

Subjective and Objective: Alexithymia and Social Cognition in Eating Disorders

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ABSTRACT

Background: Emotional difficulties characterize eating disorders (ED). We examined the construct of alexithymia (disability to recognize and understand emotions) and neurocognitive factors of social cognition in patients diagnosed with B/P-EDs and their mothers.

Method: 34 mother-daughter dyads, in which the daughter has B/P-ED and 31 control dyads conducted subjective self-evaluation of alexithymia and underwent objective neuro-cognitive evaluation of their ability to recognize and understand emotions. Results were compared.

Results: First, significant differences were found between the daughters' groups on their subjective but not objective evaluation of alexithymia. Second, within group mother-daughter correlation was positive for controls, but not for the ED group.

Conclusions: People with B/P-ED show subjective high levels of alexithymia but not an objective deficit in emotional understanding. However, there is an interesting dis-correlation between them and their mothers, which calls for further research.

(1), including both anorexia nervosa (AN) and bulimia nervosa (BN) (2). There is a growing trend that relates interpersonal difficulties to deficiencies in social cognition (3). In this study, we will focus on affect processing, as an aspect in social cognition, in patients with BN and their mothers. We examine affect processing by subjective evaluation of the ability to process emotion (alexithymia) and by objective neurocognitive evaluation of others' emotional states.

SUBJECTIVE EVALUATION OF AFFECT PROCESSING – ALEXITHYMIA

The concept of alexithymia refers to a disability of identifying, describing and external orientation thought and is considered a common feature in EDs (4-6). Alexithymia is likely associated with problems in modulating affects and with difficulties in the interpersonal and social realm.

Neuropsychological models may explain the relationship between alexithymia and interpersonal difficulties, specifically dysfunction of mirror neurons in premotor areas around the central sulcus. Moreover, the interpretation of others' behavior may be connected to emotional areas in the brain. For example, Adolphs et al. (7) has shown with neuroimaging techniques that people use their mirror neurons to identify with the facial expressions of others while processing their emotions. Connections between alexithymia and social cognition were found in people with autistic spectrum disorders, suggesting that Theory of Mind may be important for both alexithymia and social cognition (8).

In a literature review, Nowakowski, McFarlane and Cassin (9) conclude that individuals with eating disorders have elevated levels of alexithymia, particularly difficulties identifying and describing their feelings, and to a lesser extent they also have specific deficits in communicating

INTRODUCTION

The aim of the present study was to examine the construct of alexithymia and neurocognitive factors of social cognition in patients diagnosed with EDs and their mothers.

Difficulties in interpersonal relationships are considered a core characteristic in eating disorders (EDs)

emotions. Data show that restrictive anorexia participants reported higher levels of alexithymia in comparison to participants with bulimia or controls (6, 10). Specifically, 40%-50% of people with bulimia and 56%-69% of the restrictive eating disorder people fulfilled the criteria for alexithymia (11, 12).

There is a question about whether alexithymia is a state or trait variable. Nonetheless, some studies have shown that individuals with eating disorders continue to have elevated alexithymia scores, even when controlling for depression levels (13).

Nowakowski et al. (9) also concluded that alexithymia has its own heritability component that cannot be fully explained by depression or a genetic susceptibility to general distress and psychopathology. The literature suggests that alexithymia, although significantly related to depression, is an independent construct that needs to be considered separately.

OBJECTIVE EVALUATION OF OTHERS' EMOTIONAL STATES

In the scant literature on emotion recognition in ED patients, the findings tend to be equivocal. Whereas Kessler et al. (14) did not identify any difference in the ability to recognize emotions between women suffering from EDs and the control group, Kucharska-Pietura et al. (15) found such difference.

Studies of patients with anorexia suggest they have difficulties in emotion recognition, and attentional bias for angry face expressions (16), similar to women with Asperger syndrome in their cognitive-behavioral profile in ToM task (17).

Regarding BN, several studies showed no significant differences in subjects' general ability to recognize emotions in ED (18, 19). Research (18, 20) concluded that, in general, basic social cognition does not appear to be impaired in people with BN.

Overall, studies show a connection between alexithymia social cognition and eating disorders, whereas there are no consistent results regarding deficits in objective judgment of social situations and EDs. In the present study, we examined both self-report of alexithymia and objective tests constructed to evaluate the ability to recognize emotions, ignore emotions and understanding social situations, and the relationship between alexithymia and the objective measures in an intergenerational context.

SOCIAL COGNITION AND FAMILIES

The literature shows that both social skills and eating disorders tend to run in families (5, 21, 22). For example,

in a previous study, we found a specific abnormal hemispheric connectivity in judging emotions among women with EDs and their sisters (23). In this study, control participants had a significant bilateral advantage for perceiving emotions (suggesting strong hemispheric connectivity), while ED patients and their sisters did not demonstrate that advantage. Women with EDs and their relatives also reported higher levels of alexithymia. In the present study, we assessed dyads of daughters and mothers.

A connection between alexithymia and parental style was presented in previous publications (11, 24-27). Fonagy et al. (25) suggest that mental processing is an ability that develops under condition of secure attachment. The secure base also allows the child to explore the inner mental world of the self and the other (28).

There is no significant evidence showing that women with B|P-ED present irregular ability to recognize emotions. Clinical impression shows that they are actually very sensitive to social situations, even though they might report emotional confusion or difficulties in emotion regulation. Thus, we tested both their subjective evaluation of their ability to understand emotions, and compared these results to their objective ability to recognize emotions. Since the development of the ability to regulate emotions is connected to early childhood and parental reflective function, in the present study we were also interested in mothers of women with B/P-ED. Therefore, we investigated both mothers and daughters in recognizing emotions and the correlations between mothers and daughters for emotion recognition and understanding.

AIMS AND HYPOTHESIS OF THE STUDY

Our main aim is to test the ability to perceive and interpret emotional and social situation among people with B/P-ED and their mothers from the perspective of objective vs. subjective evaluation.

Hypotheses:

1. Participants with B/P-ED and their mothers will present higher levels of alexithymia compared with the control group, and they will be less accurate in objective emotions recognition and the social cognition tasks.
2. We also assume that there may be differences in the way B/P-ED participants perceive their subjective ability to understand emotions (alexithymia) vs. their objective emotional understanding. This is due to previous research showing low differences in the ability to recognize emotions, but higher levels of self-report alexithymia. We were interested in the connection

(correlations) between the objective and subjective measures of emotions processing.

- Based on the assumption of familial effects, we expect a positive mother-daughter correlation within both the ED and the control dyads in the objective and subjective tests. First, we tested the correlation between the alexithymia self-evaluation (TAS) and performance on the objective emotions recognition tests. Then we tested the correlation in the more complicated social interpretation task. We expected a positive mother-daughter correlation.

METHOD

PARTICIPANTS

The ED group included 31 dyads of daughters with either normal weight binge/purge eating disorder (ED-B/P: bulimia nervosa purging type), or eating disorder not otherwise specified binge/purge type. They were tested with their mothers (ED-M). Participants hospitalized in the eating disorder department in the Sheba Medical Center in Tel Hashomer were allocated for participation within two weeks of the hospitalization (when considered medically stable). The control group included 34 dyads of healthy control women (C) and their mothers (C-M). This group was asked to participate via ads, focused direct mail and personal familiarity.

All participants were volunteers. They were all Hebrew speakers who reported no previous diagnosis of severe learning difficulties or attention deficit hyperactivity disorder (evaluated by preliminary interview). The age range for the daughters was 17-35 years; and for the mothers 35-62. The range of the body mass index (BMI) for inclusion in the daughters group was between 18-25. No between group differences were found in these variables. See Table 1 for general information including the ED screening test (EAT) (29) with a cut-off of 20.

Table 1. Participants' age, BMI, years of education and self report score of ED (EAT-26)

Group	N	Age	BMI	Education	EAT
Control daughters (C-D)	34	22.06 (3.4)	20.92 (1.79)	12.76 (1.3)	9.24 (8.17)
Control mothers (C-M)	34	52.03 (6.03)	25.55 (4.28)	15.48 (3.56)	7.79 (5.6)
ED daughters (ED-B/P)	31	21.46 (3.12)	20.07 (1.94)	12.31 (1.32)	38.19 (16.76)
ED mothers (ED-M)	31	51.37 (4.79)	24.76 (4.05)	15.32 (2.34)	5.76 (4.42)

* 8 BN participants and 4 control participants did not fulfill all the questionnaires due to emotional and technical reasons

MEASURES

SUBJECTIVE EVALUATION - SELF REPORT SCALES

TAS-20 – The Toronto Alexithymia Scale (30, 31). the 20 items of the TAS-20 are divided into three subscales: difficulty in identifying feelings (DIF, 7 items), difficulty in describing feelings (DDF, 5 items) and externally oriented thinking (EOT, 8 items). Preliminary evidence of the reliability and factorial validity of the TAS has been previously established. The TAS-20 is now considered as one of the most widely used measures for the assessment of alexithymia (32). The internal validity for the Hebrew version was evaluated in our previous study (Cronbach's alpha=0.89) (19). The TAS represents the subjective assessment of difficulties in recognizing internal emotions and is used in this study to correlate subjective awareness with the emotionally- and socially-related abilities presented in the experimental tasks (recognizing emotions of the self vs. emotions of others).

OBJECTIVE EVALUATION: SOCIAL COGNITION AND THEORY OF MIND

Tasks were computerized run with IBM ThinkPad laptop with a screen size of 28cm

- Basic emotions naming.** Participants were presented with a facial expression stimulus (33) and four optional definitions of emotions (angry, happy, confused, sad) and were asked to choose the definition of the emotion that best describes the facial expression. There was no time limitation for this task (see Figure 1 for example). (Reported alpha Cronbach = 0.85-0.89) (33).

- Facial expression matching in a split visual field task:** Each trial began with a fixation point presented at the center of the screen

Figure 1. Participant has to choose the correct emotion to describe the picture:

- Angry
- Happy
- Confused
- Sad

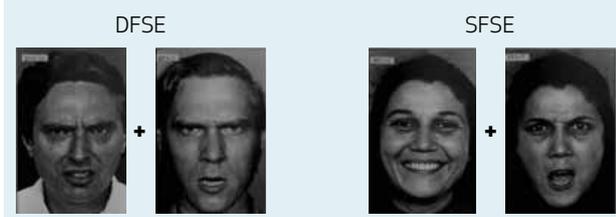


for 100 ms (millisecond). Then, the stimuli were presented for 180 ms. A blank screen was presented while waiting for response for no longer than 2,900 ms (or until the participant responded). The interval was 2 s. The stimuli were presented 1° of visual angle from the center of the screen (inner edge). In order to control for the visual fields location, participants used a chin rest to fix the head position 57 cm distance from the center of the screen. The size of the pictures size 1.5x2 cm. The first 36 trials were for practice and were not analyzed. The aim was to get the participants used to the speed of the

tasks and memorize the response keys. During the practice mode participants received feedback stating whether their response was true or false. The practice block was followed by two blocks of 44 trials with a short break in the middle. There were four possible conditions: 42 trials of Same Face Same Emotion (SFSE); 42 trials of Same Face Different Emotion (SFDE); 42 trials of Different Face Same Emotion (DFSE); and 42 trials of Different Face Different Emotion (DFDE).

Participants were given this task twice. On the first examination they were asked to match the facial photo with the respective emotion (pressing the “same” key for similar facial expression and emotion and the “different” key when the facial expression and the described emotion were different (see Figure 2 for example). In the second task, the participants were presented with pairs of similar or different faces showing similar or different emotions. They were asked to ignore the emotions and focus their attention on the identity (ID) of the face in the photo, thus pressing the “same” key in the case of the same face in the two photos and the “different” key for different faces. We analyzed the difference between the two tasks to eliminate the effect of focusing on the emotion as well as possible interpersonal differences in perception. The stimuli were presented at the left visual field (LVF), the right visual field (RVF) or bilateral visual fields (BVF) – one photo in each visual field. This paradigm allows for the testing of the separate function of each hemisphere function (LVF and RVF) and of inter-hemispheric connectivity (BVF). We analyzed the difference in performance between the emotion task and the ID task. Since the stimuli were identical in both tasks, and the only manipulation used was with the instructions (“pay attention to the identity or to the emotion”), this paradigm may assist in eliminating possible interference of personal differences in facial perception. Accordingly, we calculated the difference between performance at the Identity task and the Emotion task into a variable that reflects the emotional attention.

Figure 2. an example of stimuli. On the left there are photos of different persons both presenting angry face (Different Face Same Emotion – DFSE). On the right there are photos of the same person presenting happy vs. angry face (Same Face Different Emotion – SFDE)



In this novel task, created specifically for this experiment, emotional animated cartoons were presented. The participants were asked to complete a sentence describing the emotional state or motivation of the presented cartoons. The task offered forced choice decision out of two options; both might be rationally correct, but only one referred to the emotional context, which was the better choice and considered as true for this task. In this task there were a large range of emotions (in contrast to the two other computerized tasks that only tested basic emotions).

There were three conditions (blocks): block 1 – one animated figure (SI-1); block 2 - an interaction between two or three figures (SI-2); block 3 - a multilevel interaction (this condition was similar to an animated comic’s story – SI-3). The participants viewed the whole “story” at the same time with captions pointing to the time line (which was always from right to left and top – down). The importance of this task was that emotion recognition was in a context, assessing the participants’ understanding of motivations and causality in the situation.

Fifteen trials were presented in each block.

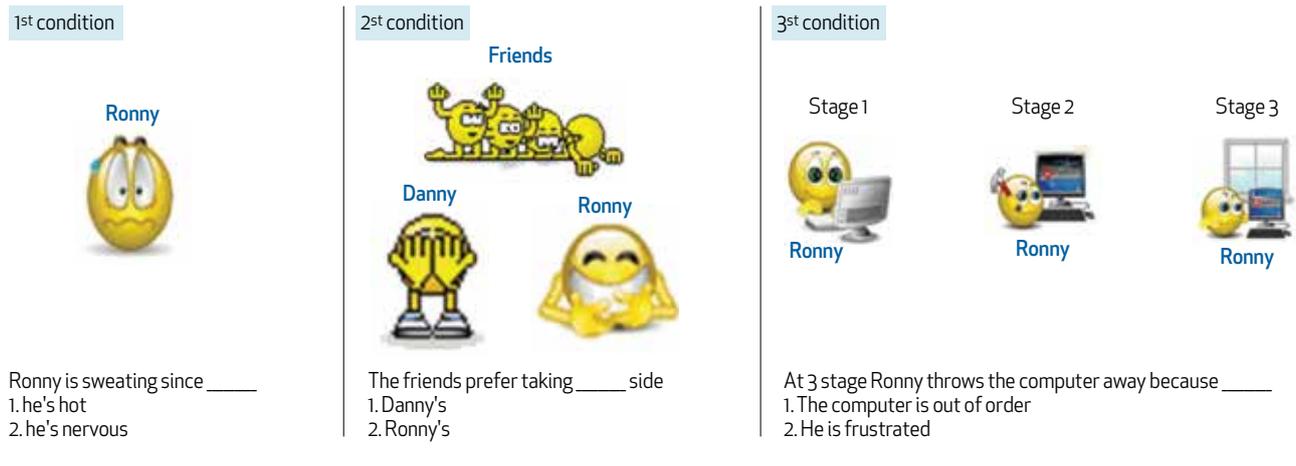
Since this task was created and used for the first time in this study, we tested its reliability. Reliability test for this task was computed among the experimental groups and non-reliable items were removed from analyses. The internal reliability of the task was also assessed in a preliminary testing of a group of 40 psychology students not including the experimental groups. During the pre-test, some items were removed from the analyses due to low reliability or accuracy of less than 45% likely suggesting that the item was not difficult (which would have brought the results to a chance level), but systematically confusing. Accordingly, we removed four items from the first block, three from the second block and five from the third block. Following this procedure, the internal validity of the 33 items left was: Cronbach’s Alpha = 0.846.

Eating Attitudes Test-26 (29) is a self-reported presence of pathological eating-related preoccupations attitude and behaviors, includes three subscales: (a) dieting, refraining from fatty food, and preoccupation with physical appearance; (b) bulimic symptomatology and preoccupation with food; and (c) personal control over eating habits. This inventory served for screening with a cut-off point of 20.

PROCEDURE

All participants, and their parents in the case of minors under age 18, gave their written informed consent to participate in the study. The research was approved by

Figure 3. Example for the three conditions of the Social Interpretation (SI) task



the Ethics (Helsinki) Committee of the Sheba Medical Center the Rambam Medical Center in Haifa, Israel, and the Ethic Committee of the University of Haifa.

Two experienced child and adolescent psychiatrists independently interviewed the inpatients. ED diagnosis according to the criteria of the DSM-IV (34) was established using the Eating Disorders Family History Interview (35). The degree of inter-rater reliability (according to the correlation coefficient procedure) between the two interviewers for the EDFHI and the SCID-I/P was $r=.91$. Only those participants for whom there was unanimous agreement as to their ED diagnosis were included in the study.

For the control group, a first session was held with each potential participant individually to screen out those with potential psychiatric disorders, medical disorders and ED symptoms. The controls were interviewed using a structured interview assessing demographic and clinical variables, including weight history and current weight and height, menstruation history and current menstruation status, life-time and current psychiatric and medical disorders, and life-time and current use of psychotropic and other medications. They also filled a screening self-report scale for ED (29). Only those control participants (34 out of 36 volunteers) with no pathological EAT-26 scores ($EAT-26 > 20$) and with a normal reported body-mass index (BMI) of at least 18.5 kg/m^2 were included in the study.

The self-report questionnaires and the computed tasks were administered individually in random order by graduate clinical psychology, who were blind to the participants' self-report outcomes.

Participants in the ED group (both mothers and daughters) were paid 90 NIS for travel and time expenses.

The mothers were asked to participate along with their daughters. When both mother and daughter agreed to participate an appointment was set.

*We found low levels of commitment from some participants, who dropped out during the study and never returned or filled in all the questionnaires. This was one of the greatest limitations of the study. Thus, we only calculated tests that were completed, which affected the significance levels and interfered with covariance tests for depression and anxiety. However, for the alexithymia level and the computerized tasks, data were collected at the first session, thus this was complete.

The procedure with respect to minors under the age of 18 was similar to that carried out for the ED participants. Control participants were asked to report their age, weight, height and education in a previous telephone interview. They were also asked about current or past ED or other psychopathology in first degree relatives. Two control participants reached the cut off-point criteria for suspected ED, another two control female adolescents had a borderline BMI, two of the control mothers had obesity, one control mother reported of a past ED. In all these cases we carried out an interview based on DSM-IV criteria to screen for ED, none of the suspected ED had past or active symptoms of ED and they were included in the study.

RESULTS

To examine the first hypotheses suggesting that participants with ED and their mothers will present higher levels of alexithymia compared with the control group and they will be less accurate in objective emotions rec-

Table 2. Differences between daughters with EDs and their mothers and control daughters and their mothers in self-rating scales for alexithymia and social function and attentional emotional tasks

	Daughters				Mothers			
	Scales of the TAS							
	Control (N=33)	B/P-ED (n=27)	F	Effect size (t)	Control (N=27)	B/P-ED (n=23)	F	Effect size (t)
TAS (total)	38.66 (10.41)	55.33 (15.3)	25.876**	-0.537	40.44 (9.79)	42.76 (13.31)	.577	-0.09
TAS (Difficulty Identifying Feelings)	13.03 (5.08)	21.85 (7.54)	30.239**	-0.56	13.91 (5.37)	15.01 (7.5)	.442	-0.08
TAS (Difficulty Describing Feelings)	9.03 (4.01)	14.67 (5.49)	26.215**	-0.50	9.44 (3.68)	11.36 (4.26)	3.334 (marginal)	-0.23
TAS (Externally Oriented Thought)	16.61 (4.99)	18.81 (5.73)	1.81	-0.2	17.09 (5.52)	16.36 (5.22)	.260	0.07

% accuracy	Daughters				Mothers			
	Objective computerized tasks							
	Control (N=33)	ED (n=27)	F	Effect size (t)	Control (N=27)	ED (n=23)	F	Effect size (t)
BL (difference: ID-Emotions)	10.52 (9.3)	13.39 (12.86)	0.823	-0.13	12.37 (10.83)	19.49 (12.29)	4.739*	-0.61
LVF (difference: ID-Emotions)	9.39 (10.32)	6.09 (10.68)	1.204	0.15	10.65 (10.68)	14.36 (12.42)	1.293	-0.16
RVF (difference: ID-Emotions)	10.19 (11.84)	11.53 (8.79)	0.194	-0.06	16.27 (12.18)	17.78 (12.04)	.193	-0.12
Naming	82.41 (7.51)	78.41 (9.82)	2.575	0.22	80 (8.2)	80.65 (8.3)	.078	-0.04
SI1	77.49 (17.71)	77.27 (18.91)	0.002	0.01	65.81 (19.36)	68.23 (19.03)	.196	-0.07
SI2	83.33 (13.3)	82.73 (12.02)	0.027	0.02	73.7 (14.71)	73.91 (18.27)	.002	0
SI3	79.17 (16.98)	81.25 (13.22)	0.221	-0.07	63.89 (16.01)	63.04 (16.33)	.033	0.03

*P<.05, **p<.01

ognition and the social cognition tasks, we conducted ANOVA test with four groups. Table 2 summarizes the differences between research and control participants and their mothers.

The first hypothesis (between groups’ differences) was only partially confirmed. For subjective evaluation we found significant differences between the patients with B/P-ED and the control group. Compared to controls, daughters with B/P-EDs evaluate themselves with higher alexithymia on the TAS scales with the exception of Externally Oriented Thinking (EOT). For the mothers’ group, we found that the mothers of B/P-ED were only marginal different from control mothers in Difficulty in Describing Feelings (DDF) scale of TAS, but not in the general score and the other subscales.

In the objective tests, no significant differences were found between the daughters’ groups. Interestingly, differences were found between the mothers’ groups. Mothers of patients with B/P-ED had a greater difference between their attention on the identity task and their attention on the emotion task in comparison to mothers of controls in the bilateral visual field (BVF) condition. We carefully suggest the possibility of dysfunction of hemispheric connectivity for emotional attention among the mothers of B/P-ED patients. Mother of B/P-ED patients had more attentional bias in the emotional task in the BVF condition than mothers of controls. No significant difference was

found in the performance of the other social cognition tasks (see Table 2).

As for the second hypothesis, about the within participants correlation of the subjective vs. objective tasks, results were mixed. We used multi-correlation tests for this pioneer study to get a hint of possible patterns.

Among the daughters two between group difference were detected: first, a significant correlation between the TAS subscale measuring difficulty in identifying feelings (DIF) and basic emotions recognition part of the SI task (block 1 – one animated figure) was significant only for the B/P-ED group but not for the controls. Secondly, the B/P-ED group showed a negative correlation between TAS subscale measuring Externally Oriented Thinking (EOT) and the ability to ignore emotions on the LVF (right hemisphere), whereas the controls did not. This last result may suggest the likelihood of a difference in hemispheric function among the two populations.

Among the mothers there were also two main differences. Firstly, the TAS scores of the control mothers were negatively correlated with their ability to ignore emotions at the BVF condition, indicating that low alexithymia is correlated with good hemispheric connectivity. By contrast, the mothers of B/P-ED patients revealed an opposite direction in the association between these two variables indicating low level of alexithymia is correlated with poor hemispheric connectivity. Secondly, SI-1 task (simple

recognition) correlated positively with TAS Externally Oriented Thinking (EOT) subscale among the mothers of B/P-ED patients and negatively among the control mothers.

The third hypothesis postulated a positive mother-daughter correlation within both the ED and the control dyads in the objective and subjective tests. To test this, we computed Pearson correlation within each group, matching the mothers and daughters, and then compared the correlations using Fisher *r*-to-*z* transformation. Thus, we assessed the differences in the associations between the TAS (subjective evaluation of the ability to recognize emotions) and the computerized tasks (objective evaluation of the ability to recognize emotions) among the research and control participants (for daughters and mothers separately). Within the computerized task, we measured both the ability to recognize emotions and the ability to ignore emotions (the identity task in which the participants were asked to decide whether the same person presented twice while ignoring the emotion). Table 3 summarizes the results of these analyses. Only significant results are presented.

We assessed differences in the association of daughters-mother variables at the social identity objective tasks (see Table 3 for the results, only significant results are presented).

Several significant correlations were found between mothers and daughters of both groups for the different scales of the Social Interpretation (SI) task, which represent a trend, but only one between-group difference emerged. Thus, the SI3 scale of the mothers was significantly correlated with the SI1 scale of the daughters in

Table 3. Correlations and Z-score between the TAS and the computerized objective tasks (face recognition/ignoring affect and the split visual field tasks) among ED patients and control mothers and daughters

	Variables	Controls (r)	B/P-EDs (r)	Z-score DF=24, 31
Daughters	Difficulty Identifying Feelings & Basic Emotions Recognition	.071, ns	.517, p<.05	2.32, p<.05
	External Oriented Thought & Identity Task-Left VF	-.241, ns	-.436, p<.05	-2.6, p<.01
Mothers	TAS & Identity Task-Bilateral VF	-.38, p=.06	.33, ns	2.64, P<.01
	Difficulty Identifying Feelings & Identity Task-Bilateral VF	-.436, p<.05	.33, ns	2.88, P<.005
	External Oriented Thought & Identity Task-Bilateral VF	-.372, p=.09	.139, ns	1.88, p=.06
	External Oriented Thought & SI-1	-.208, ns	.69, p<.05	2.12, p<.05

*P<.05, **p<.01

the ED group but not among the controls. Interestingly, Table 4 demonstrates that as the SI task becomes more complicated, the associations between the mothers' and daughters' scales are weaker, specifically in the case of the ED dyads. One can see that for the simple tasks, there are mother-daughter correlations in both groups, however, as the tasks became more complicated, the correlation between ED daughters and their mothers disappeared.

We also correlate the subjective evaluation of alexithymia among mother-daughter's dyads and found no significant interactions and no significant differences between the groups' correlations.

DISCUSSION

This study was designed to test emotional and social interpretation in an objective vs. subjective evaluation among people with B/P-ED and their mothers.

First, we referred to the objective tasks of emotion recognition, in which no special difficulty was found among all participants (all four groups), similar to findings from anorexia research in previous studies (5, 6, 17, 18, 36, 37). The only significant difference between the mothers' groups was found in an objective task that was designed to test the ability to ignore emotions. The B/P-ED mothers ignored emotions better than the control mothers when the stimuli were presented to both hemisphere simultaneously (which is the natural presentation in everyday life). Control mothers could not ignore the emotions presented to them. As for the subjective evaluation of alexithymia, we found differences between B/P-ED participants and control daughters (but not the between mothers' groups).

It is interesting to see that the B/P-ED daughters considered themselves less able to recognize emotions as measured by their alexithymia scale (although they had no objective difficulty), while their mothers did not.

Table 4. Correlations between ED and control daughters-mothers dyads

Variables	Control (r)	B/P-ED (r)	Z-score DF=30, 29
SI-1-mothers & daughters	.681, p<.05	.682, p<.05	-.01, ns
SI-1-mothers & SI-2-daughters	.56, p<.05	.336, p<.05	1.02, ns
SI-1-mothers & SI-3-daughters	.549, p<.05	.475, p<.05	.45, ns
SI-2-mothers & SI-1-daughters	.734, p<.05	.474, ns	1.52, ns
SI-2-mothers & SI-2-daughters	.41, p=.05	.179, ns	.92, ns
SI-3-mothers & SI-1-daughters	.58, p<.05	.104, ns	2.01, p<.05
SI-3-mothers & SI-2-daughters	.365, p<.05	.216, ns	.59, ns

*P<.05, **p<.01

This raises a question about why a daughter who can interpret social situations and recognize emotions feels as if she is unable to.

Although no between-group differences were found in the two objective neuropsychological tasks assessing social cognition, significant differences were shown for the association of these parameters with the subjective evaluation. **The worse they value themselves, the better they performed.** This may be connected to the negative correlation between externally oriented thought and the right hemisphere function (RH=LVF) among the B/P-ED daughters. Higher external orientation is correlated with greater attention to emotions – they become more sensitive. It is opposite to the controls, and may reflect that their external orientation is biased for emotions. These results match previous findings about alexithymia among B/P-ED (9) and add a neuropsychological perspective to the process. However, these findings should be carefully handled due to the statistical limitations presented in the method section.

Among the mothers, we found a different correlation between self-rating of alexithymia and bilateral functioning. While control mothers showed the expected negative correlation between alexithymia and ignoring emotions, ED mothers showed the opposite trend. **The ED mothers ignored emotions, without reporting alexithymia.** In particular, among the ED mothers, lower external orientation leads to lower social cognition as expected. However, it is harder to explain why, among the controls, high external orientation impaired the ability to judge emotions, opposite to the ED mothers. It may be that the difficulties to identify emotions overwhelm them and they become more sensitive and henceforth pay more attention to them.

As for the daughter-mother dyads, one can see that control mothers' ability to address complex situations (SI-3) positively affects their daughters' ability to recognize emotions. This correlation was not found for the ED dyads.

In 1995 Fonagy and Target (37) hypothesized that the care-givers who had emotional difficulties in the past will tend to have uncontrolled hypersensitive response to the negative emotions of the infant. In these cases, they hypothesized that the care-giver will respond with biased mirroring. They will either highlight and increase the distress or ignore the emotion and express a response that is different from the infant's emotions. She can ignore it or smile while the infant is frustrated, angry or sad. In these cases, the infant may have difficulties developing introspective and mentalizing abilities.

Norris et al. (38) proposed that social and emotional processing are highly intertwined and interrelated in the brain. Attentional bias was found among ED patients referring to anger, criticism and social rank (16, 39). B/P-ED patients were as accurate in emotional recognition as the control group, which does not mirror earlier findings on anorexia (16, 40). However, there is lack of research about B/P-ED and especially bulimia. Kenyon et al. (18) found that in Theory of Mind task, overall performance in BN and EDNOS-BN groups was equivalent to controls. Legenbauer, Vocks and Rüdell (40) found results that are similar to ours. They found significant difference for emotional self-awareness but no difference from controls in emotion recognition, except minor effect for surprise faces. In the current study reduced effects may also be due to low power, high variance, and poor salience of the stimuli. The greatest advantage of the current study was the testing of the mothers, which is an issue that was not addressed earlier. Our findings suggest that the emotion recognition seems to be impaired among B/P-EDs and their mothers. However, there may be differences in more complex socio-emotional situations.

Study limitations: This is a pioneer study, using new social cognition tasks. We tested many elements that may be affected by the disorder, including bilateral connectivity and subjective evaluation of one's ability to understand emotions. We understand that there might be statistical limitation to the study, thus the results should be repeated. However, results fit clinical observation of patients reporting significant social difficulties and lack of emotional validation, with hypersensitivity to others' emotions.

Another limitation was the collaboration of participants that was partial in some cases and typical for ED patients. As noted before, participation was not completed. In order to make participation comfortable for participants they were allowed to withdraw at any stage, causing some missing data or performance that was not totally concentrated all the time. This was a limitation due to the relatively small sample available for such research in Israel. Ceiling and floor effect were also presented in some of the tasks. Ceiling effect was found in the first level of EI task, and floor effect was found among the mothers at the SVF task (50% errors in force choice between two options, in one of the conditions).

CONCLUSIONS

As in previous research, we did not find significant differences in accordance with emotion recognition in

participants with EDs and their mothers. However, there is some bias in the way they process emotions and especially in complicated social situations. This issue should be further investigated with more sensitive and accurate tools, such as functional instance brain imaging. We believe that although the study had statistical limitations, it presents an important trend that may explain many clinical observations. Thus, for clinical application, it may be suggested to put focus on emotional understanding.

The role of alexithymia is clearly relevant in the treatment of ED and should be addressed in therapy. The issue of family treatment was also raised by the findings. It is clear that there are differences between ED daughters and their mothers in perception and understanding of interpersonal situations that may contribute to the maintenance of ED. It is also important to increase clients' confidence in their ability to judge social-emotional situations. These girls feel like their evaluation is wrong most of the time, which may lead to higher sensitivity to others' emotions at the expense of their own.

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