

# What Does the Subjective Assessment of Cognitive Functioning Measure in Bipolar Disorder? Correlation with the Objective Assessment of Cognitive Functioning

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## Abstract

**Objective:** Even in remission, cognitive deficits are frequently observed in bipolar disorder. Because these deficits are assessed with complex and comprehensive tests, they seem to be neglected in routine daily practice; however, assessing them with short self-rated questionnaires could be beneficial. This study aimed to investigate the correlation between objective and subjective cognitive assessment in bipolar disorder.

**Method:** The study included 38 patients with bipolar disorder that were in remission for at least 6 months and 19 healthy controls. The Stroop Test and Auditory Verbal Learning Test were used for the objective assessment of cognitive functioning, and the cognitive functioning subscale of the Bipolar Disorder Functioning Questionnaire was used for the subjective assessment of cognitive functioning. Mood symptoms were assessed using the Hamilton Depression Rating Scale and Young Mania Rating Scale.

**Results:** Based on objective assessment there were significant differences in all domains of the Auditory Verbal Learning Test between the bipolar patients and healthy controls, whereas there weren't any significant difference in Stroop Test results. Based on subjective assessment there were significant differences between the bipolar patients and healthy controls in terms of cognitive functioning subscale total score and first item score, but not in terms of the other items. When the correlation between the objective and subjective cognitive assessments was investigated, total score of the cognitive functioning subscale and 2 items—1. to run simple calculations in one's mind and 2. gathering and performing what one is asked to do—were moderately to weakly correlated with immediate recall, verbal learning, recognition, retrieval, and reading shape color. No correlation was observed between the other items of the cognitive functioning subscale.

**Conclusion:** Based on subjective assessment of cognitive functioning, the bipolar patients tended to over-estimate themselves. Furthermore, bipolar patients tended to report more deficits correlated with objective cognitive assessment when they had to display active performance, whereas they did not report cognitive deficits at this level when such a condition was not present.

**Key Words:** Bipolar disorder, cognitive dysfunctions, attention, memory, self-assessment

## INTRODUCTION

In bipolar disorder (BPD), even during remission impairment in cognitive functioning has been observed. In euthymic BP patients impairment in attention, verbal learning, memory, and frontal executive functions has been documented (Bora et al., 2008). Martinez-Aran et al. (2005) reported cognitive dysfunction in verbal memory and frontal executive functions in euthymic BP patients. When age, premorbid IQ, and depressive symptoms are

controlled for, BP patients in remission have lower executive functions scores (Ferrier et al., 1999). Quraishi and Frangou (2002) suggested that verbal learning is reliably demonstrated and that the number of perseverative errors and deficits in verbal fluency and planning are present. Mur et al. (2007) reported that impairment in executive functions and loss of inhibition are features of BPD, independent of its severity and of drugs used for treatment. Impairment in cognitive functioning also negatively af-

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TABLE 1. Demographic and clinical features of the BP and the control groups.

|                                | BP<br>n = 38 |       | Control<br>n = 19 |       |
|--------------------------------|--------------|-------|-------------------|-------|
| Age (years)                    | 38.5 ± 13.1  |       | 35.5 ± 8.5        |       |
| Gender                         |              |       |                   |       |
| Male                           | 22           | 57.9% | 14                | 73.7% |
| Female                         | 16           | 42.1% | 5                 | 26.3% |
| Education                      |              |       |                   |       |
| Primary school                 | 6            | 15.8% | 5                 | 26.3% |
| High school                    | 17           | 44.7% | 7                 | 36.8% |
| University                     | 15           | 39.5% | 7                 | 36.8% |
| Diagnosis                      |              |       |                   |       |
| Bipolar I Disorder             | 33           | 86.8% |                   |       |
| Bipolar II Disorder            | 5            | 13.2% |                   |       |
| The last episode type          |              |       |                   |       |
| Manic                          | 15           | 39.5% |                   |       |
| Depressive                     | 12           | 31.6% |                   |       |
| Hypomanic                      | 5            | 13.2% |                   |       |
| Mixed                          | 6            | 15.8% |                   |       |
| Age of onset (years)           | 26.6 ± 9.9   |       |                   |       |
| Duration of illness (years)    | 12.9 ± 11.1  |       |                   |       |
| Number of episodes             | 5.9 ± 8.1    |       |                   |       |
| Duration of remission (months) | 17.5 ± 13.5  |       |                   |       |
| HAM-D <sup>1</sup>             | 4.6 ± 2.4    |       | 1.5 ± 0.9         |       |
| YMRS <sup>1</sup>              | 1.5 ± 1.8    |       | 0.2 ± 0.4         |       |

<sup>1</sup>P < 0.0001

fects the quality of life of BP patients (Dias et al., 2008).

In the assessment of cognitive functioning in BP patients, various batteries of neurocognitive tests are used; however, they are time consuming and require a health professional for administration. Thus, they are not routinely used in daily practice. Yet, the importance of cognitive assessment in BPD is clearly evident; therefore, self-report questionnaires are utilized for the assessment of neurocognitive functioning. Burdick et al. (2005) reported that most BP patients exhibit objective signs of cognitive impairment, but that they are unable to accurately report them. In other words, the subjective assessment of cognitive impairment in BPD is not at the expected level. On the other hand, BP patients with more subjective cognitive complaints demonstrate more noncompliance with treatment (Scott and Pope, 2002).

The Bipolar Disorder Functioning Questionnaire, which was developed by the Scientific Section for Mood Disorders, Psychiatric Association of Turkey, assesses cognitive functioning with 4 items (Aydemir et al., 2007). The reliability coefficient of the cognitive functioning subscale is 0.58. The items on this subscale assess attention, working memory, and immediate memory, and de-

TABLE 2. Pharmacotherapeutic agents used by the BP patients.

| Pharmacotherapy                         | n  | %     |
|-----------------------------------------|----|-------|
| Lithium                                 | 8  | 21.1  |
| Valproate                               | 6  | 15.8  |
| Carbamazepine                           | 1  | 2.6   |
| Atypical antipsychotics                 | 2  | 5.3   |
| Lithium + atypical antipsychotics       | 10 | 26.3  |
| Valproate + atypical antipsychotics     | 7  | 18.4  |
| Carbamazepine + atypical antipsychotics | 3  | 7.9   |
| Lithium + valproate                     | 1  | 2.6   |
| Total                                   | 38 | 100.0 |

termining at what level subjective cognitive assessment is correlated with objective assessment remains a topic of interest.

The present study aimed to determine the correlation between subjective cognitive assessment and objective cognitive assessment in BPD. The correlation between the cognitive subscale of the Bipolar Disorder Functioning Questionnaire, which is a self-report instrument, and objective neurocognitive tests was examined.

## METHOD

The study included patients that were being followed-up at the Mood Disorders Department of the Celal Bayar University School of Medicine. The study was approved by the Celal Bayar University Ethics Committee.

### Subjects

Patients with a diagnosis of BPD with at least 6 month of remission were invited to join the study. One patient declined to participate and the study was carried out with 38 BP patients. The inclusion criteria included age between 18 and 65 years, and demonstration of sufficient physical and cognitive ability to comply with the study protocol without excessive assistance. Exclusion criteria included any psychiatric disorder other than BPD, neurological or organic disease diagnosed with the questioning of the systems, and alcohol or any other substance misuse. BPD remission was confirmed with a 17-item Hamilton Depression Rating Scale score < 8 and a Young Mania Rating Scale score < 5. Patient records and SCID-CV interviews also demonstrated that all the BP patients were in remission. The healthy control group included individuals that had never had a psychiatric, neurological, or organic disease or treatment. All participants provided written informed consent.

TABLE 3. Comparison of the BP and the control groups, in terms of subjective and objective cognitive assessments.

|                                          | BP<br>n = 38<br>Mean ± SD | Control<br>n = 19<br>Mean ± SD |
|------------------------------------------|---------------------------|--------------------------------|
| AVLT                                     |                           |                                |
| Immediate recall <sup>1</sup>            | 6.3 ± 1.8                 | 7.5 ± 1.7                      |
| Verbal learning <sup>2</sup>             | 11.2 ± 2.6                | 13.3 ± 1.0                     |
| Delayed recall <sup>2</sup>              | 8.8 ± 3.3                 | 12.2 ± 1.5                     |
| Recognition <sup>1</sup>                 | 13.6 ± 2.4                | 14.6 ± 0.8                     |
| Retrieval <sup>1</sup>                   | 13.6 ± 2.4                | 14.6 ± 0.8                     |
| Stroop Test                              |                           |                                |
| Reading shape color                      | 39.8 ± 9.6                | 37.5 ± 6.1                     |
| Reading color (Stroop effect)            | 73.6 ± 19.3               | 67.4 ± 13.5                    |
| Cognitive functioning #1 <sup>1</sup>    | 2.3 ± 0.7                 | 2.8 ± 0.3                      |
| Cognitive functioning #2                 | 2.8 ± 0.4                 | 2.7 ± 0.5                      |
| Cognitive functioning #3                 | 2.6 ± 0.6                 | 2.7 ± 0.6                      |
| Cognitive functioning #4                 | 2.7 ± 0.5                 | 2.5 ± 0.6                      |
| Cognitive functioning total <sup>2</sup> | 105 ± 1.6                 | 6.9 ± 1.2                      |

<sup>1</sup>P < 0.05

<sup>2</sup>P < 0.0001

## Instruments

The 17-item Hamilton Depression Rating Scale (HAM-D), with a structured interview guide, was used to assess depressive symptoms; the Turkish version was reported to be reliable and valid by Aydemir et al. (2006). The Young Mania Rating Scale (YMRS) was used to assess manic symptoms; the Turkish version was reported to be reliable and valid by Karadag et al. (2002).

The cognitive subscale of the Bipolar Disorder Functioning Questionnaire was used to assess subjective cognitive functioning. The reliability coefficient of the subscale is 0.58, the item-total score correlation coefficient is 0.40, and the discriminant validity is 97.5%. For each item, the item-total score correlation coefficient and the factor load, respectively, based on confirmatory factor analysis, are as follows: “Are you having difficulty under-

standing what you read in a newspaper or book?” (0.38 and 0.53); “Are you able to run simple calculations in your mind when shopping?” (0.30 and 0.40); “Are you having difficulty gathering and performing what you are asked to do?” (0.44 and 0.65; “Are you able to focus on what people are saying during a conversation?” (0.35 and 0.50). Because the items on this subscale examine the effects of attention and memory deficits in daily life, the Stroop Test and the Auditory Verbal Learning Test, which measure these domains and are very frequently used in BPD, were used for the objective assessment of cognitive functioning.

The Stroop Test (ST) was originally developed by Stroop in 1935 as an experimental task. The test is regarded as the gold standard of attention measurement (MacLeod, 1992). The Stroop effect is based on reading the names of colors that are printed in colors different than that which they denote. There are several different individually administered ST forms. Adaptation of the test for the Turkish population was performed by Karakas et al. (2004). In the present study the ST-TBAG form based on the ST version developed for the Turkish population, combined with the Victoria form, which consists of 3 cards and 6 rows of 4 items in each row with the characteristics of the original ST, was administered to both to the BP and control groups.

The Auditory Verbal Learning Test (AVLT) developed by Rey is a commonly used measure of the ability to encode, consolidate, store, and retrieve verbal information. The AVLT was determined to be a sensitive test of verbal learning and memory (Karakas, 2004).

## Statistical Analysis

For statistical analysis of the comparison between the BP and control groups in terms of demographic and clinical features the chi-square and t tests were used.

TABLE 4. Correlation between the objective and subjective cognitive assessments in the BP group.

|                                                                               | Immediate<br>recall | Verbal<br>learning | Delayed<br>recall | recognition       | retrieval         | reading<br>shape color | reading<br>color |
|-------------------------------------------------------------------------------|---------------------|--------------------|-------------------|-------------------|-------------------|------------------------|------------------|
| Are you having difficulty understanding what you read in a newspaper or book? | 0.06                | 0.11               | 0.28              | 0.02              | 0.02              | -0.22                  | -0.22            |
| Are you able to run simple calculations in your mind when shopping?           | 0.32 <sup>1</sup>   | 0.39 <sup>1</sup>  | 0.24              | 0.54 <sup>2</sup> | 0.54 <sup>2</sup> | -0.50 <sup>2</sup>     | -0.28            |
| Are you having difficulty gathering and performing what you are asked to do?  | 0.27                | 0.35 <sup>1</sup>  | 0.27              | 0.35 <sup>1</sup> | 0.35 <sup>1</sup> | -0.39 <sup>1</sup>     | -0.28            |
| Are you able to focus on what people are saying during a conversation?        | -0.01               | 0.16               | 0.16              | 0.05              | 0.05              | 0.08                   | 0.24             |
| Cognitive functioning                                                         | 0.25                | 0.381              | 0.38 <sup>1</sup> | 0.34 <sup>1</sup> | 0.34 <sup>1</sup> | -0.39 <sup>1</sup>     | -0.23            |

<sup>1</sup>P < 0.05

<sup>2</sup>P < 0.0001

For comparison between the BP and control groups in terms of objective and subjective cognitive assessments the *t* test was used. In order to determine the correlation between objective and subjective cognitive assessments, the Bipolar Disorder Functioning Questionnaire cognitive subscale, Stroop Test, and AVLT scores were subjected to Pearson's correlation test. In interpreting the correlation test results the *r* coefficient was accepted to be weak if it was between 0.2 and 0.4, moderate between 0.4 and 0.6, good between 0.6 and 0.8, and excellent when it is between 0.8 and 1.0. Statistical significance was accepted as  $P < 0.05$ .

## RESULTS

### Demographic and Clinical Features of the Study Groups

Mean age of the BP patients was  $38.5 \pm 13.1$  years and 22 (57.9%) of the BP patients were male. Mean duration of BPD was  $12.9 \pm 11.1$  years (range: 1–40 years), mean number of episodes was  $5.9 \pm 8.1$  (range: 1–35), and mean duration of the current remission was  $17.5 \pm 13.5$  months. Three (7.8%) of the BP patients had a single episode, and the remainder had more than one episode. In all, 20 controls with identical demographic features as the BP patients were invited to join the study; 1 control declined participation and the study included 19 controls. Mean age of the controls was  $35.5 \pm 8.5$  years and 14 (73.7%) were male. The demographic and clinical features of the BP and control groups are shown in Table 1. There were no differences between the BP and control groups in terms of age ( $t = 1.029$ ,  $P = 0.308$ ), gender ( $\chi^2 = 0.383$ ,  $P = 0.192$ ), or education ( $\chi^2 = 0.603$ ,  $P = 0.437$ ).

Table 2 shows the medications that were used at the time the BP patients were assessed. In all, 17 (44.7%) of the BP patients received monotherapy, and 21 (55.3%) received polytherapy. Fifteen (38.4%) of patients received mood stabilizers, and the remainder received atypical antipsychotics or combination therapy. None of the BP patients received any drug treatment containing benzodiazepines.

### Comparison of the Patient and Control Groups, in terms of Cognitive Assessment

When the BP patient and control groups were compared in terms of subjective cognitive assessment (Table 3) there was a statistically significant difference in terms of cognitive subscale score ( $t = 8.53$ ,  $P < 0.0001$ ). Among the items on the cognitive subscale, only the item, "Are you having difficulty understanding what you read in

a newspaper or book?" (#1) was significantly different between the 2 groups ( $t = -3.39$ ,  $P = 0.001$ ). When the 2 groups were compared in terms of objective cognitive assessment there was a statistically significant difference in terms of the following AVLT domains: immediate recall ( $t = -2.30$ ,  $P = 0.025$ ), verbal learning ( $t = -4.26$ ,  $P < 0.0001$ ), delayed recall ( $t = -5.17$ ,  $P < 0.0001$ ), recognition ( $t = -2.27$ ,  $P = 0.027$ ), and retrieval ( $t = -2.27$ ,  $P = 0.027$ ). There weren't any statistically significant differences between the 2 groups in terms of the domains of Stroop Test and the Stroop effect ( $t = 1.29$ ,  $P = 0.217$ ).

### Correlation between the Objective and Subjective Cognitive Assessments in the BP Patient and Control Groups

When the correlation between the objective and subjective cognitive assessments was examined (Table 4), only the BP group was considered and the correlation test was performed. In this regard, the item "Are you having difficulty understanding what you read in a newspaper or book?" did not have any correlation with the Stroop Test or AVLT domains. The item "Are you able to run simple calculations in your mind when shopping?" showed a weak correlation with immediate recall ( $r = 0.32$ ,  $P = 0.049$ ) and verbal learning ( $r = 0.39$ ,  $P = 0.015$ ), and a moderate correlation with recognition ( $r = 0.54$ ,  $P < 0.0001$ ), retrieval ( $r = 0.54$ ,  $P < 0.0001$ ), and reading square color on the Stroop Test ( $r = -0.50$ ,  $P = 0.001$ ). The item "Are you having difficulty gathering and performing what you are asked to do?" had a weak correlation with immediate recall ( $r = 0.35$ ,  $P = 0.028$ ), recognition ( $r = 0.35$ ,  $P = 0.029$ ), retrieval ( $r = 0.35$ ,  $P = 0.029$ ), and reading square color on the Stroop Test ( $r = -0.39$ ,  $P = 0.014$ ). The item "Are you able to focus on what people are saying during a conversation?" was not correlated with the AVLT domains or the Stroop Test. The Bipolar Disorder Functioning Questionnaire cognitive subscale had a weak correlation with verbal learning ( $r = 0.38$ ,  $P = 0.017$ ), delayed recall ( $r = 0.016$ ,  $P = 0.38$ ), recognition ( $r = 0.34$ ,  $P = 0.032$ ), retrieval ( $r = 0.34$ ,  $P = 0.032$ ), and reading square color on the Stroop Test ( $r = -0.39$ ,  $P = 0.015$ ).

When the correlation between the objective and subjective cognitive assessments in the control group was examined only the item "Are you able to run simple calculations in your mind when shopping?" had a significant correlation with the AVLT recognition domain ( $r = 0.45$ ,  $P = 0.048$ ); the other items and the total score of the cognitive subscale were not significantly correlated with objective cognitive assessments.

## DISCUSSION

In BPD residual symptoms persist inter-episode and cognitive symptoms consist of an important symptom domain in this period (Kaya et al., 2007). To identify these symptoms precisely and without delay, assessment tools are needed. In the present study, euthymic BP patients had a higher level of cognitive impairment than the control group. Additionally, based on the Bipolar Disorder Functioning Questionnaire cognitive subscale (a self-report instrument) there was only a weak correlation with objective cognitive deficits.

### **Comparison of the BP and Control Groups, in Terms of Objective and Subjective Cognitive Assessments**

When the BP patients were compared with the controls there was a significant difference in terms of all objective cognitive domains measured by AVLT; however, there was a significant difference in only 1 domain measured by the cognitive subscale—used as a subjective assessment tool. This result suggests that the BP patients were not sufficiently aware of their objective cognitive deficits and that they did not express these deficits in subjective assessments. Martinez-Aran et al. (2005) reported objective cognitive impairment in patients that complain of cognitive deficits, but they also observed significant cognitive deficits in patients without complaints. Burdick et al. (2005) reported that most BP patients have objective cognitive deficits, but that they are unable to report them accurately and may even ignore them. It is known that BP patients are not sufficiently aware of their disease, especially in terms of their cognitive deficits (Pallanti et al., 1999). On the other hand, in the present study there wasn't a significant difference between the BP and the control groups in terms of Stroop Test score. In chronic, and in particular remitted BP patients, Stroop Test results are not consistent (Quraishi and Frangou, 2002). Considering the Stroop Test, Paradiso et al. (1997) reported that BP patients perform better than unipolar patients, and Krabbendam et al. (2000) did not observe any differences between BP patients and control subjects.

### **Correlation between the Objective and Subjective Cognitive Assessments in the BP and Control groups**

When the Bipolar Disorder Functioning Questionnaire cognitive subscale used for subjective assessment of BP disorder is taken into account, while 2 of the items had a weak correlation with most of the objective cogni-

tive assessments, the other 2 items were not significantly correlated. All of the items were positively correlated with the objective cognitive assessments and this finding supports straight assessment. As there wasn't a correlation between the 2 assessment modalities in the control group, this finding might be associated with BPD. Among the items, the strongest correlation was for "Are you able to run simple calculations in your mind when shopping?" (#2). This item was moderately correlated with recognition, retrieval, and reading shape color, and had a weak correlation with verbal learning and immediate recall. The inability to run calculations in one's mind seems to be an acceptable discriminating feature in subjective assessment. The other item with a significant correlation was "Are you having difficulty gathering and performing what you are asked to do?" (#3). This item was significantly correlated with verbal learning, recognition, retrieval, and reading shape color. The items that weren't correlated with objective cognitive assessment were "Are you having difficulty understanding what you read in a newspaper or book?" and "Are you able to focus on what people are saying during a conversation?" The 2 items with significant correlations are related to situations in which the BP patients were asked to perform a task and in which the BP patients were required to actively contribute. The other 2 items were related to situations in which the BP patients were passive and were not required to perform a task. In other words, if the BP patients felt inadequate when they were expected to be active and to perform a task, they tended to express this as a complaint; however, if there wasn't such a condition, they did not feel an urge to perform a task and thus did not express feelings of inadequacy. Moreover, it should be kept in mind that the objective cognitive assessment instruments may not be selective in the rating of the items of the cognitive subscale.

Furthermore, in interpreting these findings, it should also be kept in mind that the sensitivity of the Bipolar Disorder Functioning Questionnaire cognitive subscale to rate cognitive deficits is not known and it may, therefore, fail to identify mild deficits.

The difference between the BP and control groups in terms of subjectively expressed and objectively observed cognitive deficits, and the weak correlation between the objective and subjective cognitive assessments led us to consider the source of this difference in BP patients. Dias et al. (2008) reported that BP patients with preserved insight had better cognitive performance when compared to BP patients with impaired insight. They suggest that insight is both a determinant of cognitive performance and a specifi-



er in the expression of cognitive deficits in BP patients. On the other hand, the effort of BP patients to present themselves as good may also be influential. BP patients deny the existence of their illness, as they do not experience many symptoms inter-episode (Camp et al., 2002), and with this denial comes the tendency to present themselves as good. In contrast, the tendency of BP patients towards self-stigmatization is another issue (Aydemir, 2004). The attitudes of BP patients towards their illness, and their perception and experience of their illness require further research. Finally, residual mood symptoms may also affect the subjective complaints of BP patients. In particular, residual manic symptoms lower the threshold of BP patients for expressing complaints (Burdick et al., 2005). In fact, BP patients with residual depressive symptoms exhibit more cognitive impairment than those with residual manic symptoms, independent of disease severity and drug treatment regimen (Kaya et al., 2007). The fact that BP patients do not sufficiently express their objective cognitive deficits should be the subject of ongoing research.

### Limitations and Advantages of the Study

This present study has some limitations. The study sample was relatively small and for more precise interpretations and generalizations of the results, additional research with larger samples is needed. Another limitation related to the BP group was its heterogeneity in terms of clinical features and disease history. Another limitation of the study is that the sensitivity of the Bipolar Disorder Functioning Questionnaire cognitive subscale to meas-

ure cognitive deficits is not known and that it may fail to identify mild cognitive deficits. The pharmacotherapy of the BP patients at the time of the study is another factor that might have affected the results of the study. Due to ethical considerations, as it is almost impossible to find BP patient not being treated pharmacologically this is a shared limitation of all researchers working on cognitive functions in BPD. Another limitation is the cross-sectional nature of the study. Longitudinal follow-up of the BP patients would have increased the accuracy of the data. A major strong point of the study is that it used reliable and valid assessment instruments for both objective and subjective cognitive assessment.

### CONCLUSION

BP patients were unsuccessful in subjectively assessing their objective cognitive deficits. They considered themselves no different than the general population, in terms of cognitive functioning. On the other hand, the BP patients felt and expressed inadequacy when they were expected to perform a task; however, when there wasn't such an expectation they didn't feel and express inadequacy. In fact, this finding highlights that the BP patients had, to some extent, insight concerning their illness. In assessing the BP patients with the Bipolar Disorder Functioning Questionnaire, the second and the third items of the cognitive subscale had the strongest correlations with the objective cognitive assessment, even though the correlation was relatively weak.

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