63 (85.15 - 96.12)	87.00 (81.87 - 92.13)	0.328
TAS-DIF	19.23 (16.93 - 21.53)	12.55 (10.98 - 14.12)	**<0.001**
TAS-DDF	16.06 (14.78 - 17.35)	12.90 (11.88 - 13.92)	**<0.001**
TAS-EOT	25.29 (23.93 - 26.64)	26.25 (25.02 - 27.48)	0.292
TAS-TOTAL	60.26 (56.77 - 63.75)	51.70 (49.01 - 54.39)	**<0.001**
TASIT-EET1	10.27 (9.75 - 10.78)	10.85 (10.45 - 11.25)	0.072
TASIT-EET2	14.60 (14.23 - 14.97)	14.61 (13.85 - 15.36)	0.981
TASIT-SIM1	16.47 (15.29 - 17.64)	17.28 (15.90 - 18.66)	0.366
TASIT-SIM2	17.63 (16.72 - 18.55)	17.97 (16.93 - 19.01)	0.619
TASIT-SIM3	17.57 (16.53 - 18.61)	18.09 (17.43 - 18.76)	0.382
TASIT-SIE1	26.13 (25.21 - 27.05)	25.75 (24.59 - 26.91)	0.603
TASIT-SIE2	26.43 (25.37 - 27.50)	27.25 (26.17 - 28.33)	0.272
IRI-F	19.13 (17.71 - 20.55)	19.80 (18.43 - 21.16)	0.498
IRI-EC	21.00 (19.93 - 22.07)	20.23 (19.21 - 21.24)	0.297
IRI-PT	22.06 (20.58 - 23.55)	22.10 (21.08 - 23.12)	0.954
IRI-PD	20.74 (19.38 - 22.30)	18.35 (17.31 - 19.19)	**0.009**

Note: TAS-DIF: Difficulty Identifying Feelings; TAS-DDF: Difficulty Discriminating Feelings; TAS-EOT: Externally Oriented Feelings; TASIT-EET1: Emotion Evaluation Task 1- Positive emotions; TASIT-EET2: Emotion Evaluation Task 2 – Negative emotions; TASIT-SIM 1: Social Inference Minimal 1 – Sincere exchanges; TASIT-SIM 2: Social Inference Minimal 2 – Sarcastic exchanges; TASIT-SIM 3: Social Inference Minimal 3 – Paradoxical Scripts; TASIT-

SIE 1: Social Inference Enriched 1 – Lies; TASIT-SIE 2: Social Inference Enriched 2: Sarcasm; IRI-F: Fantasy; IRI-EC: Empathic Concern; IRI-PT: Perspective Taking; IRI-PD: Personal Distress.