

# Assessment of Serum Total Cholesterol and Triglycerides in Bipolar Disorder Subjects

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## ABSTRACT

**Background:** Bipolar disorder (BD), being a psychiatric condition, is defined as mood swing that alternates between mania, hypomania, and depression. Studies have been conducted globally to assess lipid profile for bipolar disorder with varying results. No such studies have been conducted in Pakistan. Therefore, present study was designed to assess total cholesterol and triglycerides in clinically diagnosed bipolar disorder.

**Materials and methods:** One hundred and twelve blood samples were collected of diagnosed bipolar patients visiting Sheikh Zayd Hospital (SZH) and Punjab Institute of Mental Health (PIMH) Lahore. Total Cholesterol (TC) and Triglycerides (TG), were estimated using standard biochemical methods

**Results:** Results obtained were statistically analyzed using SPSS. A total of 112 bipolar patients, 48 (58.5%) were manic, 26 (31.7%) were depressive, 8 (9.8%) were euthymic. The mean Cholesterol level ( $191.01 \pm 40.67$  mg/dl), in bipolar group (manic, depressive and euthymic) were statistically significant as compared to control group with p-value 0.026. The mean TG level ( $163.01 \pm 89.08$  mg/dl), in bipolar and control groups were statistically insignificant with p-value 0.609.

**Conclusions:** The present study suggests that TC level is raised in depressive patients. TG levels were same in bipolar and control groups.

**Keywords:** Bipolar Disorder, Lipid Profile, Total Cholesterol, Triglyceride.

## INTRODUCTION

A medical condition known as a mental health illness involves "significant changes in thought, emotion, and behaviour, as well as distress or difficulty functioning in social, occupational, or familial activities."<sup>1</sup> According to the American Psychiatric Association 2021, a brain illness called bipolar disorder (BD) alters a person's mood, level of energy, and capacity for functioning. This disorder was previously known as manic depressive disorder. Bipolar condition swing between 'up' states and 'down' states. Bipolar 'up' states known as mania, while bipolar 'down' states referred as depressive.

World Health Organization (WHO) indicated that BD is the twelfth most significant disorder worldwide with high morbidity and mortality.<sup>2</sup> Suicide rates in BD range from 4 to 14 percent for fatalities and 23 to 26 percent for attempts. According to another study, between 25 and 50 percent of bipolar individuals would attempt suicide at some time in their lives, with 8 to 19 percent actually succeeding.<sup>3</sup>

Based on symptoms BD, Mayo Clinic Staff<sup>4</sup> classified BD into mania and depression, with intervening state of euthymia. (Episodes of hypomania accompanied with depressed intervals that do not match the requirements for major depressive episodes). An abnormally elevated or agitated mood that lasts for at least a week characterizes a manic episode. Extreme irritability, being easily distracted, having racing thoughts, and psychosis, that may include delusions or hallucinations are all signs of mania. Characteristics of depression are feeling down, teary, depressed, or empty for the most of the day every day, losing interest in routine tasks, and fluctuating weight and uncontrollable crying.

Many risk factors are associated with BD which includes age, sex, and genetic predisposition, having a history of suicide attempts, mixed or manic states with psychotic symptoms, or being more depressed than usual and stressful life events.<sup>5</sup> Association of various lipids (fatty acids, phospholipids, and cholesterol) with the pathophysiology of BD has been reported.<sup>6</sup>

BD patients are diagnosed on basis of psychiatric symptoms which include stressful life event, psychotic behaviour, suicidal behaviour as well as by mood charting.

Low cholesterol has been linked to several psychological symptoms, including anxiety, depression, euphoria and suicidal ideation. Cholesterol is one of the molecules that is abundant in the nervous system and vital for a variety of cellular functions and

structures (such as regulating the fluidity of biological membranes). Lipid homeostasis in the brain is particularly important for maintaining the integrity of cell membranes and signalling across membranes, therefore, it is related with BD.<sup>7</sup> The biomedical importance of lipids include insulating effect in the body, constituents of membranes such as cell walls and cell organelles like mitochondrion etc, act as a fuel in the body.<sup>8</sup> TC level in blood is an indicator of cholesterol level. Serum cholesterol levels are influenced by a variety of variables, including age, a high-fat diet, and heredity.<sup>9</sup> Fasting TCs are broken down into three categories: low (<200 mg/dl), borderline high (200 to 239 mg/dl), and high (>240 mg/dl).<sup>10</sup> Fasting TG (TAG) values are categorised by the National Cholesterol Education Programmed (2002) as normal (<150 mg/dl), borderline high (150 - 199 mg/dl), high (200 - 499 mg/dl), and very high (>500 mg/dl).

Many studies<sup>11</sup> have been shown that there is association between lipid profile (TC, TG) and BD.

More recently, Su, et al. documented that TG; Cholesterol, LDL and VLDL were significantly different between unipolar and bipolar in Chinese population.<sup>12</sup> Recently Poli et al., 2020 described that no significant difference was found in lipid profile (TC and TG) of Italian population.<sup>13</sup>

Multiple studies<sup>14</sup> have been conducted globally to assess lipid profile for BD with varying results. No such studies have been conducted in Pakistan. There is need for conducting research study to assess lipid profile in local Lahori population with BD.

## MATERIALS AND METHODS

The subjects of BD (age, 20 - 70 years) for the present study were selected after clinical psychiatric diagnosis from Sheikh Zayed Hospital Lahore (SZH) and Punjab Institute of Mental Health Lahore (PIMH). Among 112 samples, 76 (67.85%) males and 36 (32.14%) females, 82 were with BD and 30 samples were belonging to normal healthy controls. Inclusion criteria include number of depressive or manic episodes, presence or absence of suicidal behavior and presence of psychotic behavior. Patients were excluded on the following diabetes mellitus, cardiovascular disease, chronic inflammatory disease, hypertension, and other mental illnesses. Fasting serum was collected, centrifuged, stored at -20°C in eppendorf tubes. TC was evaluated through CHOD PAP (cholesterol oxides) method by using the spectrophotometer at absorbance 500 nm.<sup>15</sup> The estimation of TG was evaluated

through glycerol phosphate oxides method by using the spectrophotometer at absorbance 500 nm. (Kit method) <sup>16</sup> Data was interpreted by using standard Statistical Package for the Social Sciences (SPSS) software version-20 (SPSS Inc, Chicago). The continuous variable's mean and Standard Deviation (SD) were calculated. Significance of study was determined using a Student t-test (two-tailed, independent). p values considered significant at 0.05

**RESULTS**

By considering their family history 28 cases had BD, 41 cases showed the psychotic behavior, 17 cases showed suicidal behavior and 50 cases underwent stressful life events. This data revealed the age of onset of disease from 6 months to 50 years and the total duration was prolonged from 1 month to 58 years of suffering.

Table 1: Demographic Characteristics of the Study participants

Variables	Characteristics
Gender	Male (76) and Female (36)
Age (Years)	20-70
Family history of Bipolar (cases)	Yes (28)
Duration of disease	1 month to 58 Years
Age of onset of disease	6 month to 50 Years
Psychotic behavior	41 cases shows psychotic behavior
Suicidal behavior	17 cases show suicidal behavior
Stressful event	50 cases underwent stressful life event

Biochemical evaluation (TC, TG, of the study subjects is presented in Table 2 and graphical data is depicted in fig 1. By using ANOVA F-ratio, in bipolar groups TC was found to be 191.01±40.67 as compared to control group 187.20±30.67. The value of TC was statistically significant (p-value 0.026) in bipolar group.

TG was found to be 163.01±89.08 in bipolar subjects as compared to control subjects 149.67±79.6 in bipolar it was statistically insignificant (p-value 0.609).

Table 2: Biochemical Evaluation of study Participants

Variables	Control group	Bipolar group	F	P-Value
N	30	82		
TC	187.20±30.67	191.01±40.67	3.195	0.026*
TG	149.67±79.61	163.01±89.08	0.489	0.609

ANOVA, (\*p-value significant at 0.05) (F: Degree of freedom)  
 TC: NORMAL (<200mg/dl), HIGH (>240mg/dl), BORDERLINE (200-239mg/dl).  
 TG: NORMAL (<150mg/dl), HIGH (>200mg/dl), BORDERLINE (151-159mg/dl).

When independent t test performed on stages of bipolar it has been found that the all the parameter of lipid profile (TC, TG, show statistically insignificant (p-value>0.05).

Table 3: Biochemical Evaluation of Stages of BD

Stages of Bipolar	Variables	Male	Female	P-Value
Manic	No of cases	39	11	
	TC	221.85±3.32	188.55±39.13	0.760
	TG	171.05±99.98	195.18±124.43	0.506
Depressive	No of cases	14	11	
	TC	201.07±40.79	222.36±47.33	0.239
	TG	158.71±60.41	149.82±95.72	0.779
Euthymic	No of cases	5	2	
	TC	189.80±21.19	165.50±26.16	0.249
	TG	157.20±22.33	161.50±64.35	0.889
Control	No of cases	17	13	
	TC	200.35±27.37	170.0±26.61	0.005*
	TG	156.35±49.57	140.92±109.04	0.608

INDEPENDENT SAMPLE T TEST, P-VALUE SIGNIFICANT AT 0.05TC: NORMAL (<200mg/dl), HIGH (> 240mg/dl), BORDERLINE (200-239mg/dl),

TG: NORMAL (< 150mg/dl), HIGH (> 200mg/dl), BORDERLINE (151-159mg/dl)

This bar chart gives the graphical representation of the bipolar patients vs. controls as well as comparison of values of lipid profile in both groups. It shows highest value of TC for depressive and TG for manic group.

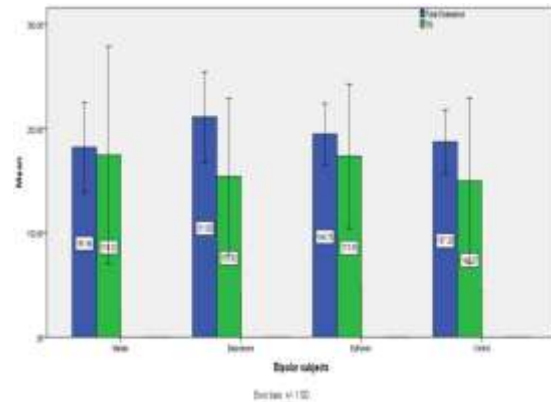


Fig 1: Bar chart to explain lipid profile in BD and control subjects

**DISCUSSION**

The present work was conducted to assess TC, TG, in bipolar subjects. The study population consisted of 112 subjects (82 bipolar patients and 30 control subjects). There were 76 (67.85%) males and 36 (32.14%) were females in both groups. Among bipolar subjects, there 50 (44.6%) patients were manic, 25 (22.3%) were depressive and only 07 (6.25%) were euthymic. Overall prevalence in the current study was 34% (112/240) in bipolar subjects. Individual group stages prevalence was 48 (58.5%) in manic, 26 (31.7%) in depressive and 8 (9.8%) in euthymic subjects.

No statistically significant association (p>0.05) was found as regard TC, TG, values between males and females in Bipolar subjects. In addition to this no gender differences among male and female patients among lipid profile as regard to BD stages- manic, depressive and euthymic. Similar results were obtained by Huang 2017, among Chinese BD patients. <sup>17</sup> However, Shiny 2014, showed significant association with respect to TG value (p<0.01). <sup>18</sup>

Significant association was observed between High TC, with BD as compared to controls (p<0.05). In these result, the mean ±SD of serum Cholesterol levels was 191.01±40.67mg/dl in bipolar patients and 187.20±30.67 mg/dl in healthy controls. Serum cholesterol level was statistically significant among bipolar group by (F-value 3.194, P-value 0.026). BulBul et al., 2014 reported that male patients had considerably higher TC and TG values (p0.05) in Turkey's Bipolar patients. The increase in TC values were p=0.066 and p=0.056 were not significant in female patients. <sup>19</sup>The level of TG was high in bipolar group 163.01±89.08mg/dl as compared to controls 149.67±79.61mg/dl but statistically insignificant association was found among bipolar subjects and controls (F-value 0.489, P-value 0.609). There was no statistically significant association found in TGs and among the bipolar subjects and healthy controls.

Chung et al., 2007 conducted study on serum lipids and mood symptoms during the acute phase of BD in Taiwan BD patients. <sup>20</sup> Serum TG levels were shown to be negatively correlated with BD patients. There could be variations in the blood lipids of BD patients amid acute mood episodes as compared to earlier research on Western populations.

Similarly, Berardis et al., 2008 indicated that TC was altered during different phases of BD. <sup>21</sup> The presented study revealed that components of lipid profile such as TC can be used as tentative diagnostic criteria in BD. Further studies are needed to verify this observation.

Huang et al., 2018 did a research work on state-dependent alterations of lipid profiles in patients with BD. They compared the fasting blood levels of TC, TG, of manic or depressed patients in the acute phase and normal controls. The result of their study was the mean TC level in acute mania was significantly lower than that in acute depression ( $p < 0.025$ ). The low level of dyslipidemia, TG was also observed in acute mania. <sup>22</sup>

John, 2014 conducted a descriptive study to investigate the correlation of between psychiatric disorders with lipid profile. They also compared the TG levels in lipid profile between males and females, which indicated a statistically significant correlation ( $p < 0.01$ ) but remained within the normal range. Additionally, there was no statistically significant link between the lipid profiles of the psychotic and neurotic spectrums, as determined by the  $p < 0.05$  threshold. At the end of their study they concluded that no statistically significant association was found between lipid profile and different psychiatric diseases. <sup>23</sup>

Su et al., 2019 examined the variations in lipid content in the serum among unipolar and bipolar depressed population of China. The bipolar group had significantly lower TGs, TC, compared with the unipolar group. At the end of their study they conclude that TGs, TC levels were considerably different between unipolar and bipolar depressive individuals, suggesting that they might serve as diagnostic indicators. <sup>24</sup>

Vemuri et al., 2011 did research work on lipid profiles unique to gender in BD patients, with the aim to assess gender differences of dyslipidemia in patients with BD. When they compared men with women, they found significantly lower mean TG ( $105.58 \pm 64.12$  vs.  $137.99 \pm 105.14$ ,  $p = 0.009$ ). At the end they concluded that prevalence of TC and TG was substantially lower in men as compared to women. <sup>25</sup>

According to Sagud et al. (2009), there was a significant difference in blood TG levels across the groups ( $F = 6.909$ ,  $P < 0.000$ ). In comparison to healthy controls, patients with BDs in manic ( $P = 0.007$ , Tukey's test) or depressive ( $P < 0.001$ , Tukey's test) episodes had substantially higher TG levels. Healthy controls and patients with BD did not substantially vary in terms of blood cholesterol levels. Compared to healthy persons, patients with BD had higher TG levels. No changes in TC were found, however there were substantial variations in the ratios of cholesterol to HDL and LDL in each group. <sup>26</sup>

## CONCLUSION

In conclusion the present on BD indicated raised value of TC in depressive patients. The values of TG are in normal range when compared with the control group.

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