

Psychosocial stress differentially affects emotional empathy in women with borderline personality disorder and healthy controls

Wingenfeld K, Duesenberg M, Fleischer J, Roepke S, Dziobek I, Otte C, Wolf OT. Psychosocial stress differentially affects emotional empathy in women with borderline personality disorder and healthy controls

Objective: Deficits in empathy, an important part of social cognition, have been described in patients with borderline personality disorder (BPD). Importantly, psychosocial stress enhances emotional empathy in healthy participants. However, it remains unknown whether stress affects empathy in BPD.

Method: We randomized 47 women with BPD and 47 healthy women to either the Trier Social Stress Test or a control condition. Subsequently, all participants underwent the Multifaceted Empathy Test (MET), a measure of cognitive and emotional facets of empathy.

Results: Across groups, stress resulted in a significant increase in cortisol and stress ratings. There was a significant stress \times group interaction for emotional empathy ($F_{df1,92} = 5.12$, $P = 0.04$, $\eta_p^2 = 0.05$). While there was no difference between patients with BPD and healthy participants after the control condition, patients with BPD had significantly lower emotional empathy scores after stress compared to healthy individuals. There were no effects for cognitive empathy.

Conclusion: The current finding provides first evidence that stress differentially affects emotional empathy in patients with BPD and healthy individuals such that patients with BPD showed reduced emotional empathy compared to healthy women after stress. Given the strong impact of stress on acute psychopathology in patients with BPD, such a response may exacerbate interpersonal conflicts in stress contexts and may be an important target for therapeutic interventions.

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Key words: psychosocial stress; emotional empathy; cognitive empathy; borderline personality disorder; cortisol

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Significant outcomes

- Psychosocial stress differentially influenced emotional empathy in patients with borderline personality disorder (BPD) and healthy controls.
- There was no impairment in emotional and cognitive empathy in BPD in a non-stressful control condition. However, after stress, patients with BPD showed less emotional empathy compared to healthy individuals.
- Reduced emotional empathy after stress may exacerbate interpersonal conflicts, which fits to the clinical observation that stress impacts acute psychopathology in BPD.

Limitations

- Only women were included in this study. Therefore, no conclusions can be drawn with regard to men.
- A high proportion of patients with BPD were medicated and suffered from comorbid psychiatric disorders.

Introduction

Social cognitive abilities are impaired in several mental disorders, including borderline personality disorder (BPD) (1). Of note, many of the symptoms seen in BPD occur within social contexts. This has led to the hypothesis that BPD is characterized by aberrant social cognition (1, 2). While many studies in BPD focus on mentalizing abilities (3) or facial emotion recognition (4), only little is known concerning empathy, another important aspect of social cognition. Empathy consists of at least two components: a cognitive component, which captures the capacity to infer others' mental states (5), and an affective component, that is an observer's emotional response to another person's emotional state (6). One task to measure empathy is the 'Multifaceted Empathy Test' (MET) (7), which is a well-validated task to assess the two main components of empathy: cognitive and emotional empathy. With respect to BPD, one previous study found impaired emotional and cognitive empathy in the MET (8), while another did not find deficits (9). This is in line with other equivocal findings on social cognition in BPD suggesting either impaired social cognition, no alterations, or even better performance in patients compared to healthy controls (see e.g. 1, 2, 10, for review). There are several potential explanations for these inconsistencies. Comorbid psychiatric disorders, especially post-traumatic stress disorder (PTSD), a history of childhood trauma as well as emotion dysregulation have been shown to influence social cognition, including empathy in patients with BPD (2, 11). Furthermore, differences in the used tasks might be important, for example, task complexity or difficulty (12). Interestingly, deficits were mostly found in more socially interactive paradigms (10). Perceived stress seems to be another important factor contributing to dysfunctional social cognitive abilities in BPD (1, 12). This hypothesis is strengthened by studies showing that patients with BPD are more sensitive to social rejection and negative evaluation (e.g. 13, 14). Therefore, it is worth looking at the association between stress and social cognition, especially empathy. Importantly, in healthy individuals, several studies suggested

beneficial effects of stress on social cognition (e.g. 15–17). Most studies in the field used a well-validated psychosocial stress paradigm the 'Trier Social Stress Test (TSST)'. Using the TSST, it has been shown that empathy for pain in others was enhanced after the stressor (18). Another study found that healthy young men showed enhanced prosocial behaviour in terms of trust, trustworthiness and sharing behaviour after psychosocial stress (group version of the TSST) (19). Furthermore, Deckers and colleagues reported an increase in emotion recognition performance after the TSST (16). Interestingly, a recent study by Wolf and colleagues found enhanced emotional empathy after the TSST in young healthy men, while cognitive empathy was unaffected by stress (17). These results are in line with the 'tend-and-befriend' hypothesis (20, 21). This concept predicts enhanced prosocial behaviour in response to a stressor instead of the well-described 'fight-and-flight' response (22).

Only very few studies investigated the effect of stress (hormones) on social cognition in patients with BPD, which is surprising as BPD symptoms often exacerbate under stress. One study found better facial recognition after psychosocial stress with no differences between patients with BPD and controls (16). This is in line with our own data showing higher emotional empathy scores after mineralocorticoid receptor (MR) stimulation in women with BPD and healthy women (9).

Aims of the study

The primary aim of the study was to investigate whether stress differentially affects empathy in healthy individuals compared to patients with BPD, which is suggested by several studies and clinical observations (1). In our study, we used the MET as a behavioural task instead of mere self-report. Using the MET also allowed us to differentiate between cognitive and emotional empathy. We hypothesized reduced empathy after psychosocial stress in patients with BPD compared to a control condition. Furthermore, we assumed emotional but not cognitive empathy to be

increased after psychosocial stress compared to a control condition in the control group of healthy women (17).

Methods and material

Participants

In total, 47 women with BPD and 47 healthy women completed the study. Of note, current major depressive disorder as comorbid disorder (MDD) led to exclusion from the study. We decided to do so because depression not only influences HPA axis function, but cortisol effects on cognition differ between BPD patients with and without MDD (23, 24). Participants were further excluded if they had any of the following medical conditions: CNS diseases or severe somatic diseases, metabolic or endocrine diseases, autoimmune diseases, current infections or pregnancy. Further exclusion criteria were schizophrenia, schizoaffective disorder, bipolar disorder, depressive disorder with psychotic features, anorexia, alcohol or drug abuse and dependence in the last 6 months (all assessed by DSM-IV SCID axis I Interview). Written informed consent was obtained from all participants. Healthy participants were recruited by local advertisement and received financial remuneration (100€, for healthy controls only). The study was approved by the local ethics committee.

Procedure

Borderline personality disorders were diagnosed using the Structured Clinical Interview for DSM-IV axis II (25). Furthermore, DSM-IV axis I disorders were assessed by SCID I.

In this study, a between-subject design was used, as no parallel versions of the MET exist. Participants were randomized to either the Trier Social Stress Test (TSST) or a control condition (Placebo (P-)TSST). Subsequently, all participants underwent the Multifaceted Empathy Test (MET), measuring cognitive and emotional empathy. The participants were tested in a quiet room and were only allowed to drink some water.

The TSST or P-TSST took place in the afternoon and begun at approximately 16:00 h. The MET started 65 min after the stressor. We applied several memory tests before the MET started. The memory results will be presented elsewhere.

We collected saliva for cortisol analyses and measured blood pressure at the following time points: -15 min, 0 (baseline measurements:

15 min and directly before the (P-)TSST), +20 min (directly after the (P-)TSST), +30, +45 and +80 min.

Twenty-two patients with BPD and 23 healthy women underwent the TSST, while 25 patients with BPD and 24 healthy women performed the P-TSST.

Stress induction

We used the Trier Social Stress Test (TSST) as a standardized psychosocial stress test (26) and a control condition, the Placebo-TSST (P-TSST) (27). The TSST consists of a preparation phase (5 min) followed by a speech in front of a trained audience (5 min) and an arithmetic task (5 min). The TSST reliably induces activation of the HPA axis and sympathetic nervous system (SNS). The Placebo-TSST is designed to be as similar as possible to the TSST (including orthostatic load) without being stressful to the participant. In an empty room, the participant is asked to talk aloud about a topic of his choice after a preparation phase. Afterwards, the participant is asked to add up the number 15 starting at 0.

We used a frequent used nine-item questionnaire to assess the subjective stressfulness of the TSST and the P-TSST (28). The participants were asked to rate how challenging, strenuous, controllable, difficult, stressful, new and threatening the task was, whether they performed well and the extent of their personal involvement. The questionnaire was administered before and after the (P-)TSST.

To assess state dissociation, the short version of the Dissociation-Tension-Scale acute, (DSS-4) (29) was administered before and after the (P-)TSST as well as after the MET. Additionally, self-reported depression was assessed with the Beck Depression Inventory (BDI) (30).

Measurement of blood pressure and salivary cortisol

Systolic and diastolic blood pressure was assessed by an automatic device (Carescape 169 V100, GE Healthcare).

After collection, saliva was kept at -80°C until biochemical analysis. Free cortisol concentrations were determined in the Neurobiology Laboratory of the Department of Psychiatry, Charité –Universitätsmedizin Berlin, Campus Benjamin Franklin. Intra-assay coefficients of variation were below 8%, and interassay coefficients of variation were below 10%. The limit of detection of free cortisol was 0.2 nm. All samples and standards were measured in duplicates (for detailed description, see 31).

Multifaceted empathy test (MET)

To assess cognitive and emotional empathy, the 'Multifaceted Empathy Test' (MET) was used (7) in a modified version (8, 32, 33), which was also used in our recent studies (9, 31). Briefly, the MET is a PC-assisted test consisting of photographs that show 30 picture stimuli with people in emotionally charged situations. To assess cognitive empathy, participants were required to infer the mental state of the subject in the photo and were asked to indicate the correct one from a list of four. To assess emotional empathy, participants were asked to rate the degree of empathic concern they felt for the person in the picture (Likert scale, 0 = not at all, 9 = very much).

Statistical analysis

Statistical analyses were performed using SPSS version 22.0. Demographic data were analysed using Pearson's chi-squared test for categorical data and Student's *t*-test for continuous data.

Effects of stress on social cognition were analysed using analysis of variance (ANOVA) with the main factors stress (TSST vs. P-TSST, between-subject design) and group (BPD vs. controls). Cognitive and emotional empathy scores served as dependent variables. Partial η^2 was used as effect size, with $\eta_p^2 = 0.01$ – 0.039 representing small effects, $\eta_p^2 = 0.04$ – 0.139 representing mediate effects and $\eta_p^2 \geq 0.14$ representing large effects (34).

Questionnaire data were also analysed using ANOVA with the main factors stress (TSST vs. P-TSST, between-subject design), time (before and after (P-)TSST, within-subject design) and group (BPD vs. controls).

Cortisol and blood pressure were analysed by 2 (stress) \times 2 (group) \times time (6 measurement points, repeated measurement/within-subject design) ANOVA. As cortisol and blood pressure

values were not normally distributed, log transformation was used.

All reported results were corrected by the Greenhouse–Geisser correction if assumption of sphericity was violated.

Partial correlations were used to calculate associations between cortisol, blood pressure, questionnaire data and empathy scores in TSST and P-TSST, respectively, controlling for group.

Results

Demographic and clinical data

In patients with BPD, the following current comorbid DSM-IV axis I disorders were reported as follows: panic disorder $n = 4$, agoraphobia with panic $n = 3$, social phobia $n = 7$, generalized anxiety disorder $n = 2$, obsessive–compulsive disorder $n = 7$, PTSD $n = 20$, bulimia nervosa $n = 5$, substance abuse $n = 2$, alcohol abuse $n = 1$. Of note, comorbid MDD was an exclusion criterion.

Fifteen patients with BPD were free of medication, while 33 took psychotropic medication (P-TSST: $n = 5$ without, $n = 20$ with medication; TSST: $n = 9$ without, $n = 13$ with medication; $P = 0.12$). Out of these 33 medicated patients, four took three and 11 took two different drugs, while 18 patients received monotherapy. The medication included selective serotonin reuptake inhibitors (SSRI) $n = 19$, serotonin and noradrenaline reuptake inhibitors (SNRI) $n = 8$, tricyclic antidepressants $n = 3$, dopamine and noradrenergic reuptake inhibitors (NDRI) $n = 2$, antipsychotics $n = 9$, anticonvulsants $n = 6$, alpha/beta-adrenergic blocker $n = 5$. All healthy controls were unmedicated.

Patients with BPD and healthy women did not differ with regard to age, years of education and body mass index. BDI scores were significantly higher in patients compared to healthy women, which is a typical finding in BPD (23). There were significantly more smokers in the patient group, while more healthy women took oral contraceptives (OC). Thus, we also tested whether smoking or intake of OC influenced our results using ANCOVA. Sample characteristics are presented in Table 1.

Cortisol release and blood pressure

Three patients with BPD refused to collect saliva, because they felt awkward to chew on salivettes. There were missing data for one further patient at two measurement points. Thus, complete cortisol data were available for 43 patients with BPD. In the control group, 45 complete data sets were

Table 1. Sample characteristics

	Healthy women	BPD	Statistics (<i>t</i> -test/ χ^2)
Age (mean/SD)	30.2 (8.1)	28.9 (7.3)	$P = 0.41$
Years of school education (mean/SD)	11.8 (1.4)	11.5 (1.7)	$P = 0.43$
Body mass index (mean/SD)	22.5 (2.7)	23.6 (7.1)	$P = 0.11$
Smoker (yes/no)	8/38	25/20	$P < 0.001$
Intake of oral contraceptives (yes/no)	21/25	12/33	$P = 0.06$
Beck Depression Inventory (BDI) (mean/SD)	2.4 (0.4)	28.6 (9.9)	$P < 0.001$

BPD, borderline personality disorder

available. Compared to the P-TSST, the TSST evoked a stronger increase in cortisol release (main effects of time $F_{df5,420} = 23.28$, $P \leq 0.001$, stress $F_{df1,84} = 9.59$, $P = 0.003$ and stress \times time interaction effect $F_{df5,420} = 10.35$, $P < 0.001$). There were no main effects of group or group \times time/stress interaction effect (all $P > 0.57$) (see Figure 1).

Concerning blood pressure, the following effects could be detected as follows: systolic blood pressure: main effect time ($F_{df5,430} = 3.13$, $P = 0.007$), a trend for main effect group ($F_{df1,86} = 2.97$, $P = 0.08$), stress \times group interaction effect ($F_{df1,86} = 3.79$, $P = 0.05$); diastolic blood pressure: main effect time ($F_{df5,435} = 5.77$, $P < 0.001$), main effect group ($F_{df1,87} = 3.83$, $P = 0.05$), trend stress \times time interaction effect ($F_{df5,435} = 1.86$, $P = 0.10$), stress \times time \times group interaction effect ($F_{df5,435} = 2.55$, $P = 0.02$). As depicted in Figure 1, blood pressure was most pronounced after the TSST but only in healthy women.

Ratings of subjective stressfulness and state dissociation

In the stress questionnaire, we found significant main effects of stress, time, group and significant stress \times time interaction effects for the following items: challenging, strenuous, controllable, difficult, stressful, threatening and performed well. For the rating whether the situation was threatening, the main effect of stress was absent. Concerning the rating whether the situation was new, we found no significant effects and concerning personal involvement there was only a main effect of time. Detailed information including P values is given in Table 2. There were no group \times stress, group \times time or group \times stress \times time interaction effects, suggesting a similar psychological response to the stressor. Overall, both situations were rated as to be more stressful by the patients with BPD compared to healthy women.

Concerning state dissociation, we found significant main effects of time ($F_{df2,147} = 7.79$, $P = 0.001$) and group ($F_{df1,87} = 65.33$, $P < 0.001$) and a group \times time interaction effect ($F_{df2,147} = 5.36$, $P = 0.006$). As expected, patients with BPD reported stronger state dissociation. Increases in dissociation after the TSST and the P-TSST followed by decreases in dissociation scores were only seen in patients with BPD (see Table 2 for mean/SD).

Effects of stress on cognitive and emotional empathy

When analysing emotional empathy, we found a significant stress \times group interaction effect ($F_{df1,92} = 5.12$, $P = 0.04$, $\eta_p^2 = 0.05$). Furthermore, the main effect of group ($F_{df1,92} = 4.14$, $P = 0.02$, $\eta_p^2 = 0.06$) was significant but there was no main effect of stress ($P = 0.90$, $\eta_p^2 = 0.001$). While there was no difference between patients with BPD and controls after the control condition ($P = 0.84$, $\eta_p^2 = 0.001$), patients with BPD had significantly lower emotional empathy score after stress compared to healthy individuals ($P = 0.004$, $\eta_p^2 = 0.18$). Further *post hoc* tests within each group revealed non-significant changes concerning emotional empathy in response to stress compared to the control condition (control group: $P = 0.16$, $\eta_p^2 = 0.04$; BPD group: $P = 0.12$, $\eta_p^2 = 0.05$).

Concerning cognitive empathy, no main effect of stress ($P = 0.99$, $\eta_p^2 = 0.001$), group ($P = 0.95$, $\eta_p^2 = 0.001$) or stress \times group interaction effect ($P = 0.17$, $\eta_p^2 = 0.02$) could be revealed.

Results are shown in Figure 2.

Intake of oral contraceptives and smoking did not influence empathy scores (ANCOVA). Within the group of patients with BPD, we also analysed for explorative purpose whether patients with comorbid PTSD differed from those without PTSD. Neither for cognitive nor for emotional empathy did we find a main effect of PTSD or stress \times PTSD interaction

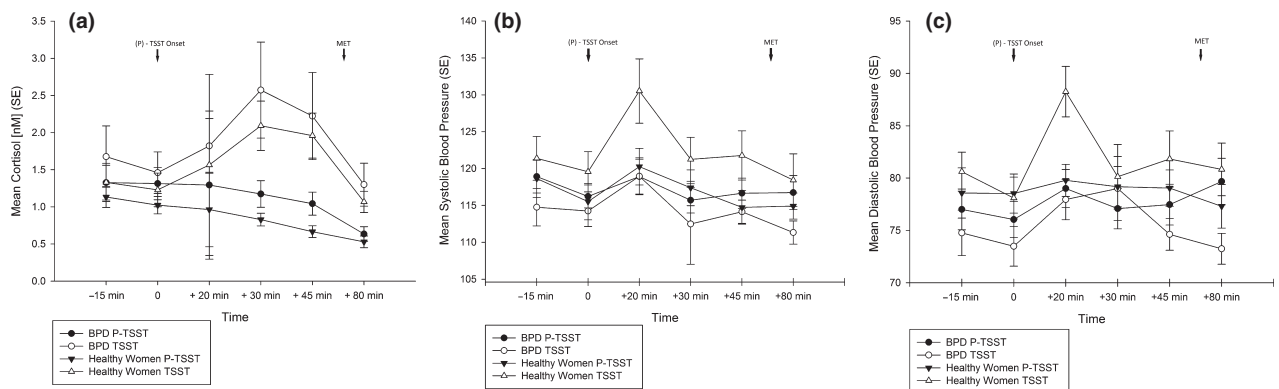


Fig. 1. (a) Salivary cortisol ($n = \text{nano mol/l}$) and (b) systolic and (c) diastolic blood pressure after Trier Social Stress Test (TSST) and the placebo version of the TSST (P-TSST) in patients with borderline personality disorder (BPD) and healthy women.

Table 2. Ratings of subjective stressfulness (mean/SD) after P-TSST and TSST

	Healthy women P-TSST	Healthy women TSST	BPD P-TSST	BPD TSST	Statistics (sign. effects only)
Challenging					
Before	3.3 (1.7)	4.1 (1.6)	4.8 (2.0)	4.6 (1.6)	group: $P = 0.007$ stress: $P = 0.004$ time: $P < 0.001$ stress \times time: $P = 0.007$
After	4.0 (1.7)	5.7 (1.6)	4.9 (2.0)	6.2 (1.8)	
Strenuous					
Before	2.8 (1.7)	2.7 (1.4)	3.8 (2.0)	3.4 (1.9)	group: $P = 0.003$ stress: $P = 0.005$ time: $P < 0.001$ stress \times time: $P < 0.001$
After	3.2 (1.7)	5.4 (1.5)	4.5 (2.2)	6.1 (1.5)	
Controllable					
Before	4.8 (1.5)	4.8 (1.0)	3.4 (1.5)	3.4 (1.7)	group: $P < 0.001$ stress: $P < 0.001$ time: $P = 0.03$ stress \times time: $P < 0.001$
After	5.5 (1.4)	3.3 (1.9)	4.0 (1.7)	2.1 (1.4)	
Difficult					
Before	2.7 (1.4)	2.7 (1.4)	3.8 (1.8)	3.2 (1.9)	group: $P < 0.001$ stress: $P = 0.008$ time: $P < 0.001$ stress \times time: $P < 0.001$
After	2.8 (1.4)	5.2 (1.9)	4.5 (2.1)	5.8 (1.7)	
Stressful					
Before	2.6 (1.5)	2.1 (1.1)	3.8 (1.8)	3.1 (1.7)	group: $P < 0.001$ stress: $P = 0.06$ time: $P < 0.001$ stress \times time: $P < 0.001$
After	2.7 (1.7)	4.3 (2.3)	3.7 (2.4)	5.6 (2.1)	
Performed well					
Before	4.6 (0.9)	5.2 (1.0)	4.2 (1.7)	4.1 (1.9)	group: $P < 0.001$ stress: $P = 0.001$ time: $P < 0.001$ stress \times time: $P < 0.001$ time \times group: $P = 0.07$
After	5.1 (1.3)	3.3 (1.6)	3.6 (1.7)	1.8 (1.2)	
Personal involvement					
Before	5.0 (1.5)	5.0 (1.9)	5.4 (1.6)	5.2 (2.1)	time: $P = 0.01$
After	4.8 (1.7)	4.7 (1.6)	4.5 (1.9)	4.9 (2.0)	
New					
Before	4.6 (2.0)	5.3 (1.9)	5.4 (2.1)	5.1 (2.2)	—
After	5.3 (2.3)	5.4 (2.3)	5.7 (1.8)	4.8 (2.3)	
Threatening					
Before	1.4 (0.8)	1.4 (0.7)	2.8 (2.0)	1.8 (1.3)	group: $P < 0.001$ time: $P < 0.001$ stress \times time: $P < 0.001$
After	1.4 (1.1)	2.5 (1.6)	2.8 (2.1)	4.1 (2.0)	
Dissociation					
Before	0.4 (1.4)	0.8 (1.7)	9.8 (8.0)	5.6 (4.6)	group: $P < 0.001$ time: $P = 0.001$ group \times time: $P = 0.006$
After	0.2 (0.6)	1.1 (2.2)	11.0 (10.9)	10.2 (6.8)	
After MET	0.2 (0.9)	0.1 (0.3)	8.1 (8.3)	6.5 (5.6)	

P-TSST, Placebo Trier Social Stress Test; TSST, Trier Social Stress Test.

effect. When comparing patients with and without intake of medication, there were no differences concerning cognitive empathy, but on trend level significance lower scores of emotional empathy in the unmedicated group ($P = 0.07$). No interaction effects (stress \times medication) were seen for both scores.

Partial correlations between cortisol, blood pressure, questionnaires and empathy

There were no significant correlations between cortisol, blood pressure (area under the curve) and

empathy scores, neither in the TSST nor in the control condition.

As dissociation might have influenced the endocrine stress response, we performed correlation analyses between cortisol release and stress, but found no significant association. Furthermore, none of the DSS-4 scores (before and after TSST, as well as after MET) was associated with empathy scores.

Additionally, we performed correlations between intake of OC and empathy scores. There were no significant associations for neither cognitive nor emotional empathy.

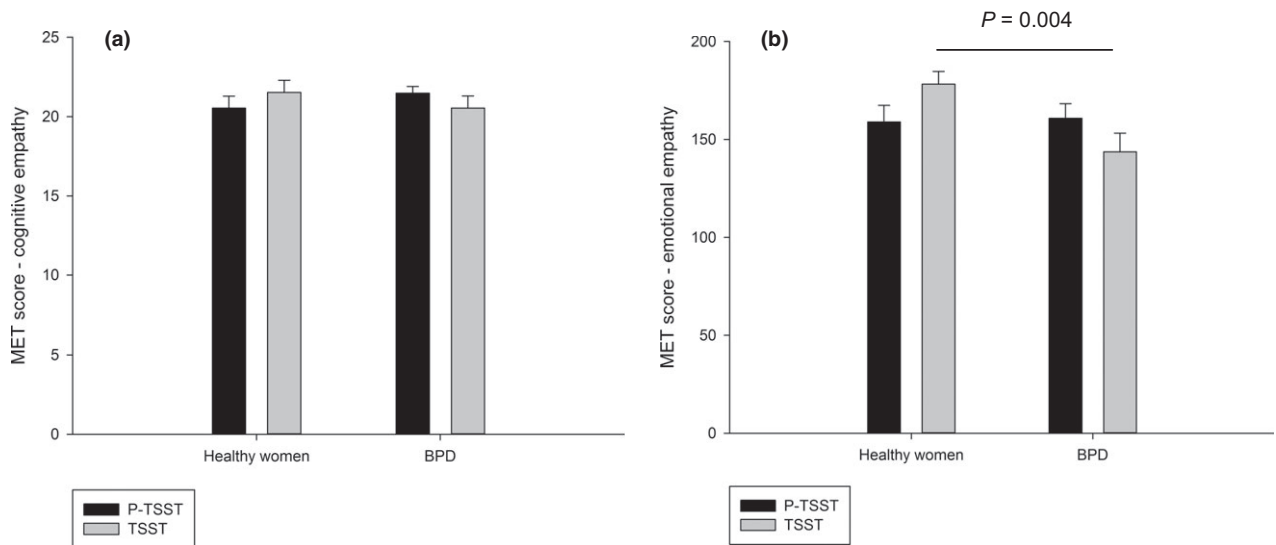


Fig. 2. (a) Cognitive and (b) emotional empathy measured with the Multifaceted Empathy Test (MET) after Trier Social Stress Test (TSST) and the placebo version of the TSST (P-TSST) in patients with borderline personality disorder (BPD) and healthy women. There was a significant main stress * group interaction effect ($P = 0.04$) in the emotional empathy test part.

Discussion

We examined the effects of psychosocial stress on cognitive and emotional empathy in women with borderline personality disorder (BPD) and in healthy women. After a non-stress control condition, we found no significant differences between patients with BPD and healthy individuals, neither concerning cognitive nor emotional empathy. After stress, however, we found significant differences between our study groups with respect to emotional empathy: patients with BPD had a significantly lower emotional empathy score after stress compared to healthy individuals. Of note, within group *post hoc* tests comparing emotional empathy after stress with the control condition failed statistical significance, but effect sizes suggest medium effects, suggesting a lack of power due to the relatively small sample size. Thus, the main finding of our study is that psychosocial stress differentially affects emotional empathy in healthy controls compared to patients with BPD.

First of all, the findings in healthy individuals are in line with our hypothesis that stress enhances emotional empathy but has no effect on cognitive empathy as also shown in other studies (15, 17). This fits also well with one of our previous studies, in which the mineralocorticoid receptor (MR) agonist fludrocortisone exclusively enhanced emotional empathy (9). In contrast, after administration of hydrocortisone, which binds also to the GR, no effects of the drug on empathy were seen (31). Accordingly, one might suggest that the MR plays an important role in mediating the

effects of stress hormones on emotional empathy. Indeed, the MR is suggested to be involved in the appraisal of novel situations and in selection of response strategies (35) as well as in modulating stress-associated emotional arousal and adaptive behaviours (36). At this point the question rises, why these effects are seen only on emotional but not cognitive empathy. One might argue that especially MRs are expressed in high density in limbic brain areas, which are strongly involved in the processing of emotional information (37, 38). Notably, several other studies could also show that stress enhanced social cognition, including facial emotion recognition and prosocial behaviour such as trust and sharing (16, 19). All of these findings above are compatible with the ‘tend-and-befriend’ hypothesis (20, 21). This hypothesis states that in addition to the ‘fight-and-flight’ model, enhanced prosocial behaviour after stress is a reasonable response pattern.

The primary aim of the study was to investigate the effects of psychosocial stress on empathy in patients with BPD. This is of great interest, as the question whether BPD is characterized by impairments in social cognition remains equivocal (1, 2, 10). Most studies, which used self-report measurements such as the Interpersonal Reactivity Index (39) measuring cognitive and affective empathy, found lower scores in cognitive empathy, that is perspective taking (2, 40). Concerning self-reported affective empathy, higher, lower and equal scores have been reported in BPD compared to controls (8, 40–42).

Of note, in this and a previous study—using a behavioural paradigm to assess empathy—we did not find deficits in empathy in BPD (9). One promising candidate to explain—in part—heterogeneous results in earlier studies is the extent of stress, especially psychosocial stress (1, 12). Deficits in social cognition in BPD were predominantly found in socially interactive paradigms (10). Furthermore, it is well established that patients with BPD are more sensitive to social rejection and negative evaluation (13, 14). Of note, one of the most stressing components of the TSST is the lack of feedback from the audience, which can be perceived as social rejection. Accordingly, we found that in patients with BPD, emotional empathy was decreased after the TSST. We interpret these findings as a stress-induced ‘fight-and-flight’ response in patients with BPD resulting in an inhibition of prosocial behaviour. This is in contrast to a more ‘tend-and-befriend’-like behaviour in the controls. Thus, healthy individuals seem to be able to protect themselves against stress effects by recruiting social skills, while these stress-buffering effects are missing in patients with BPD. From a clinical point of view, this observation makes sense: patients with BPD are highly sensitive to social exclusion, and many symptoms are especially prominent in social contexts, for example fear of abandonment or unstable social relationships (43, 44). Acute stress often leads to further worsening of symptoms and (social) function with stress-related dissociative and paranoid symptoms, anger, aggression or even suicidal behaviour (13, 45). Thus, stress-induced deficits in emotional empathy likely contribute to problems in interpersonal interactions in BPD and could be targeted for psychosocial interventions, as it has been proposed in mentalization-based treatment (46, 47).

Other authors emphasized the importance of dissociation in the context of (social) cognition and BPD. For example, a recent review described associations between dissociation and task performance especially when interfering (emotional) stimuli are presented (48). On the brain level, dissociation-induced impairments in working memory are accompanied by lower activity in the amygdala and other areas associated with emotion processing (49). In our study, self-reported dissociation was higher in patients with BPD compared to healthy women, and a stress-related increase was only seen in patients. However, there was no association between dissociation scores and empathy measurements. Possibly, there are no direct effects but mediated by underlying neural changes or disturbances. This is supported by an fMRI study, which used the MET and found patients

with BPD to have impaired empathy (8). During the emotional part of the MET, patients with BPD showed greater brain activity compared to controls in the right insular cortex and superior temporal sulcus (8). Interestingly, these changes were associated with skin conductance responses, which suggest an impact of stress on emotional empathy in BPD. Possibly, the fMRI procedure was more stressful to the patients, which might have contributed to the observed changes in brain activation and task performance.

In our BPD sample, there were no differences in the cortisol response to the stressor compared to healthy controls. Up to now, only few studies investigated endocrine reactions including HPA axis parameters to psychosocial stress in BPD, suggesting rather a reduced than enhanced cortisol response to stress (50, 51). Other authors reported dissociation to be an important mediator of the cortisol response to stress in BPD (52). Of note, comorbid psychiatric disorders, especially major depressive disorder, are known to influence HPA axis regulation in BPD (23, 24). Thus, we excluded patients with comorbid MDD. Furthermore, higher skin conductance and heart rate responsivity to the TSST have been found in BPD (50).

There are some limitations of the study. First, the sample consisted of a high proportion of medicated patients and many suffered from comorbid psychiatric disorders, with PTSD being the most prominent. Even though our sample size was relatively large compared to most of the previous studies, it was still too small to conduct subgroup analyses with sufficient power, for example with regard to comorbid mental disorders as PTSD or intake of medication. However, in our explorative analyses, PTSD and intake of medication were not associated with stress effects on empathy. Our sample was also too small to detect small effects, for example the stress \times group interaction on cognitive empathy with an effect of $\eta_p^2 = 0.02$. Furthermore, only women were included in this study as BPD is more frequently diagnosed in women. Therefore, no conclusions can be drawn with regard to men. Last but not least, further studies may include additional measures of social cognition and it should be investigated, whether our results are specific to BPD or are also seen in other (personality) disorders (53).

In sum, the current findings provide first evidence that stress differentially affects emotional empathy in patients with BPD and healthy individuals with lower emotional empathy after stress in women with BPD compared to healthy women. This might—in part—explain heterogeneous results

concerning social cognitive abilities in BPD. As the results in healthy individuals suggest a ‘tend-and-befriend’ behaviour after stress, reduced emotional empathy in BPD can be interpreted as an inhibition of prosocial behaviour after stress in favour of a ‘fight-and-flight’ response. This might lead to a vicious circle, in which stress leads to a ‘fight-and-flight’ response resulting in more pronounced impairments in social situations which in turn enhances (psychosocial/interpersonal) stress. In the context of psychotherapy, our results strengthen the use of methods increasing interpersonal effectiveness, emotion regulation and distress tolerance skills as for example done in Dialectical Behavior Therapy (DBT) (54), Metacognitive Interpersonal Therapy (MIT) (55) and others.

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Declaration of interest

There is no conflict of interests, financial or otherwise, to declare.

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