Association of executive dysfunctions and symptoms in a sample of bipolar affective disorder patients

Magda Fahmy[a], Wafaa Hagagg[a], Khaled Abd El Moez[a], Mona Elsayed[a], Sabry Elsayes[b]

[a]Department of Psychiatry, Faculty of Medicine, Seuz Canal Universiy, Ismalia, [b]Ministry of Health, Egypt

Correspondence to Mona Elsayed, Department of Psychiatry, Faculty of Medicine, Seuz Canal University, Ismailia, Egypt;
Tel: +20 111 953 1430;
e-mail: monaneuro_24@yahoo.com

Received 19 January 2017
Accepted 12 June 2017

Egyptian Journal of Psychiatry
2017, 38:147–153

Background
Executive functions are defined as the higher-level cognitive functions that are necessary to plan and execute goal-directed behaviors and may include cognitive flexibility, creativity, planning ability, abstract thinking, concept formation, and response inhibition. Recently, it has been shown that those with schizophrenia, as well as those with bipolar disorder, exhibit deficits in executive functions relative to controls. Executive function capability is an important predictor of the treatment, prognosis, and functional outcomes of these disorders.
Patients and methods
This cross-sectional study was carried out in Suez Canal University Outpatient Psychiatric Clinic. It included 60 patients with bipolar disorder type 1 (male and female). All studied patients were subjected to assessment of the manic symptoms using the total scores of Young's Mania Rating Scale and the depressive symptoms using the total scores of the Hamilton Depression Rating scale by researcher. Assessment of cognitive functions was carried out by an expert psychologist using the Wechsler Adult intelligence Scale, Wechsler Memory Scale-III-Revised Hayling Sentence Completion Test, Trail Making Test, and the Wisconsin Card-Sorting Test.
Result
The results showed worsening in the executive function associated with manic than with depressive symptoms.
Conclusion
Manic symptoms had a significant effect on cognitive functions.

Keywords:
bipolar disorder, depression, executive functions, manic

Egypt J Psychiatr 38:147–153

1110-1105

Introduction

Executive functions are a highly complex structure consisting of several internal mental processes designed to solve mental and environmental complex problems in an efficient and acceptable way to the person and the society (Papazian *et al.*, 2006).

Generally, executive function is defined as the higher-level cognitive functions that are necessary to plan and execute goal-directed behaviors and may include cognitive flexibility, creativity, planning ability, abstract thinking, concept formation, and response inhibition (Jurado and Rosselli, 2007). Recently, it has been shown that those with schizophrenia, as well as those with bipolar (BP) disorder, exhibit deficits in executive function relative to controls. Executive function capability is an important predictor of the treatment, prognosis, and functional outcomes of these disorders (Ritsner *et al.*, 2006).

Sweeney *et al.* (2000) observed widespread cognitive disturbances during manic and mixed affective states, which contrasted with less extended deficits in depression. Similarly, Murphy *et al.* (1999) found suboptimal decision-making, reduced accuracy, and decreased ability to inhibit responses in an affective shifting task, in manic, but not depressed, BP patients. The latter were impaired in their ability to reverse the focus of attention.

The present study compared the associations of symptom pattern with executive functions in BP I disorder patients with manic and depressive symptoms.

Patients and methods

This cross-sectional study was carried out in Suez Canal University Outpatient Psychiatric Clinic. It included 60 patients with BP disorder type 1

 DOI: 10.4103/ejpsy.ejpsy_7_17

(male and female). Patients were divided into two subgroups according the predominant current clinical symptoms, either with predominant manic symptoms or with predominant depressive symptoms. Conse- quently, all patients who met the inclusion and exclusion criteria were included in the study.

Inclusion criteria

(1) Age between 18 and 45 years to minimize the influence of aging on cognitive functions.
(2) Diagnosis of BP type 1 according to American *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. (DSM-IV), Text Revision).
(3) Both sexes.
(4) Duration of last hospitalization less than 6 months.
(5) Duration of the disorder of at least 1 year.
(6) No electroconvulsive therapy during the last 6 months.
(7) Having symptoms in the stabilizing or the maintenance phase.

Exclusion criteria

(1) Mental retardation (Intelligence Quotient less than 70).
(2) History of head trauma.
(3) Severe general medical conditions, which can interfere with test performance, such as hepatic precoma, renal failure, and delirium.
(4) Moderate-to-severe sensory defect such as hearing or visual defect.
(5) History of alcohol or substance abuse during the past year.
(6) Comorbidity of other axis one psychiatric disorders for both schizophrenia and BP patients.

Sample size

The sample size was calculated using the following equation:

$$n = \frac{\left(z_{\alpha/2} + z_{\beta}\right)^2 \times \left(P_1(1-P_1)\right) + \left(P_2(1-P_2)\right)}{\left(P_1 - P_2\right)^2},$$

where:

(1) $z_{\alpha/2}$ (confidence level)=1.96,
(2) z_{β} (power of the study)=0.84,
(3) P_1 (prevalence of executive dysfunction among schizophrenic patients)=65%,
(4) P_2 (prevalence of executive dysfunction among BP I patients)=30%,
(5) n (sample size)=60 patients per group.

Methods

All studied patients were subjected to the following:

(1) Detailed history taking and mental status examination performed by researcher through a semistructured interview (First*et al.*, 1996).
History taking included the following:
  (a) Age at illness onset.
  (b) Duration of illness.
  (c) Type of medications.
  (d) Family history and consanguinity.
(2) Complete physical and neurological examination to exclude neurological or organic comorbidities.
(3) Assessment by researcher of the manic symptoms in BP I patients using the total scores of Young's Mania Rating Scale (YMRS) (Young*et al.*, 1978).
(4) Assessment by researcher of the depressive symptoms in BP I patients using the total scores of the Hamilton Depression Rating scale (Hamilton, 1960).
(5) Assessment of cognitive functions by an expert psychologist included the following:
  (a) Assessment of IQ using the Wechsler Adult intelligence Scale, Arabic version (Wechsler, 1955).
  (b) Assessment of memory (verbal, visual, and working memory) using the Wechsler Memory Scale-III-Revised (WMS-R) Wechsler (1997).
  (c) Assessment of the executive functions for the patient and control groups included the following:
    (i) Assessment of response initiation and inhibition using the Hayling Sentence Completion Test (Burgess and Shallice, 1996).
    (ii) Assessment of cognitive flexibility using the Trail Making Test (Retain and Wolfson, 1985).
    (iii) Assessment of reasoning, decision-making, and strategic planning using the Wisconsin Card-Sorting Test (Berg and Grant, 1948).

Ethical considerations

Along the procedures of the present study, the following ethical considerations taken:

(1) A brief explanation of the aim of the study to patients and their families, stressing the importance of data they are going to offer.
(2) Obtaining informed consent before the start of the study from patients and their families based on information given about the nature of the study.
(3) No obligation to participate.

(4) Ensuring the confidentiality of the collected data.
(5) Results of this study used for the benefit of patients.
(6) During the study, participants were not exposed to any harm.

Ethical committee of the Faculty of Medicine, Suez Canal University approved the ethical consideration of the study.

Result

This cross-sectional study was carried out in Suez Canal University Outpatient Psychiatric Clinic. It included 60 patients with BP I disorder (26 male and 34 female) with a mean of age 34.364± 9.012 years. Table 1 shows a statistically significantly lower working memory score in BP I group with predominant manic symptoms compared with BP I group with predominant depressive symptoms.

Table 2 shows a statistically significantly lower overall scaled score in the BP I group with predominant manic symptom compared with the BP I group with predominant depressive symptoms. There was statistically significantly higher A errors-connected errors in the BP I group with predominant manic symptoms compared with the BP I group with predominant depressive symptoms.

Table 3 shows a statistically significant prolonged MT-B part in the BP I group with predominant manic symptoms compared with the BP I group with predominant depressive symptoms.

Table 4 shows a statistically significantly lower TC in the BP I group with predominant manic symptoms compared with the BP I group with predominant depressive symptoms. There was a statistically significantly higher preservative error (PE) in the BP I group with predominant manic symptoms compared with the BP I group with predominant depressive symptoms.

Table 5 shows that the very severe YMRS score exhibited significant negative associations with WMS-III Working memory (r=−0.239; P=0.04).

Table 1 Comparison between bipolar I patients as regards Wechsler Memory Scale-III

	Bipolar I group with pred. depressed symptoms (n=28) (mean±SD)	Bipolar I group with pred. manic symptoms (n=32) (mean±SD)	t	Significance
WMS-III composite score	28.27±8.19	26.75±6.54	0.834[a]	0.072 (NS)
WMS-III Verbal Memory	6.93±2.75	6.41±2.55	0.953[a]	0.064 (NS)
WMS-III Working Memory	7.82±2.54	5.97±1.96	1.820[a]	0.04 (S)
WMS-III Visual Memory	9.17±3.32	8.54±2.95	0.591[a]	0.193 (NS)

S, significant; WMS, Wechsler Memory Scale. [a]Independent samples t-test between two patient groups. P-value 0.05.

Table 2 Comparison between bipolar I patients as regards Hayling Sentence Completion Test

	Bipolar I group with pred. depressive symptoms (n=28) (mean±SD)	Bipolar I group with pred. manic symptoms (n=32) (mean±SD)	t	Significance
Overall scaled score (range 1–10))	6.7±1.1	5.0±1.8	4.336[a]	0.0001 (HS)
Section 1 scaled score (range 1–7)	5.8±1.1	5.3±0.9	1.935[a]	0.06 (NS)
Section 2 scaled score (range 1–8)	6.8±1.9	5.9±0.9	1.980[a]	0.057 (NS)
Suppression score (s)	22.8±15.9	28.7±19.4	1.875[a]	0.07 (NS)
Section 2 error scaled score (range 1–8)	6.3±2.5	6.0±1.9	0.527[a]	0.600 (NS)
A errors-connected errors (range 0–15)	0.8±0.5	1.7±1.4	3.223[a]	0.001 (HS)
B errors-unconnected errors (range 0–10+)	2.8±2.3	2.0±1.2	1.719[a]	0.09 (NS)

HS, highly significant; S, significant. [a]Independent sample t-test between two patient groups. P-value>0.05.

Table 3 Comparison between bipolar I patients as regards Trial Making Task

	Bipolar I group with pred. depressive symptoms (N=28) (mean±SD)	Bipolar I group with pred. manic symptoms (N=32) (mean±SD)	t	Significance
TMT-A time (s)	25.6±8.4	29.9±9.4	1.857[a]	0.086 (NS)
TMT-B time (s)	56.8±27.5	77.1±39.4	3.512[a]	0.03 (S)
Time difference TMT-B-A	71.1±24.6	77.3±34.3	0.502[a]	0.126 (NS)

S, significant; TMT, Trial Making Task. [a]Independent samples t-test between two patient groups. P-value >0.05.

Table 4 Comparison between bipolar I patients as regards the Wisconsin Card-Sorting test

	Bipolar I group with pred. depressive symptoms (*N*=28) (mean±SD)	Bipolar I group with pred. manic symptoms (*N*=32) (mean±SD)	*t*	Significance
TC	47.9±13.9	40.4±9.9	2.333[a]	0.02 (S)
TE	22.7±11.9	28.2±13.2	1.204[a]	0.096 (NS)
CR	10.9±8.6	12.7±6.6	0.915[a]	0.263 (NS)
PE	8.9±5.3	10.9±5.3	1.958[a]	0.04 (S)
CC	3.9±1.9	2.3±1.2	1.150[a]	0.132 (NS)

CC, categories completed; CR, number of continuous reaction; PE, preservative error; S, significant; TC, total correct; TE, total error.
[a]Independent samples *t*-test between two patient groups. *P*-value<0 .05.

Table 5 Correlations between the severities of Young's Mania Rating Scale and cognitive functions using Wechsler Memory Scale-III

	Mild score (6–12)		Moderate score (13–19)		Severe score (20–29)		Very severe score (30+)	
	r	*P*	*R*	*P*	*R*	*P*	*R*	*P*
WMS-III composite score	0.043	0.720	0.127	0.089	–0.138	0.094	–0.218	0.056
WMS-III Verbal Memory	0.057	0.852	0.274	0.546	0.032	0.986	–0.112	0.148
WMS-III Working Memory	0.087	0.992	0.219	0.073	0.076	0.525	–0.239	0.04 (S)
WMS-III Visual Memory	0.127	0.089	0.133	0.091	0.056	0.861	0.164	0.068

WMS, Wechsler Memory Scale *r*: Pearson's partial correlation coefficient-value 0.05.

Table 6 Correlations between the severity of Young's Mania Rating Scale and cognitive functions using Hayling Sentence Completion Test, Trial Making Task, and Wisconsin Card-Sorting Test

	Mild score (6–12)		Moderate score (13–19)		Severe score (20–29)		Very severe score (30+)	
	R	*P*	*R*	*P*	*r*	*P*	*R*	*P*
Overall scaled score (range 1–10)	0.065	0.568	0.453	0.065	0.046	0.774	–0.317	0.074
Section 1 scaled score (range 1–7)	0.186	0.256	0.046	0.774	0.132	0.181	0.286	0.064
Section 2 scaled score (range 1–8)	0.047	0.776	0.097	0.546	0.054	0.794	0.186	0.256
Suppression score (s)	0.054	0.413	0.065	0.568	0.018	0.257	0.067	0.569
Section 2 error scaled score (range 1–8)	0.045	0.754	0.221	0.092	0.213	0.083	–0.025	0.982
A errors-connected errors (range 0–15)	0.196	0.276	0.046	0.774	0.132	0.181	0.286	0.064
B errors-unconnected errors (range 0–10+)	0.221	0.092	0.097	0.546	0.046	0.774	0.016	0.918
TMT								
TMT-A time (s)	0.062	0.984	0.186	0.156	0.232	0.082	0.221	0.092
TMT-B time (s)	0.032	0.865	0.021	0.982	0.273	0.057	0.186	0.156
Time difference TMT-B-A	0.045	0.775	0.232	0.068	0.057	0.852	0.061	0.982
WCST								
TC	0.043	0.781	0.047	0.774	0.058	0.862	0.069	0.897
TE	0.075	0.443	0.253	0.056	0.097	0.546	0.047	0.774
CR	0.057	0.852	0.045	0.775	0.232	0.068	0.186	0.156
PE	0.072	0.438	0.054	0.612	0.221	0.092	0.337	0.04 (S)
CC	0.047	0.774	0.213	0.112	0.049	0.781	0.221	0.092

CC categories completed; CR, number of continuous reaction; PE preservative error; TC, total correct; TE total error; TMT, Trial Making Task; WCST, Wisconsin Card-Sorting Test. *r*: Pearson's partial correlation coefficient-value <0.05.

There were nonsignificant correlations between different severity YMRS scores and different WMS-III scores.

Table 6 shows that the very severe YMRS score exhibited significant positive associations with PE in Wisconsin Card-Sorting Test (WCST) (*r*=337; *P*=0.04).

Table 7 shows a nonsignificant correlation between different severity Hamilton Depressive Rating Scale (HDRS) scores and different WMS-III scores.

Table 8 shows a nonsignificant correlation between different severity HDRS score and different Hayling Sentence Completion Test, Trial Making Task (TMT), and WCST scores.

Discussion

Results of the current study showed a statistically significantly lower working memory score in the BP I group with predominant manic symptoms (*n*=32) compared with the BP I group with predominant

Table 7 Correlations between the severities of Hamilton Depressive Rating Scale and cognitive functions by Wechsler Memory Scale-III

	Mild score (8–13)		Moderate score (14–18)		Severe score (19–22)		Very severe score (22+)	
	R	*P*	*r*	*P*	*r*	*P*	*R*	*P*
WMS-III composite score	0.056	0.861	0.127	0.089	0.133	0.091	0.164	0.068
WMS-III Verbal Memory	0.056	0.861	0.164	0.068	0.076	0.525	–0.138	0.094
WMS-III Working Memory	0.057	0.852	0.032	0.986	0.274	0.546	–0.112	0.148
WMS-III Visual Memory	0.087	0.992	0.056	0.861	0.141	0.078	0.219	0.073

WMS, Wechsler Memory Scale. *r*: Pearson's partial correlation coefficient. *P*-value 0.05.

Table 8 Correlations between the severity of Hamilton Depressive Rating Scale and cognitive functions using Hayling Sentence Completion Test, Trial Making Task, and Wisconsin Card-Sorting Test

	Mild score (8–13)		Moderate score (14–18)		Severe score (19–22)		Very severe score (+22)	
	r	*P*	*R*	*P*	*r*	*P*	*R*	*P*
Overall scaled score (range 1–10)	0.054	0.413	0.065	0.568	0.046	0.774	–0.317	0.069
Section 1 scaled score (range 1–7)	0.047	0.776	0.097	0.546	0.054	0.794	0.186	0.256
Section 2 scaled score (range 1–8)	0.045	0.754	0.221	0.092	0.213	0.083	–0.025	0.982
Suppression score (s)	0.186	0.256	0.046	0.774	0.132	0.181	0.286	0.064
Section 2 error scaled score (range 1–8)	0.132	0.181	0.286	0.064	0.286	0.064	0.186	0.256
A errors-connected errors (range 0–15)	0.221	0.092	0.097	0.546	0.046	0.774	0.016	0.918
B errors-unconnected errors (range 0–10+)	0.065	0.568	0.018	0.257	0.016	0.918	0.054	0.413
TMT								
TMT-A time (s)	0.045	0.775	0.232	0.068	0.057	0.852	0.061	0.982
TMT-B time (s)	0.062	0.984	0.186	0.156	0.232	0.082	0.221	0.092
Time difference TMT-B-A	0.032	0.865	0.021	0.982	0.263	0.057	0.186	0.156
WCST								
TC	0.057	0.852	0.045	0.775	0.062	0.984	0.232	0.072
TE	0.047	0.774	0.213	0.112	0.049	0.781	0.221	0.092
CR	0.043	0.781	0.047	0.774	0.058	0.862	0.069	0.897
PE	0.032	0.865	0.062	0.984	0.075	0.443	0.228	0.090
CC	0.075	0.443	0.057	0.852	0.097	0.546	0.273	0.056

CC categories completed; CR, number of continuous reaction; PE preservative error; TC, total correct; TE total error; TMT, Trial Making Task; WCST, Wisconsin Card-Sorting Test. *r*: Pearson's partial correlation coefficient-value <0.05.

depressive symptoms (*n*=28). Thus, there was poor working memory performance in BP patients with manic symptoms compared with BP patients with depressive symptoms.

Similar to our results, Martínez-Arán *et al.*, (2000) found a poorer performance in the BP manic group as regards executive function and verbal and working memory compared with the BP depressive group.

Our results are in agreement with those of Sweeney *et al.* (2000), who observed widespread cognitive disturbances during manic and mixed affective states, which contrasted with less extended deficits in depression. Similarly, Murphy *et al.* (1999) found suboptimal decision-making, reduced accuracy, increased working memory impairments, and decreased ability to inhibit responses in an affective shifting task, in manic, but not depressed, BP patients.

Our results are not in agreement with those of Hoda *et al.* (2015), who conducted a study in El Maamora Mental Hospital over a 6-month period; they found that BP patients in the three groups (manic, depressive, and euthymic) showed significant cognitive deficits compared with controls. Both manic and depressive patients showed impairment in attention, working memory, and executive functions. Euthymic patients showed a significant impairment in working memory and executive functions. This may be attributed to the difference in patients' groups division, study design, and psychological tools used.

Results for the BP I group show a statistically significantly lower overall scaled score in the BP I group with predominant manic symptom compared with the BP I group with predominant depressive symptoms. There was statistically significantly higher A errors-connected errors in the BP I group with

predominant manic symptoms compared with the BP I group with predominant depressive symptoms.

Thus, executive function performance in BP I patients with manic symptoms is lower than that in BP I with depressive symptoms. BP I patients with positive symptoms exhibited longer average response latency for response suppression and demonstrated an increased rate of response errors compared with BP I with depressive symptoms.

Similar to our results, Stoddart *et al.* (2007) and Dixon *et al.* (2004) found that BP patients during manic phase make more errors on HSCT performance.

Similar to our results, Sweeney *et al.* (2000) and Murphy *et al.* (1999) found widespread executive function impairments during manic state of BP, which contrasted with less extended deficit in depression state. They found reduced accuracy, increased error intrusion, and decreased ability to inhibit responses in manic, but not depressed BP patients.

Our results are not in agreement with the results of Joshua *et al.* (2009), who found no difference between the BP group and healthy controls on HSCT performance, and Arts *et al.* (2008), who found that there is no difference in executive functions, mainly response inhibition between BP patients with euthymic, mania, and depression. This discrepancy may be attributed to differences in the sample number, sample design, patient group arrangement, and psychological tests used.

Results of the current study showed that there was a significantly prolonged TMT-B in the BP 1 group with predominant manic symptoms compared with the BP 1 group with predominant depressive symptoms.

Thus, the cognitive flexibility (part B) performance is impaired in BP 1 patients' predominant manic symptoms compared with the BP 1 group with predominant depressive symptoms.

Similar to our results, Martínez-Arán *et al.* (2000), Murphy *et al.* (1999), and Arts *et al.* (2008) found impaired executive functions, cognitive flexibility decision-making, decreased ability to shifting task in manic, but not depressed, BP patients.

Different from our results, Hoda *et al.* (2015) found both manic and depressive BP patients showed impairment in attention, working memory, and executive functions. Murphy *et al.* (1999) found impaired ability to reverse the focus of attention in depressed BP 1 patients. This discrepancy may be attributed to the difference in the symptom classification, severity of symptoms, and study design.

There was a statistically significantly lower total correct in the BP I group with predominant manic symptoms compared with the BPI group with predominant depressive symptoms. There was statistically significantly higher PE in the BP I group with predominant manic symptoms compared with the BP I group with predominant depressive symptoms.

Thus, the executive function performance (decision-making, reasoning. and strategic planning) more affected in the BP 1 group with predominant manic symptoms compared with the BP 1group with predominant depressive symptoms.

Similar to our results, Stoddart *et al.* (2007) and Dixon *et al.* (2004) found reduced accuracy of decision-making and increased error intrusion in manic, but not depressed BP patients.

Our results are not in agreement with those of Arts *et al.* (2008), who found no difference between BP manic and depressive on WCST performance. This discrepancy may be attributed to differences in symptom arrangement, severity of symptoms, and psychological tests used.

The current results show that very severe YMRS score exhibited significant negative associations with WMS-III Working memory (r=−0.239; P=0.04) and no significant correlation between different severity YMRS score and different WMS-III scores.

The current results showed a nonsignificant correlation between different severity HDRS score and different WMS-III scores.

Thus, in BP patients, only the manic symptoms have inverse relation with working memory.

The current results show that very severe YMRS score exhibited a significant positive associations with PE in WCST (r=337; P=0.04) and no significant correlation between different severity YMRS score and different HSCT and TMT scores.

The current results showed a nonsignificant correlation between different severities of HDRS score and different WMS-III scores.

Thus, in BP patients, only the manic symptoms have a direct relation with executive dysfunctions (decision-making).

Similar to our results, Stoddart *et al.* (2007), Dixon *et al.* (2004), Murphy *et al.* (1999), Sweeney *et al.* (2000), and Martínez-Arán *et al.* (2000) found a relation between executive dysfunction (suboptimal decision-making, increased working memory impairments, and decreased ability to inhibit responses in an affective shifting task) and manic symptoms, not depressed, in BP patients.

Our results are not in agreement with the findings of Hoda *et al.* (2015), who found that both manic and depressive symptoms of BP patients have a relation with impairment in attention, working memory, and executive functions. This discrepancy may be attributed to differences in the sample number, symptom arrangement, and psychological tests used.

Limitations

(1) It is a cross-sectional study and not longitudinal study, which is better in studying cognition.
(2) Small sample size.
(3) Lack of information on premorbid cognitive functions.
(4) The effects of medications on cognitive function are unclear.

Conclusion

Manic symptoms had a significant effect on cognitive functions.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

Arts B, Jabben N, Krabbendam L, van Os J (2008). Meta-analyses of cognitive functioning in euthymic bipolar patients and their first-degree relatives. Psychol Med 38:771–785.

Berg EA, Grant DA (1948). A simple objective test for measuring flexibility in thinking. J Gen Psychol 39:15–22.

Burgess PW, Shallice T (1996). Response suppression, initiation, and strategy use following frontal lobe lesions. Neuropsychologia 34:263–284.

Dixon T, Kravariti E, Frith C, Murray RM, McGuire PK (2004). Effect of symptoms on executive function in bipolar illness. Psychol Med 34: 81–82.

First ME, Spitzer RL, Gibbon M, Williams JBW (1996). Structured Clinical Interview for DSM-IV Axis I Disorders. New York, NY: New York State Psychiatric Institute.

Hamilton M (1960). A rating scale for depression. J Neurol Psychiatry 23: 56–62.

Hoda S, Aly H, Ibrahim S, El-Shestawy H (2015). Sex differences in cognitive dysfunction among bipolar disorder patients. Egypt J Psychiatry 36:1–8.

Joshua N, Gogos A, Rossell S (2009). Executive functioning in schizophrenia: a thorough examination of performance on the Hayling Sentence Completion Test compared to psychiatric and non-psychiatric controls. Schizophr Res 114:84–90.

Jurado MB, Rosselli M (2007). The elusive nature of executive functions: a review of our current understanding. Neuropsychol Rev 17:213–233.

Martínez-Arán A, Vieta E, Colom F, Reinares M, Benabarre A, Gasto C, Salamero M (2000). Cognitive dysfunctions in bipolar disorder: evidence of neuropsychological disturbances. Psychother Psychosom 69:2–18.

Murphy F, Sahakian B, Rubinsztein J, Michael A, Rogers R, Robbins T, Paykel E (1999). Emotional bias and inhibitory control processes in mania and depression. Psychol Med 29:1307–1321.

Papazian O, Alfonso I, Luzondo RJ (2006). Executive functions, Departamento de NeurofisiologíaClínica, Miami Children's Hospital, Florida, EstadosUnidos. Rev Neurol 42(Suppl 3):S45–S50.

Retain R, Wolfson D (1985). The Halstead-Retain neuropsychological test battery. Theory and clinical interprétations. Tucson, AZ: Neuropsychology press.

Ritsner MS, Blumenkrantz H, Dubinsky T, Dwolatzky T (2006). The detection of neurocognitive decline in schizophrenia using the Mind streams Computerized Cognitive Test Battery. Schizophr Res 82:39–49.

Stoddart SD, Craddock NJ, Jones LA (2007). Differentiation of executive and attention impairments in affective illness. Psychol Med 37:1613–1623.

Sweeney J, Kmiec J, Kupfer D (2000).Neuropsychological impairments in bipolar and unipolar mood disorders on the CANTAB Neurocognitive Battery. Biol Psychiatry 48:674–685.

Wechsler D (1955). Wechsler Adult Intelligence Scale manual. New York, NY: Psychological corp.

Wechsler D (1997). WAIS-III/WMS-III technical manual. San Antonio, TX: Psychological Corporation.

Young R, Biggs J, Ziegler V, Meyer D (1978). A rating scale for mania: reliability, validity and sensitivity. Br J Psychiatry 133:429–445.