

## ORIGINAL PAPER

# A Study of Serum Total Cholesterol and HDL-Cholesterol in Depression

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### ABSTRACT

**Introduction:** In keeping with the emerging danger of depression, this study has been carried out to estimate serum total cholesterol and HDL-cholesterol in cases of depression and compare the levels with that of age and sex matched healthy controls. **Aim:** To measure the serum total cholesterol and HDL-Cholesterol in clinically diagnosed patients with depression and study their levels in different age groups and gender. **Method:** Serum Cholesterol estimation by CHOD/PAP method. HDL cholesterol estimation by PEG/ CHOD-PAP method. **Results:** Serum cholesterol and Serum HDL-Cholesterol were observed to be significantly ( $p < 0.05$ ) lower in patients with depression, when compared with that of healthy controls. In addition, serum total cholesterol concentration showed a declining trend as the disease progressed from mild to severe. **Conclusion:** It is suggestive that cholesterol may have an important role to play in our efforts to ameliorate the social burden of depression and mitigate the disease progression. A larger sample size, longer duration of study and inclusion of drug-naïve cases could have been more conclusive.

**Keywords:** Serum lipids, Psychiatry, Assam

### INTRODUCTION

Depression, the common psychological disorder, affects about 121 million people worldwide. World Health Organization (WHO) states that depression is the leading cause of disability as measured by Years Lived with Disability (YLDs) and the fourth leading contributor to the global burden of disease. By the year 2020, depression is projected to reach second place in the ranking of Disability Adjusted Life Years (DALY) calculated for all ages. Today, depression already is the second cause of DALYs in the age category 15-44 years.<sup>1</sup>

25% of the total cholesterol in the body is synthesized in the brain. Among various functions of cholesterol is that it helps in the building of myelin sheath as well as in synaptogenesis.<sup>2</sup> The

association of cholesterol with depression stems from the epidemiological studies that lipid lowering drugs (statins) leads to higher risk of depression in a proportion of cases.<sup>3</sup>

Cholesterol is an important factor in the receptor sites of the cells binding with the appropriate neurotransmitter, in particular acetylcholine and serotonin. Research has suggested that cholesterol is the facilitator of the attachment between the neurotransmitter and the cell membrane, as well as their delivery to specific protein receptors.<sup>4</sup> Another study hypothesizes that this mechanism actually causes inhibition of neurotransmitter release due to the low levels of cholesterol.<sup>5</sup>

The present study aims to measure the serum total cholesterol and HDL-Cholesterol in clinically diagnosed patients with depression and study their levels in different age groups and gender.

### MATERIALS AND METHODS

The present study comprised of 50 cases of depression and 50 age and sex matched healthy controls visiting the Department of Psychiatry, Assam Medical College, Dibrugarh, Assam.

Inclusion Criteria: Patients of age group 16 to 50 years, newly diagnosed cases of depression as diagnosed by DSM IV and previously diagnosed cases of depression in which patient is

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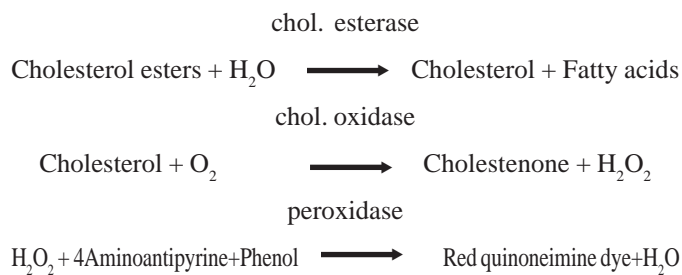
drug free for atleast one month.

Exclusion Criteria: Patients with other associated psychiatric disorders and dementia, Substance abuse, systemic illness like diabetes, hypertension, hypothyroidism, renal disease, liver disease, obesity and cancer, pregnant ladies and lactating mothers, patients on multivitamins and oral contraceptive pills (OCP) and patients with mental retardation and hearing impairment

The Grading of the cases included in the present study into mild/moderate/severe was done using the 17 item Hamilton Depression Rating Scale.

**SERUM CHOLESTEROL ESTIMATION: (CHOD/PAP METHOD),<sup>6,7,8</sup>**

Principle: Cholesterol esterase (CHE) hydrolyses cholesterol ester to free cholesterol. Free cholesterol is oxidized to hydrogen peroxide. Hydrogen peroxide formed reacts with 4-amino antipyrine and phenol in the presence of peroxidase (POD) to produce red coloured quinoneimine dye complex. Intensity of the colour formed is directly proportional to the amount of cholesterol present in the sample.

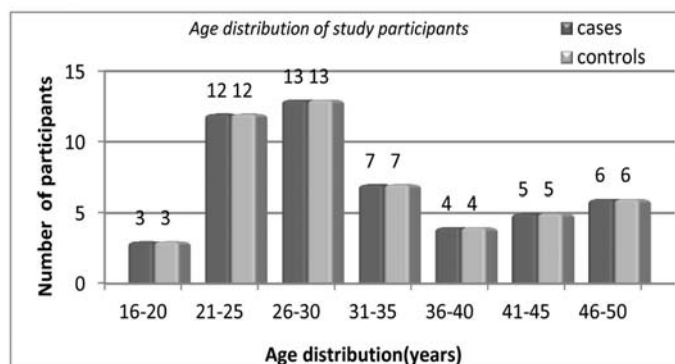


**HDL CHOLESTEROL ESTIMATION (PEG/ CHOD-PAP METHOD),<sup>6,7,8,9,10</sup>**

Principle: Chylomicrons, VLDL and LDL were precipitated by adding precipitating reagent containing polyethylene glycol to the sample. Centrifugation of the precipitant leaves only the HDL in the supernatant (centrifugation done at 2500-3000 rpm). The supernatant was separated out and its cholesterol content was determined using the cholesterol reagent.

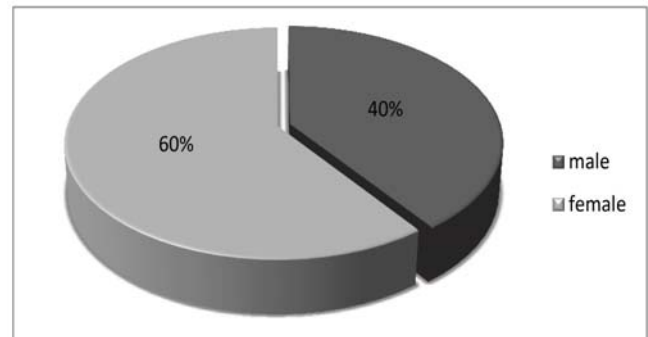
Apart from unpaired student’s test, ANOVA, Regression Analysis were the statistical tools applied.

**RESULTS**



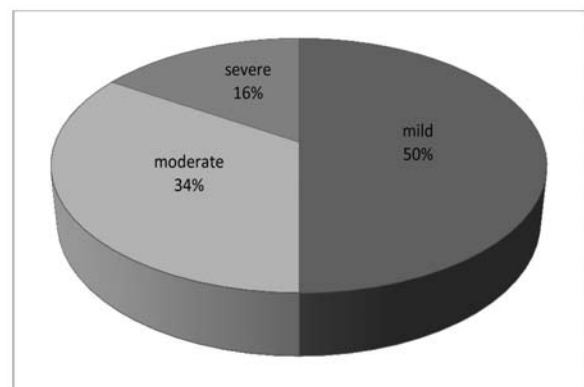
**Figure 1** Age distribution of cases

The diagram shows that highest number of depression cases included in the study were in the 26-30 years age group (26%), followed by 21-25 years age group (24%). 16-20 years age group with only 3 cases showed the lowest number of cases i.e., 6%.



**Figure 2** Gender distributions of cases

The diagram shows that majority of the cases in the present study were females. 40% of cases were males and 60% of the cases were females with a male female ratio of 0.67:1.



**Figure 3** Different grades of depression

In the diagram, it is seen that mild depression constitutes the majority of the cases under study. 25 cases (50%) of total cases were mild depression, 17 cases (34%) were moderate depression and 8 cases (16%) were severe depression.

**Table 1** Comparison in cases and controls

Parameters	C A S E S ( m g / d l )		C O N T R O L S ( m g / d l )		P - v a l u e
	M e a n	S . D	M e a n	S . D	
Total cholesterol	149.57	27.75	162.54	25.05	<0.05*
HDL - C	42.15	8.83	45.33	5.06	<0.05*

\*= Statistically significant

Serum cholesterol in cases (149±27.75mg/dl) was significantly lower (p<0.05) than in the controls (162.54±25.05mg/dl). Serum HDL in cases (42.15±8.83mg/dl) was also significantly lower (p<0.05) than in the controls (45.33±5.06mg/dl).

**Table 2** Comparison in male and female cases

Parameters	C a s e s		C o n t r o l s		P-value	
	M e a n	S . D	M e a n	S . D		
TC (mg/dl)	M a l e	149.0	25.89	171.20	26.26	N S
	F e m a l e	149.96	29.35	156.76	22.86	N S
HDL(mg/dl)	M a l e	39.44	6.67	45.91	4.80	<0.01*
	F e m a l e	43.95	9.71	44.95	5.27	N S

\*= Statistically significant; NS= Not Significant(p>0.05)

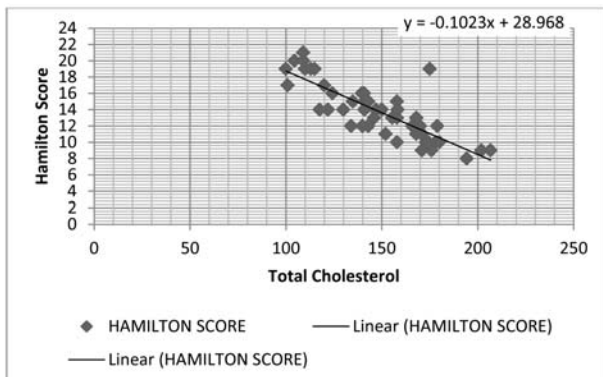
From the above table, it is observed that both the parameters in male and female cases were respectively lower than in the male and female controls. However, serum HDL (39.44±6.67vs.45.91±4.80 mg/dl) in the males was statistically significant (p<0.01).

**Table 3** Comparison on basis of different grades of depression in cases and controls

		M I L D	MODERATE	S E V E R E
		Mean ±SD	Mean ±SD	Mean ±SD
TC(mg/dl)	C a s e	169.31±18.97	135.91±15.13	116.93±23.42
	C o n t r o l	162.9±24.97	165.67±26.25	154.76±24.22
	p-value	N S	<0.0001*	<0.01*
HDL(mg/dl)	C a s e	42.93±7.02	43.24±10.43	37.38±9.89
	C o n t r o l	49.71±4.96	46.07±5.53	45.73±4.70
	p-value	N S	N S	<0.05*

\*= Statistically significant; NS= Not significant

In the table, it is observed that in mild depression cases, serum cholesterol was higher in the cases compared to the controls, but in cases of moderate and severe depression, total cholesterol and HDL-cholesterol were lower in cases than in controls.



**Figure 4** Correlation of total cholesterol and Hamilton score correlation in cases

Regression analysis revealed that a = 28.96 and b= -0.102  
Now, the equation becomes,

$$\text{Hamilton score} = 28.96 - 0.102 \times \text{serum cholesterol}$$

Thus, the Hamilton score can be calculated from the serum total cholesterol level.

**DISCUSSION**

Anita B. Kale et al<sup>11</sup> in an Indian study found significantly low serum lipid levels in the study group as compared to the control group. Our study was also in agreement with findings of BN Patra et al<sup>12</sup> and Marko Martinac et al<sup>13</sup> with regard to serum total cholesterol. Verma et al in an Indian study in suicide attempters found total serum cholesterol, serum Triglyceride, LDL levels and HDL-cholesterol to be lower in suicide attempters but were not statistically significant<sup>14</sup>. Lower HDL-Cholesterol was also observed by Kale AB, Kale BS, Chalak SS, TaTankhiwale SR, Bang G, Agrawal M, et al.<sup>11</sup>

When analysed gender wise serum total cholesterol was found to be lower in the depressed study participants than in the healthy controls in both the genders, and different age groups; but results were not statistically significant.

When analysed according to severity of depression, lowest value of total serum cholesterol was found in the severe depression cases. Statistically significant difference was seen on comparing the mild and the moderate (p<0.001), and mild and the severe (p<0.001). However, there was no statistically significant difference between the moderate and the severe group(p>0.05).

The above finding was consistent with a metaanalysis which found that higher TC was associated with lower levels of depression, and this association was substantially larger among medication-free samples.<sup>15</sup>

On gender wise analysis, serum HDL was found to be lower in the depressed study participants than in the healthy controls in both the genders, and it was statistically significant in the males (p<0.01). When analysed in the different age groups, serum HDL was found to be lower in the cases than in the controls of all ages but the findings were not statistically significant.

When we analysed HDL-cholesterol according to severity of depression, lowest value was found in the severe depression cases. However, the difference in the mean values of serum HDL was not statistically significant (p>0.05).

Low cholesterol in depression may be explained by the cholesterol serotonin hypothesis. This hypothesis states that reduction of serum TC may decrease brain cell membrane cholesterol and thereby lowering microviscosity of the cell membrane and subsequently decreasing the exposure of protein serotonin receptor on the membrane surface resulting in poorer uptake of serotonin from blood and less serotonin into brain cells leading to depression.<sup>16</sup>

Penttinen J suggested another possible mechanism that interleukin-2 lowers cholesterol and increases triglycerides and also suppresses melatonin secretion, thus causing depression and suicidal tendencies.<sup>17</sup>

Low serum HDL in depression was consistent with the findings of Maes et al. It was suggested that (i) lower serum HDL-C levels are a marker for major depression and suicidal behaviour in depressed men, (ii) lower serum HDL-C levels are probably

induced by the immune/inflammatory response in depression and (iii) there is impairment of reverse cholesterol transport from the body tissues to the liver.<sup>18</sup>

Grading of depression cases was done using the Hamilton Scale which is a purely subjective scale, so there might be overlapping of symptoms and it is also difficult to differentiate borderline cases. This may be a cause for non significant results in the moderate vs. severe group comparison.

### CONCLUSION

From the present study, it was observed that total cholesterol and HDL-cholesterol was significantly lower in patients with depression patients as compared to age and sex matched healthy controls. In addition, serum total cholesterol concentration showed a declining trend as the disease progressed from mild to severe. Individuals with low levels of cholesterol could be screened for depression so that corrective measures are taken at the earliest to prevent deaths from suicides. It could be further argued that serum total cholesterol may serve as a prognostic marker for disease conversion from mild to severe which would go a long way in decreasing the social burden of the disease. However, a larger sample size, longer duration of study and inclusion of drug-naïve cases could have helped in conclusively settling the debate on the stellar role of cholesterol in depression.

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**Contribution of Authors:** I (We) declare that this work was done by the author(s) named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. The study was conceived, designed by Dr. Jahnabi Barua along with data collection. Statistical analysis was carried out by Dr. Jahnabi Baruah and Dr. Pratim Gupta.

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