

ASSOCIATION OF ANAEMIA WITH LOW SERUM LIPID CONCENTRATION: OUR EXPERIENCE FROM A TERTIARY CARE CENTER OF EASTERN INDIA

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ARTICLE INFO

Article History:

Received 6th August, 2019
Received in revised form 15th
September, 2019
Accepted 12th September, 2019
Published online 28th November, 2019

Key words:

Anaemia, Coronary artery disease,
Dyslipidaemia, Ischemic heart disease,
Lipid profile.

ABSTRACT

Background & objectives: Elevation of serum lipid levels increases the risk of atherosclerosis and coronary artery disease (CAD). The burden of coronary artery disease (CAD) in India is increasing and addressing the risk factors for the same is the need of the hour to reduce its prevalence. Another equally important public health concern is the prevalence of anaemia. Hence, we planned to determine if there is any correlation between anaemia and abnormalities in lipid profile in adult population which ultimately predisposes to CAD. **Materials and methods:** 309 cases with anaemia and above the age of 18 years were enrolled along with equal numbers of matched controls. All participants were evaluated on the basis of haemoglobin, MCV, ferritin and lipid profile. **Results:** The lipid profile in subjects with anaemia and iron deficiency anaemia were lower than the non-anaemic control. **Interpretation and conclusion:** Lower lipid profile levels in anaemic individuals suggested that they were less predisposed to develop CAD as compared to non-anaemic controls.

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INTRODUCTION

Ischemic heart disease (IHD) represents a group of pathophysiologically related syndromes resulting from myocardial ischemia, an imbalance between myocardial perfusion and cardiac demand for oxygenated blood. The dominant cause of IHD syndromes is insufficient coronary perfusion relative to myocardial demand; in the vast majority of cases, this is due to chronic, progressive atherosclerotic narrowing of the epicardial coronary arteries, and variable degrees of superimposed acute plaque change, thrombosis, and vasospasm.¹ One of risk factor for the formation of atherosclerotic plaques is abnormally elevated lipid levels in the blood. Elevation of serum lipid levels increases the risk of atherosclerosis and coronary artery disease (CAD). The burden of coronary artery disease (CAD) in India is increasing and addressing the risk factors for the same is the need of the hour to reduce its prevalence.²

Another equally important public health concern is the prevalence of anaemia. Anaemia is a condition in which the number of red blood cells (RBCs), and consequently their oxygen-carrying capacity, is insufficient to meet the physiological needs of the body. The function of RBCs is to deliver oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs. This is accomplished by using haemoglobin (Hb) which is a tetramer protein composed of haem and globin. In anaemia the ability of our body for gas

exchange is impaired by decreasing the number of RBCs transporting oxygen and carbon dioxide. Iron is necessary for synthesis of haemoglobin and iron deficiency is thought to be the most common cause of anaemia globally. But other nutritional deficiencies (including folate, vitamin B₁₂ and vitamin A), acute and chronic inflammation, parasitic infections, and inherited or acquired disorders that affect haemoglobin synthesis, red blood cell production or red blood cell survival can all cause anaemia.³

Dyslipidaemia may be more prevalent in an affluent society, whereas anaemia obviously more common in people with low socioeconomic status.⁴ Most CAD risks are attributable to smoking, uncontrolled diabetes mellitus and sedentary lifestyle habits. Keeping these aspects in mind, we hypothesized that the serum lipid profile consisting of total cholesterol (TC), triglycerides (TG), low density lipoprotein (LDL) and very low-density lipoprotein (VLDL) shall be lower in the anaemic group. Hence the objectives of our study were to evaluate the serum TC, TG, LDL, VLDL and high-density lipoprotein (HDL) concentrations in anaemic patients and to find out any relation of lipid profile between anaemic and non-anaemic group.

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MATERIALS AND METHODS

Design and setting

Study Design: It is a hospital based clinical observational study done in a single center.

Study Setting: Department of Biochemistry, AIIMS Bhubaneswar, which is a premiere tertiary care center.

Study Population: Patients of 18 years and above diagnosed with anemia.

Sample size: 309 numbers of patient samples were analyzed with equal number of age sex matched controls.

Study duration: Over a period of twelve months from 1st August 2018 to 31st July 2019.

Selection Criteria: Patients visiting Medicine OPD having hemoglobin <13 g% in men and <12 g% in women were taken in the anemia group and equal number of age sex matched control were taken.³

Exclusion Criteria

1. Smokers,
2. Diabetics,
3. Patients taking lipid lowering drugs,
4. Chronic disease conditions
5. Pregnant lady and lactating mothers.

Data collection procedure: Ethical clearance from Institutional Ethics Committee (IEC) was obtained before commencement of the proposed study. Blood samples were collected after taking consent from the patients for complete blood count (CBC), lipid profile and ferritin estimation in the laboratory of Department of Biochemistry observing all aseptic procedures.

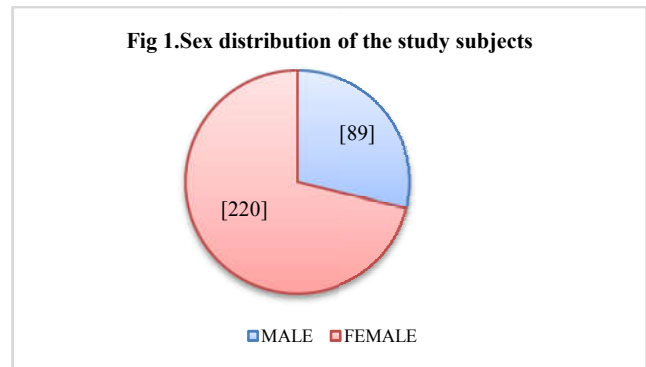
Instrument: Blood Hb% and MCV were obtained from Sysmax XT4K analyzer. The assays were done for serum TC, TG, LDL and HDL using Beckman Coulter AU5800 automated analyzer in the laboratory of Department of Biochemistry and the concentration of VLDL was calculated. Serum ferritin was estimated using ELISA kit from Bio-Detect, USA.

Quality control: Daily two levels of quality control material from Biorad were run in the Beckman Coulter analyzer. Controls provided with the kit were run during performing the ferritin assay by ELISA.

Statistical tools: Chi square test and student's t test was used for tests of statistical significance wherever appropriate. A p value of < 0.05 was considered significant. Statistical analysis was done using Microsoft Excel software.

RESULTS

After selecting the subjects based on the exclusion and the inclusion criteria 309 test subject having haemoglobin less than 13 g% for men and less than 12 g% for women were collected and 309 age sex matched healthy control subjects were taken who were not anaemic. The sex distribution is showed in Figure 1.



Mean age of study population in our study: 43.68±43.84 years with range of 18-80 years. Figure 2 is showing the age distribution of the study subjects. This wide range of ages helps in giving a more randomized and holistic result to our study.

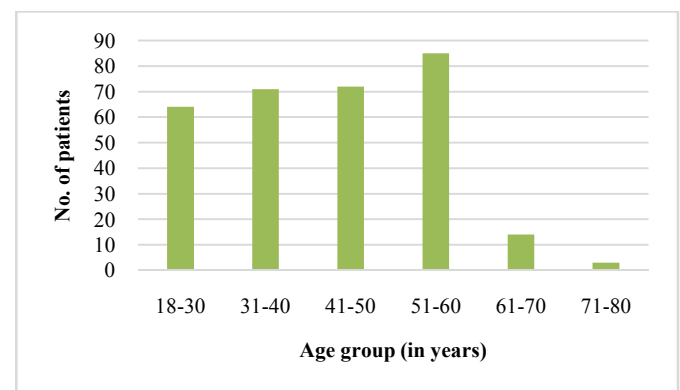


Table 1 presents the mean blood Hb%, MCV, Serum TC, TG, HDL, LDL and Ferritin concentrations in two groups of anaemic and non-anaemic subjects.

Table 1 Status of anaemia indices and lipid profile in all the subjects

Variable	Anaemic (Mean±SD)	Non-anaemic (Mean±SD)	p value
Haemoglobin (g%)	11.04±0.14	13.83±0.19	<0.001
MCV (fL)	81.45±10.69	87.52±15.23	0.0042
Ferritin (µg/dl)	67.56±2.74	130.67±32.45	0.0083
Cholesterol (mg/dl)	133.61±16.89	178.5±13.74	0.0066
Triglyceride (mg/dl)	100.36±5.09	127.15±21.23	0.0554
LDL (mg/dl)	85.75±22.13	115.19±20.18	0.0086
HDL (mg/dl)	39.98±4.10	49.78±5.35	0.0556
VLDL (mg/dl)	20.07±1.02	34.43±7.32	0.0320

It is evident from above table that there is alteration of lipid profile in anaemic patients with decrease in all components with decreasing haemoglobin concentration. Table 2 is a gender wise comparison of demographic information, status of anaemia indices, and lipid profile of cases.

Table 2 Demographic information, status of anaemia indices, and lipid profile of cases

Variable	Men (Mean±SD)	Women (Mean±SD)
Age (Years)	48.72±43.84	41.65±36.77
Haemoglobin(g%)	11.80±0.14	10.75±0.63
MCV (fL)	81.65±10.71	82.70±8.56
Ferritin(µg/dL)	76.85±3.54	42.65±8.36
Cholesterol(mg/dL)	122.84±16.90	138.24±32.59
Triglyceride(mg/dL)	102.56±5.09	99.47±69.50
LDL(mg/dL)	80.70±22.13	87.79±7.99
HDL(mg/dL)	37.91±4.90	40.82±12.23
VLDL(mg/dL)	20.51±1.02	19.89±13.90

DISCUSSIONS

In the given period of twelve months a total of 618 patient samples were taken constituting two groups of 309 each for cases and matched controls. About 71% of our study population were female and 29% male. The present study found that all lipid parameters were decreased in the anaemic subjects, as compared to healthy controls although the decrease in TG and HDL concentration is statistically not significant. This finding is similar to the findings of Shirvani M *et al.* where they have got significant decrease in all lipoproteins except HDL.⁵

Another study by Chowta NK *et al.* described significant decrease in lipid profile amongst anaemic patients.² Verma *et al.* detected significantly lower levels of LDL cholesterol in those patients with anemia compared with healthy controls.⁶ A study by Ohira *et al.*⁷ found that the serum level of cholesterol increases following the increased haemoglobin through blood transfusion. They argued that the amount of red blood cells probably affects cholesterol synthesis or its displacement from tissue to plasma. Various other studies have been performed to define the related mechanisms underlying dyslipidaemias in anaemia, especially iron deficiency anaemia (IDA). The exact mechanism by which iron regulates or functions in lipid metabolism has not yet been established. Venkateshwarlu *et al.* in their follow up study found that IDA in Indian adults is attended by abnormally low serum lipid profile, which responds significantly to iron therapy.⁸ Sandeep *et al.*⁹ also demonstrated that although there were no significant differences in serum lipid concentrations between patients with moderate IDA and healthy controls, serum total cholesterol and TG level were significantly lower in severely anemic patients (HB <8.0 g/dl) compared with normal controls. They also showed that the reduced serum lipid levels returned to normal following iron supplementation.

IDA is the world's most widespread nutritional disorder, regardless of age, gender and socioeconomic status, affecting both industrialized and developing countries. Although there is alteration in the lipid profile but the authors of the present study could not find any significant manifestation about the cardiological or cerebro-vascular accidents in the study. The authors feel that in future a larger randomized controlled trial with iron supplementation can be planned for long duration, by adopting more vigilant screening for anaemia and motivating those suspected of the condition who may be symptomatic or asymptomatic, for follow up in the hospital, where relevant cardiovascular and biochemical investigations could be performed on them.

In conclusion, from this hospital based observational study it is quite clear that the values of lipid profile in subjects with anaemia and iron deficiency anaemia were lower than the control, which is consistent with the findings of some other studies. But, to identify the possible mechanisms, further interventional studies are recommended to be carried out.

Acknowledgement

Authors acknowledge all patients with anaemia and healthy controls who participated in the study.

Conflict of Interest

All the authors have no potential conflict of interests to disclose.

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How to cite this article:

Debanjit Das *et al* (2019) 'Association of Anaemia with Low Serum Lipid Concentration: Our Experience from a Tertiary Care Center of Eastern India', *International Journal of Current Medical and Pharmaceutical Research*, 05(11), pp 4725-4727.
