

## Reward Sensitivity and Decision Making in Depressive Episode: Are Unipolar and Bipolar Patients Different?

Rumeysa Yeni Elbay<sup>1</sup> and Sermin Kesebir<sup>2\*</sup>

<sup>1</sup>Medeniyet University, Göztepe Training and Research Hospital, Istanbul, Turkey

<sup>2</sup>Üsküdar University, NP Istanbul Neuropsychiatry Hospital, Istanbul, Turkey

### Abstract

**Objective:** The aim of the present study was to determine whether unipolar and bipolar depressive episodes differ with respect to reward sensitivity and decision making.

**Methods:** In the present study, 25 patients diagnosed with bipolar disorder, depressive episode (BD) and 25 patients with Major depressive disorder, recurrent (UD), according to DSM-IV, were investigated. Inclusion criteria were not initiating treatment for the present period and not using antipsychotics as preventive treatment. Iowa Gambling Task was used in order to evaluate reward sensitivity and decision making process. The severity of depressive period was evaluated with Hamilton Depression Rating Scale.

**Results:** Overall score of IGT was found to be lower in BD group, than UD and healthy controls. HDRS scores are similar between patients with BD and UD. No relation could be shown between HDRS and IGT net scores in two depressive groups. If we consider and compare IGT scores separately for each of the five steps of the test, according to posthoc analysis results, at the first step (pre-punishment) no difference was found between BD and UD groups and healthy controls. At the second step (pre-hunch), in BD group obtained lower scores than UD group and healthy controls (BD<UD=HC). At the third step (hunch), patients diagnosed with BD, obtained scores similar to patients diagnosed with UD with both groups obtaining lower scores than healthy individuals (BD=UD<HC). At fourth and fifth steps (conception) patients with BD obtained lower scores than those with UD and healthy controls (BD<UD=HC and BD<UD=HC).

**Conclusion:** Impairment in reward sensitivity and risk associated decision making processes is more pronounced in bipolar patients.

**Keywords:** Reward sensitivity; Decision making; Bipolar depression; Unipolar depression

### Introduction

Hedonic capacity decreases in depressive episode. Increase in single reward sensitivity associated with disadvantageous stimulus is a dysfunctional reward process. Gotlib et al. [1] compared the children of healthy mothers and mothers with unipolar depression (UD), between the ages of 10-14 and disclosed that in children carrying risk due to family history, impairment in the mechanism of response to reward stimulus preexisted the emergence of depressive symptoms.

In a metanalysis investigating bipolar patients in euthymia, bipolar cases were found to be similar to healthy individuals in terms of total number of risky choices and learning [2]. In the study of Adida et al. [3] comparing manic, depressive, euthymic patients with healthy controls, the number of cards taken from the risky groups was reported as follows, M>D>E>HC. In the study of Van der Gucht et al. [4] with a similar design comparing manic, depressive and euthymic patients with healthy individuals, a relation was shown between learning disorder and depressive symptoms and reward sensitivity and manic symptoms. In the same study, it was stated that impairment to the response to reward stimulus was most marked in depressive period.

In Iowa Gambling Task (IGT), which is proposed as an index for reward sensitivity, risky choices are increased in bipolar disorder (BD) [3]. It is also suggested that IGT also reflects Behavioral Activation System (BAS) activity, which is an independent index of reward sensitivity [5]. It is very suitable for the investigation of BD since it also evaluates decision making mechanism. Decision making is a executive function responsible for the regulation of reward and loss perception and making advantageous choices [6]. Impairment in decision making process is interpreted as impairment in learning from experience.

Differentiation of unipolar and bipolar is a clinically primary problem. The presence of objective markers for bipolarity will yield clinically and functionally beneficial results for all depressive individuals [7]. Functional abnormalities in control and maintenance of attention and regulation of affect and reward response will be different in unipolar and bipolar groups. Actually, left middle frontal activity associated with reward sensitivity was reported to be predictor of conversion to BD I in cyclothymic and BD II diagnosed cases with 4.7 years follow up [8]. In another follow up study, 14-19 year old risk adolescents were investigated in terms of BAS (behavioral activation system) sensitivity and those with high and moderate sensitivity were separated and it was shown that adolescents with high sensitivity developed BD earlier and at higher rates [9]. It was reported that in this high risk group, BAS activity was focused on being popular and famous and financial success [10].

As far as we know, there is no previous study in the literature comparing depressive cases diagnosed with UD and BD in terms of reward sensitivity and decision making processes. Differentiation of unipolar and bipolar in terms of reward sensitivity and decision making

**\*Corresponding author:** Sermin Kesebir, Professor of Psychiatry, Üsküdar University, NP Istanbul Neuropsychiatry Hospital, Istanbul, Turkey, Tel: +90 216 633 0633; E-mail: [serminkesebir@hotmail.com](mailto:serminkesebir@hotmail.com)

**Received** March 07, 2016; **Accepted** April 24, 2016; **Published** April 28, 2016

**Citation:** Elbay RY, Kesebir S (2016) Reward Sensitivity and Decision Making in Depressive Episode: Are Unipolar and Bipolar Patients Different? J Depress Anxiety S2: 010. doi: [10.4172/2167-1044.S2-010](https://doi.org/10.4172/2167-1044.S2-010)

**Copyright:** © 2016 Elbay RY, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

processes will be useful to management of current depression especially anhedonia and functionality. The aim of the present study was to determine whether unipolar and bipolar depressive episodes differ with respect to reward sensitivity and decision making.

## Method

### Sample

In the present study, 25 patients diagnosed with bipolar disorder, depressive episode and 25 patients with Major depressive disorder, recurrent, according to DSM-IV, were investigated. They all presented to our outpatient clinic and gave informed consent to participate in the study. Patients with comorbid diagnoses were not included in the study. Inclusion criteria were not to use initiating treatment for the current depressive episode and not to use atypical antipsychotics as a maintenance treatment before the evaluation. In addition, cases using benzodiazepine were excluded from the study.

Healthy controls were chosen from staff our hospital without any present or past psychiatric complaints and history of psychiatric presentation and treatment.

### Procedure

Necessary approval for the study was obtained from Erenköy Mental and Neurological Disease Training and Research Hospital, Scientific Research Unit and Local Ethics Committee.

Age, gender and duration of education were recorded and diagnostic interviews were carried out with SCID-I. Iowa Gambling Task was used in order to evaluate reward sensitivity and decision making process. The severity of depressive period was evaluated with Hamilton Depression Rating Scale.

Tests were administered to outpatients cases on the same day, and to inpatients within the first three days of being included in the study. Tests were administered by the same investigator to all cases.

### Tools

**Structured Clinical Interview for DSM-Axis I Disorders-SCID-I** [11]: Its reliability and validity study in Turkish was carried out by Özkürkçügil et al. [12].

**Iowa Gambling Task (IGT)** [13]: In IGT, decision making process is analysed in five separate steps using 100 cards. First step corresponds to pre-punishment second step pre-hunch, third step hunch, and fourth and fifth steps to conceptual function [5]. Its reliability and validity study in Turkish was carried out by Güleç et al. [14].

**Hamilton Depression Rating Scale (HDRS)**: Scale is used to measure the severity of depression [15] and its Turkish reliability and validity study was carried out by Akdemir et al. [16].

### Statistical analysis

Group comparisons were made by variance analysis and in posthoc analysis Bonferroni correction was used. In correlation analysis, Pearson correlation test was employed. All tests were two sided and p value of <0.05 was considered significant.

## Results

### Sample

Age, gender and education were similar between bipolar and unipolar patients and healthy controls (Table 1). HDRS scores are

	BD n = 25	UD n = 25	HC n = 25	Analysis x <sup>2</sup> /F, p
Age (mean ± SD)	39.2 ± 9.2	41.9 ± 11.8	40.4 ± 11.7	0.387, 0.680
Gender (F/M)	18/7	16/9	14/11	1.389, 0.499
Education (year), (mean ± SD)	9.5 ± 4.1	9.0 ± 4.5	9.0 ± 3.7	0.124, 0.884
HDRS (mean ± SD)	26.9 ± 4	27.8 ± 3.4	2.7 ± 0.8	63.841<0.001

**Note:** PostHoc analysis (Bonferroni) for HDRS: UD = BD>HC (p<0.001, p<0.001).

**Table 1:** Comparison of sociodemographic characteristics and depression scores between bipolar and unipolar patients and healthy controls.

	BD n = 25	UD n = 25	HC n = 25	Analysis F, p
1. pre-punishment	51.2 ± 6.9	54.1 ± 4.7	54.2 ± 6.9	1.770, 0.178
2. pre-hunch	43.1 ± 7.8	48.4 ± 7.5	50.0 ± 7.3	5.522, 0.006
3. hunch	44.1 ± 8.2	47.5 ± 8.9	55.3 ± 7.9	11.447<0.001
4. early conception	43.2 ± 10.3	50.9 ± 9.2	57.2 ± 11.0	11.549<0.001
5. conception	44.0 ± 8.9	54.8 ± 7.3	57.4 ± 9.8	16.137<0.001
IGT overall net score	43.2 ± 8.9	52 ± 7.9	57.3 ± 8.1	18.002<0.001

**Note:** PostHoc analiz: 1. BD = UD = HC, 2. BD<UD = HC (p = 0.051, p = 0.009), 3. BD = UD<HC (p = 0.005, p<0.001), 4. BD<UD=HC (p= 0.030, p< 0.001), 5. BD<UD=HC (p< 0.001, p< 0.001), Overall net score BD<UD = HC (p< 0.001, p< 0.001).

**Table 2:** The comparison of IGT overall and step scores between bipolar and unipolar patients and healthy controls.

similar between patients with BD and UD and higher than healthy controls (Table 1).

### Comparison of IGT scores between bipolar and unipolar patients and healthy controls

Overall score of IGT was found to be lower in BD group, than UD and healthy controls (Table 2). The difference between UD cases and healthy controls did not reach statistical significance (p = 0.079).

If we consider and compare IGT scores separately for each of the five steps of the test, according to posthoc analysis results, at the first step (pre-punishment) no difference was found between BD and UD groups and healthy controls (Table 2). At the second step (pre-hunch), in BD group obtained lower scores than UD group and healthy controls (BD<UD=HC). At the third step (hunch), patients diagnosed with BD, obtained scores similar to patients diagnosed with UD with both groups obtaining lower scores than healthy individuals (BD=UD<HC). At fourth and fifth steps (conception) patients with BD obtained lower scores than those with UD and healthy controls (BD<UD=HC and BD<UD=HC).

### Relation between HDRS and IGT scores

No relation could be shown between HDRS and IGT net scores in two depressive groups.

## Discussion

In the present study, IGT net score was found to be lower in cases diagnosed with BPD than those diagnosed with UPD and healthy controls. The difference between UPD cases and healthy controls did not reach statistical significance. When IGT score was compared separately for each of the five steps of IGT; at pre-punishment step no difference was found between BD, UD and healthy controls. In pre-hunch step, depressive patients diagnosed with BD obtained lower scores than UD and healthy controls. At hunch step, depressive patients diagnosed with BD, obtained similar scores with UD patients and both groups of patients obtained lower scores than healthy controls. At

conceptual step (fourth and fifth steps) depressive patients diagnosed with BD, obtained lower scores than UD patients and healthy controls. When these findings are evaluated together, it can be stated that while depressive patients diagnosed with BD had no difference with unipolar depressive patients at pre-punishment and hunch steps and they displayed a worse performance than unipolar depressive patients at pre-hunch, early conceptual and conceptual steps. However, when the difference between bipolar and unipolar depressive patients in pre-hunch step was compared with that at conceptual step, it was found to be less marked.

Depressive episode itself may be defined as decreased response to reward stimulus. Increase in single reward sensitivity associated with non aversive stimulus is a dysfunctional reward process. This can be explained with the loss of phasic activity in dopamine neurons. The question that should be answered here is whether this is a kind of insensitivity to reward stimulus or an error of prediction associated with impaired learning. Actually, when asked to score affectively, cases diagnosed with depressive disorder scored not only reward but, also loss lower than healthy controls [17].

Hypomania and mania refers to a reward sensitivity characterized by impulsive decision making and risk taking. In paradigm characterized by earlier and lesser reward versus later and higher reward, hypomanic and manic cases preferred the former option unlike healthy controls [18]. Were reported N1 amplitude corresponding to this choice to be higher in cases diagnosed with BD, pointing to the fact that in reward sensitivity there was bias regarding early stage attention. Ibanez et al. [19] administered IGT to euthymic bipolar cases and demonstrated increase in P3 amplitude, among event related potentials corresponding to impairment in learning with negative feedback and reward sensitivity in IGT. Based upon this finding, they evaluated learning with negative feedback as a relatively late function associated with evaluation and then reaching a decision. According to the findings of the present study, cases diagnosed with BD, unlike those diagnosed with UD and healthy controls, displayed similar behavior to hypomanic and manic cases at pre-hunch step and to euthymic bipolar cases at early conceptual and conceptual steps. In other words, in bipolar cases, unlike unipolar depressive cases and healthy controls, a kind of lack of reward sensitivity and a prediction error associated with impairment in learning are concurrent.

In the study of Adida et al. [3], the severity of impairment in IGT performance in cases with BD was in the following order: manic period, depressive period, remission period, and healthy controls. However, in the study of Van der Gucht et al. [4] with a similar design, impairment in the response was most pronounced in depressive period. It should be stressed here that education level and severity of depression (HDRS score) which are found to be predictors of impairment in decision making in depressive period in both studies [3,4], are similar between bipolar and unipolar patients in the present study.

It is also suggested that preferences disregarding loss and sensitive to only reward are independent of the current mood [20]. Compatible with this hypothesis, in the present study, both in bipolar and unipolar patients and healthy controls, no relation could be shown between HDRS scores and IGT performance scores. In other words, reward sensitivity and risk associated decision making is independent of the severity of depression. At this point, it may be suggested that, specific to depressive episode, learning based on negative feedback is impaired at a higher degree than reward sensitivity. In association with this assumption, it is stated, in a meta-analysis including 392 cases and based upon six data bases, that depressive mood and anhedonia impairs

reward sensitivity more than learning based on negative feedback does and that pramipexol improves learning more markedly than learning based on feedback [21]. In addition, it was reported that in cases diagnosed with BD, after the use of pramipexol, which is a D2/D3 agonist, for eight weeks, options with higher risks are preferred more frequently [20].

In view of the aforementioned findings, new studies on the issue with sound methodology, which can explain the discrepant results are required. Our findings need to be addressed by subsequent studies. The need for further multicenter studies on the issue which have large samples and resupported by functional brain imaging and electrophysiology is clear. The use of psychotropics is an important limitation of the present study and other studies on the issue. In the study of Adida et al. [3], it was reported that benzodiazepin use was one of the predictors in disturbance of decision making process. In the study of Roiser et al. [22], it was reported that in 49 bipolar cases who are not on drugs and are in depressive period, there was impairment in reward sensitivity, short term spatial memory and learning associated with negative feedback. In another study, inverse relation was reported between reward sensitivity and medication [23]. Cases included in the present study were those in whom treatment was not regulated yet for current depressive episode, and antipsychotic and benzodiazepin use were excluded.

In conclusion, in the present study investigating the difference between unipolar and bipolar depression in terms of reward sensitivity and risk associated decision making processes, some differences were demonstrated between unipolar and bipolar patients. Such a marker may influence and refine individual treatment goals and options. Mason et al. [18] proposed that the cases will benefit from awareness training at different processes. According to our findings, impairment in reward sensitivity and risk associated decision making processes is more pronounced in bipolar patients. Differentiation of unipolar and bipolar is a clinically primary problem. The presence of objective markers for bipolarity will yield clinically and functionally beneficial results for all depressive individuals. Functional abnormalities in maintenance of attention and regulation of affect and reward response will be different in unipolar and bipolar groups. As far as we know, there is no previous study in the literature comparing depressive cases diagnosed with UD and BD in terms of reward sensitivity and decision making processes. Differentiation of unipolar and bipolar in terms of reward sensitivity and decision making processes will be useful to management of anhedonia and functionality.

## References

1. Gotlib IH, Hamilton JP, Cooney RE, Singh MK, Henry ML, et al. (2010) Neural processing of reward and loss in girls at risk for major depression. *Arch Gen Psychiatry* 67: 380-387.
2. Edge MD, Johnson SL, Ng T, Carver CS (2013) Iowa gambling task performance in euthymic bipolar I disorder: a meta-analysis and empirical study. *J Affect Disord* 150: 115-122.
3. Adida M, Jollant F, Clark L, Besnier N, Guillaume S, et al. (2011) Trait-related decision-making impairment in the three phases of bipolar disorder. *Biol Psychiatry* 70: 357-365.
4. Van der Gucht E, Morriss R, Lancaster G, Kinderman P, Bentall RP (2009) Psychological processes in bipolar affective disorder: negative cognitive style and reward processing. *Br J Psychiatry* 194: 146-151.
5. Struglia F, Stratta P, Gianfelicce D, Pacificoa RN, Riccardia I, et al. (2011) Decision making impairment in schizophrenia: Relationship with positive symptomatology. *Neuroscience Letters* 502: 80-83.
6. Tomassini A, Struglia F, Stratta P, Pacifico R, Gianfelicce D, et al. (2009) The decision making: neuroanatomy, functional exploration and mental disorders. *Riv Psichiatr* 44: 226-241.

7. Cardoso de Almeida JR, Phillips ML (2013) Distinguishing between unipolar depression and bipolar depression: current and future clinical and neuroimaging perspectives. *Biol Psychiatry* 73: 111-118.
8. Nusslock R, Harmon-Jones E, Alloy LB, Urošević S, Goldstein K, et al. (2012) Elevated left mid-frontal cortical activity prospectively predicts conversion to bipolar I disorder. *J Abnorm Psychol* 121: 592-601.
9. Alloy LB, Bender RE, Whitehouse WG, Wagner CA, Liu RT, et al. (2012) High Behavioral Approach System (BAS) sensitivity, reward responsiveness, and goal-striving predict first onset of bipolar spectrum disorders: a prospective behavioral high-risk design. *J Abnorm Psychol* 121: 339-351.
10. Fletcher K, Parker G, Manicavasagar V (2013) Behavioral Activation System (BAS) differences in bipolar I and II disorder. *J Affect Disord* 151: 121-128.
11. First MB, Spitzer RL, Gibbon M (1997) Structured clinical interview for DSM-IV Clinical Version (SCID-I / CV), Washington DC, American Psychiatric Press, USA.
12. Özkürkçügil A, Aydemir Ö, Yıldız M (1999) DSM-IV Eksen I bozuklukları için yapılandırılmış klinik görüşmenin Türkçe'ye uyarlanması ve güvenilirlik çalışması. *İlaç ve Tedavi Dergisi* 12: 233-236.
13. Bechara A, Damasio H, Tranel D, Damasio AR (1997) Deciding advantageously before knowing the advantageous strategy. *Science* 275: 1293-1295.
14. Güleç H, Tamam L, Güleç MY (2008) Barratt Dürtüsellik Ölçeğinin Türkçe uyarlanmasının psikometrik özellikleri. *Klinik Psikofarmakoloji Dergisi* 18: 251-8.
15. Williams JB (1988) A structured interview guide for the Hamilton depression rating scale. *Arch Gen Psychiatry* 45: 742-747.
16. Akdemir A, Örsel S, Dag I (1996) Hamilton depresyon derecelendirme ölçeğinin geçerliği, güvenilirliği ve klinikte kullanımı. *Psikiyatri Psikoloji Psikofarmakoloji Dergisi* 4: 251-259.
17. Gruber J (2011) A review and synthesis of positive emotion and reward disturbance in bipolar disorder. *Clin Psychol Psychother* 18: 356-365.
18. Mason L, O'Sullivan N, Blackburn M, Bentall R, El-Deredy W (2012) I want it now! Neural correlates of hypersensitivity to immediate reward in hypomania. *Biol Psychiatry* 71: 530-537.
19. Ibanez A, Cetkovich M, Petroni A, Urquina H, Baez S, et al. (2012) The neural basis of decision-making and reward processing in adults with euthymic bipolar disorder or attention-deficit/hyperactivity disorder (ADHD). *PLoS One* 7: e37306.
20. Burdick KE, Braga RJ, Gopin CB, Malhotra AK (2014) Dopaminergic Influences on Emotional Decision-making in Euthymic Bipolar Patients. *Neuropsychopharmacology* 39: 274-282.
21. Huys QJ, Pizzagalli DA, Bogdan R, Dayan P (2013) Mapping anhedonia onto reinforcement learning: a behavioural meta-analysis. *Biol Mood Anxiety Disord* 3: 12.
22. Roiser JP, Cannon DM, Gandhi SK, Taylor Tavares J, Erickson K, et al. (2009) Hot and cold cognition in unmedicated depressed subjects with bipolar disorder. *Bipolar Disord* 11: 178-189.
23. Linke J, King AV, Rietschel M, Strohmaier J, Hennerici M, et al. (2012) Increased medial orbitofrontal and amygdala activation: evidence for a systems-level endophenotype of bipolar I disorder. *Am J Psychiatry* 169: 316-325.