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Neuropsychological Functioning in Affective Disorders

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Affective disorders have been associated with fluctuations in mood and emotions. However, recent research found that besides mood symptoms, cognitive functions have been impacted as well. These impairments continue well into remission. The cognitive functions that have been found to be impaired in the mood states and in the euthymic state are attention, executive functions and learning & memory. The objective of this study was to compare the mood states on these cognitive functions that have been uniformly implicated in previous literature. A cross-sectional design was used for the phenotype comparison in a sample of 60 affective disorder patients and the 't' values were calculated for the same. Mood states differed with each other in degree and nature of performance in neuropsychological tests.

Keywords: Mood disorders, cognitive impairment, executive functions, verbal memory, attention

In 1921, Kraepelin proposed the concept of affective disorders as "das manisch melancholisce Iression". The understanding of mood disorders has come a long way since then. A clear understanding of the symptoms has been established. Once an under-appreciated feature of mood disorder, cognitive impairments are now seen as a frequently present feature of the disorder. A number of longitudinal studies and family studies have been conducted and the findings suggest that cognitive impairments persist during remission and have also been found in healthy first degree relatives of bipolar disorder patients (Pattanayak 2011). Thus, these findings indicate that it is not just a core feature; it is now seen as a trait marker and a potential endophenotype in bipolar disorder (Pattanayak et al 2011). Domains that have been examined are executive function, attention, psychomotor speed, memory and social cognition (Latalova 2011). Depressive disorders with a prevalence rate of 15 percent (Saddock et al., 1998) seem to be associated with memory impairments and executive dysfunctions. Impairments in this case appear to be more severe on tasks that require more effortful information processing (Georgieff et.al 1998; Thomas et.al 1999). Also, in this group of affective disorder, a treatment resistant course is most likely to associate itself with frontal and stratial atrophy (Soares & Mann, 1997). Depressions with a treatment resistant course lasting for more than 2 years tend to show structural brain changes (Shah et al., 2002).

In comparison to major depressive disorder, bipolar disorder predicts a more severe form of cognitive impairment in depression (Murphy et al., 2001). In general, bipolar disorder involves dysfunctions in thought and speech, learning and memory, sustained and selective attention and executive function (Martinezet, 2002). Some studies have implicated only executive functions. This hybrid nature of cognitive profile appears to be embedded in strong reciprocal neuroanatomical connections between the prefrontal cortex and temporo limbic circuit (Ferrier et al., 1999). Severity levels of these dysfunctions sometimes match up severity levels of schizophrenia. Morphological brain abnormalities in bipolar disorder appear to be present in some of the patients and often are seen to explain the neurological dysfunctions. Structural abnormalities in the brain such as a larger amygdalla (Altshuler et al., 2000) and white matter lesions in young patients

with bipolar disorder (Ferrier et al.,1999) are frequently reported in literature.

A major advancement in the understanding of neuropsychological impairments in bipolar disorder is that it is no longer considered more state like phenomena (Goldberg 1995) but is thought to run a persistent course (Attshuler 2000) and may in fact be a vulnerability factor (Sigurdsson et al.,1999). It appears to be stable and persists well into remission pointing to the possibility of it being a genetic vulnerability for bipolar disorder (Pattanayak et al., 2011). Factors such as blood plasma levels of lithium impact onset of the illness at a younger age and lower levels of education predict more severe forms of cognitive impairment (Latalova 2011). This information becomes significant because there is lifetime prevalence of greater than fifty percent psychosis amongst those with bipolar disorder (Keck et al., 2003).

Unlike depression, mania has received little attention of researchers. The dearth of literature could be because of practical difficulties of using standard neuropsychological procedures in this condition. Mania could be associated with some "dysexecutive syndrome" since disrupted social skills and decision making similar to persons with frontal lesions are also seen in them (Bechara et al., 1994). Learning and memory and a few executive functions such as planning and attentional set shifting are some of the areas which have been studied. Majority of research that has compared mania and depression have found striking similarity in their neuropsychological profile indicating a global neuropsychological dysfunction (Elliot et al.,1996), indicative of a common underlying mechanism despite almost opposite clinical presentations. In depression at least some studies suggest that reduced motivation (Miller 1975), conservative response style (Williams et al., 1997), diminished cognitive capacity (Harsher & Zacks 1979) could explain the pervasive deficits. However, in mania, few attempts have been made to utilise this framework. Mania has also been compared with schizophrenia. Some have found them indistinguishable on some tasks such as selective attention (Oltmans, 1978), perceptual span (Strauss et al., 1984) and attentional set shifting (Morice, 1990). However, some have found them perform distinctly e.g. Goldberg (1993).

The euthymic state remains the most debatable group amongst the affective disorder for residual neuropsychological impairments. Some 30-50 percent of Euthymic patients fail to reach the pre-morbid levels of functioning indicative of cognitive impairments (Goodwin and Jamison, 1990). Studies that have focussed on Euthymic patients have implicated sustained attention, psychomotor speed, executive functions and verbal memory (Bora at. al 2009). Similar neuropsychological functions have been implicated in Indian studies on euthymia (Taj et al., 2005, Goswami et al., 2006, Trivedi et al., 2008). In fact, impairments in euthymia are thought to worsen with every episode (Nehra et al., 2006). There is a requirement for more studies that will quantify manic and depressive symptoms during this phase since sub-clinical psychopathology could explain residual neuropsychological deficits.

Rigorous research in the area is imperative as cognitive impairment could be an important factor effecting social and vocational difficulties of those in remission (Taj et al., 2005). Studies have shown that occupationally low functioning euthymics display cognitive impairments (Martinez et al., 2004). Intervention would require cognitive remediation which in turn would require drawing up clear profiles of all the mood states.

Objectives:

To compare the neuropsychological performance of individuals in depressed, manic and euthymic mood states in bipolar disorder and recurrent depressive disorder.

Method

Sample:

Includes 60 patients attending inpatient and outpatient psychiatric services in various mental health centres in the city of Hyderabad. Inclusion criteria followed was: a) Meeting International Classification of Disorders 10 criteria for mild to moderate depression or mania or recurrent depressive disorder or currently euthymic with

HDRS (Hamilton Depression Rating Scale) score of less than 7 or YMRS (Young Mania Rating Scale) score of less than 6, at least for a minimum period of 1 year. b) Age ranges 25-40 and of both genders, and c) Education 10th standard and above

The exclusion criteria applied for the purpose of screening was: presence of psychotic features, co-morbid physical or psychiatric conditions, co-morbidity, neuropsychiatric condition or history of cognitive decline, treatment history of ECT, family history of neurological disorders, secondary depression, highly excitable and severely depressed conditions

Sample:

A total of 60 patients were included in the study utilising the inclusion and exclusion criteria. Some 15 were diagnosed with recurrent depressive disorder. Another 30 in the group were recovering from bipolar disorder, 15 of whom had current episode depression and the other 15 had mania. Another set of 15 patients in the sample were currently euthymic. 63 patients were recruited out of which 60 completed the studies. 2 patients withdrew from the study and 1 had seizure during assessment phase. Out of the 45 patients of the symptomatic group, majority (61.7%) were recovering from a moderately severe episode. This could be due to the fact that most of the symptomatic group were inpatients and therefore, of a higher severity level. Also, amongst the bipolar group, 55% reported a history of less than 2 manic episodes. The symptomatic group were on mood stabilizers and the euthymic group was drug free for a minimum of 4 weeks prior to testing.

Psychological Measures:

Mood Assessment: Mood was assessed at the time of recruitment using HRSD (Hamilton 1960) and YMRS (Young 1978).

Neuropsychological Assessment: A battery was designed for the purpose of the study. Tests used were the ones that have been found to be sensitive to functioning in areas that are known to be affected in affective disorders. The domains assessed were visual, spatial and verbal, learning and memory, attention and executive functions. The battery consists of the following: Complex Figure test (CFT) by Rey1941, Digit Vigilance Test (DVT) (Lezak in 1995) Rey Auditory Verbal learning test (RAVLT) developed by Rey 1964 and adapted in NIMHANS Neuropsychological Battery by RAO et al. (2004), Controlled Word Association Test (COWA)/FAS (Beneton and Hamsher 1989) adapted by Rao et al.,(2004) in NIMHANS Neuropsychological Battery, Wisconsin Card Sorting Test (WCST) (Milner 1963), Animals Names test- (Lezak 1995) , and Tower of London (TOL) (Shallice, 1982)

Clinical ratings based on detailed observation, case history, informant interview and mental status examinations were used to establish adequate motor, sensory and language functions, attention and motivation.

Phenotype comparison was attempted using a cross-sectional design and 't' values were computed for the same.

Results

Table1. Demographic details (N = 60)

		Minimum	Maximum	Mean	Frequency	Percent
Age		21	40	30.4	-	-
sex	Female				31	51.7
	Male				29	48.3
	Total				60	
Education	College Educated	10+2+1 Pass-	10+2+3 Pass		34	56.7
	School Educated	10th pass	10+2 pass		26	43.3
	Total				60	

Table I gives demographic details of the participants. The sample comprised of educated individuals: 56.7% had completed at least 13 years of education while 43.3% has received at least 10 years of education. Participants were similar in terms of years of formal education as an alternative to matching for pre-morbid IQ.

Neuropsychological Testing:

Various neuropsychological tests were compared with each other within each group, based on number of individuals found impaired on it and were ranked accordingly. The test in which maximum number of individuals in the group were found impaired, that test was ranked (1) for that particular group and the test in which the group had least number of individuals impaired was ranked (10) for the same group. Bipolar depressed group erred mostly on Rey Auditory verbal learning test(1) and (2) along with that, complex figure test (3), digit vigilance task(3) and Wisconsin card sorting task(3). Group of patients who were recovering from a manic episode the poorest performance of the group is on the test of digit vigilance (1) and RAVLT (1) followed by WCST (2) and TOL (3).

Table 2 gives test wise frequency of individuals impaired based on norms given in NIMHANS Neuropsychological battery.

	Name of test	groupEU	group ReD	groupBPAD(D)	groupBPAD(M)
		Euthymic (EU)	Recurrent Depressive (ReD)	Bipolar Depressed BPAD(D)	Mania BPAD(M)
1	Complex Figure Test				
	Copying	4(8)	5(6)	8(5)	8(5)
	Immediate Recall	6(6)	7(5)	9(4)	10(4)
	Delayed Recall	7(5)	9(3)	10(3)	8(5)
2	Digit Vigilance				
	Total Number Of errors	5(7)	14(1)	14(2)	15(1)
	Total time taken	10(3)	10(3)	10(3)	2(7)
3	RAVLT				
	Total number of correct responses	9(4)	14(1)	15(1)	15(1)
	Immediate Recall	13(1)	11(2)	15(1)	10(4)
	Delayed Recall	13(1)	11(2)	14(2)	10(4)
4	Animals Names Test	2(10)	2(7)	9(4)	1(8)
5	FAS	11(2)	1(8)	1(8)	0(9)
6	WCST				
	Total number of errors	11(2)	5(6)	9(4)	10(4)
	Perseveratory errors	4(8)	8(4)	10(3)	4(6)
	Arbitrary errors	2(10)	2(7)	6(6)	14(2)
7	Tower of London				
	Problem solved with minimum moves	3(9)	1(8)	4(7)	11(3)
	Total time	7(5)	8(4)	8(5)	4(6)

Unbracketed numbers show the number of individuals found impaired on the test

Bracketed numbers indicate ranks of tests based on number of individuals found impaired on it from the group

For the recurrent group the majority in the group were impaired in digit vigilance task (1) and in immediate (2) and delayed recall (2) measures of Rey Auditory Verbal Learning Test. Majority of the Euthymic group is impaired in the task of verbal learning (1) followed by WCST and FAS (2) digit vigilance test (3).

Comparison between the performance of the groups on the tests of CFT, Digit Vigilance Test, RAVLT, Animals Names Test, FAS Test, WCST, TOL.

Table 3 (a) Findings for CFT and Digit Vigilance Test

	CFT								Digit Vigilance Test							
	Immediate Recall				Delayed Recall				Total Number of Errors				Total Time (in secs)			
	M	SD	t	P	M	SD	t	P	M	SD	t	P	M	SD	t	P
EU	12.6	3.961	0.467	0.696	12.87	5.63	1.067	0.47	11.53	5.37	1.4	0.47	710.33	194.725	37.2	0.6
ReD	12.13	2.295			11.8	2.981			12.93	4.026			747.53	160.574		
EU	12.6	3.961	2.6	0.033*	12.87	5.63	3.933	0.01**	11.53	5.37	4.533	0.022*	710.33	194.725	56.133	0.429
BPAD(D)	10	3.703			8.93	4.48			16.07	3.77			766.47	251.374		
EU	12.6	3.961	1.4	0.696	12.87	5.63	2.733	0.068	11.53	5.37	4.6	0.020*	710.33	194.725	84.467	0.236
BPAD(M)	11.2	2.783			10.13	2.615			16.13	7.2			625.87	148.42		
ReD	12.13	2.295	2.133	0.078	11.18	2.981	2.867	0.056	12.93	4.026	3.133	0.109	747.53	160.574	18.933	0.789
BPAD(D)	10	3.703			8.93	4.148			16.07	3.77			766.47	251.374		
ReD	12.13	2.295	0.933	0.436	11.13	2.981	1.667	0.261	12.93	4.026	3.2	0.102	747.53	160.574	121.667	0.9
BPAD(M)	11.2	2.783							16.13	7.2			625.87	148.42		
BPAD(D)	10	3.703	1.2	0.317	8.93	4.143	1.2	0.417	16.07	3.77	0.067	0.972	766.47	251.374	140.6	0.5
BPAD(M)	11.2	2.783			10.13	2.615			16.13	7.2			625.87	148.42		

*p<0.05 **p<0.01

3 (b) Findings for RAVLT and Animals Names test

	RAVLT												Animal Name Test			
	Total no. of corrects				Immediate Recalls				Delayed Recalls							
	M	SD	t	P	M	SD	t	P	M	SD	t	P	M	SD	t	P
EU	36.13	7.586	13	0.071	6.53	2.56	0.6	0.54	5.73	3.173	0.68	0.51	13.4	2.898	2	0.083
ReD	31.8	6.635			7.07	2.314			6.4	2.165			11.4	2.53		
EU	36.13	7.586	13	0.000**	6.53	2.56	1.03	0.31	5.73	3.173	0.97	0.34	13.4	2.898	5.133	0.000**
BPAD(D)	23.13	5.963			5.8	1.014			4.87	1.302			8.27	4.079		
EU	36.13	7.586	6.333	0.009**	6.53	2.56	0.5	0.54	5.73	3.173	0.16	0.87	13.4	2.898	1.2	0.294
BPAD(M)	29.8	5.388			7.07	1.751			5.93	3.576			12.2	2.651		
ReD	31.8	6.635	3.667	0.001**	7.07	2.314	1.95	0.062*	6.4	2.165	2.35	0.03*	11.4	2.530	3.133	0.008
BPAD(D)	23.13	5.963			5.8	1.014			4.87	1.302			8.27	4.079		
ReD	31.8	6.635	2	0.399	7.07	2.314	0.00	1	6.4	2.165	0.44	0.67	11.4	2.530	0.8	0.0483
BPAD(M)	29.8	5.388			7.07	1.751			5.93	3.576			12.20	2.651		
BPAD(D)	23.13	5.963	6.667	0.001**	5.8	1.014	2.43	0.02	4.87	1.302	1.08	0.29	8.27	4.079	3.933	0.001**
BPAD(M)	29.8	5.388			7.07	1.751			5.93	3.576			12.20	2.651		

*p<0.05 **p<0.01

Table 3(c) Findings for FAS and WCST Test

	FAS				WCST											
					Total number of errors				Total no. of perceivatory errors				Total no. of arbitrary errors			
	M	SD	t	P	M	SD	t	P	M	SD	t	P	M	SD	t	P
EU	13.07	2.017	3.4	0.002**	17.53	7.605	4.133	0.027*	11.93	5.483	4.2	0.023*	5.27	2.52	0.333	0.771
ReD	9.67	2.664			21.67	3.309			16.13	2.722			5.6	2.613		
EU	13.07	2.017	2.933	0.007*	17.53	7.605	7.933	0.000**	11.93	5.483	5.6	0.003**	5.27	2.52	1.4	0.225
BPAD(D)	10.13	4.138			25.47	3.461			17.13	5.33			6.67	3.109		
EU	13.07	2.017	1.6	0.132	17.53	7.605	5.467	0.004*	11.93	5.483	2.33	0.198	5.27	2.52	8.133	0.000**
BPAD(M)	11.47	2.134			23	4.276			9.6	5.501			13.4	4.032		
ReD	9.67	2.664	0.467	0.657	21.67	3.309	3.8	0.041*	16.13	2.722	1.4	0.437	5.6	2.613	1.067	0.354**
BPAD(D)	10.13	4.138			25.47	3.461			17.13	5.33			6.67	3.109		
ReD	9.67	2.664	1.8	0.091	21.67	3.309	1.333	0.466	16.13	2.722	6.533	0.001**	5.6	2.613	7.8	0.000**
BPAD(M)	11.47	2.134			23	4.276			9.6	5.501			13.4	4.032		
BPAD(D)	10.13	4.138	1.333	0.208	25.47	3.461	2.467	0.18	17.13	5.33	7.933	0.000**	6.67	3.109	6.733	0.000**
BPAD(M)	11.47	2.134			23	4.276			9.6	5.501			13.4	4.032		

*p<0.05 **p<0.01

Table 3(d) Findings for TOL

	TOL							
	No. of minimum moves				Total Time			
	M	SD	t	P	M	SD	t	P
EU	7.93	2.84	0.133	0.868	30.27	5.873	0.32	0.75
ReD	7.8	1.207			30.93	5.496		
EU	7.93	2.84	1.133	0.162	30.27	5.873	0.58	0.57
BPAD(D)	6.8	1.821			31.4	4.823		
EU	7.93	2.84	4.667	0.000**	30.27	5.873	1.99	0.057
BPAD(M)	3.27	2.52			26.93	2.815		
ReD	7.8	1.207	1	0.216	30.93	5.496	0.23	0.82
BPAD(D)	6.8	1.821			31.4	4.823		
ReD	7.8	1.207	4.533	0.000**	30.93	5.496	2.51	0.02*
BPAD(M)	3.27	2.52			26.93	2.815		
BPAD(D)	6.8	1.821	3.533	0.000**	31.4	4.823	3.1	0.000**
BPAD(M)	3.27	2.52			26.93	2.815		

*p<0.05 **p<0.01

Table 3 (a) (b)(c)(d) depicts mean sd and t values after comparison of each group's performance on neuropsychological tests with that of the other three clinical groups. The euthymic group performs significantly better in some measures than the symptomatic group. It performs better in delayed and immediate recall measures of complex figure test compared to the bipolar depressed group, in digit vigilance task compared to both the bipolar groups, in RAVLT compared to the bipolar groups, in animal names test compared to bipolar depressed group, in

FAS test compared to both the depressed group (bipolar and recurrent), in WCST compared to the symptomatic group in and in TOL test compared to the manic group. Comparing both the depressed groups, the bipolar depressed group performs significantly worse than the recurrent depressive group on delayed and immediate recall measures of RAVLT. It also makes significantly more number of errors in WCST compared to recurrent depressive group. Comparison between the bipolar group shows that manic group performs significantly worse than the depressed group in tasks of TOL and better on animal names test and RAVLT. On WCST, the depressed group made more perseveratory errors whereas the manic group made significantly more arbitrary errors.

Discussion

Demographic details of the sample show that it could be considered homogenous in terms of education and IQ, which are the two important variables that affect cognitive functioning.

When we analyse each clinical group's performance on various neuropsychological test (table 2), there are some differences in the pattern of neuropsychological functioning. Bipolar depressed group erred mostly on verbal memory task. Along with that, non-verbal memory and attention and executive functions task featured prominently amongst impairments. Studies have found such pervasive cognitive impairment in depression in bipolar disorder (Malhi et al., 2007).This group of patients was unable to generate adequate number of correct responses in verbal learning task, as they were unable to learn adequately or retain adequately. The finding is supported by studies by Malhi et al., 2007 and Illeys 1995. Most of them took longer time in sustained attention task than the norms given and made more errors. Sustained attention has been implicated in depression in research before (Bearden 2001). The group also found it difficult to retain nonverbal material. This is considered more of state deficit since studies have shown that this group performs better on the task once euthymic and residual symptoms are controlled (Rubinsztein 2000). Maximum number of patients who were recovering from a manic episode performed poorly in measure for sustained attention compared to all other neurocognitive functions. It has been theorized that their impulsive response pattern results in errors of commission (Sax et al., 1995). This along with attentional difficulties could also explain their poor performance in verbal learning. Additionally, majority of them showed a tendency to make a lot of arbitrary errors while in the process of concept formation. This also indicates a difficulty in maintaining set. This could be related to the characteristic feature of mania, where they have flight of ideas and action, leading them to jump concepts and make arbitrary assessment. The group also appears impaired on planning. This difficulty in planning was also reported in similar studies earlier (Murphy et al., 1999, Sweney et al., 2000 & Rubinsztein, 2000). Most patients with recurrent depressive disorder performed poorly in sustained attention and verbal Learning and memory. Since majority of Euthymic group is impaired in executive functions, sustained attention and verbal memory, these appear to be trait deficit rather than state deficit as these continue even after the symptoms resolve. Thus in affective disorders they could explain the adjustment difficulties experienced by remitted patients. Large effect sizes have been reported for executive functions and verbal memory and medium size effects have been reported for sustained attention tasks. These have been reported uniformly across culture (Robinson, 2006, Goswami et al., 2006, Pattanayak, 2011).A wide range of cognitive impairment appears to be present even in remission (Malhi et al., 2004).

A phenotype comparison (table 3), where groups are similar on neuropsychlogical tests, demographical variables and in the extent of morbidity was felt necessary. A mere 'between subject design' comparing mood states with healthy controls can lead to limited inference regarding neuropsychological profiles of the mood states (Malhi, 2004).

Bipolar depressed and recurrent depressive disorder groups do not differ much in their pattern of performance. Verbal memory and attention featured prominently amongst impaired performances. However, in tasks of verbal learning and attentional set shifting, bipolar

group performs significantly worse than the recurrent depressive group. Thus, it indicates that depression in bipolar disorder appears to be associated with more severe neuropsychological impairment when compared with recurrent depressive disorder. Similar finding is reported by Wolfe et al (1987). They compared both depressed groups with healthy controls.

Past literature indicates that mania and depressed group (both recurrent and bipolar) appear impaired in attention and verbal memory. Current study shows that manic groups make marginally more errors (non-significant) in sustained attention task than the recurrent depressive group. Studies analysing the performance on sustained attention tasks of both the bipolar groups have found that depressed group makes more errors of omission against manic group which makes more errors of commissions (Sax et al., 1995). Also, bipolar depressed group is significantly poorer in tasks of verbal memory and category fluency. Additionally, both the bipolar groups perform poorly on tasks of executive function. However, the nature of performance varies. In concept formation, the depressed group tended to make more perseveratory errors when compared to manic group and manic group tended to make more arbitrary errors. The tendency of depressed group to perseverate concepts explains their difficulty in establishing new adaptive patterns of thinking. The manic group's results in planning are significantly worse than both the depressed groups. This poorer performance of the manic group lends support to the conclusion of other studies that manic group has highest impairment in executive function compared to the other groups (Bora et al., 2009).

Research on this area has been indicating that euthymia can no longer be considered a complete remission. Studies have proved this persistent impairment by comparing the performance of the euthymic group with healthy controls. The authors tested euthymics with the symptomatic groups in domains that have been implicated in affective disorder to see if they perform significantly better than the symptomatic groups. Euthymics perform significantly better in some domains than the symptomatic groups. In tasks of verbal memory, attention and concept formation they perform significantly better than the bipolar group. Additionally, the group performed significantly better than the bipolar depressed group in tasks of nonverbal memory and verbal fluency and the manic group in planning. Some studies have not found any substantial difference amongst euthymic group and the symptomatic group (Martinez Aran A, 2004). This study shows that the eythymic group is able to perform significantly better than some of the symptomatic groups in some neuropsychological test. However, research comparing euthymics with healthy controls have found that euthymics continue to underperform when compared to healthy groups especially in domains of verbal memory, attention and executive function (Martinez-Aran A, 2004, Pattanayak et al., 2011 & Latalova 2011). Thus, considering the results of the study in light of previous literature it can be said that even though euthymic group performs better than the symptomatic group in implicated cognitive function, it cannot be considered at an unimpaired level.

Conclusion

The study has shown that although broadly neurocognitive profiles of the mood states tend to overlap, a detailed analysis of the same reveals that some subtle differences exist amongst the groups. Between the depressed groups (both bipolar and recurrent), the difference is noted in terms of their level of performance. Here, the bipolar group appears to be performing at a poorer level. Between the bipolar groups (mania and depression), the difference is seen in both the nature and degree of the neurocognitive performance. Performance in verbal memory and learning is worse in the depressed group whereas the manic group's executive functions appear poorer.

The euthymic group performs significantly better than the symptomatic group in some cognitive functions though it cannot be considered as unimpaired in those cognitive domains. To make the findings of comparative profiles more robust, further research must rely on a larger sample size. Further studies will have to consider effects

of medicine, severity of episodes, psychological and personality variables e.g. anxiety levels, neuroticism and other socio demographic variables such as age, education etc.

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