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Affective theory of the mind and suicide in women with borderline personality disorder and schizophrenia: a comparative study



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Abstract

Background: Theory of mind (ToM) is one of the essential components of social cognition. Affective ToM enables us to interpret other's feelings and behaviors. Borderline personality disorder (BPD) and schizophrenia are two distinct mental disorders, yet they have a mutual deficit in interpreting emotions, thoughts, and intentions which may lead to a higher incidence of suicidality. Studies that involved social cognition, particularly ToM in schizophrenia, or BPD have controversial results. Therefore, this study aimed at comparing affective ToM functioning in female patients with BPD, schizophrenia, and healthy controls. In addition, identifying the possible impact and any correlation exists between the affective ToM and liability for suicide in those patients. Sixty individuals were recruited from the Institute of Psychiatry, Ain Shams University, Cairo, Egypt, and assigned into 3 groups where group A involved 20 BPD patients, group B involved 20 schizophrenic patients, and group C were healthy persons as a control. Assessment of affective ToM was done using Reading the Mind in the Eyes Test (RMET), and probability of suicide was measured using Suicide Probability Scale (SPS).

Results: Regarding ToM, the three groups were assessed using RMET and the results revealed a significantly higher mean score (*hypermentalization*) in BPD patients than both schizophrenic patients and controls. While schizophrenic patients had significantly lower mean scores than the control group (*hypomentalization*). As well, BPD patients had a significantly higher suicide probability total score than Schizophrenic patients and in all subdomains except for the hostility subdomain that was significantly higher in schizophrenic patients. Interestingly, in BPD, the suicide probability total score was positively correlated with RMET.

Conclusions: BPD patients have enhanced affective ToM and hypermentalization that is significantly associated with increased suicide probability in those patients, while in schizophrenia, hypomentalization could not be linked to increased suicide probability. Rehabilitation and proper management of ToM abnormalities might be a crucial tool in suicide prevention in mental illnesses, particularly, BPD.

Keywords: Theory of mind, Borderline personality disorder, Schizophrenia, Suicide

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Background

The term “social cognition” can be defined as social interactions that include the perception and interpretation of the intentions, dispositions, and behaviors of others with the generation of a response to these behaviors. Social cognition consists of subdomains, namely theory of mind, social perception, social knowledge, attributional bias, and emotion processing. Thus, social cognition is vital for successful and adaptive behavior in social life [1]. For a long time, studies of social behavior and genetics were parallel spectrums of research that rarely interfaced. Surprisingly, recent studies identify a network of brain structures ‘social brain’ as an intermediate step between these two fields and genes are now considered as possible factors in daily social interaction [2].

The Theory of Mind (ToM) reflects the ability to infer mental states such as beliefs, desires, intentions, imagination, and emotions that cause actions [3]. Poor performance in ToM tasks has been reported to be associated with social and behavioral deviations. Deficits in ToM exhibit a cornerstone in the etiology of many psychiatric symptoms and have been used to predict social competence [4]. ToM deficits have been reported in many psychological and neurological disorders, such as the ToM deficit in schizophrenia and its effect on social behavior [1], and personality disorders such as borderline personality disorder [5–7]. An additional distinction can be made between components of ToM: one component is involved in understanding others’ intentions and beliefs (cognitive, ‘cold’ ToM or cognitive empathy), whereas the other one processes other people’s feelings and emotions (affective, ‘hot’ ToM or affective empathy) [8].

Schizophrenia is characterized by changes in language, thinking, mood, social activity, affection, and volition [9]. Schizophrenic patients usually exhibit impaired social cognition interpreted as difficulties in identifying emotions and feelings. Studies have pointed the characteristic symptoms in schizophrenia to social cognition rather than neurocognition [1].

Borderline personality disorder (BPD) is characterized by interpersonal and affective instability, impulsivity, and identity problems [10]. The impairment in interpersonal appraisals comprises the core in severe interpersonal instability seen in BPD, e.g., expectations of abandonment and extremely positive and negative views of others which may initiate suicidality and self-injurious behaviors [11]. Nevertheless, the change in ToM has been linked to the disturbance that occurs in individuals diagnosed with BPD when compared to healthy individuals [12]. A controversy regarding social cognition effect and level has been detected. Some studies have found a decrease or no change in ToM in BPD patients [6, 13, 14], while other studies have found increased performance compared to healthy controls on ToM [4,

6]. The significant role and involvement of ToM in BPD and schizophrenia urge further investigation of that crucial tool.

In the current study, we hypothesized that patients with borderline personality disorder and patients with schizophrenia have the theory of mind abnormalities compared to healthy controls. This could be the key to interpersonal appraisal deficits which underly social interaction difficulties. Therefore, we expect that theory of mind abnormalities may be linked to suicidal probability in those patients.

The rationale of our study is that understanding the type of social cognition dysfunction in BPD and schizophrenia patients and the possible association between ToM deficits and suicide would help in early prediction of who is at risk for suicide, benefit from including new interventions targeted at improving social cognition and functioning which could decrease suicidal risk and improve prognosis and overall quality of life of those patients.

Methods

Study design and participants

A cross-sectional, comparative study was approved by the ethics committee of the Institute of Psychiatry, Ain Shams University. A convenient sample of patients diagnosed with BPD and schizophrenia was selected from the outpatient clinics of Ain Shams University, Psychiatry Department, Cairo, Egypt, which was held during the period between October 2018 and January 2021. The Institute of Psychiatry is located in Eastern Cairo and serves a catchments area of about the third of Greater Cairo. It serves both urban and rural areas.

The study included a statistically significant number of 60 individuals, and they were divided into three groups, each included 20 patients. Group (A): patients that were diagnosed with BPD, group (B): patients that were diagnosed with schizophrenia, and group (C): healthy controls.

Inclusion criteria

Patients included in the group (A) were (1) diagnosed using the Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II), for assessment and diagnosis of personality disorders; (2) age: 18–45 years; and (3) sex: females. All group (A) patients were not medicated. Patients included in the group (B) were (1) diagnosed using the (SCID-I); (2) patients in full remission (a period after a previous episode during which no disorder-specific symptoms are present), all were on the second-generation antipsychotics; (3) age: 18–45 years; and (4) sex: females. The inclusion criteria for group (C) were (1) healthy subjects that did not have a mental illness or

personality disorders, based on the SCID-I and II, and (2) matching the patient's groups in age and sex.

Gender was limited to females only as to our knowledge females are more likely to attempt suicide than males are; however, males are more likely to succeed to complete suicide.

Exclusion criteria

Individuals were excluded from the three studied groups if (1) they were presented with any other psychiatric comorbidity (any patient with additional current or past DSM-IV diagnosis on Axis I/II were not recruited); (2) they were presented with mental retardation or developmental disability; (3) they were presented with a neurological disorder or uncontrolled medical condition as indicated by the clinical history, physical examination, laboratory, or radiological findings; (4) they cannot read or write; and (4) they refused to sign the informed consent before enrolment in the study.

Study tools

All subjects were assessed by using the following tools.

A detailed history data sheet (Ain Shams Psychiatry Clinical Interview) was used to record demographic information, clinical history of the participants, and concurrent medical conditions.

The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) [15]

SCID-I is a structured diagnostic interview designed for use by mental health professionals. It assesses 33 of the more commonly occurring psychiatric disorders described in the fourth edition of the DSM-IV of the APA. Furtherly, the Arabic version of SCID I was also previously validated and used in our study accordingly [16].

The Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II) [17]

SCID-II is a valid and reliable is a tool that has been conducted as a clinical interview to mainly assess the dimensions and categories of the DSM-IV personality disorders. The Arabic version of SCID II was previously validated and used accordingly in our study [18].

The Reading the Mind in the Eyes Test (RMET) (mental state decoding) (eyes task) [19]

This test was genuinely reported for properly assessing affective ToM. A total of 36 pictures were presented for both genders, exhibiting the eye region of the faces. It should be noted that four emotion-descriptive words usually surround each one of the 36 pictures, and subjects were then asked to describe and interpret these pictures. The Arabic version of RMET was previously validated and used accordingly in the present study [20].

The Suicide Probability Scale (SPS) [21]

This test has been adequately validated by previous investigations for assessment of the risk of suicide among adolescents and adult populations that exceed 14 years of age. The test is composed of a total of 36 items that assess suicide ideation, negative personal evaluation, hopelessness, and hostility, as reported by the tested individuals to obtain a proper diagnosis in the most comprehensive and fair method. Each item of the test is graded by a 4-point scale ranging between 1 and 4, referring to "little or none" to "all or most" of the time. Three summary scores were furtherly reported, including the SPS, a total weighted score, and a normalized *T* score. The Arabic version was validated and used accordingly in the present study [22].

Statistical analysis

For adequate assessment and evaluation of our outcomes, chi-square test, means (standard deviations), independent *t* test, analysis of variance (ANOVA), and Tukey's test for analyzing the included data were involved, for which the Statistical Package for Social Science (SPSS) V20 was used. A *P* value <0.05 is considered significant.

Results

Socio-demographic and clinical data

The means of the age of both groups of BPD and schizophrenia patients were 27.100 ± 4.909 years and 30.150 ± 5.696 years, respectively, and that of controls was 30.250 ± 5.428 years, all included participants were females. The studied groups were matched based on age, marital status, educational level, and medical comorbidities with no significant differences among the 3 groups.

However, the schizophrenia group had more unemployed patients and more family history of psychiatric illness compared to both BPD and controls, while BPD had more history of separated parents, as shown in Table 1.

Comparative results between the three groups

RMET among the three groups disclosed that BPD patients had significantly higher mean scores than both schizophrenic patients and healthy controls, with a *P* value <0.001. While schizophrenic patients had a significantly lower mean score than the control group with a *P* value <0.001, as shown in Table 2 and Fig. 1. Meanwhile, on the suicide scale, the SPS revealed that both BPD and schizophrenic patients had a significantly higher suicide probability compared to healthy controls in both total score and its subdomains. Nonetheless, BPD patients showed a significantly higher suicide probability than schizophrenic patients except hostility that was

Table 1 Sociodemographic and clinical data of the studied groups.

Variables	BPD		Schizophrenia		Control		P value	
	N	%	N	%	N	%		
Age	Range	20	38	21	46	21	45	0.116
	Mean ±SD	27.1	4.909	30.15	5.696	30.25	5.428	
Marital status	Single	16	80	12	60	12	60	0.352
	Married	2	10	7	35	7	35	
	Divorced	2	10	1	5	1	5	
Educational level	Technical	5	25	6	30	4	20	0.925
	University	11	55	11	55	11	55	
	Postgraduate	4	20	3	15	5	25	
Work	Unemployed	7	35	16	80	6	30	0.002*
	Employed	13	65	4	20	14	70	
Parental separation	Non separated	12	60	14	70	19	95	0.031*
	Separated	8	40	6	30	1	5	
Medical comorbidities	Positive	8	40	6	30	1	5	0.153
	Negative	18	90	15	75	19	95	
FH of psychiatric illness	Negative	11	55	7	35	17	85	0.005*
	Positive	9	45	13	65	3	15	
DOI	Range	1	20	1	20	-	0.281***	
	Mean ±SD	6.1	5.077	7.85	5.05	-		
Number of the previous admissions	Range	1	7	1	7	-	0.799***	
	Mean ±SD	2.857	2.854	2.6	2.062	-		
Medical comorbidities	Positive	8	40	6	30	1	5	0.153
	Negative	18	90	15	75	19	95	
FH of psychiatric illness	Negative	11	55	7	35	17	85	0.005*
	Positive	9	45	13	65	3	15	

P value > 0.05: Significant, SD standard deviation. Chi-square test was used for comparison; *statistically significant, **comparison was done by ANOVA, ***comparison was done by t test, BPD borderline personality disorder, DOI duration of illness, FH family history

significantly higher in schizophrenic patients, as shown in Table 3 and Fig. 2.

REMT and suicide in patients with BPD

All suicide subdomains and suicide probability total scores had a significant positive correlation with RMET, except negative self-evaluation. Hopelessness, hostility, and suicidal ideation were moderately correlated with a P value of 0.008, 0.001, and 0.003, respectively, and suicide probability was strongly correlated with a P value < 0.001. Consequently, indicating that boosted score of

ToM in BPD is associated with significantly higher suicide probability, as shown in Table 4.

REMT and suicide in patients with schizophrenia

Suicidality in schizophrenia was negatively correlated with RMET score. Although the insignificant correlation was seen in all SPS subdomains and total score with RMET, hopelessness was found inversely proportional with significant correlation (P value 0.017), as shown in Table 5.

Table 2 Comparison of RMET mean score between the studied groups

RMET	Groups									ANOVA		Tukey's test		
	BPD			Schizophrenia			Control			F	P value	B&S	B&C	S&C
Range	25	-	33	10	-	21	19	-	26	151.477	<0.001*	<0.001*	<0.001*	<0.001*
Mean ±SD	28.750	±	2.124	15.100	±	3.024	22.200	±	2.191					

P value > 0.05: significant, *statistically significant, SD standard deviation, RMET Reading the Mind in the Eye Test, B borderline, C controls, and S schizophrenia

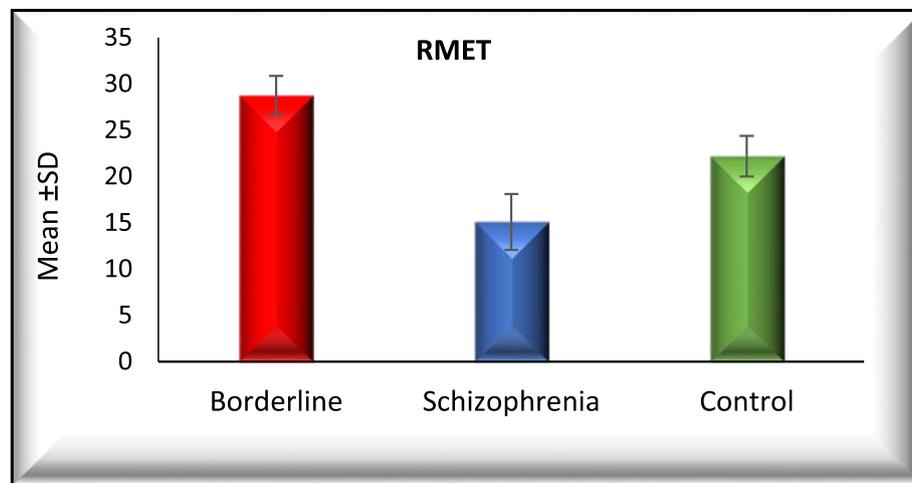


Fig. 1 Comparison of RMET mean score between the studied groups

Discussion

Social functioning impairment can be a clue to understand interpersonal problems associated with two of the most common mental illnesses namely, schizophrenia and BPD [23]. The interpersonal changes associated particularly with BPD involve affective, cognitive, behavioral, and disturbed relatedness symptoms, whereas negative symptoms of asociality, avolition, social withdrawal, and poor social skills are the characteristics of schizophrenia [4]. Interestingly, there is a strong evidence that ToM is considered a core concept in social functioning which can be used as a diagnostic criterion in these mental illnesses.

To our knowledge, there are inconsistent results regarding theory of mind (mentalization) processes, and what type of mentalization errors, occurs in patients with schizophrenia or BPD. Also, there is a lack of

studies that linked ToM to suicidality in both BPD and schizophrenia.

This study aimed to assess affective ToM in BPD patients compared to schizophrenia patients and healthy controls and to identify the impact of ToM functioning and its clinical correlates to suicidal probability in the three groups.

Affective ToM was assessed by RMET as the most common measure for understanding how people process other’s feelings and emotions [24, 25], and it was obvious that BPD had superiority in RMET score than control or schizophrenic patients ($P < .001$), which means that BPD patients have enhanced affective theory of mind (hypermentalization). This has an agreement with findings of two similar studies [26, 27]. Another study has agreed with ours where BPD patients with and without the major depressive disorder (MDD) were found

Table 3 Comparison of suicide probability among the studied groups

Variables		Groups						ANOVA	Tukey’s test		
		BPD		Schizophrenia		Control		P value	B&S	B&C	S&C
Hopelessness	Range	12	25	14	18	11	16	<0.001*	<0.001*	<0.001*	0.003*
	Mean ±SD	19.95	3.395	15.75	1.209	13.35	1.348				
Suicidal ideation	Range	16	28	10	28	11	15	<0.001*	<0.001*	<0.001*	0.048*
	Mean ±SD	23.05	3.187	15.25	5.486	12.4	1.142				
Negative self-evaluation	Range	11	23	10	24	7	17	<0.001*	0.047*	<0.001*	0.011*
	Mean ±SD	17.15	3.014	14.55	3.927	11.35	3.117				
Hostility	Range	9	24	12	25	8	13	<0.001*	0.014*	<0.001*	<0.001*
	Mean ±SD	15.25	4.756	18.85	4.66	9.8	1.361				
Suicide probability score	Range	33	48	31	44	32	39	<0.001*	<0.001*	<0.001*	0.031*
	Mean ±SD	43.4	4.109	37.25	3.567	34.4	2.521				

P value > 0.05: significant, *statistically significant, SD standard deviation, ANOVA analysis of variance, BPD borderline personality disorder, B borderline, C controls, and S schizophrenia

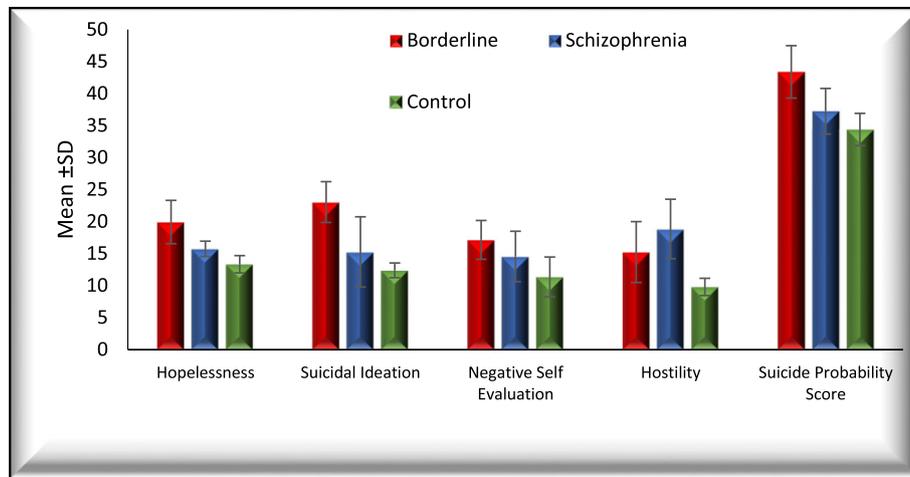


Fig. 2 Comparison of Suicide probability among the studied groups

scoring higher in affective ToM using RMET, particularly those without MDD [28]. This also supports earlier study findings that individuals with BPD are more accurate than healthy controls at detecting certain emotional states in facial emotion recognition tasks [29, 30].

Also, Normann-Eide and colleagues have agreed with our study results in that BPD patients were found to have a tendency to hypermentalize where ToM was investigated by the Movie for the Assessment of Social Cognition. Also, the study concluded that there was an association between hypermentalization and interpersonal problems in BPD patients and that they tend to misinterpret social information [31].

In line with our results, a study by Ortega-Díaz and colleagues has revealed that BPD patients have ToM deficits in the form of overmentalization when investigated by MASC and social functioning scale. Also, their first-degree relatives showed significant differences in social functioning with regard to family relationships and interpersonal behavior compared to controls [14]. Consequently, according to all the mentioned studies BPD patients have increased sensitivity to the mental states

and social signals of others which may be an explanation for the social function difficulties.

Nevertheless, our results contradict other studies like a study by Levine et al. (1997) which found that individuals with BPD were less accurate at facial recognition tasks than healthy controls [32], a finding also supported in a later study by Bland and colleagues [13]. In addition, a study by Górska and Marszał revealed no difference in BPD patients and the control group in ToM level and the study relates such controversy of their results to a small sample size as well as the large intragroup differences particularly in education and age [8]. Similarly, the findings of an earlier study conducted by Preißler et al. did not report differences in mentalizing between BPD and healthy subjects [33]. However, in this study, some patients were medicated with psychotropic medications, which may have influenced the results.

Came in the same line, another study by Petersen and colleagues that have revealed the equal capability of both BPD and control groups in undertaking simple mentalization tasks, yet deficits in mentalization were detected in more complex tasks. The study

Table 4 Correlation between RMET and suicide probability in BPD group

BPD group	Correlations	
	RMET	P value
Hopelessness	0.575	0.008*
Suicidal ideation	0.632	0.003*
Negative self-evaluation	0.236	0.316
Hostility	0.705	0.001*
Suicide Probability Score	0.826	<0.001*

P value > 0.05: significant, *statistically significant, BPD borderline personality disorder, RMET Reading the Mind in the Eye Test

Table 5 Correlation between RMET and suicide probability in the schizophrenia group

Schizophrenia group	Correlations	
	RMET	P value
Hopelessness	-0.526	0.017*
Suicidal Ideation	-0.224	0.343
Negative Self Evaluation	-0.014	0.954
Hostility	-0.133	0.575
Suicide Probability Score	-0.159	0.504

P value > 0.05: significant, *statistically significant, RMET Reading the Mind in the Eye Test

showed significantly more mentalization errors on affective and cognitive understanding of faux pas and a Joke Appreciation task [34].

In schizophrenia, our study results have revealed a lower RMET score compared to both BPD patients and healthy controls indicating a deficit in ToM (hypomentalization) ($P < 0.001$). This goes with the results of García-Fernández and colleagues which compared the performance of 90 patients with schizophrenia in both first episode and chronic stage versus healthy controls using two ToM tasks (Hinting Task and RMET) and schizophrenia patients showed significantly poor performance than controls with more worsening in chronicity [35]. Another agreement came from a meta-analysis was conducted to answer a question regarding the possible impairment in ToM in schizophrenia and revealed a significant mentalization impairment in schizophrenia. Interestingly, patients in remission were also impaired which supports that mentalizing deficit is a core feature in schizophrenia, which agrees with the findings of our study [36].

Furthermore, by using another scale to assess ToM functioning as in a study done by Abdel-Hamid and her colleagues (2009) who used a computerized theory of mind (ToM) test consisting of a picture sequencing task and a questionnaire, ToM deficits existed in schizophrenia patients more frequently than controls [37]. Going through all of this research, we emphasize the fact that impairment in ToM is a stable trait feature in patients with schizophrenia.

In contrast, older studies that used another tool for ToM assessment compared patients with different symptom profiles or remitted to controls. Generally, it was concluded that deficits are only related to the severity of symptoms [38–40].

Suicide is a major psychiatric emergency, as the second leading cause of death in youth among adolescents and young adults [41].

In our study, BPD patients had superiority in suicide probability score than both patients with schizophrenia and healthy controls. Moreover, findings from the current study reveal that hypermentalization (enhanced affective ToM) detected in BPD patients shares a significant relation with suicidal probability. However, hypomentalization (less ToM) detected in schizophrenia had a non-significant relation with suicidal probability. This is in agreement with the findings of a study by Hatkevich and colleagues which revealed a significant relation between hypermentalization and suicide in adolescence [25].

In addition, several studies have suggested that individuals who engage in self-harm behaviors have significant hypermentalization errors that lead to difficulties with managing specific mental states and emotional dysregulation [42, 43]. Similarly, other findings proposed that these

behaviors are coping strategies to alleviate negative effect resulting from hypermentalizing state [44].

To explain, Allen et al. (2008) named patients who have enhanced mental sensitivity to social signals by pseudo-mentalizing style, as they are overconcerned with the interpretation of information from others' mental states or emotions [45], which may be under affection by their own memories and personal beliefs [46]. Therefore, hypermentalizing is maladaptive for interpersonal functioning, as it may lead individuals to assume malevolent intentions of others and inappropriately respond (e.g., poor peer relations, misunderstanding of social interactions, severe rejection sensitivity, and loss of social support), all of which could underlie and exacerbate the emotion dysregulation [47–49].

So, Hatkevich et al.'s study has pointed out the importance of (1) early detection of patients with pseudo-hypermentalization tendency and (2) providing secondary prevention programs to adjust mentalizing style [25].

In contrast, Laghi et al.'s (2016) found mentalization skill deficits in patients with self-harm behaviors, compared to the controls. The differences between the studies' results could have been attributed to different tools used. Laghi et al. used the Theory of Mind Assessment Scale (T.H.o.m.a.s), a semi-structured interview that assesses the subject's understanding of other's mental states in different situations [50].

Impairments in overall ToM especially the affective part are associated with suicidal probability. Therefore, psychotherapy programs which target mentalization skills hold promise for suicide risk identification, treatment, and prevention work.

Thus, current findings support results of previous treatment-based research, suggesting that interventions targeting social-cognitive processes and defects in mentalization as mentalization-based therapy (MBT) may be helpful in improving ToM impairments and associated suicide in BPD. For example, 3 previous RCT assessed the effects of MBT in BPD compared to standard clinical management. It was found that MBT was superior in terms of its effects on suicide attempts and self-harm. The experienced reduction in suicidality was sustained at the 5-year follow-up [51–53].

In schizophrenia, a significant high suicide probability existed compared to control ($P < 0.001$). However, unfortunately, the correlation between RMET and suicidality assessed by SPS could not be proven with a significant difference in this study except for the hopelessness subdomain ($R = -0.526$, $P = 0.017$), though insignificant weak inverse relation existed between all suicide probability score domains and RMET. This is inconsistent with findings of the study by Canal-Rivero and colleagues conducted in 2019 to investigate the factors associated with multiple suicidal attempts in patients

with the first episode of psychosis, and they found that patients with ToM deficit detected by false belief task (FBT) made more suicidal attempts than those without ($P=0.02$). Moreover, errors in FBT were predictors of the number of suicides attempts in those patients ($B=0.48$, $t=2.11$, $P=0.04$) [54]. Similarly, in an earlier study, ToM impairment was associated with suicidal behaviors in schizophrenia [55]. This finding also supported by a recent study revealed that social cognitive impairment is a predictor of suicidal behaviors in schizophrenic patients [56]. This controversy could owe to different tests used to investigate mentalization skills, different study designs, and criteria of the included participants.

Our study is limited by the small sample size, our sample is comprised of females only due to few numbers of males presented with BPD at our institute. So, our results cannot be generalized to whole BPD and schizophrenia patients. A second limitation is that not all domains of social cognition were assessed only affective ToM, as well we did not examine more complex mentalizing tasks to give more illustration of the magnitude and different patterns of social cognitive problems in BPD and schizophrenia. Therefore, further investigations are urged for further validation of the current evidence.

Conclusions

In summary, this comparative study aimed to differentiate between affective ToM deficit in borderline personality disorder and schizophrenia patients. The results revealed that hypermentalization in BPD patients was significantly correlated with a high probability of suicidality in those patients. While in schizophrenia, hypomentalization could not be linked to increased suicidality, though suicide probability in those patients was strongly exhibited more than control. Consequently, these results encourage the use of the RMET score to assess the affective theory of mind as a tool for early detection of suicidality in mental illnesses, particularly, BPD.

Abbreviations

ANOVA: Analysis of variance; BPD: Borderline personality disorder; FH: Family history; MASC: Movie for the Assessment of Social Cognition; MDD: Major depressive disorder; RMET: Reading the Mind in the Eyes Test; SCID-I: Structured Clinical Interview for DSM-IV Axis I Disorders; SCID-II: Structured Clinical Interview for DSM-IV Axis II Disorders; SPS: Suicide Probability Scale; SPSS: Statistical Package for Social Science; ToM: Theory of mind

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Authors' contributions

All authors had made a substantial contribution to the design of work, data collection and interpretation, writing the manuscript, revising it, and approving the final version. M.A. made the main effort in patient data collection. A.S, M.H, R.H, and Z.M made the major contribution in analyzing the results, reviewing current literature, and writing the manuscript. The authors read and approved the final manuscript.

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Availability of data and materials

The dataset created and analyzed during the current study will be uploaded with the manuscript in Excel file format and will be available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study conformed to the standards of the Ethical Review Committee, Ain Shams University (FMASU M D 339/2018). Before the study was inaugurated, a written informed consent was signed from study participants after adequately explaining the study aims and outcomes. The anonymity of the subjects was ensured, no identifying information was obtained, and the results were stored in a secure place with access only to the main author of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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