Exploring autistic traits in adults with chronic depression: A clinical study

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ABSTRACT

Background: Chronic depression is characterized by persistent or recurrent depressive symptoms, defined according to DSM criteria, and is associated with lack of empathy; deficits in social perception, interaction, and communication; and social withdrawal. These symptoms are reminiscent of autism spectrum disorders, yet the co-occurrence of autistic traits and chronic depression has been rarely explored. We explored measures of autistic traits in chronically depressed adult patients in order to further define and delineate the overlap of symptoms between chronic depression and autism spectrum disorders.

Method: Three groups were tested: 31 patients with chronic depression, 27 patients with autism spectrum disorder, and 31 healthy controls. The Autism Spectrum Quotient (AQ) and the Empathy Quotient (EQ) were used to measure autistic traits. The severity of depression was measured by Beck's Depression Inventory.

Results: The group of chronically depressed patients showed significantly elevated autistic traits according to both AQ and EQ measures. In addition, 48.4% of the patients with chronic depression showed AQ scores within the range of the broader autistic phenotype. Similar scores were found among 3.2% of the healthy controls and 100% of the patients with autism spectrum disorder.

Conclusions: About half of the chronically depressed patients showed elevated autistic or autism-like traits. It remained unclear whether this was due to the state of chronic depression or a kind of premorbid autistic personality trait. The findings illustrate the need for further research to clarify the possible role of autistic traits in the development of chronic depression. Furthermore, they reveal that it might be clinically useful to focus on autism-like social impairments in therapy for chronic depression.

1. Introduction

Depressive disorders are a major medical problem with a very high incidence and prevalence across the life span (Kessler et al., 2003). Approximately 30% of cases are chronic, defined as the presentation of continuous symptoms for at least two years (Arnow & Constantino, 2003; Dunner, 2001; Gelenberg, Kocsis, McCullough, Ninan, & Thase, 2006). Compared to episodic depression, chronic depression (CD) is often associated with lower response rates to both pharmacological and psychotherapeutic treatment; a higher level of treatment resistance; greater functional impairment; increased healthcare utilization, including a higher hospitalization rate; and more frequent suicide attempts (Angst, Gamma, Rössler, Ajdacic, & Klein, 2009; Arnow & Constantino, 2003; Klein, Schwartz, Rose, & Leader, 2000; Satyanarayana, Enns, Cox, & Sareen, 2009). Moreover, the quality of life of chronically depressed patients is often severely affected, and the burden of this condition on patients and their relatives appears to be very high (Dunner, 2001; Ley et al., 2011). There is much evidence supporting the assumption that different subtypes of depression represent different etiologies (Tebartz van Elst, Ebert, & Hesslinger, 2006), and CD is increasingly considered to express typical psychopathologic characteristics that can be nosologically distinguished from episodic depressive disorders. McCullough (2000) proposed that the specific characteristics of CD patients include lack of empathy, associated deficits in social interaction and communication, lack of social perception, and withdrawal from social relationships. These characteristics are reminiscent of the core symptoms of autism spectrum disorder (ASD).

ASD is a neurodevelopmental condition characterized by social and communication difficulties, circumscribed interests, strong repetitive behavioral patterns, and sensitivity and resistance to change. The core clinical characteristics of ASD include impairment of social communication, social imagination, and social relationships (Lai, Lombardo, & Baron-Cohen, 2014; Levy, Mandell, & Schultz, 2009). Major depression is a very common comorbidity among ASD patients (Hofvander et al., 2009; Lehnhardt et al., 2012; Lugnegård, Hallerbäck, & Gillberg, 2011). In a sample of children with ASD, 24% met or just fell short of meeting the criteria for major depression (Leyfer et al., 2006). In studies of adults with ASD, the prevalence was even higher, reaching 45% (Hofvander et al., 2009), 31% (Joshi et al., 2013), 30% (Lehnhardt et al., 2012), and 49% (Riedel et al., 2016) within different samples. Lugnegård et al. (2011) reported that 20% of ASD patients experienced one major depressive episode and 50% experienced recurrent depressive disorders. The likelihood that patients with ASD will experience at least one depressive episode in their lifetime is 70% (Lugnegård et al., 2011).

In the last few years, research on autistic traits has been extended from clinical samples to the general population, and subclinical (subthreshold) variants of ASD have been recognized (Constantino & Todd, 2003). Such research has shown individual differences across the population (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001; Constantino & Todd, 2003). In addition, different psychiatric conditions, like attention deficit hyperactivity disorder (Chen, Chen, & Gau, 2015; Craig et al., 2015; Kotte et al., 2013; Taurines et al., 2012), anorexia nervosa (Baron-Cohen et al., 2013; Hambrook, Tchanturia, Schmidt, Russell, & Treasure, 2008; Oldershaw, Treasure, Hambrook, Tchanturia, & Schmidt, 2011; Tchanturia et al., 2013) and obsessive compulsive disorder, have been linked to autistic traits (Bejerot, Nylander, & Lindström, 2001).

There are several reasons why CD and autistic traits may be linked. Both disorders are characterized by difficulties concerning empathy, social communication, social perception, and social relationships. Impaired theory of mind is seen as a core symptom of ASD by many authors (Baron-Cohen, 2000) and has also been reported in depressive disorders (Lee, Harkness, Sabbagh, & Jacobson, 2005; Wang, Wang, Chen, Zhu, & Wang, 2008). For instance, Zobel et al. (2010) compared the performance of CD patients and healthy controls during theory of mind tasks. They found significant deficits in CD patients' ability to read social interactions, and the authors proposed that these differences between CD patients and controls might be associated with general cognitive impairments. In addition, CD and ASD patients often exhibit similar facial expressions and vocal behavior, such as reduced facial expression, diminished eye contact, and monotone prosody. Furthermore, social withdrawal and sensitivity to change are common in both groups (Riedel, 2016). Given these observations, one might hypothesize that there is a phenomenological overlap between CD and ASD.

While several studies have analyzed the prevalence of depression among ASD patients and the co-occurrence of autistic traits with other disorders, to our knowledge, only very few studies have explored the likelihood that patients with depression will suffer from ASD or autistic traits. One study of Domes et al. (2016) has explored the likelihood that patients with CD will suffer from ASD or autistic traits. Specifically, the authors explored autistic traits and empathy deficits in patients with episodic depression and CD. Both groups of depressed patients showed higher levels of autistic traits and lower levels of perspective-taking than healthy controls, and in contrast to episodically depressed patients, CD patients reported significantly higher impairment of social skills and higher levels of personal distress in social interactions. Gotham et al. (2018) compared ASD patients with typically developed adults with current depressive disorder and a control group without a history of ASD or depression. They found patients with depression to score higher than the controls and lower than the ASD group on a subscale of the Social Responsiveness Scale (SRS-2; Constantino & Gruber, 2012), a questionnaire that is used for screening and diagnosing autism. The BDI-II (Beck, Steer, & Brown, 1996) scores of the ASD group fell between the CD group and controls. In a study performed by Takara & Kondo (2014), 16% of depressed adults visiting a psychiatric clinic for the first time were diagnosed with ASD. Towbin, Pradella, Gorrindo, Pine, and Leibenluft, (2005) focused on autistic traits in children with depressive disorders and other types of mood or anxiety disorders. The authors found 48% of the children with depression and/or anxiety disorders scoring within the ASD-likely range. However, neither Gotham et al. (2018); Takara and Kondo (2014) nor Towbin et al. (2005) distinguished between episodic depression and CD.

Given the high prevalence and importance of CD in adult psychiatry and psychotherapy and the symptom overlap described above, the aim of this study was to investigate the prevalence of autistic traits in samples of non-selected adult CD patients, ASD patients, and healthy controls. Information about the co-existence of autistic traits in CD might improve the understanding of this disorder, help identify more vulnerability factors and comorbidities of CD, and improve diagnostic and therapeutic strategies. Based on our theoretical assumptions and the literature we reviewed, we expected CD patients to display intermediate levels of autistic traits and empathy in contrast to both other groups. Specifically, we hypothesized that patients with CD would show higher levels of autistic traits and lower levels of empathy than the healthy controls and lower levels of autistic traits and higher levels of empathy than the patients with ASD.

2. Methods

2.1. Participants

We included 31 consecutive patients suffering from CD (CD group), 27 patients with ASD (ASD group), and 31 healthy controls (HC group). The inclusion criteria were as follows: (a) age of 18–65 years and (b) diagnosis of chronic major depressive disorder based on the DSM-IV criteria (American Psychiatric Association, 2000) in the CD group; diagnosis of ASD based on the National Institute for Health and Clinical Excellence (NICE) guidelines (National Institut for Health & Clinical Excellence, 2012) in the ASD group; and the absence of depression (BDI < 13) and ASD in the healthy control group. The exclusion criteria were as follows: a current or lifetime diagnosis of schizophrenia or another psychotic disorder, bipolar disorder, dementia, epilepsy, or another organic psychiatric disorder or brain disease.

Participants in the CD group were current or former inpatients of the Center for Mental Disorders, University Medical Center Freiburg, Department of Psychiatry and Psychotherapy. All participants in the CD group had, for at least two years, met the criteria for major depressive disorder, major depressive disorder superimposed on a preexisting dysthymic disorder (double depression), or recurrent major depressive disorder with incomplete remission between episodes, as defined by the DSM-IV (American Psychiatric Association, 2000). Patients in the CD group took part in a special inpatient treatment program (2015, Brakemeier et al., 2011) based on the Cognitive Behavioral Analysis System of Psychotherapy (McCullough, 2000). Nineteen of the 31 patients in this group (61.3%) were diagnosed with double depression, 10 (32.2%) were diagnosed with recurrent major depression, and 2 (6.5%) were diagnosed with chronic major depression. Patients of the CD group were not formally screened for ASD before study inclusion since the purpose of the study was to investigate a sample of non-selected CD patients. We performed post-hoc clinical diagnostic procedures according to an algorithm and in accordance with the NICE guidelines (National Institut for Health & Clinical Excellence, 2012) for all chronically depressed patients with elevated AQ scores. Two CD patients (6.5%) subsequently received a comorbid ASD diagnosis. As this process was post-hoc, these patients remained included in the CD group. Axis I and Axis II comorbidities were assessed with SCID-I (Structured Clinical Interview for DSM-IV Axis I Disorders; (First, Spitzer, Gibbon, & Williams, 1997) and SCID-II (Structured Clinical Interview for DSM-IV Axis II Disorders; Fydrich, Renneberg, Schmitz, & Wittchen, 1997). Six of the 31 patients were diagnosed with comorbid attention deficit hyperactivity disorder, 2 were diagnosed with posttraumatic stress disorder, 1 was diagnosed with alcohol dependence, and 1 was diagnosed with social phobia. Regarding Axis II, 3 patients were diagnosed with comorbid avoidant personality disorder, 1 was diagnosed with dependent personality disorder, and 1 was diagnosed with obsessive-compulsive personality disorder.

The ASD group consisted of outpatients who were diagnosed with ASD (Asperger syndrome or high-functioning autism) at the Center for Mental Disorders, University Medical Center Freiburg, Department of Psychiatry and Psychotherapy. The process of diagnosing ASD was organized according to the NICE guidelines for adult autism (National Institut for Health & Clinical Excellence, 2012). It included a thorough interview, usually taking place over multiple sessions, of the patient that focused on the development of autistic symptoms throughout his or her life. In addition, the history of the patient's caregivers (parents, partners, siblings, etc.) and behavioral observations played a role in the diagnostic process. Instruments such as the ADI-R (Autism Diagnostic Interview-Revised; Lord, Rutter, & Le Couteur, 1994) and ADOS (Autism Diagnostic Observation Schedule; Lord et al., 2000) were used in selected and unclear cases, such as those in which patients exhibited low compensation and low reflection on their symptomatology. A final consensus diagnosis was made by all persons involved in the diagnostic process, including at least two experienced consultant psychiatrists or psychologists (Tebartz van Elst et al., 2014). State of depression in the ASD group was assessed by clinical interview. 7 out of 27 (25.9%) ASD patients were diagnosed with current depression and 2 (7.4%) with dysthymia. Patients in the ASD group were selected to match the demographic variables of the target CD group.

Participants in the HC group were recruited via an announcement at the Center for Mental Disorders, University Medical Center Freiburg, and primarily included hospital members and their family members and private contacts. The controls were screened with a clinical interview focusing on their current emotional health status and medical and personal history to ensure the absence of ASD or depression.

The participants were matched pairwise by gender and age (with a maximum age deviation of +/- 5 years). All participants gave written informed consent before they participated in the study. The study was carried out in accordance with the Code of Ethics of the Declaration of Helsinki and was approved by the Ethics Committee of the University of Freiburg, Germany (EK-FR: 33/14; 264/12).

Table 1 summarizes the demographic data concerning our sample. A total of n = 89 participants were included. The mean average age of the whole statistical set was M = 46.08 (SD = 10.06).

Table 1
Sociodemographic characteristics.

	Total (N = 89)	HC (n = 31)	CD (n = 31)	ASD (n = 27)	df	F/χ2	p
Sex, *n* (%)							
Male	36 (40.4)	12 (38.7)	12 (38.7)	12 (44.4)	2	0.26	.880
Female	53 (59.6)	19 (61.3)	19 (61.3)	15 (55.6)			
Age, *M* (SD)	46.08 (10.06)	46.90 (10.39)	46.29 (9.82)	44.89 (10.20)	2	0.30	.745
Marital status *n* (%)							
Single	39 (43.8)	7 (22.6)	13 (41.9)	19 (70.4)	4	18.49	.001
Married/with partner	37 (41.6)	21 (67.7)	11 (35.5)	5 (18.5)			
Divorced	13 (14.6)	3 (9.7)	7 (22.6)	3 (11.1)			
Education level *n* (%)							
Lower secondary	13 (14.6)	2 (6.5)	7 (22.6)	4 (14.8)	6	24.51	< .001
Upper secondary	18 (20.2)	0 (0.0)	10 (32.3)	8 (29.6)			
University entrance diploma	34 (38.2)	15 (48.4)	6 (19.4)	13 (48.1)			
University diploma	24 (27.0)	14 (45.2)	8 (25.8)	2 (7.4)			
Employment status *n* (%)							
Employed	57 (64.0)	27 (87.1)	12 (38.7)	18 (66.7)	2	15.88	< .001
Unemployed/early retirement	32 (36.0)	4 (12.9)	19 (61.3)	9 (33.3)			

HC: healthy controls, CD: chronic depression, ASD: autism spectrum disorder.

2.2. Measures

Measures of autistic traits were the primary outcome variables of our study. For that purpose, we employed well-established instruments: the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001) and the Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004). The AQ (Baron-Cohen et al., 2001) is a self-report questionnaire that was developed to explore how many autistic traits an individual exhibits. It consists of 50 items covering five domains (social skills, communication, attention to detail, attention-switching, imagination) and operates with a total range of 0–50 points. The sensitivity and specificity with which it distinguishes persons with ASD from healthy controls have been shown to be high. Internal consistency within the five subdomains are moderate to high (social skills = .77; communication = .65; attention to detail = .63; attention-switching = .67; imagination = .65). Its test-retest reliability (n = 17; 2 weeks) was r = .70. Within the population of people with ASD, 80% score above 32 on the AQ (Baron-Cohen et al., 2001).

The EQ (Baron-Cohen & Wheelwright, 2004) was designed as a short 40-question self-report instrument focusing purely on empathy in members of the general population with normal IQ levels and speech ability. Baron-Cohen and Wheelwright (2004) found that healthy controls achieved a mean EQ score of 42.1 (SD = 10.6), whereas the mean score of the ASD sample was 20.4 (SD = 11.6). In total, 81.1% of the ASD patients scored at or below the cut-off of 30 points. The instrument is reported to have high internal consistency (α = .92) and test-retest reliability (n = 30; 12 months; r = .97; Baron-Cohen & Wheelwright, 2004).

Beck's Depression Inventory (BDI-II; (Beck et al., 1996; Hautzinger, Keller, & Kühner, 2006) was used to monitor depressive symptoms. It is a widely used and well-established self-report instrument. International studies have shown highly specific values for reliability and validity and an internal consistency of α = .84–.94 (Arnau, Meagher, Norris, & Bramson, 2001; Beck et al., 1996; Kojima et al., 2002; Kühner, Bürger, Keller, & Hautzinger, 2007; Uher et al., 2008).

2.3. Data analysis

Statistical analyses were performed using SPSS 21. We chose a p-value of .05 to determine significance. Demographic variables were compared using analysis of variance (ANOVA) or the chi-square test when appropriate. Since group data did not follow normal distribution, we performed non-parametric Kruskal-Wallis tests to analyze the differences between the three groups in the primary outcome measures of total AQ and EQ scores. Significant differences were resolved by post hoc Mann-Whitney U tests and by applying Bonferroni correction for the numbers of tests to the accepted significance level. We then performed further Kruskal-Wallis tests to examine the differences between the groups in terms of the AQ subscales and BDI-II.

To investigate the relationship between autistic traits respectively empathy level and depression severity, groupwise correlations between total AQ and BDI, total EQ and BDI, and each AQ subscale and BDI were computed using Spearman´s rank correlation coefficient. Bonferroni correction was used to adjust for multiple comparisons.

3. Results

3.1. Autism Spectrum Quotient questionnaire

The Kruskal-Wallis nonparametric test revealed significant differences between the three groups in terms of total AQ score (χ2 = 67.80, p < .001). As shown in Fig. 1, all pairwise comparisons performed as part of post-hoc Mann-Whitney U tests also showed significant results, indicating that the samples' AQ scores differed in terms of statistical significance. The mean score of the ASD was M = 40.93 (SD = 4.77), while the mean for the CD group was 22.90 (SD = 7.48) and the mean for the HC group was 11.35 (SD = 5.96). The median scores and interquartile ranges were 42.0 (8.0) for the ASD group, 22.0 (10.0) for the CD group, and 10.0 (8.0) for the HC group.
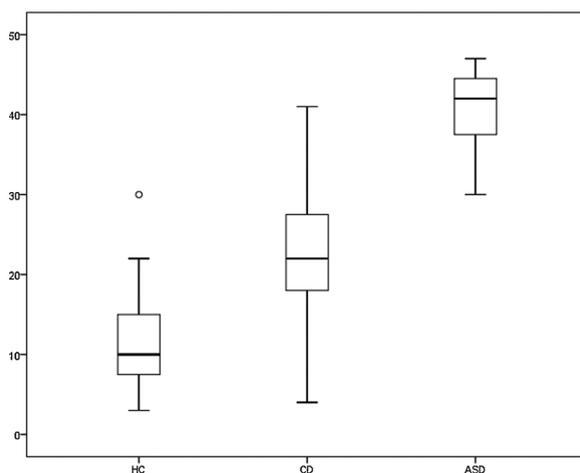
Fig. 1. AQ score in the HC, CD, and ASD groups (median and interquartile range). HC: healthy controls, CD: chronic depression, ASD: autism spectrum disorder. The outlier in the HC group was not excluded from the sample.

Statistical analysis of the AQ subscales revealed significant differences between the three samples in terms of the subscales "social skills," "attention-switching," "imagination," and "communication," with highest scores found in the ASD group and the lowest in the HC group.

Regarding the subscale "attention to detail", significant differences were found between the ASD group and CD group and between the ASD group and HC group, although there was no significant difference between the CD group and HC group (see Table 2).

Table 2
Group differences in autistic traits (AQ), empathy (EQ) and depressive symptoms (BDI-II).

	HC (n = 31)	CD (n = 31)	ASD (n = 27)	χ^2 (df), p	Post-hoc single comparisons
				Statistical test	
Total AQ score	11.35 (5.96)	22.90 (7.48)	40.93 (4.77)	χ^2 (2) = 67.80, p < .001*	ASD > CD > HC (all p < .001*)
AQ subscales					
Social skills	0.58 (1.31)	5.13 (2.76)	9.22 (1.40)	χ^2 (2) = 68.48, p < .001*	ASD > CD > HC (all p < .001*)
Attention-switching	3.52 (2.68)	6.81 (2.07)	9.07 (1.17)	χ^2 (2) = 46.72, p < .001*	ASD > CD > HC (all p < .001*)
Attention to detail	4.00 (2.08)	3.97 (2.73)	7.56 (2.29)	χ^2 (2) = 27.67, p < .001*	ASD > CD = HC (CD – ASD p < .001*, CD – HC p = .644, ASD – HC p < .001*)
Communication	1.19 (1.33)	2.87 (2.13)	7.89 (1.72)	χ^2 (2) = 57.87, p < .001*	ASD > CD > HC (CD – ASD p < .001*, CD – HC p = .001*, ASD – HC p < .001*)
Imagination	1.65 (1.87)	4.13 (2.09)	7.19 (2.02)	χ^2 (2) = 49.54, p < .001*	ASD > CD > HC (all p < .001*)
Total EQ score	49.19 (9.96)	40.8 (11.97)	13.85 (8.76)	χ^2 (2) = 53.84, p < .001*	HC = CD > ASD (CD – ASD p < .001*, CD – HC p = .011, ASD – HC p < .001*)
BDI-II	3.87 (3.74)	27.77 (7.47)	17.71 (12.06)	χ^2 (2) = 36.09, p < .001*	CD > ASD > HC (CD – ASD p = .0020*, CD – HC p < .001*, ASD – HC p < .001*)

Standard deviations are presented in brackets. *Significant differences at Bonferroni-adjusted α (Kruskal-Wallis α = .0063; post hoc Mann Whitney U α = .0021). HC: healthy controls, CD: chronic depression, ASD: autism spectrum disorder, AQ: Autism Spectrum Quotient, EQ: Empathy Quotient, BDI-II: Beck's Depression Inventory.

According to the interpretation proposed by Wheelwright, Auyeung, Allison, and Baron-Cohen, (2010), AQ scores of under 23 should be regarded as typical, scores between 23 and 28 indicate the presence of the broader autism phenotype, and those above 28 indicate the presence of the medium (29–34) or narrow (> 34) autism phenotype. In our study, 48.4% of the patients in the CD group but only 3.2% in the HC group showed AQ scores within the range of the narrow, medium or broader autistic phenotypes. All patients in the ASD group had AQ scores above the cut-off for the medium autistic phenotype (see Fig. 2 and Table A1 in the Appendix).
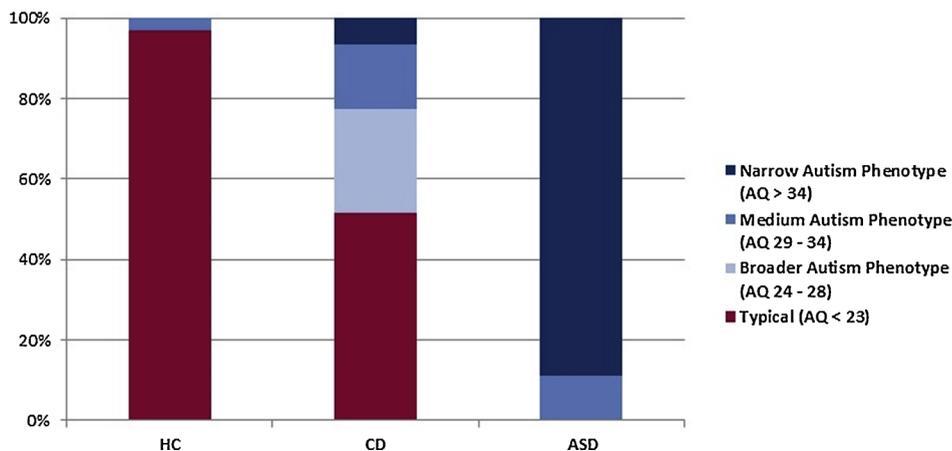
Fig. 2. Autism phenotypes. Autism phenotypes defined by Wheelwright et al. (2010) and the percentage of participants who exhibited these phenotypes HC: healthy controls, CD: chronic depression, ASD: autism spectrum disorder.

3.2. Empathy Quotient questionnaire

Analysis of the EQ scores revealed significant differences between the groups ($\chi2 = 53.84$, $p < .001$). The ASD group had the lowest average score (mean = 13.85; SD = 8.76) and differed significantly from the other two groups. The mean EQ score of the CD group was 40.80 (SD = 11.97), while that of the HC group was 49.19 (SD = 9.96).

3.3. Correlation study

Groupwise examination of the correlations between total AQ scores and BDI did not reveal significance in any of the groups (CD group: r_s (31) = .334, p = .066; ASD group: r_s (27) = .110, p = .608; HC group: r_s (31) = .112, $p = .680$). In addition, no significant correlation between total EQ scores and BDI were found in the CD group (r_s (31) = -.253, p = .178), ASD group (r_s (27) = .196, p = .360), or HC group (r_s (31) = −.091, p = .736). Examination of the AQ subscales did not reveal significant correlations with BDI either. As expected and well-established in previous research (Baron-Cohen & Wheelwright, 2004), a significant negative correlation was found between total AQ score and total EQ score (r_s (89) = −.823, p < .001). Fig. 3 shows the correlation between AQ and EQ scores in a scatter plot organized according to subgroups, illustrating that, in terms of AQ and EQ scores, the CD patients are positioned between the ASD patients and healthy controls.
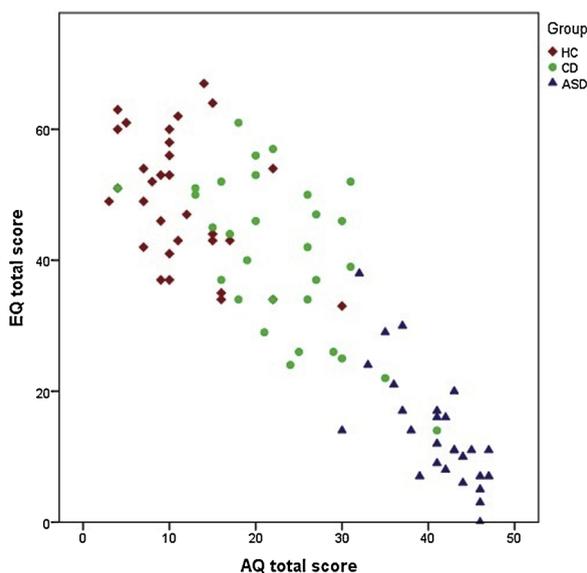

Fig. 3. Correlation between AQ and EQ scores. Unadjusted total AQ (Autism Spectrum Quotient) and EQ (Empathy Quotient) scores. HC: healthy controls, CD: chronic depression, ASD: autism spectrum disorder.

4. Discussion & implications

The main finding of our study is that patients meeting the criteria for chronic depression showed elevated autistic or autism-like traits, as evidenced by increased AQ and decreased EQ scores. From a purely descriptive psychometric perspective, these scores indicate the presence of an intermediate phenotype among the healthy control subjects and patients with ASD. For the purpose of clarification, the term "autistic traits" should be understood to refer to symptoms of ASD or the broader autistic phenotype. "Autism-like traits," on the other hand, refer to symptoms that may look similar to ASD symptoms but are not always the result of ASD or the broader autistic phenotype. In the CD group, 48.4% of patients' scores indicated the presence of the broader, medium, or narrow autistic phenotype (or autism-like symptoms). The same was true for 3.2% of the HC group and 100% of the ASD group. We did not find any significant correlation between BDI-II scores and EQ or AQ scores among CD and ASD patients. Two CD patients (6.5%) achieved AQ scores within the range indicating the presence of the narrow autistic phenotype. Post-hoc clinical diagnostic procedures performed according to an algorithm and in accordance with the NICE guidelines (National Institut for Health & Clinical Excellence, 2012) for ASD diagnosis verified that these patients did in fact meet criteria for a comorbid ASD diagnosis. As this process was post-hoc, these patients remained included in the CD group. However, patterns of results didn`t alter significantly if these two patients were excluded from the analysis.

In his landmark work, McCullough (2000) pointed out specific characteristics of CD patients—lack of empathy, deficits in social interaction and communication, and lack of social perception—that are reminiscent of the characteristics of autism. However, McCullough (2000) did not refer to the concept of autism or literally assign these psychopathologic characteristics to autistic or autism-like traits. In our study, patients in the CD group showed significantly higher AQ scores and significantly lower EQ scores compared to the healthy controls. These findings relate well to McCullough's (2000) description of reduced levels of empathy and other specific characteristics of CD patients. Our findings of elevated autistic traits and reduced empathy scores in CD patients support the observations of Domes et al. (2016). Similar to us, the authors reported significantly higher AQ scores among CD patients compared to healthy controls. Furthermore, Domes et al. (2016) found altered empathy scores among CD patients. Specifically, lower levels of perspective-taking and higher levels of personal distress were identified in CD patients by a self-reported dispositional empathy measure, the Interpersonal Reactivity Index (Davis, 1983). Increased personal distress leads to higher levels of self-focusing and enhances individuals' tendency to withdraw, express less empathy for others, and exhibit less prosocial behavior (Batson, Fultz, & Schoenrade, 1987; Batson, 2009). However, Domes et al. (2016) did not investigate an autistic sample in their study. Our results, which show reduced levels of empathy in CD patients, support Thoma et al. (2011) observation of altered empathy in depressed patients. Using the Interpersonal Reactivity Index (Davis, 1983), like Domes et al. (2016), the authors found that depressed patients had higher personal distress scores compared to healthy controls. Like us, Thoma et al. (2011) did not find any correlation between self-reported empathy levels and depression severity. This observation supports the interpretation of autism characteristics as trait markers of CD rather than state markers. More precisely, the autism-like characteristics associated with CD might cause individuals to be more vulnerable to developing CD but are not linked to the present state or extent of depression in such patients. Furthermore, Thoma et al. (2011) did not find significant differences in behavioral empathy among the examined individuals using the Multi-faceted Empathy Test (Dziobek et al., 2008). Wilbertz, Brakemeier, Zobel, Härter, and Schramm, (2010) also found impaired self-rated empathy scores in a sample of CD patients, although the theory of mind performance in their sample did not differ from the healthy controls. In the present study, we did not perform any behavioral task. Our finding of elevated autistic traits in CD patients aligns with the results of Gotham et al. (2018), who compared ASD patients with typically developed adults with current depressive disorder and a control group without a history of ASD or depression. They found a pattern similar to our results: depressed patients scored higher than the controls and lower than the ASD group on a subscale of the Social Responsiveness Scale (SRS-2; Constantino & Gruber, 2012). Moreover, the BDI-II (Beck et al., 1996) scores of the ASD group fell between the CD group and controls, like in our study. The same pattern was found in the results of a self-reported rumination questionnaire: the ASD sample scored significantly higher than the controls and significantly lower than the currently depressed adults (Gotham et al., 2018). In the ASD sample, rumination and depressive symptoms were highly correlated, and both elevated rumination levels and elevated depressive symptoms were observed. The authors speculated that ASD patients' rumination may follow similar psychophysiological processes to those of typically developing individuals with depression. In line with Towbin et al. (2005), who found that 48% of the children in their sample with depression and/or anxiety disorders scored within the ASD range, the current study found autistic traits in nearly half of the adult patients with CD. Using formal post-hoc diagnostic procedures, we verified a comorbid diagnosis of ASD in 6.5% of the patients in the CD group. This percentage is slightly lower compared to the 16% of patients with comorbidity found by Takara and Kondo (2014).

The main question arising from our results is whether the autistic or autism-like symptoms we found in CD patients are stable personality traits that could contribute to the development of CD or whether autism-like symptoms are a consequence of the state of CD and may disappear following remission of depressive symptoms. In other words, are autistic traits a risk factor for CD, or does the state of CD produce autism-like personality characteristics? In our study, the CD group has the highest heterogeneity of the three groups; the standard deviations of AQ and EQ scores of the CD group were considerably higher than in the other two groups. We posit that the high level of heterogeneity supports the hypothesis that premorbid autistic traits exist in a subgroup of CD patients. If autistic or autism-like traits were a consequence of CD, it would be difficult to explain why some patients exhibit these traits and others do not; one would expect autistic characteristics to be present in all CD patients. The high rate of comorbid depression found in ASD patients (Hofvander et al., 2009; Joshi et al., 2013; Lehnhardt et al., 2012) supports the assumption that patients with subthreshold

variants of ASD may have a higher risk of developing depression. Alternatively, elevated AQ scores and reduced EQ scores could be caused by both premorbid autistic traits and the state of depression. However, the likelihood of this explanation cannot be tested with our data. Another question that arises is whether premorbid autistic or autism-like traits in CD patients originate mainly from biological factors like classical autism spectrum disorders or from early traumatization, especially massive emotional deprivation, like learned quasi-autism. Several studies record a high rate (about 70–80%) of early traumatization among CD patients (Chapman et al., 2004; Kessler & Bromet, 2013; Klein & Santiago, 2003; Wiersma et al., 2009). Likewise, almost 79% of the CD group in this study reported early traumatic experiences. The concept of quasi-autistic (or autism-like) patterns in extremely deprived children, in contrast to "ordinary" autism, was described by Rutter et al. (2007). The similarities between autistic disorders and CD that we observed could also be the result of different underlying processes. For instance, CD patients may report socio-communicative deficits because of anhedonia, dysphoria, feelings of hopelessness and worthlessness, or a negativistic response style rather than the lack of cognitive empathy typifying autistic disorders. Factors like anxiety or another kind of comorbidity could also act as moderators. In the present study, subgroup analyses of the CD group showed almost equal AQ and EQ scores for patients with and without comorbidity. Therefore, it seems unlikely that psychiatric comorbidity could explain the findings to a great extent. Due to the cross-sectional character of the present study, we cannot clarify the role of the observed similarities between the two disorders or determine the origin of autistic traits (or autism-like symptoms) in CD patients. Thus, further studies are needed. Research focusing on this issue should compare CD patients, patients suffering from acute depressive episodes, and depressive patients in remission. Additionally, longitudinal studies that explore AQ and EQ scores in different states of depression (e.g. before and after treatment) are necessary to answer the question regarding causality.

There are a number of limitations to this study. The sample size in our study could have been larger. However, for an initial pilot study, it compares well to other research in the field. It is important to note that most of the control participants were employees in the healthcare sector. This population might not be an ideal control group for an investigation concerning empathy, since persons involved in healthcare often show remarkably high empathy, good interpersonal skills, care, and good communication skills, which may have influenced their AQ and EQ scores. Compared to the mean AQ score (16.9) of the nonclinical population in Ruzich et al. (2015) systematic review, the mean AQ score in our sample (11.4) was lower. In addition, the mean total EQ score in our HC group was slightly higher (49.2) than in the control data of other studies, which report average EQ scores of 42.1 (Baron-Cohen & Wheelwright, 2004), 48.0 (Baron-Cohen et al., 2013), 46.2 (Hambrook et al., 2008), and 44.3 (Wheelwright et al., 2006). The pattern of BDI scores (CD > ASD > HC) revealed a relatively high rate of depressive symptoms in the ASD group, similar to the study of Gotham et al. (2018). In our sample, 7 of 27 (25.9%) ASD patients suffered from current depression and 2 (7.4%) suffered from dysthymia. Therefore, there is the possibility of not only phenomenological overlap but also diagnostic overlap due to the comorbid depressive symptoms observed in the ASD group. We also note that phenotypic overlap of AQ items between ASD and CD group (see Table A2 in the Appendix) was highest for low-ASD-specific items (e.g. AQ items 14 "S/he finds making up stories easy.", 3 "If s/he tries to imagine something, s/he finds it very easy to create a picture in her/his mind."). However, the findings of Gotham et al. (2018) and our findings show the same pattern of results despite using different measurements. Gotham et al. (2018) used the SRS-2 (Constantino & Gruber, 2012), which contains items that are clearly different from those of the AQ. The similar results of Gotham`s and our study suggest that the high phenotypic overlap of low-ASD-specific items is not solely due to the instrument AQ.

Statistical analysis found significant differences in educational level and employment status between the three groups, which decreases the comparability of our samples. In addition, the aim of the study was to test AQ and EQ scores in a chronically depressed population. Therefore, the primary outcome measures were self-reported. Furthermore, we did not control for anxiety with a separate anxiety scale. In future studies, additional measures, including ratings of autistic characteristics and empathy by patients' relatives and partners as well as an anxiety scale or clinician assessment of anxiety, could be used to improve the quality of psychometric assessment.

4.1. Implications

We found that almost 50% of the patients with chronic depression displayed elevated autistic or autism-like traits. Upon formal diagnostic assessment, a subgroup of 6.5% were found to meet the diagnostic criteria for ASD. These findings illustrate that the interaction between autism, autistic traits, and depression might be an important clinical issue for CD patients.

Similar to ASD patients (Vogeley, Kirchner, Gawronski, Tebartz van Elst, & Dziobek, 2013), many CD patients report a long history of failures in interpersonal and vocational life and resistance to multiple treatments (Angst et al., 2009; Arnow & Constantino, 2003; Klein et al., 2000; Satyanarayana et al., 2009). As a consequence, these patients often develop a negative self-image and a massive sense of guilt, which in turn can reinforce depressive symptomatology. Understanding the distinctive characteristics of CD in the context of autism might be helpful for explaining the difficulties in the interpersonal domain experienced by CD patients with autistic traits that fulfill the formal criteria for comorbid ASD. Knowledge about the typical problems linked to autism, including in group settings, could improve this understanding and reduce the burden on CD patients with autistic traits.

From a diagnostic point of view, more attention should be paid to autistic or autism-like traits in CD patients. This could improve the understanding of the psycho-reactive relevance of such traits to the subsequent development of depression and CD. Also, it could help to identify undiagnosed patients who fulfill the formal diagnostic criteria for ASD. Lack of awareness of the fact that a subgroup of CD patients suffers from ASD often leads to inappropriate treatment and may result in prolonged depression, the development of further comorbidities, failed rehabilitation, and job loss (Radtke, 2016; Takara & Kondo, 2014; Tebartz van Elst, Pick, Biscaldi, Fangmeier, & Riedel, 2013).

Diagnostic distinctiveness therefore has important therapeutic implications. A high number of CD patients are treatment-resistant (Dunner, 2001). Lack of awareness of comorbid autism and autistic or autism-like traits in CD patients could partly contribute to treatment resistance; if the characteristics of autism and autistic traits are overlooked or missed in therapeutic settings, miscomprehension and excessive demands on patients and therapists may occur. Conversely, taking autistic symptoms into account might open up new therapeutic options for CD patients with treatment resistance in whom comorbid ASD can be diagnosed or ASD traits played a critical role in the development of CD. Specific social competence training and adaptation of therapeutic concepts developed to address high-functioning autism (Ebert et al., 2013; Fangmeier et al., 2011; Peters et al., 2013) could help to improve treatment plans and subsequently improve the outcomes for these patients (Radtke, 2016). We have already developed specific treatment approaches for this patient population by combining the locally in Freiburg developed and published concept of FASTER (FreiburgerAspergerSpezifisches Therapiekonzept für ERwachsene; Ebert et al., 2013; Fangmeier et al., 2011; Peters et al., 2013) with strategies that are part of the Cognitive Behavioral Analysis System of Psychotherapy (CBASP; McCullough, 2000), a disorder-tailored treatment program for CD patients (Radtke et al., 2013). In addition, CBASP has been modified for CD patients with ASD in some initial clinical case studies, which take into account the specific needs of the patient group.

4.2. Conclusion

In summary, about half of the patients with CD investigated in this study showed elevated autistic or autism-like traits. This finding illustrates that the interaction between autism, autistic traits, and depression is an important clinical issue in CD patients. As remains unclear whether this finding was due to the state of CD or a premorbid autistic personality trait, further research is needed to clarify the possible role of autistic traits in the development of CD. From a clinical perspective, it might be useful to consider autism-like traits as a possible focus of therapy for CD.

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Conflict of interest

The authors declare that they have no competing interests.

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Appendix A

Table A1
Frequency of autism phenotypes proposed by Wheelwright et al. (2010).

	HC (n = 31)	CD (n = 31)	ASD (n = 27)
Typical	30 (96.8)	16 (51.6)	0 (0)
Broader Autism Phenotype	0 (0)	8 (25.8)	0 (0)
Medium Autism Phenotype	1 (3.2)	5 (16.1)	3 (11.1)
Narrow Autism Phenotype	0 (0)	2 (6.5)	24 (88.9)

Percentages are presented in brackets. The phenotypes, according to Wheelwright, are as follows: typical (AQ < 23), broader autism phenotype (AQ 24–28), medium autism phenotype (AQ 29–34), and narrow autism phenotype (AQ > 34). HC: healthy controls, CD: chronic depression, ASD: autism spectrum disorder, AQ: Autism Spectrum Quotient.

Table A2
Phenotypic overlap of AQ items in the ASD and CD groups.

AQ Item	M_{ASD}	M_{CD}	Difference ($M_{ASD} - M_{CD}$)	Item Text
14	0.67	0.74	−0.08	S/he finds making up stories easy.
3	0.37	0.32	0.05	If s/he tries to imagine something, s/he finds it very easy to create a picture in her/his mind.
30	0.63	0.58	0.05	S/he doesn't usually notice small changes in a situation, or a persons appearance.
46	0.96	0.84	0.12	New situations make him/her anxious.
32	0.81	0.68	0.14	S/he finds it easy to do more than one thing at once.
4	0.85	0.71	0.14	S/he frequently gets so strongly absorbed in one thing that s/he loses sight of other things.
21	0.56	0.32	0.23	S/he doesn't particularly enjoy reading fiction.
29	0.63	0.39	0.24	S/he is not very good at remembering telephone numbers.
43	0.93	0.68	0.25	S/he likes to plan any activities s/he participates in carefully.
10	0.93	0.68	0.25	In a social group, s/he can easily keep track of several different people's conversations.
12	0.96	0.71	0.25	S/he tends to notice details that others do not.
2	1.00	0.74	0.26	S/he prefers to do things the same way over and over again.
16	1.00	0.74	0.26	S/he tends to have very strong interests, which s/he gets upset about if s/he can't pursue.
25	0.93	0.67	0.26	It does not upset him/her if his/her daily routine is disturbed.
49	0.65	0.39	0.27	S/he is not very good at remembering people's date of birth.
34	0.85	0.58	0.27	S/he enjoys doing things spontaneously.
24	0.93	0.65	0.28	S/he would rather go to the theatre than a musuem.
26	0.93	0.65	0.28	S/he frequently finds that s/he doesn't know how to keep a conversation going.
13	0.96	0.68	0.29	S/he would rather go to a library than a party.
8	0.52	0.23	0.29	When s/he is reading a story, s/he can easily imagine what the characters might look like.
37	0.81	0.52	0.30	If there is an interruption, s/he can switch back to what s/he was doing very quickly.
47	0.89	0.55	0.34	S/he enjoys meeting new people.
44	0.96	0.61	0.35	S/he enjoys social occasions.
40	0.85	0.48	0.37	When s/he was younger, s/he used to enjoy playing games involving pretending with other children.
36	0.85	0.48	0.37	S/he finds it easy to work out what someone is thinking or feeling just by looking at their face.
33	0.70	0.32	0.38	When s/he talks on the phone, s/he is not sure when it's her/his turn to speak.
19	0.70	0.32	0.38	S/he is fascinated by numbers.
17	0.78	0.39	0.39	S/he enjoys social chit-chat.
45	0.85	0.45	0.40	S/he finds it difficult to work out people's intentions.
27	0.74	0.32	0.42	S/he finds it easy to "read between the lines "when someone is talking to her/him.
22	1.00	0.58	0.42	S/he finds it hard to make new friends.
48	0.81	0.39	0.42	S/he is a good diplomat.
5	0.85	0.42	0.43	S/he often notices small sounds when others do not.
50	0.96	0.52	0.45	S/he finds it very easy to play games with children that involve pretending.
11	0.96	0.52	0.45	S/he finds social situations easy.
28	0.93	0.47	0.46	S/he usually concentrates more on the whole picture, rather than the small details.
9	0.59	0.13	0.46	S/he is fascinated by dates.
6	0.74	0.26	0.48	S/he usually notices car number plates or similar strings of information.
41	0.74	0.26	0.48	S/he likest to collect information about categories of things (e.g. types of car, types of bird, types oft rain, types of plant)
42	0.78	0.29	0.49	S/he finds it difficult to imagine what it would be like tob e someone else.
18	0.59	0.10	0.50	When s/he talks, it isn't always easy for others to get a word in edgeways.
35	0.77	0.26	0.51	S/he is often the last to understand the point of a joke.
1	1.00	0.48	0.52	S/he prefers to do things with others rather than on her/his own.
20	0.85	0.32	0.53	When s/he is reading a story, s/he finds it difficult to work out the characters 'intentions.
38	0.85	0.32	0.53	S/he is good at social chit-chat.
23	0.89	0.32	0.57	S/he notices patterns in things all the time.
15	0.96	0.39	0.58	S/he finds her/himself drawn more strongly to people than to things.
39	0.93	0.29	0.64	People often tell her/him that s/he keeps going on and on about the same thing.
7	0.81	0.13	0.69	Other people frequently tell her/him that what s/he said is impolite, even though s/he thinks it is polite.
31	0.81	0.10	0.72	S/he knows how to tell if someone listening to him/her ist getting bored.

AQ items are sorted in ascending order by the difference between the means of the groups. A difference in means indicates phenotypic overlap between the ASD and CD groups. Low differences represent great overlap between the groups, and high differences represent low overlap. CD: chronic depression, ASD: autism spectrum disorder, AQ: Autism Spectrum Quotient.

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