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Research Article

A STUDY OF LIPID PROFILE IN ANAEMIA: A CROSS SECTIONAL STUDY

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A B S T R A C T

Background: Anaemia is defined as, decrease in the total red cell mass. Anaemia is defined by the World Health Organization as a reduction of haematocrit value below the normal limits. Hyperlipidmia is associated with low body iron stores according to some epidemiological studies. This study was designed to compare lipid profile of iron deficiency anaemia and non iron deficiency anaemia

Material and methods: This was an observational cross-sectional descriptive study which was conducted during a period of 18 months (October 2016 and March 2018)

Results: Study included a total of 200 subjects of which 100 cases of iron deficiency anaemia (IDA) and 100 cases of non-iron deficiency anaemia (NIDA), both the groups have more female participants in numbers 139 [69 (IDA), 70 (NIDA)] than male participants 61 [31 (IDA)]. Mean and standard deviation of age in IDA group was 36.98 (±12.41) years and in NIDA group was 37.55 (±12.67) years. Mean total cholesterol in IDA group was 165.44 (±12.39) as compared to 149.61 (±5.19) in group NIDA group, it was more in IDA. Mean LDL in IDA group 96.94 (±12.26) and 80.19 (±5.96) in NIDA group, mean VLDL in IDA group 31.33 (±1.77) and 28.95 (±1.19) in NIDA group, mean TG in IDA group 177.54 (±16.98) and 146.80 (±9.45) in NIDA group, HDL in IDA group 37.16 (±1.76) and 40.46 (±0.99) in NIDA group. All lipid profile parameters were more in IDA group than in NIDA group except HDL and was statistically significant.('p' value <0.001)

Conclusion: The present study shows that there is correlation between low serum iron levels and increased triglyceride, LDL levels and VLDL levels.

INTRODUCTION

Anaemia may be defined as, decrease in the total red cell mass. Anaemia is defined by the World Health Organization as a reduction of haematocrit value below the normal limits or anaemia is considered to exist in adults whose haemoglobin levels are lower than 13 gm/dl (males) or 12 gm/dl (females).[1] Anaemia is a major health problem in the world. According to estimated data at least 20% of the world population is affected by anaemia. It is commonly found in women between the age group of 15 and 44 years. Iron deficiency is the cause of majority of the cases. In India, 30% adult males, 45% adult females, 80% pregnant females and 60% children have iron deficiency. Oxygen carrying capacity of blood is reduced by it and thereby reduces the arteriovenous oxygen difference.[2] Iron deficiency anaemia (IDA) is common disorder in our country.[3, 4, 5] Dyslipidaemia is prevalent in India, irrelevant to socio-economic status.[6, 7] IDA and dyslipidemias were reported in the same individuals according to some studies. It was also observed in some experimental animals. [8, 9] Young infants and adolescent girls are commonly affected by Iron deficiency anaemia. [10] Increased risk of coronary heart disease was related to high body iron stores according to an epidemiological study.[11, 12] Studies have shown that risk factors for myocardial infarction are low serum iron-binding capacity and high serum iron concentrations.[13, 14] In animals associations have been found between lipoprotein concentrations, serum lipid levels and dietary iron intake. [15, 16] Non iron deficiency anaemia includes deficiency of vitamins like Vitamin B_{12} deficiency, Anaemia may be due to a problem in the bone marrow, inherited disorders, excessive destruction of red cells and due to bleeding.

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METHODOLOGY

Study Design: This was an observational cross-sectional descriptive study of Lipid profile of iron deficiency anaemia and non iron deficiency anaemia

Study Setting: This study was conducted at Krishna hospital and medical research centre, a tertiary care hospital and teaching institute in Maharashtra

Study Period: The present study was conducted over a period of 18 months (October 2016 to March 2018) and data was analysed for a period of 6 months (April 2018 to September 2018)

Source of Data: Patients admitted in medicine wards of the tertiary care hospital with diagnosis of anaemia and who fulfill the inclusion criteria were enrolled in the study

Sample Size: Total 200 participants were included in the study. (100 for each group)

Group A: Study participants with iron deficiency anaemia selected by simple random sampling fulfilling inclusion and exclusion criteria.

Group B: Study participants without iron deficiency anaemia selected with age and sex matched participants.

Aim and Objectives*:* To study the lipid profile in patients with iron deficiency anaemia and non iron deficiency anaemia
To compare the lipid profile of patients with iron deficiency anaemia with non iron deficiency anaemia

Inclusion Criteria: All diagnosed cases of anaemia of both the genders Hb<10 gm% Patients willing to participate by giving written informed consent

Exclusion Criteria: Patients less than 18 years of age

RESULTS

The mean age of Iron deficiency anaemia, Mean 37;SD±12 and of Non-iron deficiency anaemia, Mean 38;SD±13. With maximum number of participants from age between 31 to 45 years, total 93[47 (IDA) and 46 (NIDA)].

The total numbers of female participants were 139(69.5%) [69 (IDA) and 70 (NIDA)] were more than male participants 61(30.5%) [31 (IDA) and 30 (NIDA)].

In present study chief complaints of study participants in both the groups were easy fatigability, headache, bodyache, shortness of breath, swelling of feet, neck pain; in which easy fatigability 106(53%) was most common presenting complaint followed by headache 86(43%), general body ache 66(33%), shortness of breath 54(27%) and swelling of feet 41 (20.5%).Of total 100 participants 19 (9.5%) were asymptomatic and 6 (3%) were presented with syncope and 27 (13.5%) were having neck pain. The difference was not statistically significant.

In the present study, study participants presented with clinical signs such as pallor, platynychia, koilonychia, cheliosis, glossitis and hemic murmur. In which maximum number of study participants were having pallor 192(96%) as clinical sign [100 in IDA and 92 in NIDA] followed by platynychia 94(47%), koilonychia 47(23.5%), cheliosis 22(11%) and glossitis 65(32.5%). Hemic murmur was found in total of 41(20.5%) participants, in which 22 participants in IDA and 19 in NIDA.

In present study mean and SD for iron profile of IDA males and females was Hb male 7.23 (±1.01) and female 7.27 (±0.99), Serum iron male 38.49 (±3.56) and female 38.46 (±3.52), TIBC male 380.21 (±20.05) and female 380.02 (±20.210), TS male 10.16 (±1.04) and 10.14 (±1.04) for female, Ferritin 8.55 (±1.88) for male and 8.50 (±1.94) for female. In present study mean and SD for iron profile of NIDA males and females was Hb male 6.81 (±1.21) and female 6.79 (±1.22), Serum iron male 96.47 (±9.49) and female 96.26 (±9.69), TIBC male 292.89 (±14.04) and female 292.63 (±14.28), TS male 34.6 (±2.44) and 34.57 (±2.48) for female, Ferritin 53.9 (±4.61) for male and 53.81 (±4.70) for female. In the present study blood haemoglobin was not statistically significant. Serum iron, total iron binding capacity, TS, serum ferritin parameters were statistically significant in between IDA and NIDA.

In present study mean and SD for lipid profile of IDA males and females was, LDL male 96.94 (±12.26) and female 96.98 (±11.81), HDL 37.17 (±1.75) and female 37.16 (±1.73), VLDL male 31.33 (±1.77) and female 31.37 (±1.75), TC male 165.44 (±12.39) and 165.52 (±12.01) for female, TG 177.54 (±16.98) for male and 178.18 (±16.71) for female. In present study mean and SD for lipid profile of NIDA males and females was LDL male 80.3 (±5.85) and female 80.2 (±6), HDL 40.48 (±0.98) and female 40.46 (±0.99), VLDL male 28.93 (±1.18) and female 28.95 (±1.2), TC male 149.73 (±5.06) and 149.6 (±5.21) for female, TG 146.62 (±9.31) for male and 146.78 (±9.49) for female. In present study difference of lipid profile in both the groups was statistically significant. Total cholesterol, low density lipoprotein, very low density lipoprotein and triglyceride were more in iron deficiency anaemia participants than non- iron deficiency anaemia. This difference was statistically significant.

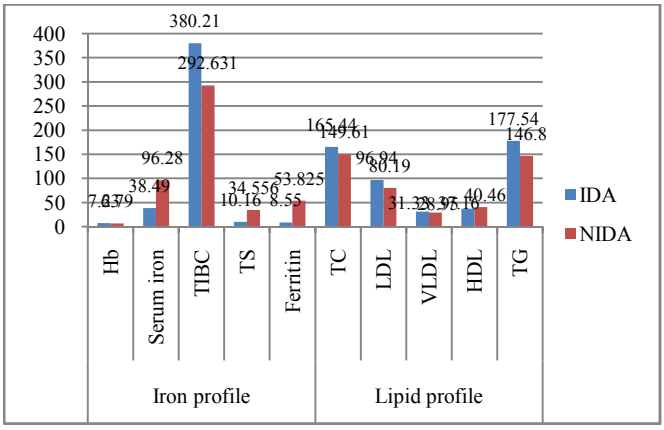

Figure 1 Comparison of IDA and NIDA of Iron and Lipid profile

Table 1 Comparison of IDA and NIDA of Iron and Lipid profile

Parameters		IDA	NIDA	p value
Iron profile	Hb	7.23	6.79	not statistically significant
	Serum iron	38.49	96.280	
	TIBC	380.21	292.631	
	TS	10.16	34.556	
	Ferritin	8.55	53.825	
Lipid profile	TC	165.44	149.61	'p' <0.001
	LDL	96.94	80.19	
	VLDL	31.33	28.95	
	HDL	37.16	40.46	
	TG	177.54	146.80	

DISCUSSION

The observations made in 100 cases of iron deficiency anaemia and 100 cases of non-iron deficiency anaemia who were admitted in the medicine wards of tertiary care hospital with diagnosis of anaemia. Micronutrient deficiency, which is due to lack of essential minerals in the diet, is a serious public health concern in most developing countries. Even though these elements are needed only in minute quantities, their deficiency leads to malnutrition syndromes with clinical sings leading to high social and public costs through increased public expenditure on health services. This results in suboptimal returns on investment in education and training by decreasing the working capacity of the population due to high

rates of illness and disability thus constituting the tragic loss of human potential. Overcoming micronutrient malnutrition is a precondition for ensuring a rapid and high overall development of the country and its people.[12] IDA is an important public health problem because of its complications.[17] Overcoming micronutrient malnutrition is a precondition for ensuring a rapid and high overall development of the country and its people. In addition to altered glucose utilization, significant changes in lipid homeostasis have been reported, though mechanistic studies investigating the utilization, uptake, and storage of lipids in ID animals have offered mixed results.[18,19,20,21,22] In the present study, maximum numbers of study participants were from the age group of 31 to 45 years in both the groups. Mean and standard deviation of age in IDA group was 36.98 (±12.41) years and in NIDA group was 37.55 (±12.67) years. Vijaykumar B. *et al* reported the same finding as present study. The study by Venkateshwarlu Nandyala *et al* were having mean age was 28.9 (± 6.82) years.[23, 24] In present study both the groups have more female participants in numbers 139 [69 (IDA), 70 (NIDA)] than male participants 61 [31 (IDA), 30 (NIDA)] that denotes anaemia is most common in females. In the present study most common presenting complaints was easy fatigability [54% (IDA) and 52% (NIDA)], headache [42% (IDA) and 44% (NIDA)], general body ache [38% (IDA) and 28% (NIDA)], and shortness of breath [30% (IDA) and 24% (NIDA)] and swelling of feet [30% (IDA) and 11% (NIDA)]. Other symptoms were neck pain and syncopal attacks. 7% in IDA group and 12% in NIDA group were asymptomatic. Venkateshwarlu Nandyala *et al* noted that on presentation 54 cases had easy fatigability, 42 had headache, 18 had neck pain, 28 had generalized body ache, 26 had shortness of breath, 10 had swelling of feet and 4 cases had syncopal attack while 12 cases were asymptomatic. In the present study, most common clinical sign was pallor [100% (IDA) and 92% (NIDA)], platynychia [49% (IDA) and 45% (NIDA)], koilonychia [22% (IDA) and 25% (NIDA)], Cheliosis [10% (IDA) and 12% (NIDA)] and glossitis [32% (IDA) and 33% (NIDA)]. 22% of the study participants in IDA group and 19% in NIDA group were having hemic murmur. Venkateshwarlu Nandyala *et al* observed the similar clinical signs in their study on IDA and lipid profile.[23] In the present study, mean Hb for IDA group was 7.23 (±1.01) and 6.79 (±1.21) in NIDA group, mean serum iron was 38.49 (±3.56) in IDA group and 96.280 (±9.64) in NIDA group, mean TIBC in IDA group was 380.21 (±20.05) and in NIDA group was 292.631 (±14.21), mean TS was 10.16 (±1.04) in IDA and 34.556 (±2.47) in NIDA, mean ferritin in IDA group was 8.55 (±1.88) and in NIDA group was 53.825 (±4.68). This denotes in IDA difference in iron profile except Hb was statistically significant. Mean total cholesterol in IDA group was 165.44 (±12.39) as compared to 149.61 (±5.19) in group NIDA group, it was more in IDA. Mean LDL in IDA group 96.94 (±12.26) and 80.19 (±5.96) in NIDA group, mean VLDL in IDA group 31.33 (±1.77) and 28.95 (±1.19) in NIDA group, mean TG in IDA group 177.54 (±16.98) and 146.80 (±9.45) in NIDA group, HDL in IDA group 37.16 (±1.76) and 40.46 (±0.99) in NIDA group. All lipid profile parameters were more in IDA group than in NIDA group except HDL and was statistically significant.('p' <0.001). Venkateshwarlu Nandyala *et al* and Tanzer *et al* in Turkish found similar observations like significantly raised levels of both triglycerides and VLDL cholesterol levels in the IDA subjects as compared to controls.[23,10] Animal studies, reporting elevated triglycerides levels, were performed by Guthrie *et al* in offspring of ID (Iron deficient) rats and by Lewis and Iammarinoin ID rodents.[25,26] Vijaykumar B observed that significantly raised levels of both triglycerides and VLDL cholesterol levels in the IDA subjects, as compared to healthy controls. [24] Lewis and Iammariano and Masiniet *et al* in 1994 observed reduction in the levels of triglycerides after iron therapy in ID rates.[10,26,27] Choi *et al* found correlation between changes in triglycerides levels and changes in serum ferritin with HDL levels. [11] Various studies have been performed to define the related mechanisms underlying dyslipidemias in IDA. High triglycerides levels have been explained on the basis of impaired carnitine biosynthesis together with increased triglycerides synthesis and decreased triglycerides degradation in IDA.[10, 28, 29] Tomás Meroño *et al* noted that triglycerides were higher (median [range]) (1.0 [0.5–1.9] vs. 0.7 [0.5–1.5] mmol/L, 'p' <0.05) and HDL-C lower (mean±SD) (1.3±0.3 vs. 1.6±0.4 mmol/L, 'p' <0.01) in the IDA group.[30] Verma *et al* stated that serum lipid profile like triglycerides, total cholesterol, high density lipoprotein cholesterol, very low density lipoprotein cholesterol and low density lipoprotein cholesterol are deranged in IDA. Triglycerides and very low density lipoprotein cholesterol levels were found to be significantly ('p' <0.001) elevated in the iron deficiency anaemia group (151.87 +/- 48.06 mg/dl and 30.40 +/- 9.71 mg/dl) as compared to controls (109.99 +/- 30.81 mg/dl and 21.96 +/- 6.69 mg/dl).[31] Sherman A R *et al* found that iron deficiency hyperlipidemia in 18-day-old rat pup and effects of milk lipids, lipoprotein lipase, and triglyceride synthesis observed that pups in the 5 ppm iron group had hyperlipidemia characterized by elevated serum triglycerides, cholesterol, and phospholipids.[29]

The present study found that iron deficiency anaemia was significantly associated with abnormal lipid profile.

CONCLUSION

Iron deficiency is the world's most widespread nutritional disorder, regardless of age, gender and socioeconomic status, affecting both industrialized and developing countries. The present study shows that there is correlation between low serum iron levels and increased triglyceride, LDL levels, which can lead to other severe conditions like coronary artery disease and liver diseases. Early detection and treatment of iron deficiency anaemia can prevent development of dyslipidemia and coronary artery diseases. The role of iron in blood lipid metabolism has received little attention, especially in India, and must be explored to establish if iron deficiency is a contributing factor in the etiology of cardiovascular disease in humans. In addition, the consequences of iron deficiency in relation to cardiovascular morbidity must be considered seriously and hence all attempts should be made to treat this micronutrient deficiency promptly. Since hyperlipidemia is recognized as a risk factor in the development of coronary artery diseases, all nutritional influences on the serum lipid concentrations assume considerable importance.

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