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Original Research Article

Lipid Profile in Anemic Patients: A Cross Sectional Study

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Abstract: ***Introduction***: Anemia is a common disorder in India, although there are plenty of reasons attributable to Anemia. Studies are reporting the beneficial effect of Anemia on lipid profile. ***Aim*****:** This research was conducted to study the pattern of lipid profiles in anemic patients. ***Material and Method*****:** Present hospital-based cross-sectional study was conducted among patients more than 18yrs of age attending the OPD or admitted to the medicine department National Institute of Medical Sciences and Research, Jaipur, with diagnosed Anemia. The study was done over a period of two years on patients with proven cases of Anemia. After informed & written consent from the patients, detailed history, clinical assessment & laboratory investigation was done. ***Results*****:** In the present study a total of 280 patients fulfilling inclusion criteria are included in the study. The mean age of the patients was found to be 39.44±14.92yrs; among them, 60% were female, and 40% were male patients with female preponderance. There was significant positive strength of association of hemoglobin with the lipid profile, which included the total cholesterol, LDL, HDL, triglycerides, and VLDL cholesterol l($p<0.05$). ***Conclusion*****:** The present study showed a significant strength of association between the hemoglobin level and the lipid profile parameters. Also, the lower mean level of lipid parameters with the severity of grade of Anemia.

Keywords: Anemia, Severity, Lipid Profile, Cholesterol, Lipoprotein.

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INTRODUCTION

Anemia is a common disorder in India, although there are plenty of reasons attributable to Anemia [1–3]. There are studies reporting the beneficial effect of Anemia on lipid profile. Type of Anemia does not influence the lowering of lipid levels. Decreased serum cholesterol levels are not due to the specific lowering of any particular lipoprotein family. Instead, it is observed that there occurs a proportionate decrease in all major lipoprotein families [4, 5]. It's interesting that this fall in serum lipids in anemic patients may decrease the risk of coronary artery disease – a disease that kills a number of Indians every year [6, 7].

Anemia may be defined as a reduction below the normal values of a total red cell mass. Anemia has been defined by the World Health Organization as a reduction of hematocrit value below the normal limits, or Anemia is considered to exist in adults whose hemoglobin levels are lower than 13 g/dl (males) or 12 g/dl (females) [8].

The mechanism by which Anemia causes changes in serum lipid levels is still a gray area. The simplest explanation is a dilution effect, increased cholesterol utilization by actively dividing cells, decreased liver oxygenation leading to reduced endogenous cholesterol synthesis, increased levels of granulocyte-macrophage colony-stimulating factor & finally – in the bone marrow – enhanced receptor-mediated uptake of LDL. Correction of Anemia is associated with a rise in serum lipids [2, 4, 9, 10].

Many research studies have collected considerable novel information about the effect of serum lipids on heart disease and vascular disease.

Elevated serum lipids have a significant correlation with the risk of atherosclerosis which in turn causes coronary artery disease, cerebrovascular disease & peripheral vascular disease, thus increasing morbidity & mortality worldwide [11–14].

Several studies have examined the relationship between anemia and lipid profile. However, the results were contradictory among these studies, especially with regard to the triglyceride and very low-density lipoprotein (VLDL) levels. Verma *et al.,* [15] and

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Antappanavar *et al.,* [16] showed that triglycerides and VLDL levels are elevated in iron deficiency anemia compared to non-anemic patients, whereas lower levels of low-density lipoprotein (LDL) cholesterol were found in anemic patients. Sandeep *et al.,* [17] observed lower levels of total cholesterol, high-density lipoprotein (HDL), LDL, VLDL, and triglyceride levels in anemic patients compared to healthy controls. These contradictory findings prompted us to carry out this study on the pattern of lipid profile among patients with Anemia.

This investigation was done to look at the lipid profile pattern in anemic patients. The previous study compared only anemic to non-anemic patients but not with the severity of Anemia, and the pattern of lipid profile is not clear. Hence our study is aimed to analyze the pattern of lipid profile in mild-moderate & severe Anemia.

Expected outcome and application: Dyslipidemia is the risk factor for cardiovascular disease, and now we compare the changes in levels of hemoglobin to falsely altered lipid levels so that accurate detection of these changes will aid in preventing major cardiovascular complications.

MATERIAL AND METHOD

This was an 18 month observational study undertaken in the department of general medicine of a tertiary care teaching hospital. The systematic process was followed to get the institutional ethics committee's approval. All patients gave informed permission.

Patient Selection Criteria

a. Inclusion Criteria:

- Patients above 18 yrs of age of either sex attending the opd or admitted in medicine wards who had proven cases of Anemia. (Men: Hb< 13 gm%, Women: Hb< 12 gm%.)
- According to WHO grading of Anemia
  - FEMALE (Mild- 11-11.9 gm%, Moderate- 8-10.9 gm%, Severe- <8gm%)
  - MALE (MILD- 11-12.9 gm%, moderate- 8-10.9 gm%, severe- <8gm%)

b. Exclusion Criteria:

- Patients below age of 18 years
- Diabetes
- Coronary artery disease
- Pregnant women

Equipment/Protocol Used

A complete haemogram was performed using the Sysmex automated analyzer. Hemoglobin levels were confirmed by the colorimetric method. Differential count and peripheral smear were done manually using Leishman's stain by a qualified pathologist.

Urine albumin and sugar were estimated by dipstick method. Urine microscopy was done manually by a qualified pathologist. Biochemical analyses were done using the fully automated Technicon RA-XT system by Bayer. TSH, T4 and T3 were estimated using the chemiluminescence method on the fully automated ADVIA Centaur system by Bayer.

Estimation of total cholesterol, HDL and triglycerides was done with the commercially available Autopak cholesterol kit on the Technicon RA-XT system. VLDL was calculated using the formula, VLDL = Triglyceride/5. Friedewald's equation was used to calculate LDL cholesterol. LDL = Total cholesterol – [(Triglycerides/5) + HDL] mg/dl.

1. Metabolic and biochemical parameters like HDL, LDL, TGL, VLDL, TC, FBS, HB, UREA, CREATININE
2. Hormonal parameters like TSH, T4and T3

RESULTS

In the study a total of 280 patients fulfilling inclusion criteria are included in the study. The mean age of the patients was found to be 39.44±14.92yrs (fig.1.); among them 60% were female (168), and 40% were male (112) patients. The p value for age of both the genders was 0.093(Table 1.) The complete blood parameters between the genders gave p-value 0.01(HB), 0.409(TC), 0.001(PCV), 0.797(RBS) among which, PCV value were found to be significant. On comparing the urea and creatinine levels between the genders the p-value not significant (p>0.001). Most of the lipid profile levels were found to be significant while comparing between the genders (TGL p-value>0.001). Upon comparing the lipid profile levels with severity of anaemia the values were found to be significant.

Thus, with the help of Pearson's correlation method, TC, TGL, HDL, LDL, VLDL level was found to be related to Anemia.

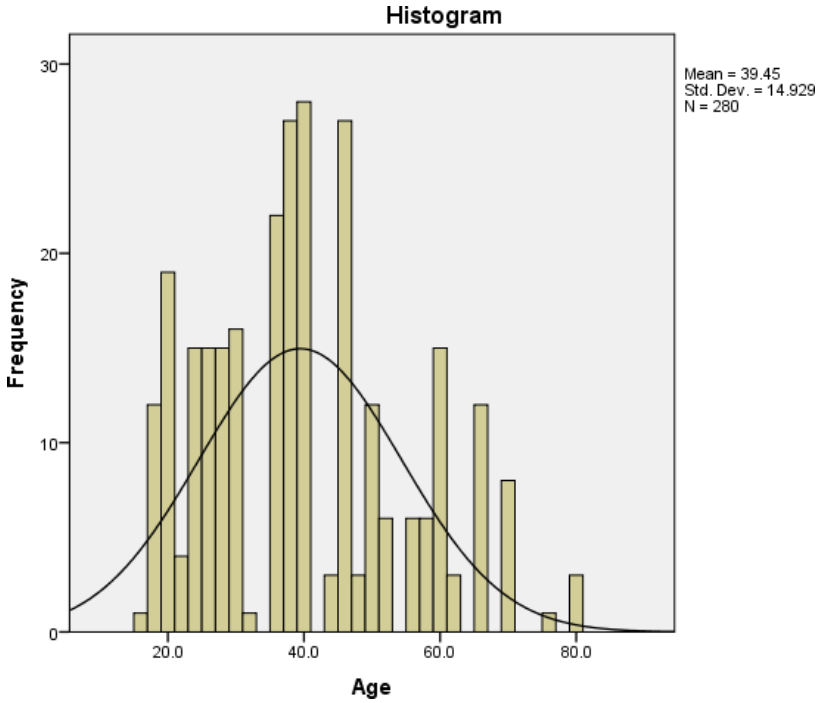

Fig 1: Age-wise distribution of the patients

Table 1: Age comparison between genders

	Male (112)		Female (168)		p-value
	Mean	SD	Mean	SD	
Age in yrs	42.0	13.7	43.1	16.0	0.093

Table 2: Comparison of the complete blood parameters between genders

	Male		Female		p-value
	Mean	**SD**	**Mean**	**SD**	
HB	10.1	2.6	9.4	2.1	0.01*
TC	6998	1943	7192	1895	0.409
PCV	27.2	9.3	31.0	9.6	0.001*
RBS	112.5	36.6	111.4	33.1	0.797

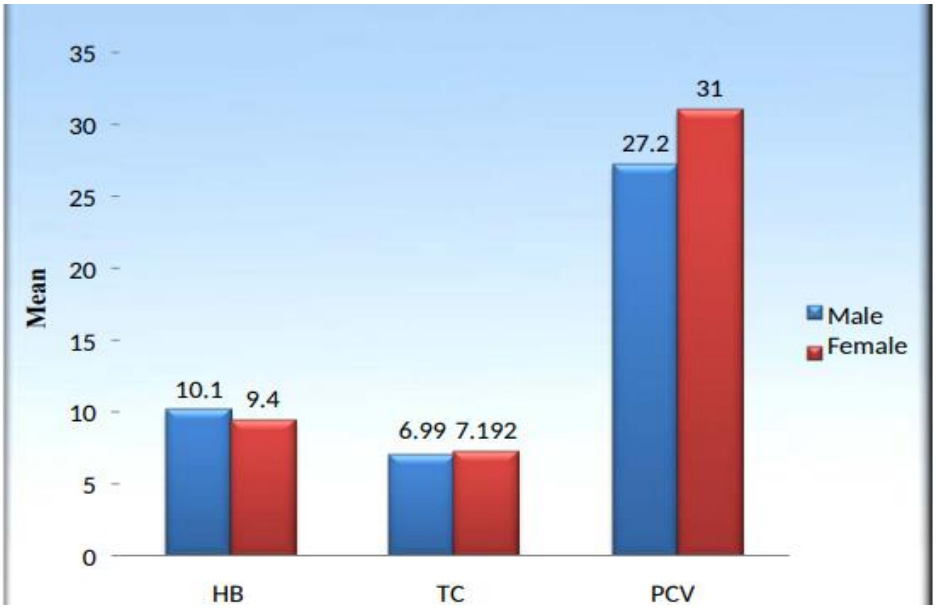

Fig 2: Comparison of the complete blood parameters between genders

Table 3: Comparison of mean level of lipid profile between the genders

	Male		Female		p-value
	Mean	SD	Mean	SD	
TGL	141.3	41.6	128.6	26.3	0.004*
HDL	28.9	6.4	24.5	5.2	0.001*
LDL	86.1	19.6	77.6	23.1	0.001*
VLDL	28.3	8.3	25.7	5.3	0.001*

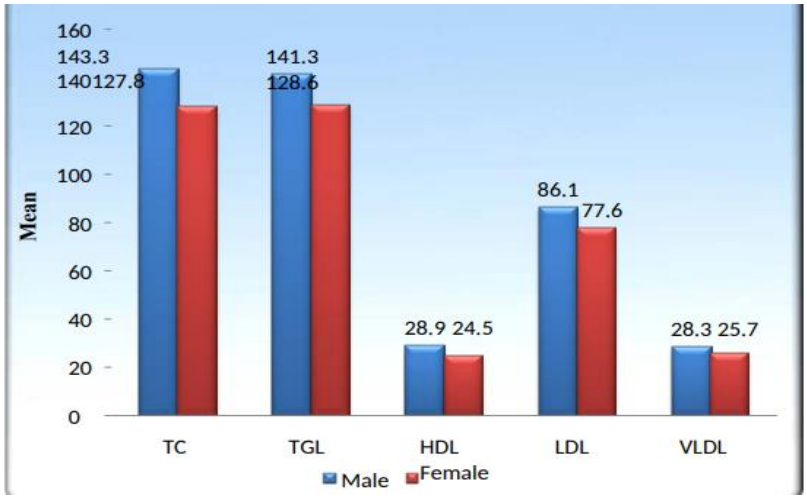

Fig 3: Comparison of the mean level of lipid profile between the genders

Table 4: Comparison of the mean level of lipid profile with the severity of Anemia

	Severity of Anaemia						ANOVA, p-value
	Mild		Moderate		Severe		ANOVA, p-value
	Mean	SD	Mean	SD	Mean	SD	
TC	47.2	9.5	32.2	6.5	24.3	1.1	0.001**
TGL	45.5	6.1	32.0	6.4	24.0	2.9	0.001**
HDL	3.6	.5	6.7	.3	4.7	7	0.001**
LDL	9.5	0.6	9.1	1.8	4.8	3.2	0.001**
VLDL	9.1	.2	6.4	.3	4.8	5	0.001**

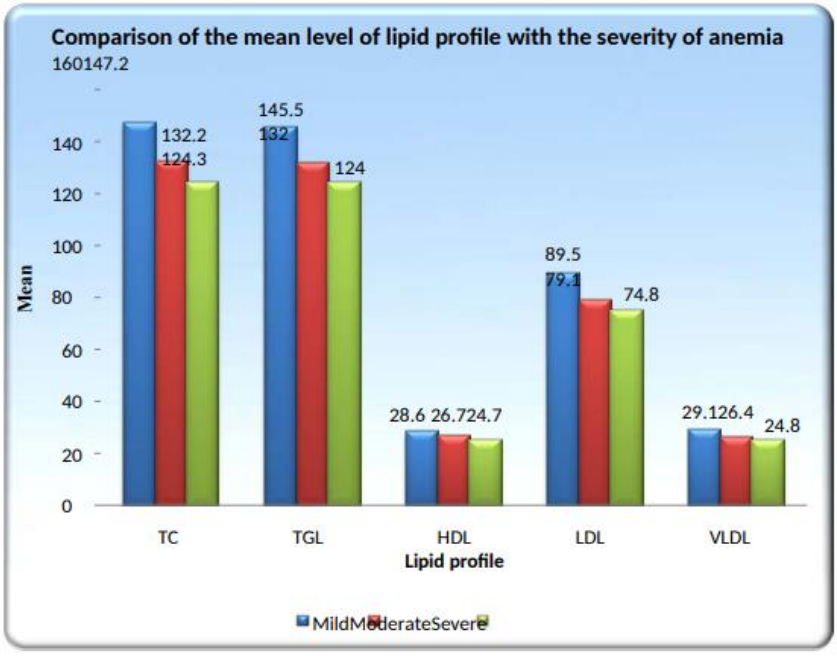

Fig. 4: Comparison of the mean level of lipid profile with the severity of Anemia

Table 5: Pearson's correlation of hemoglobin level with lipid profile parameters

Correlations						
		TC	**TGL**	**HDL**	**LDL**	**VLDL**
HB	r	.366**	.214**	.282**	.329**	.213**
	Sig	.000	.000	.000	.000	.000
**. At the 0.01 level, the correlation is significant (2-tailed).						

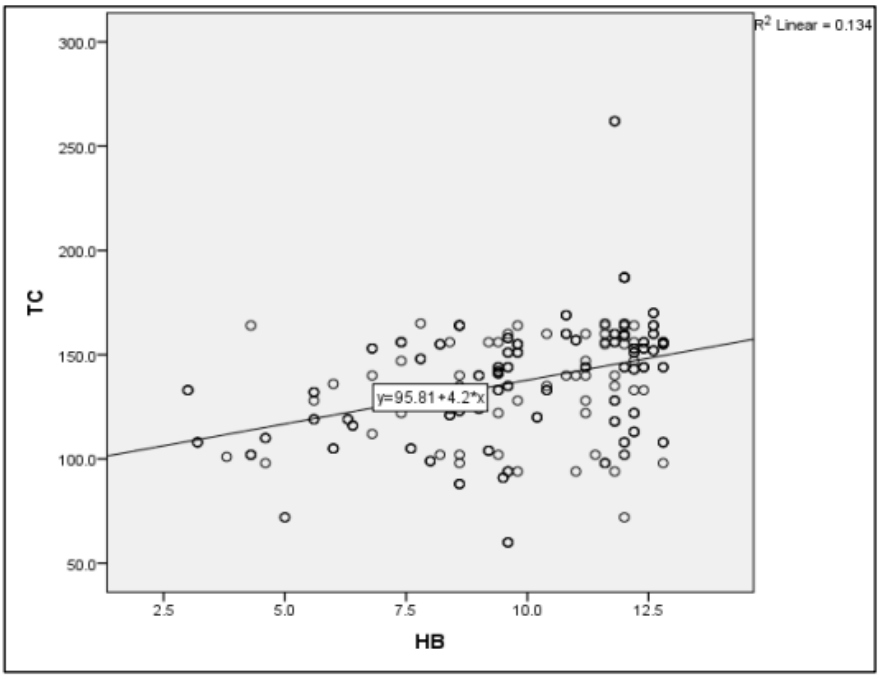

Fig. 5: Hemoglobin levels and total cholesterol are correlated

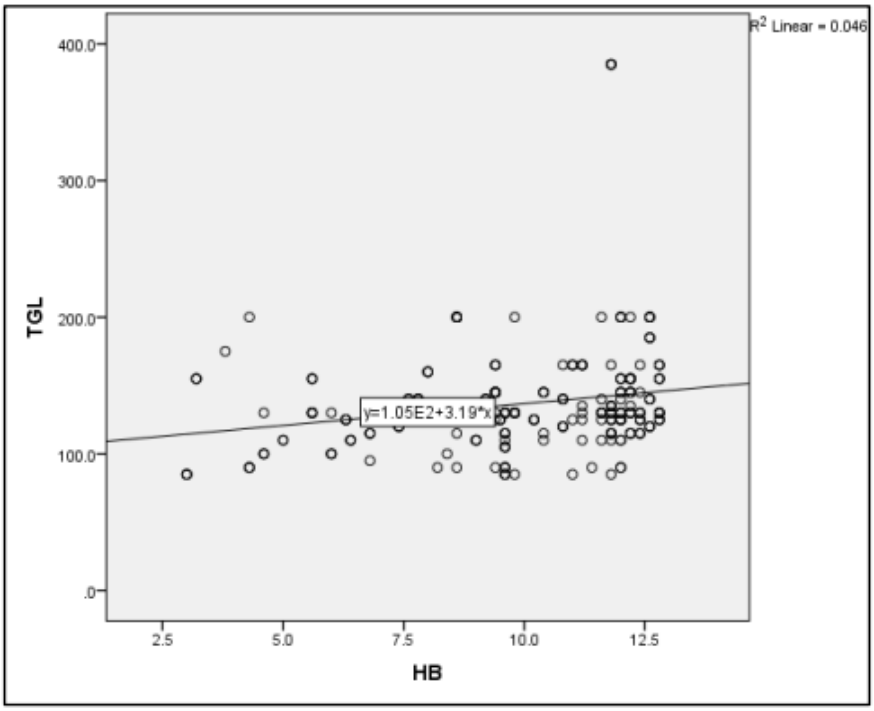

Fig. 6: Correlation of hemoglobin level with triglycerides

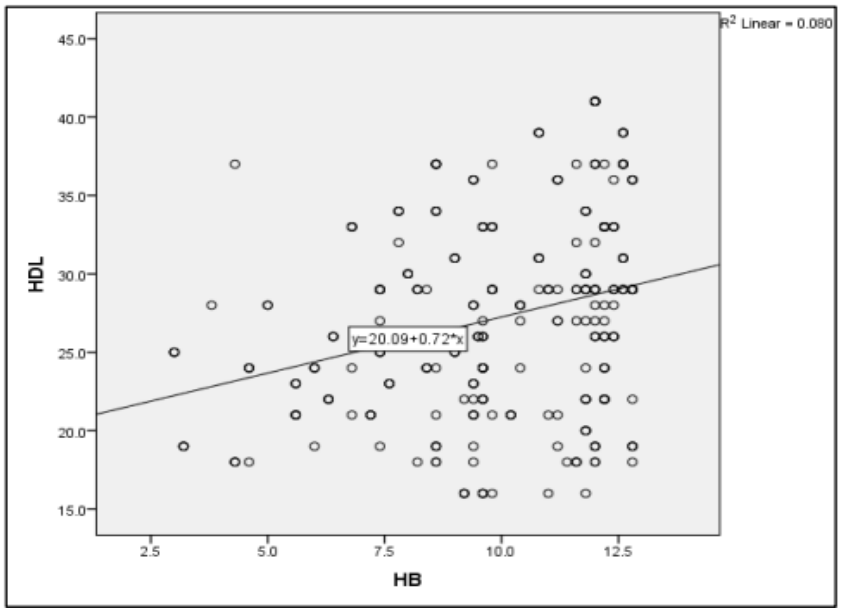

Fig. 7: Correlation of hemoglobin level with HDL cholesterol

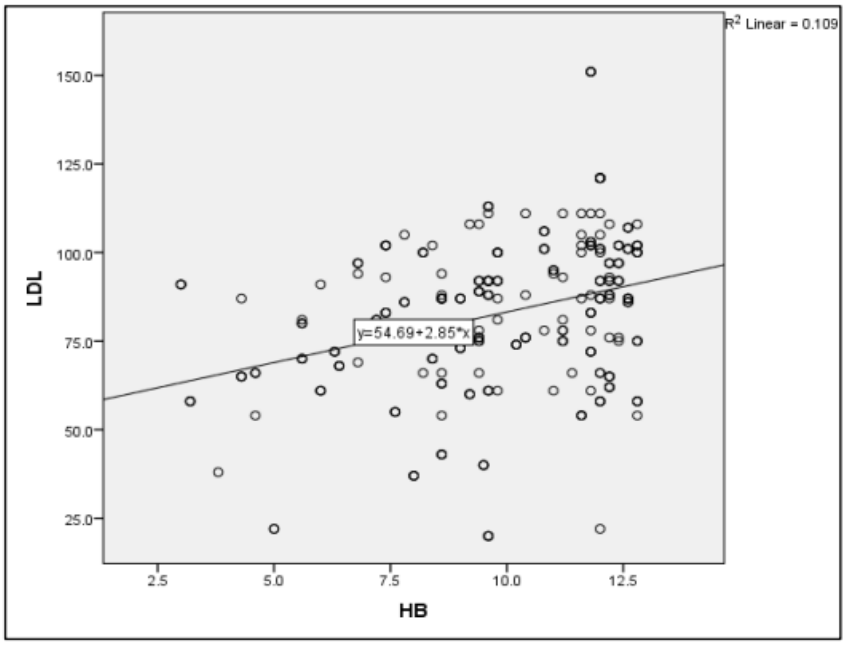

Fig. 8: Correlation of hemoglobin level with LDL cholesterol

DISCUSSION

In India, coronary artery disease (CAD) is becoming more common, making it vital to address the risk factors that go along with it. Dyslipidemia is a key risk factor for coronary artery disease (CAD). Hence it is important to implement effective preventative measures, such as lifestyle changes, to adhere to recommended lipid objectives.

Another equally important public health concern is the prevalence of Anemia. Anemia may be defined as a reduction below the normal values of a total red cell mass. Anemia has been defined by the World Health Organization as a reduction of hematocrit value below the normal limits or Anemia is considered to exist in adults whose hemoglobin levels are lower than 13 g/dl (males) or 12 g/dl (females) [18]. Anemia is a common disorder in India, although there are plenty of reasons attributable to Anemia.

The term "hyperlipidemia" refers to a group of inherited and acquired illnesses that are characterized by high lipid levels in the human body. Particularly in the Western Hemisphere, but also globally, hyperlipidemia is very prevalent. A different, more accurate definition of hyperlipidemia is low-density lipoprotein (LDL), total cholesterol, triglyceride, or lipoprotein levels that are higher than the 90th percentile when compared to the general population, or an HDL level that is lower than the 10th percentile. Cholesterol levels, lipoproteins, chylomicrons, VLDL,

LDL, apo-lipoproteins, and HDL are examples of lipids [19].

There are studies reporting the beneficial effect of Anemia on lipid profile. Type of Anemia does not influence the lowering of lipid levels. Decreased serum cholesterol levels are not due to specific lowering of any particular lipoprotein family, instead, it is observed that there occurs a proportionate decrease in all major lipoprotein families [20-24].

Many research studies have collected considerable novel information about the effect of serum lipids on heart disease and vascular disease. Elevated serum lipids have a significant correlation with the risk of atherosclerosis which in turn causes coronary artery disease, cerebrovascular disease & peripheral vascular disease, thus increasing morbidity & mortality worldwide. This research was conducted to study lipid profile patterns in anemic patients [25-29].

In the present study a total of 280 patients fulfilling inclusion criteria are included in the study. The mean age of the patients was found to be 39.44±14.92yrs; among them, 60% were female and 40% were male patients with female preponderance.

In present study on assessment of the type of Anemia, 42.1% had the dimorphic Anemia, 24.3% had microcytic hypochromic Anemia, 14.3% had Normocytic hypochromic Anemia, 10.7% with Normocytic normochromic Anemia. There was significant positive strength of association of hemoglobin with the lipid profile which included the total cholesterol, LDL, HDL, triglycerides, and VLDL cholesterol.($p<0.05$) Due to its significance for both of these metabolic processes, the liver serves as the primary site of interaction between lipid and iron metabolism.

The process of hepatic lipogenesis involves iron. Iron may have a direct impact on hepatic lipid metabolism since it is a crucial component of several enzymes and transporters involved in lipid metabolism. Lipid metabolism may be hampered by the impact of the iron shortage on transcriptional and posttranscriptional processes. Additionally, iron may have an impact on the kinetics and activity of enzymes that use iron as a cofactor. Free radicals may be produced by iron in its ferrous state, which can cause oxidative stress and lipid peroxidation [30-33].

CONCLUSION

In this study with a cross-sectional design, we discovered that individuals who had low levels of hemoglobin also had low levels of LDL cholesterol and triglycerides in their blood, And the interpretation of lipid profile level should be made after correction of Anemia only. It is essential to execute additional research in the form of a pre-post trial to evaluate the clinical implications of this finding.

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