"CORRELATION OF SERUM LIPID PROFILE IN PATIENTS WITH ANEMIA - A ONE YEAR CROSS SECTIONAL STUDY IN KLE'S DR. PRABHAKAR KORE HOSPITAL & MRC"

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ENDORSEMENT

This is to certify that the dissertation entitled **"CORRELATION OF SERUM LIPID PROFILE IN PATIENTS WITH ANEMIA - A ONE YEAR CROSS SECTIONAL STUDY IN KLE'S DR. PRABHAKAR KORE HOSPITAL & MRC"** is a bonafide research work done by **REG NO. BG0118012.**

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LIST OF ABBREVIATIONS

WHO	:	World Health Organisation
Hb	:	Hemoglobin
YLD	:	Years Living with Disability
HbA1c	:	Hemoglobin A1c
GRADE	:	Grading of Recommendations, Assessment, Development and Evaluation
FBG	:	Fasting Blood Glucose
IDA	:	Iron Deficiency Anemia
RBC	:	Red Blood Cell
GBD	:	Global Burden of Disease
AHS	:	Annual Health Survey
ICMR	:	Indian Council of Medical Research
NNMB	:	National Nutrition Monitoring Bureau
DA	:	Dimorphic Anemia
IDF	:	International Diabetes Association
ACE	:	American College of Endocrinology
CBC	:	Complete Blood Count
HCT	:	Hematocrit
MCH	:	Mean Corpuscular Hemoglobin
MCV	:	Mean Corpuscular Volume
MCHC	:	Mean Corpuscular Hemoglobin Concentration
PPBS	:	Post Prandial Blood Sugars

ABSTRACT

Background and Objectives

Anemia continues to be a medical and financial burden for both developed and developing countries, and affects all age groups. The normal value of hemoglobin varies with age, gender, ethnicity and physiologic status of the population. Dyslipidemia is another condition with increased global prevalence along with anemia and depends on fasting lipids. The use of fasting lipids for diagnosis of dyslipidemia widely advocated despite caveats to its use with anemia being cited as a major confounding factor. The value of fasting lipids may be erroneous in those with anemia, thus mandating its evaluation. The objective of this study was to identify a correlation between severity of different types of anemia and the derangement of lipid levels in an adult anemic population.

Materials and Methods

The present study was conducted on non-diabetic anemic patients admitted in the Department of General Medicine of KLES Dr. Prabhakar Kore Hospital and Medical Research Centre from January 2019 to December 2019. Relevant data was collected by a detailed interview with the patient, clinical examination and blood investigations. The patients were categorised into the 3 categories of severity of anemia, based on the WHO Grading, as per the patient's hemoglobin values. Peripheral smear was measured and recorded and a correlation of severity of different types of anemia with fasting lipids values was studied. Statistical tests such as Chi Square test and ANOVA were used for analysis.

Results

In the 100 non diabetic anemic patients, age ranged from 22-91 years. The number of female patients was slightly more than males. The commonest symptom of patient presentation was generalized weakness, and the most common sign was pallor. Majority of our patients were found to have normocytic normochromic anemia. We observed low levels of total cholesterol in our anemic patients. No correlation was found on comparison of age, types of anemia or severity of anemia with lipid profile.

Conclusion

Anemia may be affected by variables such as age, sex, chronic illnesses or drugs. We feel it is worthwhile to study these confounding factors with large sample sizes for ascertaining a correlation of fasting lipids with anemia considering these variables.

Keywords: ANEMIA, DYSLIPIDEMIA, FASTING LIPIDS

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INTRODUCTION

Throughout the world, one of the major health issue is anaemia. In both developed as well as in developing countries anemia affects all age groups. The WHO has defined anemia as "hemoglobin (Hb) levels <13.0 g/dL in males and <12.0 g/dL in females".[1] A variety of physiological and pathological mechanisms account to anemia. In order to classify anemia, mainly the history of patient, hematologic parameters and thorough physical examination is very important.[2] with respective to morphological presentation with a peripheral blood smear, anemia can be

1) macrocytic type
2) microcytic hypochromic type
3) normocytic
4) dimorphic
5) normochromic type.

Varied etiologies are present with each of these morphological types.

In a report by the WHO, 24.8% of the world's population was anemic.[3] Recent global report by Kassebaum et al.[4] it was estimated that the worldwide prevalence of anemia in 2010 was 32.9%. In India from the 2014-15 reports, anemia among all age groups and gender had a prevalence ranging between 57.1% and 89.3%. Therefore the prevalence of anemia in India is greater across all groups.[5] Throughout the world around 1.6 billion people[6] are affected by anemia, in particular with iron deficiency anemia.[7] Both Iron Deficiency Anemia (IDA)[8-10] and

dyslipidemia[11] are widely prevalent problems in the Indian population, irrespective of the socio-economic status of the people.[10,12]

In multiple studies, both in animals[13,14] and in humans[15,16] have linked IDA with the lipid profile. Deficiency of iron occurs due to decreased intake of iron, reduced absorption of iron, loss of blood, menstrual bleeding or pregnancy.[13] Thus with several etiologies, iron deficiency anemia characterises as two separate disease processes; mainly anemia and iron deficiency. Further, the severity of iron deficiency against anemia might differ by gender due to menstrual cycles in females.

The lower dietary intake animal-source foods and malabsorption are considered as most commonly given explanations for low vitamin B_{12} levels. In the previous studies across the world, strict vegetarian diet people are more susceptable to develop deficiency of vitamin B_{12}. Consumption of green leafy vegetables and legumes, which are among rich sources of vitamin, may explain why folate level can be sufficient in relatively poor population. Lactation and alcoholism are the conditions where an increase in the risk of folate deficiency can be observed.[17]

In a number of epidemiological studies, high iron reserves in the body have been reported to be associated with increased risk of coronary heart disease, the most important risk factor is hyperlipidemia.[18,19] In this regard, although the relationship between iron intake and serum lipid level has been found in animal models, this relationship has not been studied extensively in humans.[20-22] Since few studies have been conducted on the effect of anemia on serum lipid profile, the present research aimed to study the relationship between lipid profile and IDA.

Need for the study:

The results from studies[13-16] have suggested that IDA can influence the fasting lipid profile. The severity of iron deficiency anemia, however to what extent affects the lipid profile is less evaluated. The available literature mainly focusses on the effects of only iron deficiency and iron deficiency anemia on lipid profile, leaving a gap in the understanding of the effects of other types of anemia on lipid profile. In an attempt to test our hypothesis of the effects of other types of anemia on lipid profile, our study intends to assess the effects of severity of different types of anemia on lipid profile among adult population.

OBJECTIVES

The objective of the present study was

- To study the correlation between the anemia and the derangement of lipid profile levels in an adult anemic population and to establish a proven relationship between the both.

REVIEW OF LITERATURE

Anemia is a condition where, "the RBC's oxygen-carrying capacity is decreased to fulfil the body's requirements". The oxygen requirement by the body depends multiple factors like age, sex, location (high altitude or at sea level), habit like smoking, pregnancy etc.

The most common cause of anemia across the world is iron deficiency and next most common is deficiency of vitamin B_{12}, followed by folate and vitamin A. Chronic inflammation, acute inflammation, inherited or acquired disorders, and parasitic infections can also lead to anemia. These are the various physiological and pathological factors affecting the synthesis of hemoglobin and the red blood cell as a whole.

One of the vital indicators for general health is the hemoglobin value and thus the iron stores of the body on the whole. Hemoglobin concentration can provide information about the severity in deficiency of vitamin B_{12}, folate or iron.[23]

WHO GRADING OF ANAEMIA

- MALES
    - ✓ Mild: 11.0 to 12.9 g/dl
    - ✓ Moderate: 8.0 to 10.9 g/dl
    - ✓ Severe: <8.0 g/dl

- FEMALES

  - ✓ Mild: 11.0 to 11.9 g/dl
  - ✓ Moderate: 8.0 to 10.9 g/dl
  - ✓ Severe: <8.0 g

Hemoglobin levels to diagnose anemia at sea level (g/dl)[23]

Age	Non-anemia (g/dl)	Anemia (g/dl)		
		Mild	Moderate	Severe
6-59 months	11 or higher	10 - 10.9	7 - 9.9	< 7
5-11 years	11.5 or higher	11-11.4	8-10.9	< 8
12-14 years	12 or higher	11-11.9	8-10.9	< 8
Non-pregnant women (>15 years)	12 or higher	11 - 11.9	8 - 10.9	< 8
Pregnant women	11 or higher	10 - 10.9	7 - 9.9	< 7
Men (> 15 years)	13 or higher	11 - 12.9	8 - 10.9	< 8

Burden of Anemia – Global statistics

In the year 2008 WHO had released an issue stating that, around 24.8% of the world population had suffered from anemia. In pregnant females 42%, in non-pregnant females 30%, and in preschool children 47% were estimated to be anemics.[24]

In a report by the Global Burden of Disease (GBD) 2000, it was estimated that anemia came up to 2% of all YLD, and for disability-adjusted life-years it was 1%.[25] In the GBD 2004 update, similar values were seen.[26] In year 2010, the worldwide anemia prevalence was 32.9%, which was lead to 68.4 million years of YLD.[27]

Burden statistics of Anemia - India

India has seen the effect and burden of anemia since decades, inspite of various measures that have been taken up by national and state health programs to reduce the prevalence. The DLHS4 (District Level Household Survey) 2014 and AHS (Annual Health Survey) 2015 reports show the highest prevalence of anemia in India, which is highest in the globe.[28]

As per the report published by the FAO, in India about 190.7 million (14.5%) population during 2014 - 2016, was under-nourished (Food and Agriculture Organization) on the conditions of nutrition and food security.[29] The Global Burden of Disease Study 2016,[30] "reported for disability-adjusted life years for female population, iron-deficiency anemia as among its top 10 causes". MoHFW of India conducted latest, the National Family Health Survey (NFHS4), "stated anemia prevalence as 53.1, 58.6, 22.7 and 50.4 per cent, among children between the age group of 6-59 months, females aged 15 - 49 years, pregnant females aged 15 - 49 years and males aged 15 - 49 years".[31]

Indian Council of Medical Research (ICMR), New Delhi conducted a task force study across sixteen districts of eleven states. As per the study findings, "84.9 and 90.1 per cent prevalence of anemia was observed in a study group of eleven thousand two hundred and sixty which included pregnant females (n=6923) and girls in adolescent age groups (n=4337)". [32]

A survey conducted by NNMB (National Nutrition Monitoring Bureau) (under the aegis of ICMR), "in 8 States has reported anemia to be sixty-seven to seventy-eight per cent among preschool children, pregnant and lactating females and girls in

adolescent age group residing in the rural areas".[33] Reports among the rural population of Maharashtra had shown, "the prevalence rate of anemia as 91%,[34] whereas in rural Telangana, females in between age groups of fifteen to thirty-five years (n=979) reported less anemia prevalence (28.4%) than other micronutrient deficiencies like ferritin (46.3%), folate (56.8%) and vitamin B_{12} (44.4%)".[35]

Nutritional anemia in general, caused by deficiencies of micronutrients like folic acid, vitamin B_{12} and iron. The studies that have been conducted recently have stressed on deficiencies existing until now in our community of India[33] , "with as high as 70-100 per cent deficiency of vitamin B_{12}". This may be due to, 29% of the Indian population following a vegetarian diet.[33] The studies conducted at Maharashtra and New Delhi with adolescents and preschool children as study subjects have reported, "deficiency of about forty to sixty per cent. Studies have concluded the prevalence of low ferritin to be almost sixty to seventy percent of the total population in community".[35]

Dimorphic anemia (DA) is one of the common anemias in India. Bentley M. E et al. conducted a study, showing the incidence of DA to be 12.5%.[36] Research by Garg P. et al.[37] in 2017, "reported the prevalence of dimorphic anemia and spoke of the presence of dual cell populations in a peripheral smear of DA of which one population is microcytic hypochromic and other is either normocytic or macrocytic. In his study of peripheral blood smears, dual community was seen in 17.5% of people with dimorphic anemia (n=178). Out of 178, in 37.1% of subjects, normocytic normochromic with microcytic hypochromic red blood cells were observed whereas macrocytes were seen in 62.9% of subjects".

The etiology of low hemoglobin concentrations can be due to genetic traits such as thalassaemia or sickle-cell anemia.[38] Other factors are inadequate bioavailability of consumable iron in foods, vitamin B_{12} or folate, [39,40] malaria,[41] schistosomiasis,[42] hookworm infection,[43] HIV infection and other non-communicable diseases.

Types of anemia based on morphology

To diagnose anemia, we require clinical features and morphology of the bed blood cells. Here we discuss various types of the red blood cell morphologies. They are classified into the following types:

I. Red blood cell groups on the basis of its size

- Normal size: **Normocytic**
- Smaller than normal: **Microcytic**
- Larger than normal: **Macrocytic**

II. Red blood cell groups on the basis amount of hemoglobin

- Normal color: **Normochromic**
- Pale color: **Hypochromic**

III. Red blood cell groups on the basis of its shape

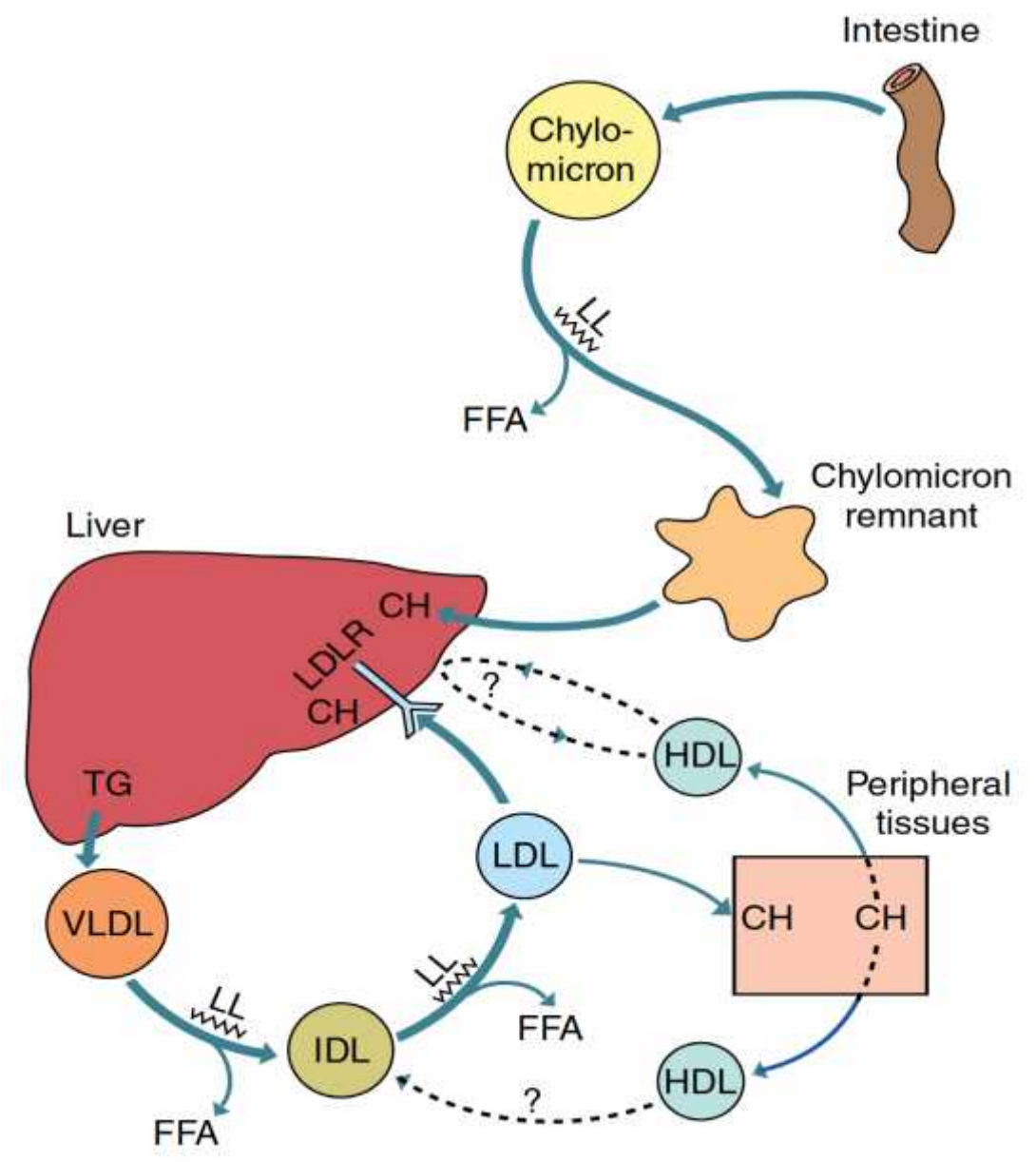
- Sickle shaped: **Sickle cell anemia**

Based on the RBC morphology and blood cell indices, anemia is classified into normocytic normochromic, microcytic hypochromic, and macrocytic. The details for classification are listed in table 2.

Classification of anemia

Microcytic, hypochromic	Normocytic, normochromic	Macrocytic
MCV <80fL MCH <27 pg	MCV 80-95 fL MCH ≥27 pg	MCV >95fL
Iron deficiency Thalassemia Anemia of chronic disease (certain cases) Lead poisoning Sideroblastic anemia (certain cases)	Many hemocytic anemias Anemia of chronic disease (certain cases) After acute blood loss Renal disease Mixed deficiencies Bone marrow failure	Megaloblastic: vitamin B12 or folate deficiency Non-megaloblastic: alcohol and liver diseases, myelodysplasia, aplastic anemia etc.

Lipid metabolism



This explains the metabolism of different lipid moieties and their metabolism. Dietary fat is absorbed from the small intestine and incorporated into chylomicrons. Chylomicrons pass via the thoracic duct into the circulation where triglyceride is removed by lipoprotein lipases and utilized or stored in tissue. The chylomicron remnant is taken up by the liver by the low- density lipoprotein (LDL) receptor related

Protein.

Dyslipidemia

- Dyslipidemia is defined as, having blood lipid levels that are too high or low. Blood lipids are fatty substances, such as triglycerides and cholesterol along with the cholesterol moieties.

- Dyslipidemia occurs when someone has abnormal levels of lipids in their blood. While the term describes a wide range of conditions, the most common forms of dyslipidemia involve:

1. high levels of low-density lipoproteins (LDL)
2. low levels of high-density lipoproteins (HDL)
3. high levels of triglycerides.
4. high cholesterol. (which includes all the cholesterol moieties along with triglycerides)

Fats or lipids are building blocks of life and provide energy to cells. Lipids include:

- **LDL cholesterol**, it can cause plaques to form in the blood vessels.
- **HDL cholesterol**, which can help to remove LDL from the blood.
- **Triglycerides**, which are helpful in lipogenesis and are stored in the form of fat cells in the adipose tissue around our body.

Types and causes of dyslipidemia

Dyslipidemia can be categorized into two types, based on the cause:

1. **Primary dyslipidemia**

Primary dyslipidemia is caused via genetic abnormalities. Common causes of primary dyslipidemia are:

- **Familial combined hyperlipidemia**, wherein the affected population belong to the young adults and have high cholesterol levels.
- **Familial hyperapobetalipoproteinemia**, wherein there is a mutation in LDL lipoproteins called apolipoproteins.
- **Familial hypertriglyceridemia**, where high triglyceride levels are observed in the patients.
- **Homozygous familial or polygenic hypercholesterolemia**, a mutation in LDL receptors leading to higher LDL levels.

2. Secondary dyslipidemia

Secondary dyslipidemia is caused by lifestyle factors or medical conditions that interfere with blood lipid levels over time.

Common causes of secondary dyslipidemia include:

- Obesity, more importantly central obesity
- Diabetes mellitus
- Hypothyroidism
- Alcoholism
- Polycystic ovary syndrome
- Metabolic syndrome
- Excessive consumption of saturated and trans fats
- Cushing's syndrome
- Inflammatory bowel disease
- Severe infections, such as HIV

Risk factors

Several factors are known to increase the chances of developing dyslipidemia and related conditions. These risk factors include:

- Obesity
- A sedentary lifestyle
- A lack of regular physical exercise
- Alcohol use
- Tobacco use
- Diabetes mellitus
- Hypothyroidism
- Chronic kidney or liver conditions
- Digestive conditions
- Older age
- A diet rich in saturated and trans fats
- A parent or grandparent with dyslipidemia
- Female sex, as women tend to experience higher LDL levels after menopause

Treatment

A. Natural treatments include:

- Reducing the consumption of unhealthy fats, such as those found in red meats, full-fat dairy products, refined carbohydrates, chocolate, chips, and fried foods
- Exercising regularly
- Maintaining a healthy body weight, by losing weight if necessary
- Reducing or avoiding alcohol consumption
- Quitting smoking and other use of tobacco products
- Avoiding sitting for long periods of time

- Increasing consumption of healthy polyunsaturated fats, such as those found in nuts, seeds, legumes, fish, whole grains, and olive oil
- Taking omega-3 oil, either as a liquid or in capsules
- Eating plenty of dietary fiber from whole fruits, vegetables, and whole grains
- Getting at least 6– 8 hours of sleep a night
- Drinking plenty of water

B. Medical management

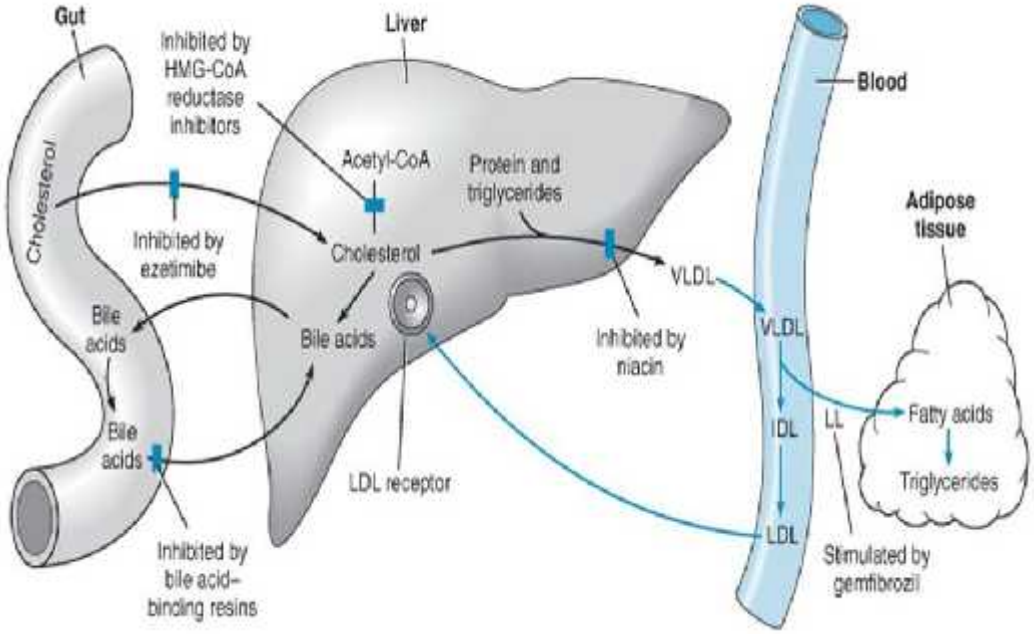
We will usually focus on lowering a person's levels of triglycerides and LDL. However, treatment can vary, depending on the underlying cause of dyslipidemia and how severe it is.

We prescribe one or more lipid-modifying medications for people with very high total cholesterol levels of at least 200 milligrams per deciliter of blood. High cholesterol is usually treated with statins, which interfere with the production of cholesterol in the liver.

If statins fail to lower LDL and triglyceride levels, we may recommend additional medications, including:

- Ezetimibe
- Niacin
- Fibrates
- Bile acid sequestrants
- Evolocumab and alirocumab
- Lomitapide and mipomersen

Some lifestyle changes and food supplements can help to encourage good blood lipid levels.



Burden statistics of dyslipidemia – Asia pacific

Until the recent past, many countries in the asia pacific had communicable diseases as one of the major health issues. In the recent times due to globalisation and other factors, non-communicable diseases are on the rise and is one of the major health concerns.[44,45] As a result of rapid urbanisation in these regions, the life style changes like alcohol and tobacco consumption is changing the very dynamics of life leading to dreadful health conditions like metabolic syndrome and coronary artery diseases.[46] The research data which we have via randomized trials[5] and large observational studies[47,48] that increased levels of cholesterol, LDL, TG and reduced levels of HDL in the blood are associated with an increased risk of CVD.

According to the WHO estimates in 2008, the prevalence of dyslipidemia (defined as blood levels of TC > 5 mmol/L [190 mg/dL]) in the Southeast Asia (30.3%) and the Western Pacific (36.7%) were much lower than that in the Europe (53.7%) and the Americas (47.7%).[49] However, the prevalence of dyslipidemia across Asia Pacific region varies. Therefore, it is necessary to carefully examine and compare the dyslipidemia between different countries.

Association with anemia and lipid profile

The probable explanation of low levels of lipids in patients with anemia could be hemodilution because of anemia to compensate for anemia, increased erythropoiesis could increase the cholesterol turnover for synthesis of the lipid membranes of the red blood cells, may be because of activation of macrophage system and reticuloendothelial cells may contribute hypocholesterinemia in patients with anemia[50]. It could be because of, as we all know liver is the main site of interaction of lipids and iron metabolism which is a common site of both these metabolic pathways (iron and lipid)[51]. Iron plays an important role in hepatic lipogenesis, iron being an important component of some enzymes and transporters in lipid metabolism and they exert a direct effect on hepatic lipid metabolism. Further the iron deficiency may influence transcriptional/post-transcriptional mechanisms which may interfere with lipid metabolism. Since iron acts as a cofactor which may also influence the kinetics/activity of enzymes in lipid metabolism[52]. A diet with low calories may ultimately lead to hypolipidemia[53].

Relevant literature

The study by Vetrivel S et. al.[54], where, a total of 50 anemic patients were included in the study with 50 age and sex matched controls. The most common clinical features were Fatigue and pallor. There was significant correlation between cholesterol in patients and controls (P<0.01) with mean cholesterol of 130.2 mg/dL in cases as compared to controls of 172.4 mg/dL. There was significant correlation between HDL in patients and controls (P<0.01) with mean HDL of 30.0 mg/dL in cases as compared to controls of 38.9 mg/dL The mean serum LDL was statistically significant (P<0.01) in cases with mean of 78.7 mg/dL in cases as compared to controls with 111.1 mg/dL as mean. The serum triglyceride levels was significant with a P<0.01. the mean value in cases was 109.1 mg/dL as compared to controls 123.5 mg/dL.

The study by Antappanavar VB et al.,[55] 100 iron deficiency anemia and 70 age and sex matched healthy controls, in the age group 18-35 years were investigated for any possible changes in serum lipid profile i.e., triglycerides, total cholesterol, high density lipoprotein cholesterol, very low-density lipoprotein cholesterol. The patients were followed up after 3 months of oral iron therapy. The results are shown as, mean± standard deviation. Triglycerides and very low density lipoprotein cholesterol levels were found to be significantly (P <0.001) elevated in the iron deficiency anemia 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), whereas level of low density lipoprotein cholesterol were found to be significantly (P = 0.02) lower in patients (90.96 ± 41.55 mg/dl) as compared to controls (105.24 ± 26.45 mg/dl). However, after treatment (in 43 patients) there was significant (P <0.001) reduction in the levels of triglycerides

and very low density lipoprotein cholesterol (111.56 ± 26.87 mg/dl and 22.30 ± 5.36 mg/dl) when compared to their pretreatment level (154.70 ± 53.89 mg/dl and 30.93 ± 10.84 mg/dl), whereas low density lipoprotein cholesterol levels did not show any significant change.

The study by Shirvani M et al.,[56] wherein it was a cross-sectional study by the Amirkola Health and Ageing Project (AHAP). The older people in the study were given a questionnaire and their blood sample was taken after 12 hours of fasting for lipid profile. The results have shown that, average age of the people was 68.95±7.43 years old. In this study, the prevalence of anemia and IDA was 31% and 9%, respectively. The mean concentration of serum triglyceride, cholesterol and LDL in the anemia group and the IDA group was less than the control groups. The amount of HDL in different groups was almost the same, although the difference was statistically significant with respect to variables like age and obesity (P=0.001).

In a study by Zaribaf, et al.,[57] which was a cross-sectional study done on 82 healthy university students and found, Pearson correlation test showed a positive and significant correlation between serum ferritin concentration levels with triglyceride (r = 0.278; P = 0.006), total cholesterol (r = 0.267; P = 0.008), and blood glucose (r = 0.275; P = 0.006); however, the correlation between serum ferritin, high-density lipoprotein-cholesterol, low-density lipoprotein-cholesterol, and insulin was not significant. Before and after adjustment of confounding factors, there was no significant correlation between hemoglobin and hematocrit with concentration of lipid profile components, glucose and insulin. Before and after adjustment of confounding factors, there was no significant correlation between total amount of iron, heme iron,

and non-heme dietary iron with concentration of lipid profile components, glucose and insulin.

In a study by Venkateshwarlu Nandyala et. al.,[58] out of 100 patients, 50 are iron deficiency anemia patients and 50 age and sex matched healthy controls. The age group of patients ranged from 18-35 years and the results observed are, total cholesterol, TG, LDL, VLDL levels were found to be significantly (<0.001) elevated in IDA group (165.9 ± 11.49, 175.32 ± 27.8, 93.53 ± 10.65, 31.74 ± 2.96) as compared to controls (149.04 ± 11.24, 103.28 ± 10.38, 80.02 ± 13.71, 20.92 ± 2.72) whereas HDL level was significantly(<0.001) decreased in IDA group (37.27 ± 3.07) compared to controls (48.34 ± 5.43). However after treatment there was significant reduction in TG and VLDL levels (87.78 ± 5.75 and 19.83 ± 1.95) when compared to their pre-treatment levels (175.32 ± 27.8 and 31.74 ± 2.96) and significant increase in HDL level (46.5 ± 3.58) as compared to pretreatment levels (37.27 ± 3.07), whereas Total cholesterol and LDL levels (153.06 ± 15.2 and 88.76 ± 16.18) reduced insignificantly compared to pre-treatment levels (165.9 ± 11.49 and 93.53 ± 10.65).

In a study by Chowta NK et al.[59] who has studied 200 patients out of which 50% were anemics and 50% controls. In their study they have also found lower levels of cholesterol, LDL, HDL and triglyceride in patients with anemia. When this group was compared to the control group, they found low levels of lipid in anemic patients when compared to healthy control group which was significant in their study.

Lacunae in Literature

Anemia and dyslipedemia are the two of the most prevalent conditions adding to the burden of disease across the world. The relationship of dyslipidemia with iron deficiency anemia has been studied extensively in literature. But the studies stating what degree of anemia does to lipid profile are few, with different opinions. Not only the severity of anemia but the etiological profile and type of anemia may also be a key factor influencing lipid levels. Hence apart from iron deficiency, the relationship between other important causes of anemia like vitamin B_{12} deficiency and folic acid deficiency with lipid levels needs to be explored. But the volume of literature studying this aspect is scarce, especially in Indian population. The current study was aimed at fulfilling the above specified lacunae, especially the association between vitamin B_{12} deficiency and severity of different types of anemia and lipid levels.

METHODOLOGY

The present study was conducted in the Department of General Medicine, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi.

Study Design

This study was a hospital based cross-sectional study.

Study Period

It was conducted over a period of one year from January 2019 to December 2019.

Study Site

The present study was carried out at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi. A tertiary care teaching hospital attached to Jawaharlal Nehru Medical College, Belagavi.

Study Population

All patients admitted to the wards of Department of General Medicine at KLES Dr. Prabhakar Kore Hospital, Belagavi fulfilling the inclusion criteria.

Sample Size

A total of 100 patients with anemia were studied.

Sampling Method

The following formula was used for calculation of the sample size

$$n = \frac{z_\alpha{}^2 P(1-P)}{d^2}$$

Where:

z_α = 1.96 (at 95% confidence interval)

P = percentage of prevalence

d = absolute error

Inclusion Criteria

- Males and females above the age of 18 years
- Male subjects with hemoglobin value less than 13.0 g/dl
- Female subjects with hemoglobin value less than 12.0 g/dl

Exclusion Criteria

- Subjects with positive history for treatment of dyslipidemias
- Anemia due to chronic diseases.
- Co-morbidities such as diabetes mellitus, nephrotic syndrome, retroviral disease on treatment, obesity and those who are receiving glucocorticoids, beta blockers, and statins are excluded from the study.
- Pregnant women
- Haemoglobinopathies

Ethical Clearance

Prior to the commencement, the study was cleared by the Institutional Ethics Committee, Jawaharlal Nehru Medical College, Belagavi.

Informed Consent

Informed consent was obtained from all the study participants and only those participants who willingly signed the informed consent were included in the study. The risks and benefits involved in the study, and the voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

Data Collection

All relevant parameters were documented in a structured Study Proforma

Methodology

Inpatient, anaemic patients above the age of 18 years and fulfilling the inclusion criteria were enrolled for the study after obtaining written informed consent in their own vernacular language. Demographic data and detailed history was recorded. A thorough physical examination included the recording of Vital Data (Pulse Rate, Blood Pressure, Temperature and Respiratory Rate), general physical examination and a thorough systemic examination.

Based on the hemoglobin values, the patients were categorised into the 3 categories of severity of anemia, based on the WHO Grading, as per the patient's hemoglobin values. Peripheral smear and fasting lipid profile was measured and recorded and a correlation of severity of different types of anemia with fasting lipid profile values was studied.

Investigations

Venous blood samples were collected and subjected to the following investigations

- Hemoglobin
- TC / DC
- ESR
- Peripheral smear for morphology
- Random blood sugar
- Serum creatinine
- Liver function tests
- Fasting lipid profile

Severity Grading of Anemia

The WHO Grading for Anemia was employed in this study, categorising patients into mild, moderate and severe anemia based on the hemoglobin levels. The grading system is as below.

❖ **WHO Grading of Anemia**

Population	Non Anemia	Mild Anemia	Moderate Anemia	Severe Anemia
Non Pregnant Women (15 years of age and older)	12 g/dl or higher	11-11.9 g/dl	8-10.9 g/dl	Below 8 g/dl
Men (15 years of age and older)	13 g/dl or higher	11-12.9 g/dl	8-10.9 g/dl	Below 8 g/dl

Statistical Methods

Data was analyzed using R i386 3.6.0 statistical software. Continuous variables are represented by mean ± SD form and categorical variables by a frequency table. Chi Square test was used to check the association between different categorical variables. ANOVA was used to analyze the relationship between severity and lipid profile. In the tables below p-value <0.05 indicates statistical significance of variables.

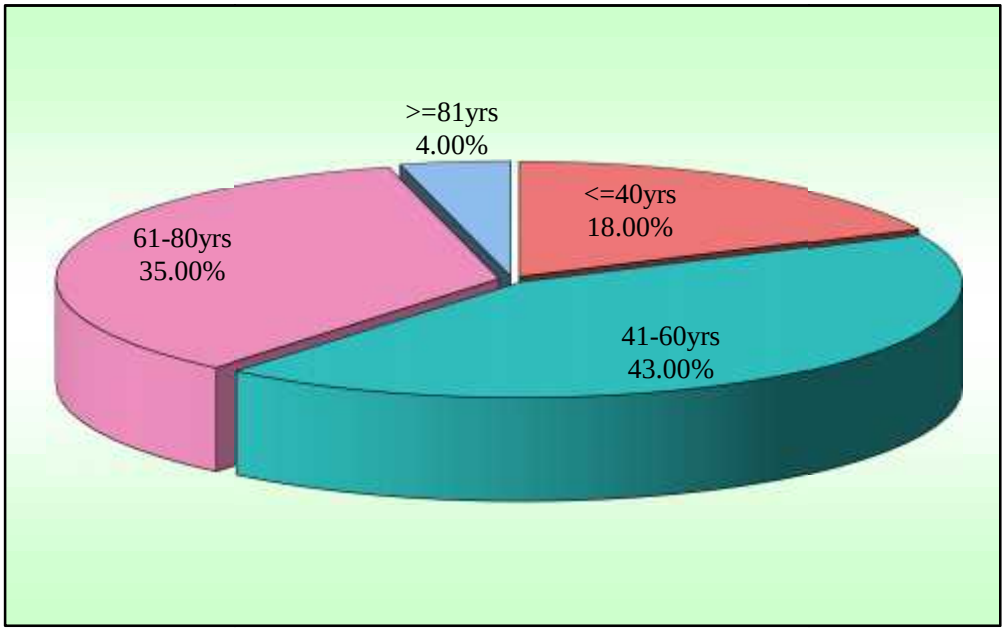
RESULTS

The present cross-sectional study titled “Correlation Of Serum Lipid Profile In Patients With Anemia - A One Year Cross Sectional Study In KLE’s Dr. Prabhakar Kore Hospital & MRC” was carried out in the Department of General Medicine. During the study period from January 2019 to December 2019, a total of 100 anemic patients were studied. The findings / observations and final results are as tabulated below.

Table 1: Age Distribution

Age groups	No of patients	% of patients
<=40yrs	18	18.00
41-60yrs	43	43.00
61-80yrs	35	35.00
>=81yrs	4	4.00
Total	100	100.00
Mean	55.58	
SD	14.90	

Figure 1: Age Distribution



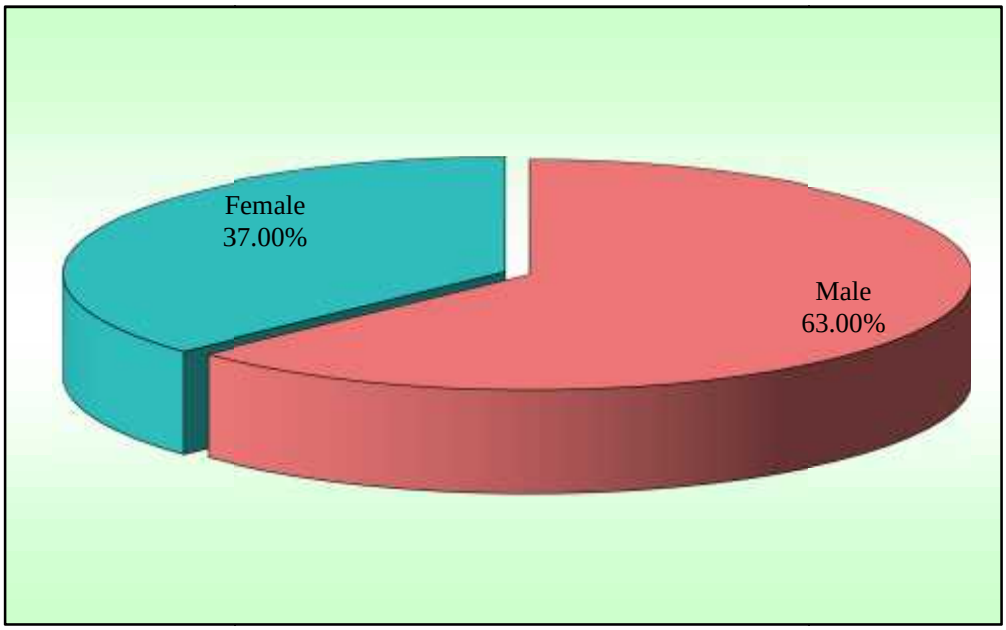
In the present study of 100 patients, ages ranged from 22-91 years. There were 43 patients (43%) in the age group 41-60 years, 35 patients (35%) between 61-80 years, 18 patients (18%) below the age 40 years and only 4 patients (4%) in the age group of above 80 years. The mean age was 55.58 with a standard deviation of 14.90 years.

Inference: maximum number cases were in age group of above 40 years and below 80 years.

Table 2: Sex Distribution

Gender	No of patients	% of patients
Male	63	63.00
Female	37	37.00
Total	100	100.00

Figure 2: Sex Distribution



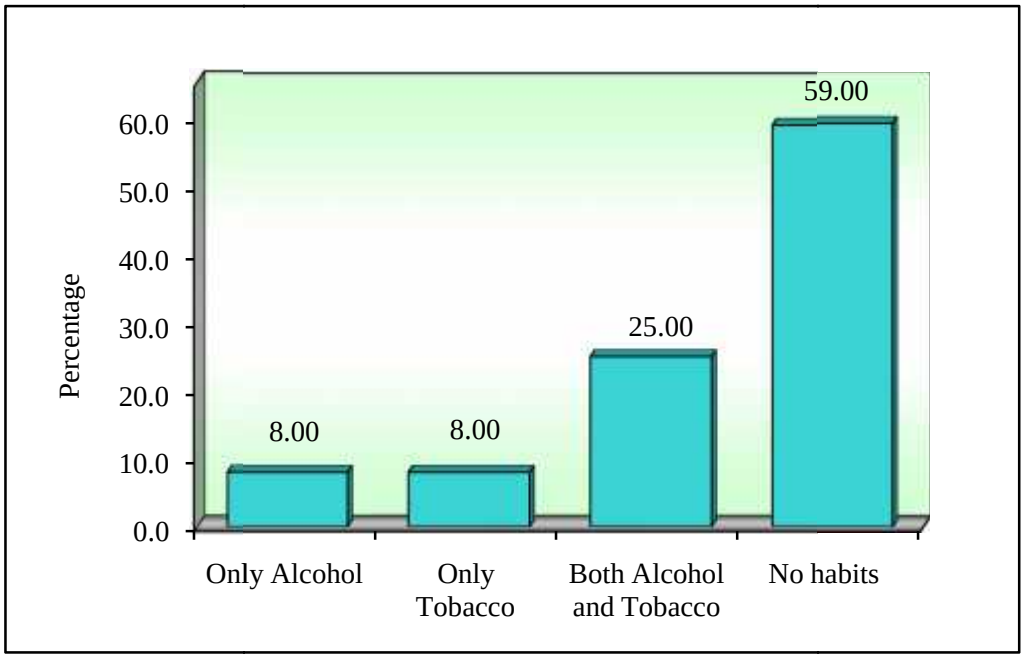
In our study, there were 63 male patients (63%) and 37 female patients (37%) accounting for a Male : Female ratio of 1.7:1.

Inference: there was a male preponderance in our study.

Table 3: Habits

Habits	No of patients	% of patients
Only Alcohol	8	8.00
Only Tobacco	8	8.00
Both Alcohol and Tobacco	25	25.00
No habits	59	59.00
Total	100	100.00

Figure 3: Habits

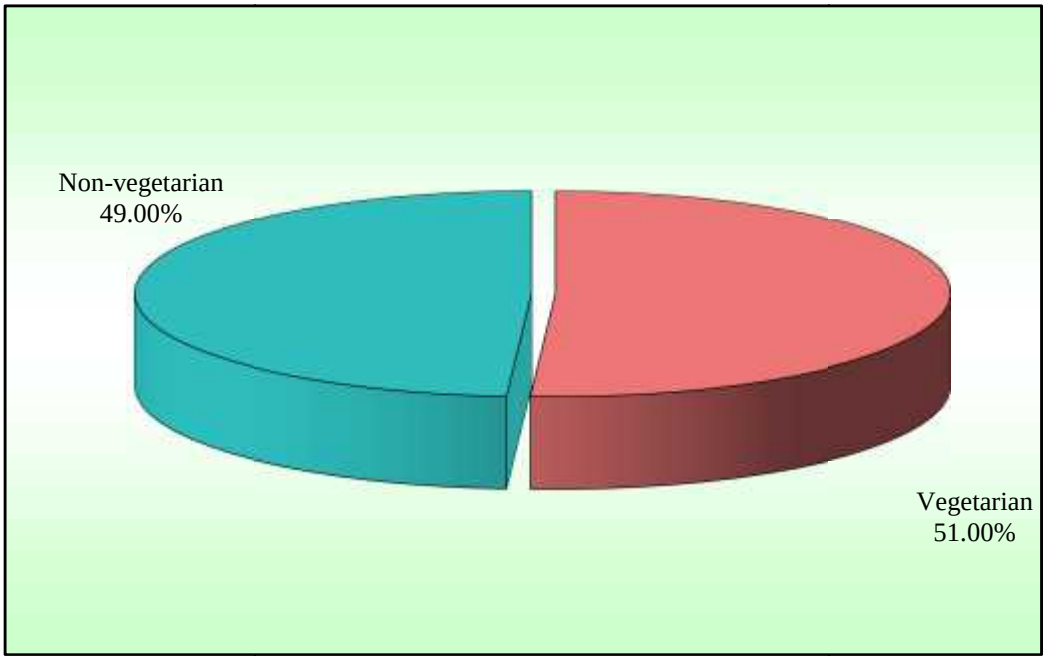


A total of 41 patients (41%) had habit of alcohol drinking or tobacco use. Few had both drinking alcohol and tobacco use (25 patients i.e., 25%). 59 patients (59%) did not have any habits.

Table 4: Diet

Diet	No of patients	% lloof patients
Vegetarian	51	51.00
Non-vegetarian	49	49.00
Total	100	100.00

Figure 4: Diet

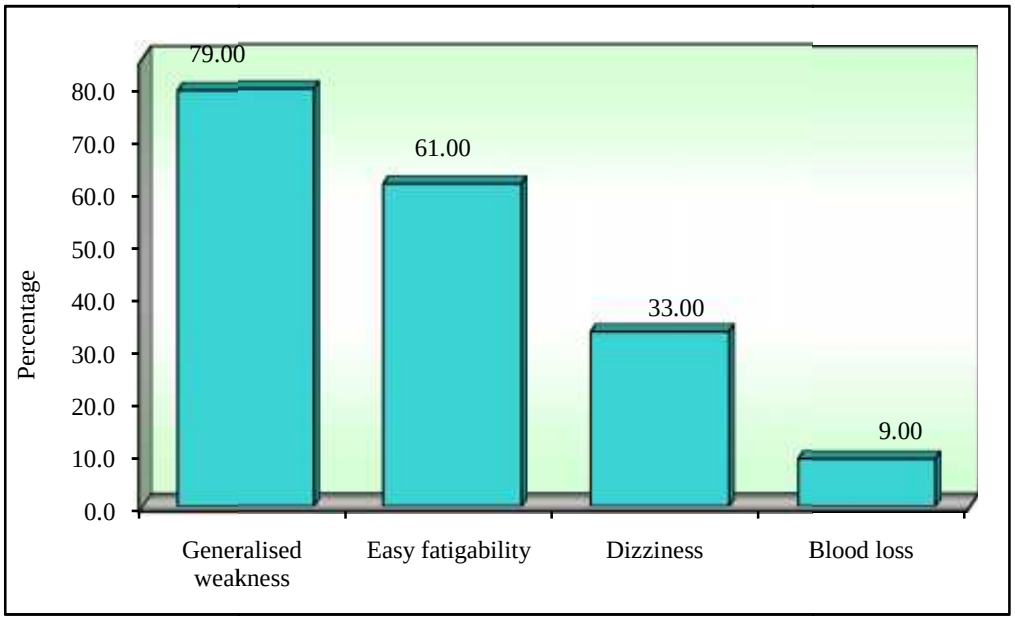


We observed in our study population, 51 patients (51%) were vegetarian and 49 patients (49%) were non vegetarian.

Table 5: Clinical Presentation

Clinical symptoms	No of patients	of patients
Generalised weakness	79	79.00
Easy fatigability	61	61.00
Dizziness	33	33.00
Blood loss	9	9.00

Figure 5: Clinical Presentation

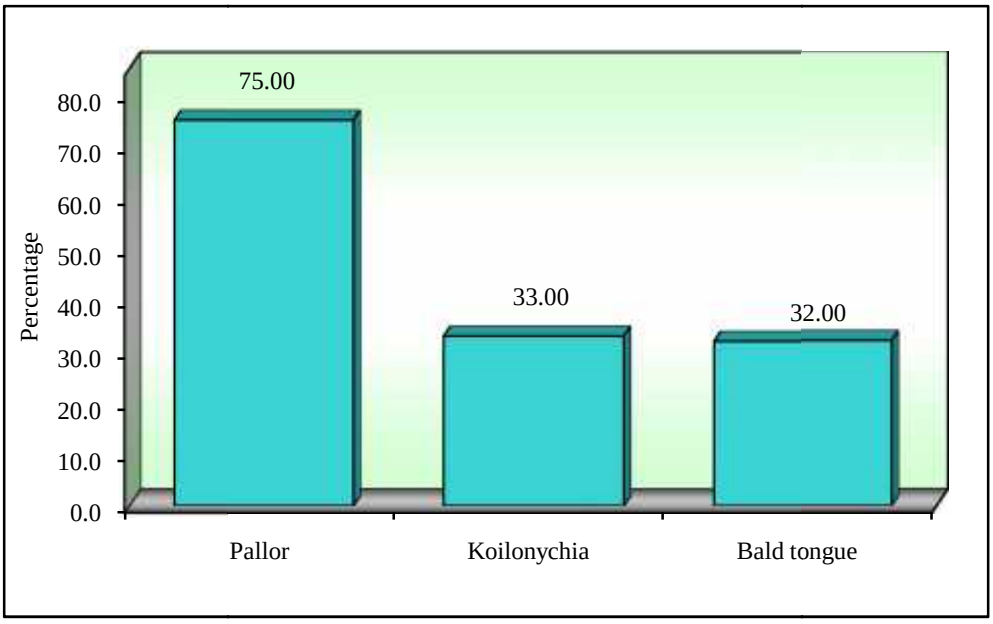


Majority of the patients with anemia had symptom of generalized weakness (79 patients i.e., 79%) as presenting complaint. 61 patients (61%) had easy fatigability, 33 patients (33%) had dizziness and 9 patients (9%) came with complaints of chronic blood loss (all 9 patients were females with history of menorrhagia). Some patients had overlapping of the above symptoms.

Table 6: Clinical Signs

Clinical symptoms	No of patients	of patients
Pallor	75	75.00
Koilonychia	33	33.00
Pale Bald tongue	32	32.00

Figure 6: Clinical Signs

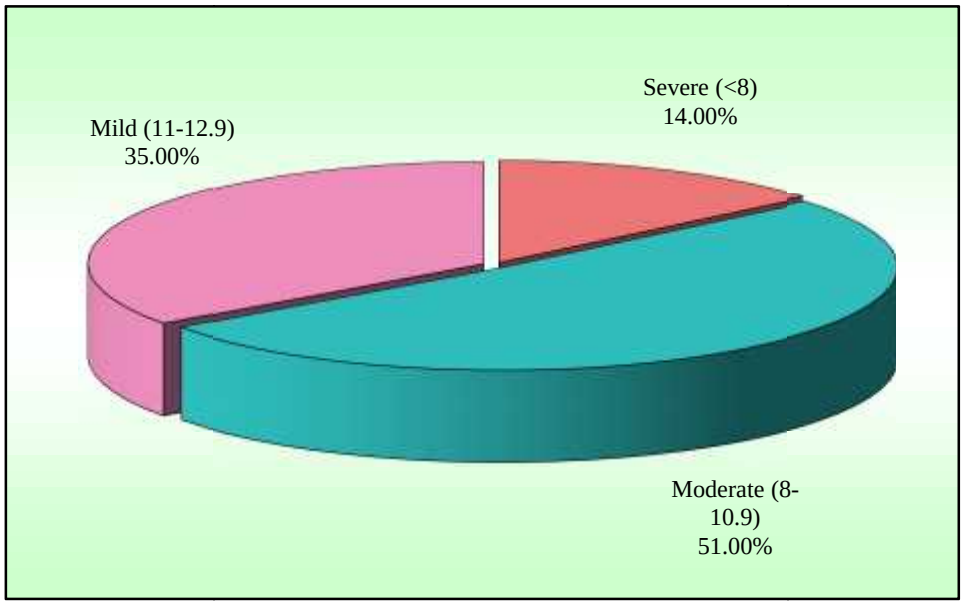


Majority of our patients had pallor as clinical sign (75 patients, i.e. 75%) followed by koilonychia in 33 patients (33%) and pale bald tongue in 32 patients (32%). Some patients had overlapping of the above clinical signs.

Table 7: Severity of Anemia (WHO Criteria)

Severity (Hb in g/dl)	No of patients	% of patients
Mild (11-12.9)	35	35.00
Moderate (8-10.9)	51	51.00
Severe (<8)	14	14.00
Total	100	100.00

Figure 7: Severity of Anemia (WHO Criteria)

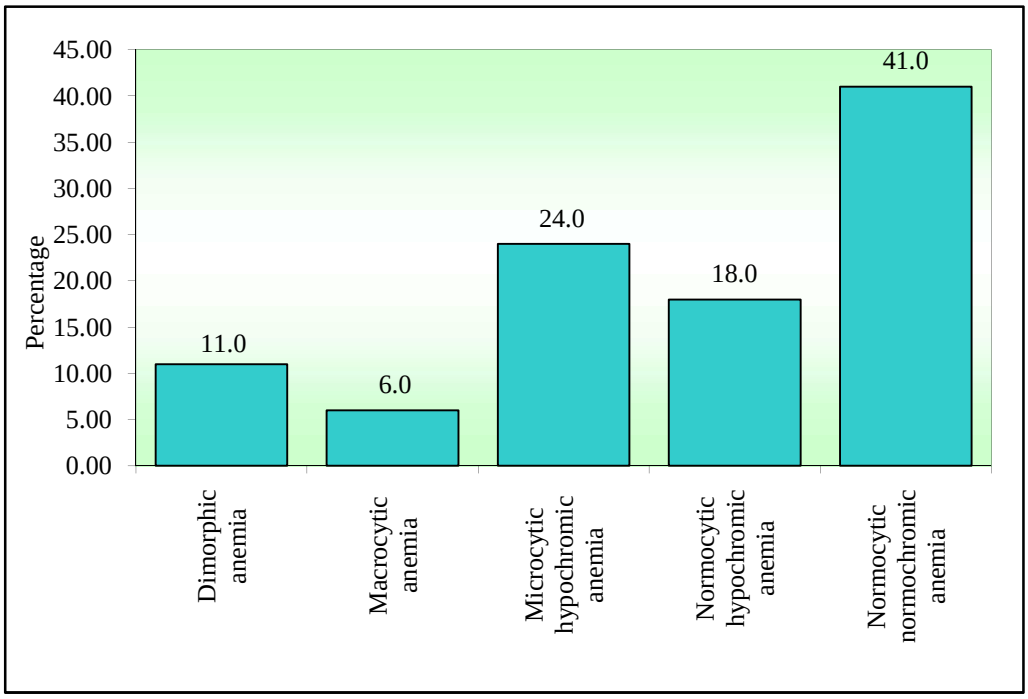


According to WHO criteria we categorized the severity of anemia as mild, moderate and severe and observed 35 patients (35%) had mild anemia (11.0 – 12.9 mg/dl), 65 patients (65%) had moderate to severe anemia (moderate – 51 patients i.e., 51% and severe – 14 patients i.e., 14%).

Table 8: Type of Anemia

Peripheral smear	No of patients	of patients
Dimorphic anemia	11	11.00
Macrocytic anemia	6	6.00
Microcytic hypochromic anemia	24	24.00
Normocytic hypochromic anemia	18	18.00
Normocytic normochromic anemia	41	41.00
Total	100	100.00

Figure 8: Type of Anemia



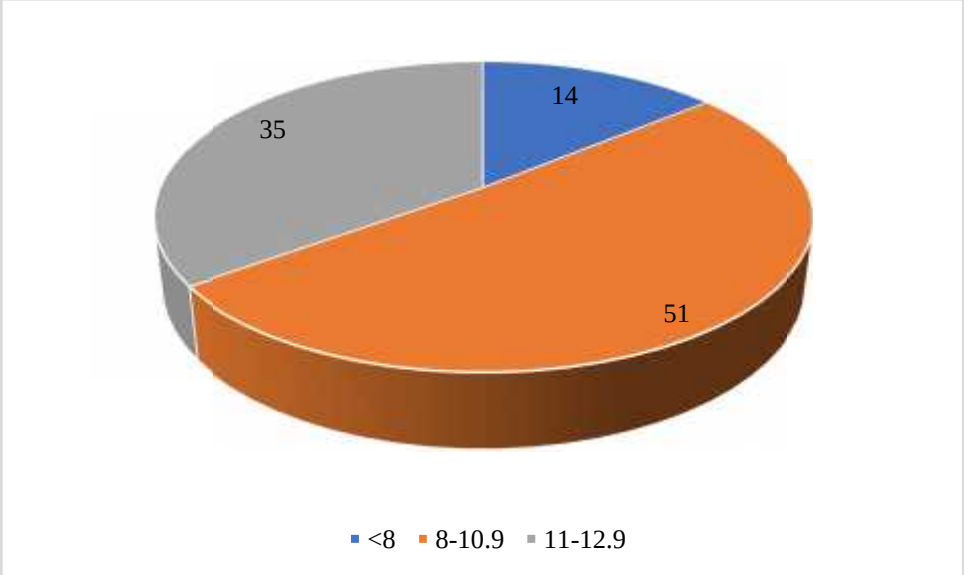
The above table 8 depicts type of anemia in our study of 100 patients. Majority of patients had normocytic normochromic anemia (41 patients i.e., 41%) whose cause could not be ascertained.

LAB PARAMETERS

Table 9: Severity of anemia (Hb% WHO Criteria)

Severity (Hb in g/dl)	No of patients	% of patients
Mild (11-12.9)	35	35.00
Moderate (8-10.9)	51	51.00
Severe (<8)	14	14.00
Total	100	100.00
Mean	9.73	
SD	1.90	

Figure 9: Severity of anemia (Hb% WHO Criteria)

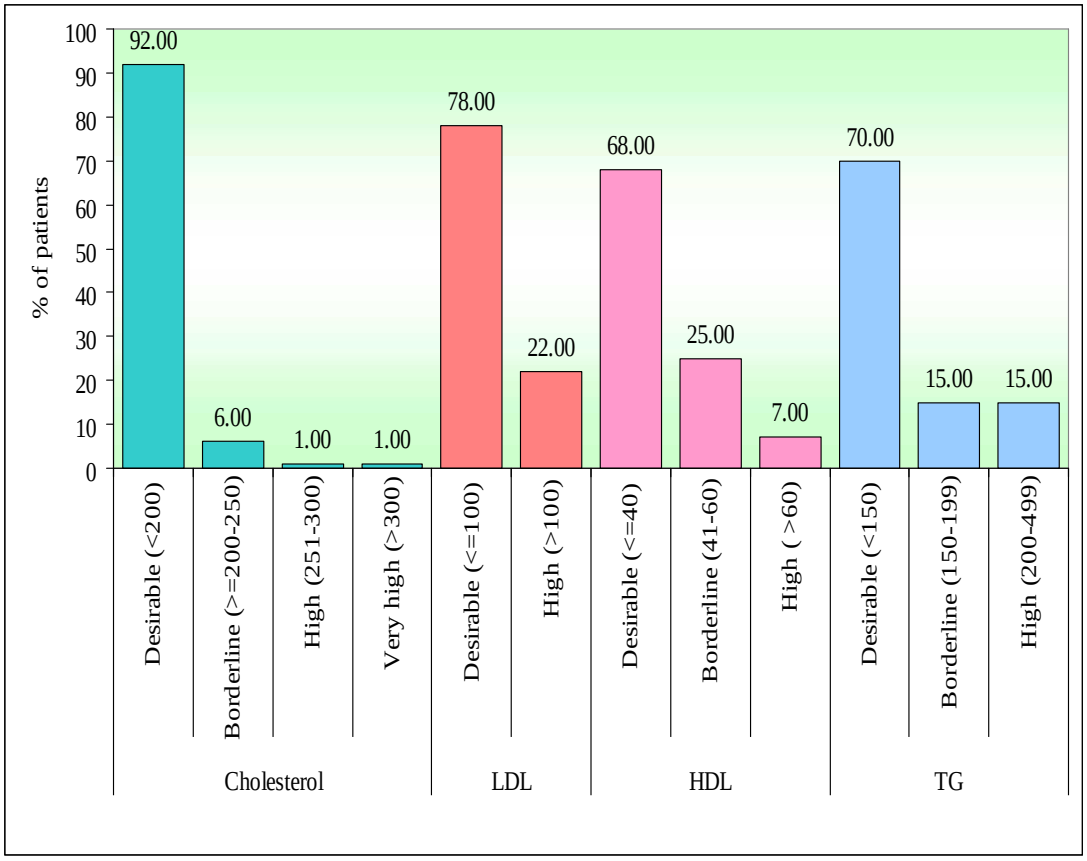


We subjected our patients to hemoglobin estimation and found to have mild anemia in 35 patients (35%), moderate in 51 patients (51%) and severe in 14 patients (14%). The mean hemoglobin in our study was 9.73 with a standard deviation of 1.90 g/dl.

Table 10: Fasting lipids

Lipid profile	Number	%
Cholesterol		
Desirable (<200)	92	92.00
Borderline (>=200-250)	6	6.00
High (251-300)	1	1.00
Very high (>300)	1	1.00
LDL		
Desirable (<=100)	78	78.00
High (>100)	22	22.00
HDL		
Desirable (<=40)	68	68.00
Borderline (41-60)	25	25.00
High (>60)	7	7.00
TG		
Desirable (<150)	70	70.00
Borderline (150-199)	15	15.00
High (200-499)	15	15.00
Total	100	100

Figure 10: Fasting lipids

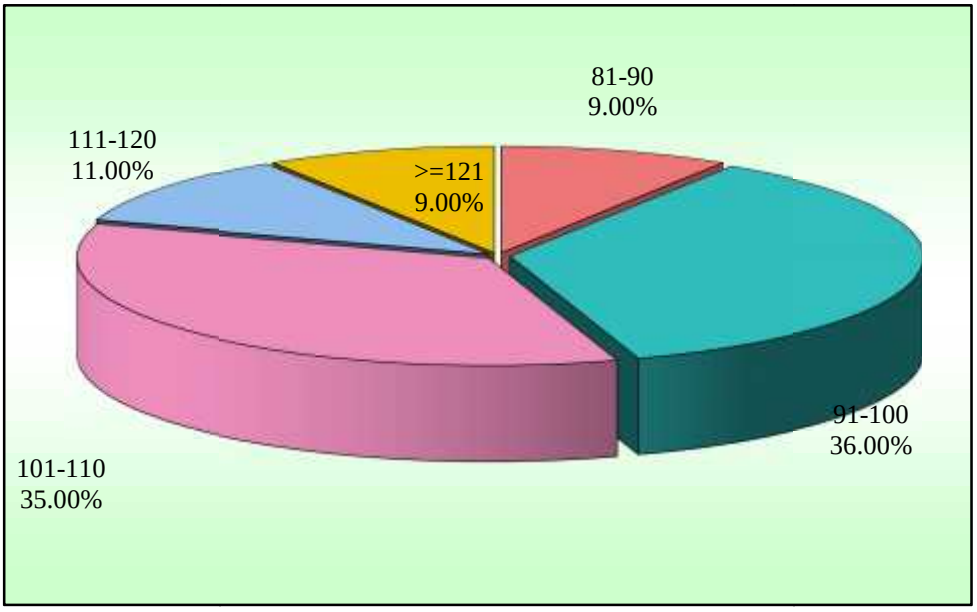


In our present study all 100 patients were subjected to fasting lipids and their results for total cholesterol were, less than 200 mg/dl had 92 patients (92%), borderline 201-250 mg/dl had 6 patients (6%) and in between 251-300 mg/dl & more than 300 with 1 patient each (1% each).

Table 11: Severity of RBS wise distribution

Severity RBS	No of patients	of patients
81-90	9	9.00
91-100	36	36.00
101-110	35	35.00
111-120	11	11.00
>=121	9	9.00
Total	100	100.00
Mean	104.36	
SD	10.42	

Figure 11: Severity of RBS wise distribution

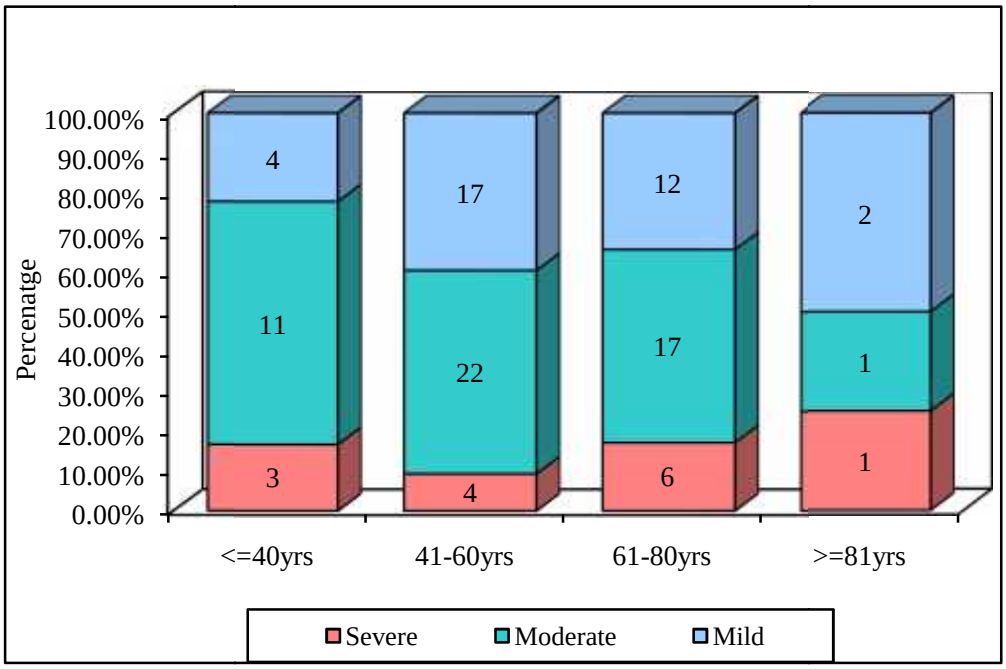


All 100 patients were subjected routinely for RBS estimation at the time of our study (known diabetics were excluded from the study) and the results observed are shown in the Table 11.

Table 12: Comparison of Age with Anemia

Age groups	Mild	Moderate	Severe	Total
<=40yrs	4	11	3	18
41-60yrs	17	22	4	43
61-80yrs	12	17	6	35
>=81yrs	2	1	1	4
Total	35	51	14	100
Chi-square=3.6486 p=0.7241,NS				

Figure 12: Comparison of Age with Anemia

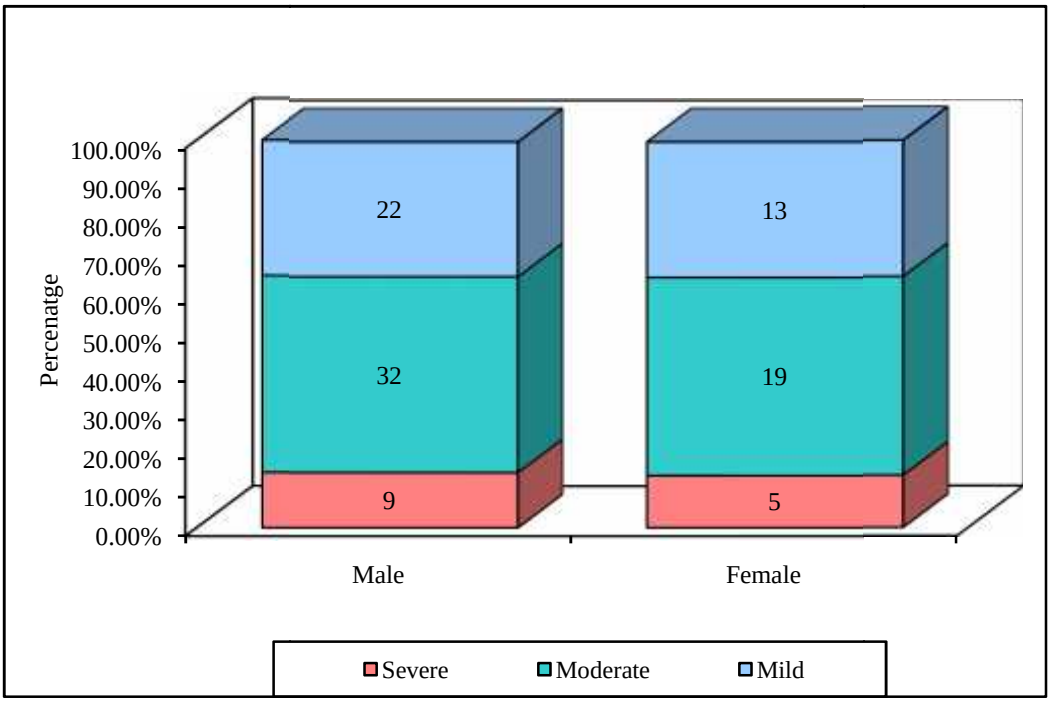


We attempted to study the severity of anemia based on age of the patients and the results obtained are shown in the table 12. The p value is statistically insignificant (p=0.7241).

Table 13: Comparison of gender with Anemia

Gender	Mild	Moderate	Severe	Total
Male	22	32	9	63
Female	13	19	5	37
Total	35	51	14	100
Chi-square=0.0120 p=0.9941,NS				

Figure 13: Comparison of gender with Anemia



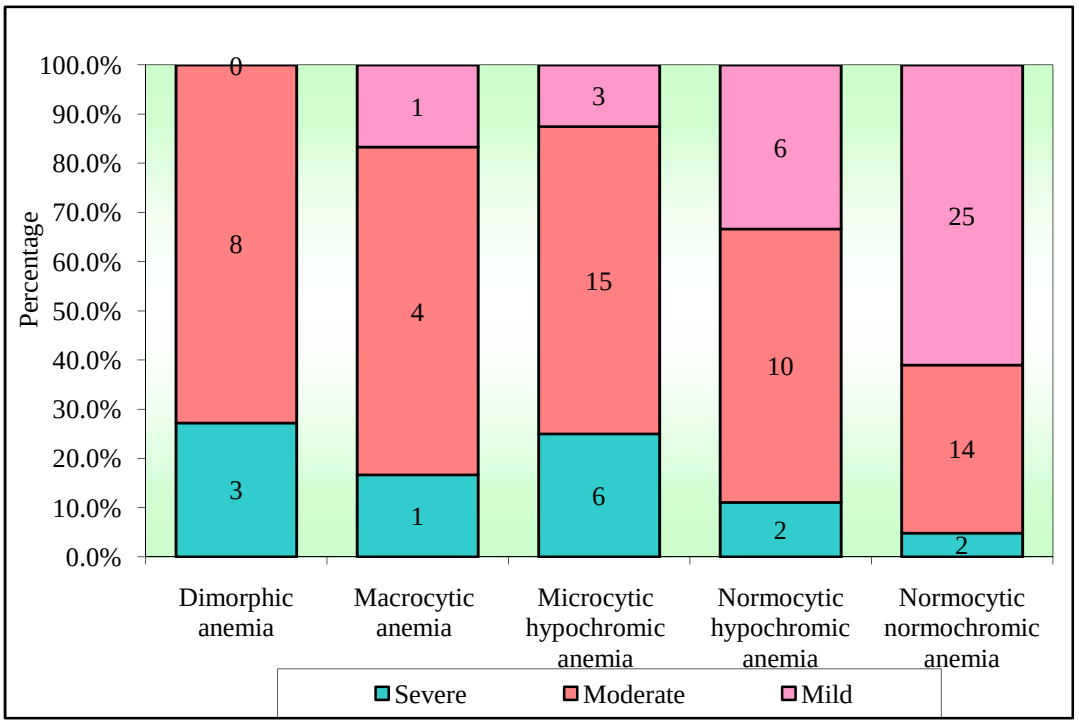
Similarly the severity of anemia according to gender was studied and it shows mild anemia as well as moderate to severe anemia was more observed in males as compared to females as shown in the above table. Again the p value was statistically insignificant (p=0.9941).

Table 14: Comparison of types of anemia and peripheral smear

Types of peripheral smear	Mild	Moderate	Severe	Total
Dimorphic anemia	0	8	3	11
Macrocytic anemia	1	4	1	6
Microcytic hypochromic anemia	3	15	6	24
Normocytic hypochromic anemia	6	10	2	18
Normocytic normochromic anemia	25	14	2	41
Total	35	51	14	100
Chi-square=26.1350, p=0.0010*, S				

*p<0.05

Figure 14: Comparison of types of anemia and peripheral smear

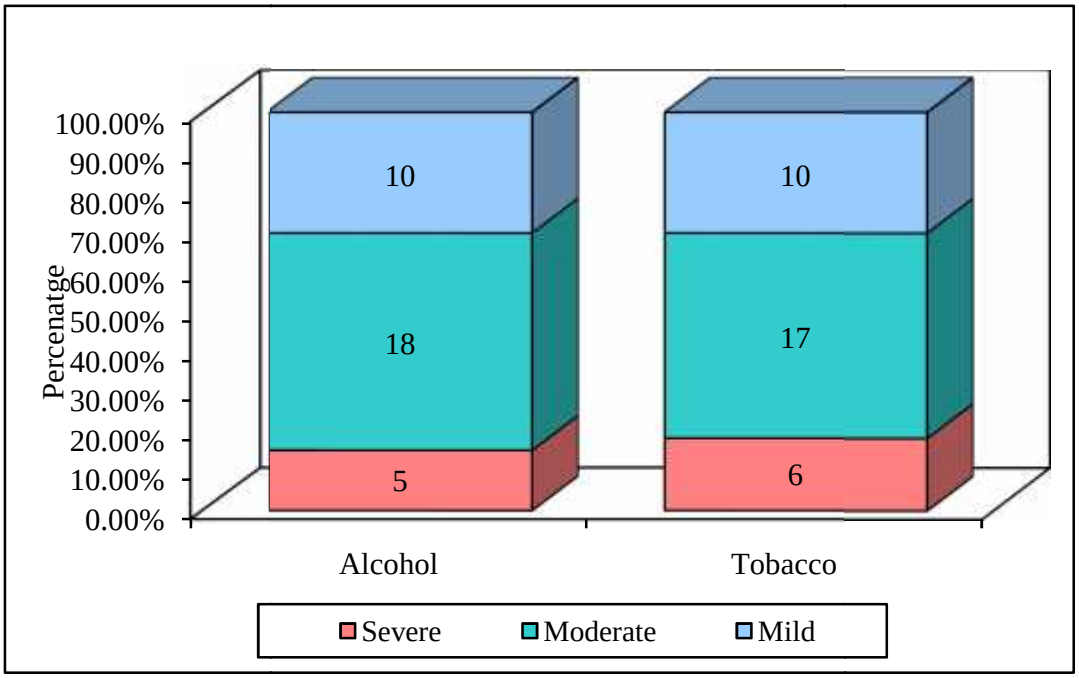


In all 100 patients, the peripheral smear was compared with severity of anemia and found to have normocytic normochromic anemia was commonly observed i.e., 41 patients (41%) with mild - 25, moderate – 14 and severe -2. Followed by microcytic hypochromic anemia with 24 patients (24%) with mild – 6, moderate – 10 and severe – 2.the other types of peripheral smear with severity of anemia are depicted in the above table 14. The p value is statistically significant (p=0.0010)

Table 15: Comparison of habits with anemia

Habits	Mild	Moderate	Severe	Total	Chi-square	p-value
Alcohol						
Yes	10	18	5	33	0.4785	0.7872
No	25	33	9	67		
Tobacco						
Yes	10	17	6	33	0.9283	0.6287
No	25	34	8	67		
Total	35	51	14	100		

Figure 15: Comparison of habits with anemia



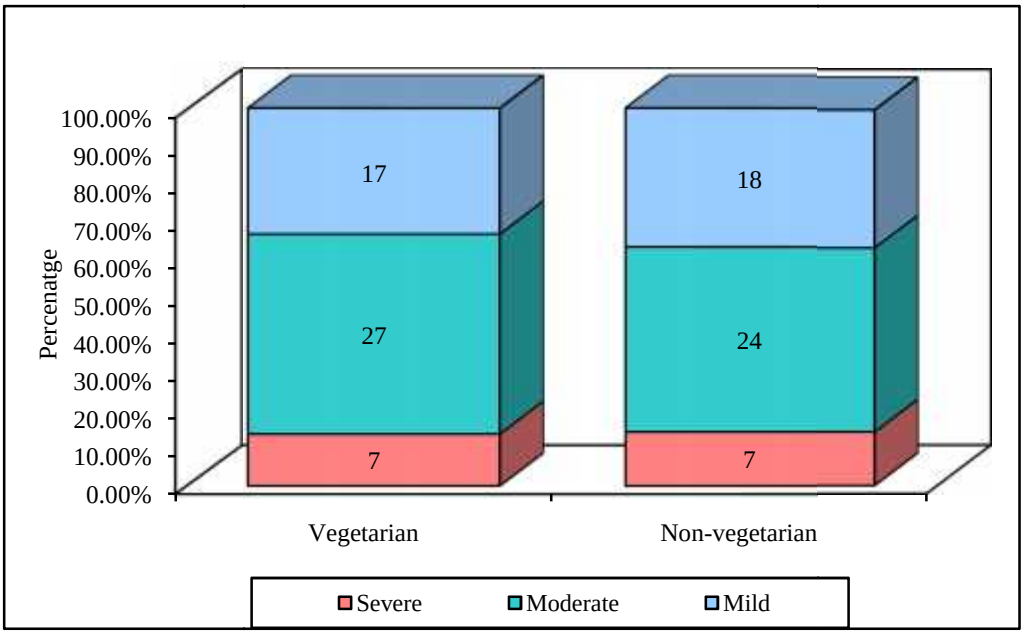
The habits of the patients were compared the severity of anemia and we found no statistical correlation. The p value was statistically insignificant in our study of 100 patients.

Table 16: Comparison of Diet with anemia

Diet	Mild	Moderate	Severe	Total
Vegetarian	17	27	7	51
Non-vegetarian	18	24	7	49
Total	35	51	14	100
Chi-square=0.1651 P=0.0208*				

*p<0.05

Figure 16: Comparison of Diet with anemia



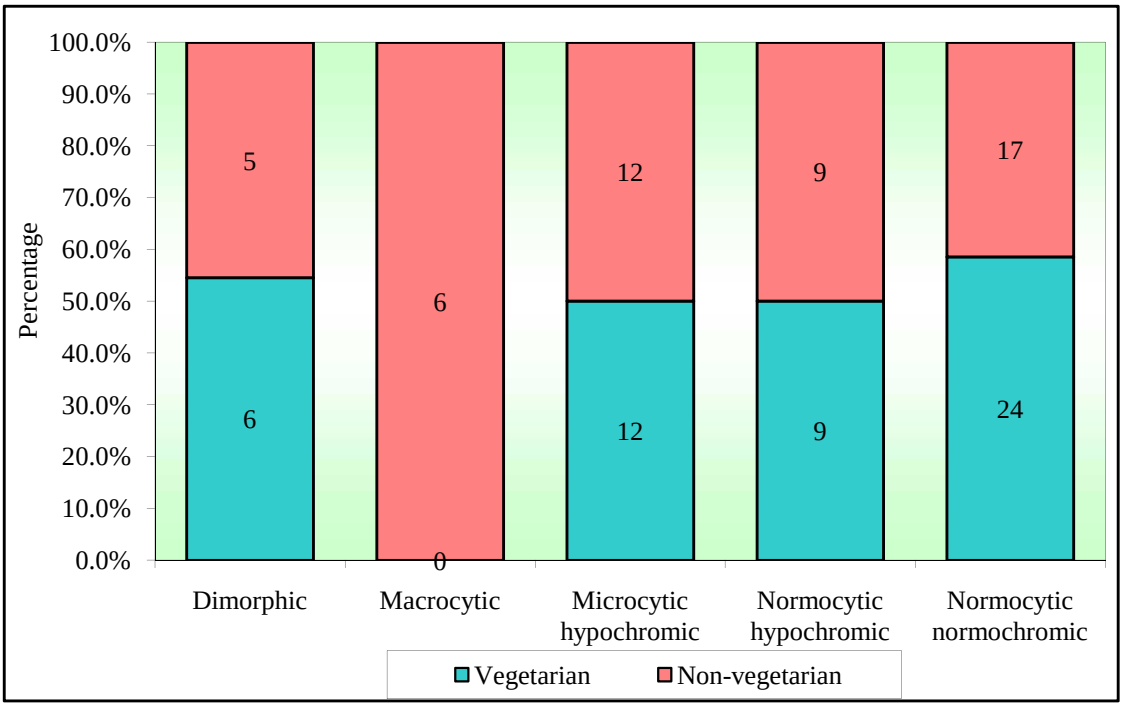
When diet was compared to severity of anemia, we found different grades of anemia (mild, moderate and severe). We observed more patients in vegetarian group falling in the moderate and severe anemia compared to the non-vegetarian group (except for mild anemia in non-vegetarian group was 18 and vegetarian group was 17). In severe anemia the number of patients in both the diet groups were equal. The p value is statistically significant (p value 0.0484).

Table 17: Comparison of Diet with peripheral smear

Diet	Dimorphic	Macrocytic	Microcytic hypochromic	Normocytic hypochromic	Normocytic normochromic	Total	Chi-square	p-value
Vegetarian	6	0	12	9	24	51	9.5698	0.0484*
Non-vegetarian	5	6	12	9	17	49		
Total	11	6	24	18	41	100		

*p<0.05

Figure 17: Comparison of Diet with peripheral smear

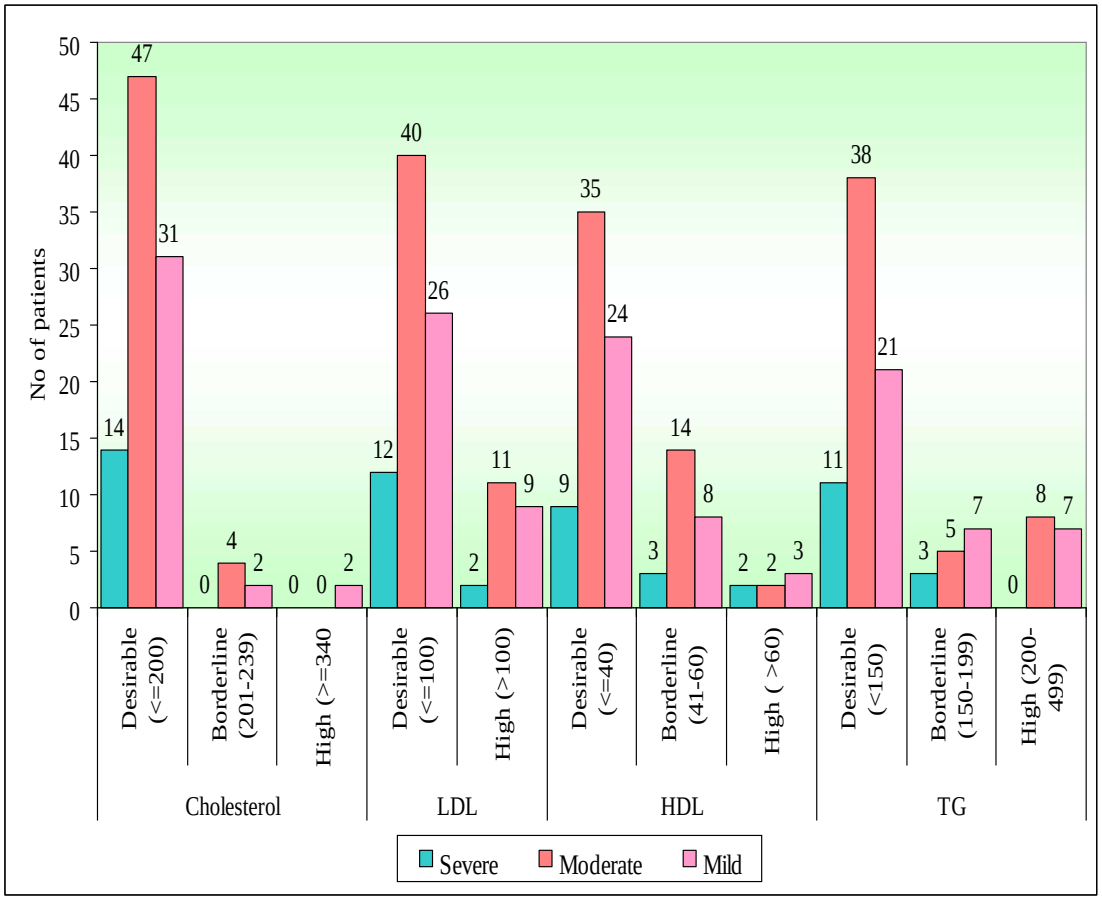


When we attempted to compare the diet with peripheral smear, we found significant correlation between them as depicted in table 17. The p value is statistically significant (p value 0.0484)

Table 18: Comparison of anemia with fasting lipids

Lipid profile	Mild	Moderate	Severe	Total	Chi-square	p-value
Cholesterol						
Desirable (<=200)	31	47	14	92	4.9901	0.2883
Borderline (201-239)	2	4	0	6		
High (>=340	2	0	0	2		
LDL						
Desirable (<=100)	26	40	12	78	0.7724	0.6796
High (>100)	9	11	2	22		
HDL						
Desirable (<=40)	24	35	9	68	2.1669	0.7051
Borderline (41-60)	8	14	3	25		
High (>60)	3	2	2	7		
TG						
Desirable (<150)	21	38	11	70	5.3815	0.2504
Borderline (150-199)	7	5	3	15		
High (200-499)	7	8	0	15		
Total	35	51	14	100		

Figure 18: Comparison of anemia with fasting lipids



We try to compare anemia with fasting lipids (cholesterol, LDL, HDL, TG) and found to have no significant correlation between different grades of anemia with fasting lipids. The p values for cholesterol (p value 0.2883), HDL-c (p value 0.6796), LDL-c (p value 0.7051) and TG (p value 0.2504).

Table 19: Correlation between Hb percentage and fasting lipids (by Karl Pearson's method)

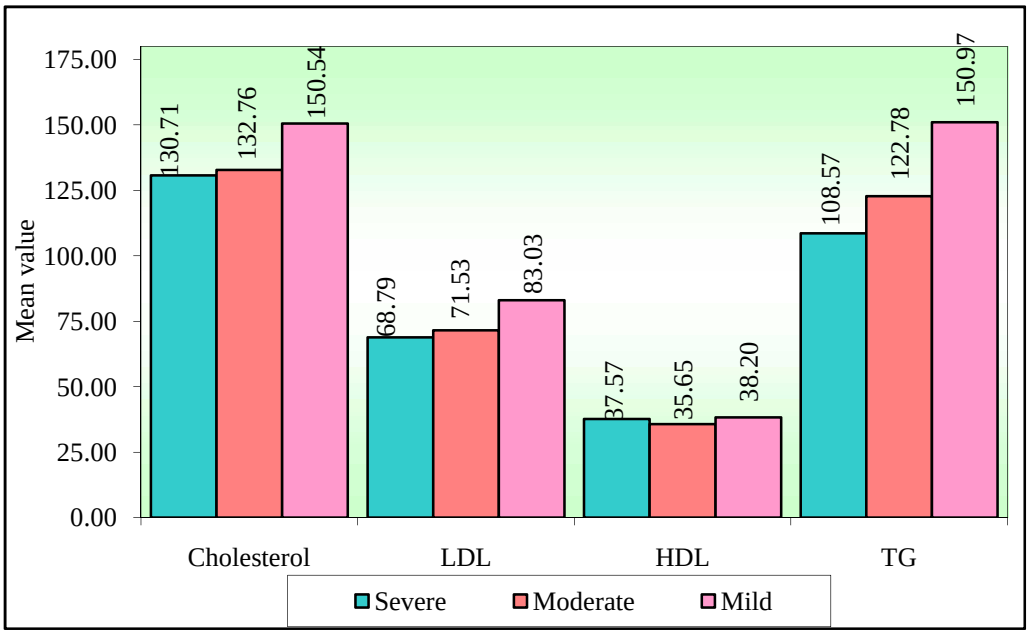
Lipid profile	Correlation between Hb (in g/dl) with		
	r-value	t-value	p-value
Cholesterol	0.1114	1.1099	0.2698
LDL	0.0969	0.9640	0.3374
HDL	0.0621	0.6159	0.5394
TG	0.1275	1.2727	0.2061

By deploying the Karl Pearson's method with fasting lipids, we found a weak positive correlation between hemoglobin and cholesterol, LDL-c, HDL-c and TG. The above table 19 depicts the same.

Table 20: Comparison of severity of anemia with fasting lipids (by one way ANOVA method)

Severity of anemia	Cholesterol		LDL		HDL		TG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Mild	150.54	51.63	83.03	44.60	38.20	16.62	150.97	84.49
Moderate	132.76	39.52	71.53	32.96	35.65	16.83	122.78	65.01
Severe	130.71	35.41	68.79	22.16	37.57	16.08	108.57	37.51
Total	138.70	44.11	75.17	36.48	36.81	16.53	130.66	70.83
F-value	1.9917		1.2881		0.2607		2.5091	
P-value	0.1420		0.2805		0.7710		0.0866	

Figure 19: Comparison of severity of anemia with fasting lipids (by one way ANOVA method)



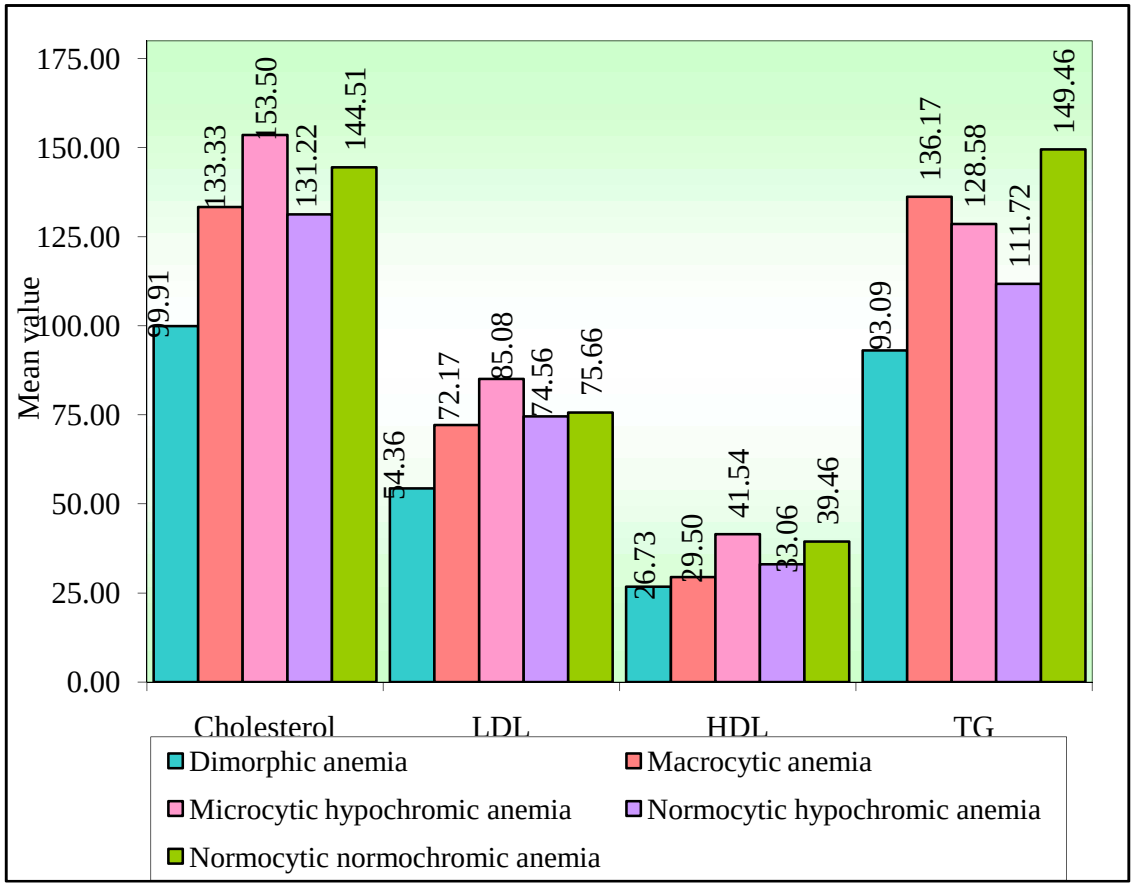
When we tried our best to compare the different grades of anemia (mild, moderate and severe) by one way ANOVA method, we did not find any significant correlation between severity of anemia and fasting lipids which is shown in the above table 20.

Table 21: Comparison of peripheral smear with fasting lipids (by one way ANOVA method)

Types of peripheral smear	Cholesterol		LDL		HDL		TG	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Dimorphic anemia	99.91	30.19	54.36	20.27	26.73	12.56	93.09	37.62
Macrocytic anemia	133.33	32.51	72.17	33.46	29.50	7.92	136.17	49.51
Microcytic hypochromic anemia	153.50	43.87	85.08	36.44	41.54	14.51	128.58	57.05
Normocytic hypochromic anemia	131.22	41.28	74.56	34.09	33.06	10.88	111.72	47.75
Normocytic normochromic anemia	144.51	44.89	75.66	40.17	39.46	19.87	149.46	89.43
Total	138.70	44.11	75.17	36.48	36.81	16.53	130.66	70.83
F-value	3.4404		1.3714		2.4371		1.8983	
P-value	0.0114*		0.2497		0.0524		0.1171	

*$p<0.05$

Figure 20: Comparison of peripheral smear with fasting lipids (by one way ANOVA method)



The peripheral smear had a positive correlation with total cholesterol moiety. However, it did not show any correlation with other fractions of cholesterol like HDL-c, LDL-c and also with TG's as shown in the above table 21.

Table 22: Overall summary of various numerical factors

Variables	Min	Max	Range	Mean	Median	SD	95% CI for mean	
							Lower	Upper
AGE	22.00	91.00	69.00	55.58	55.00	14.90	52.62	58.54
Hb	3.30	12.20	8.90	9.73	10.25	1.90	9.35	10.10
RBS	82.00	136.00	54.00	104.36	103.00	10.42	102.29	106.43
Cholesterol	50.00	308.00	258.00	138.70	139.50	44.11	129.95	147.45
LDL	13.00	225.00	212.00	75.17	72.00	36.48	67.93	82.41
HDL	14.00	107.00	93.00	36.81	34.00	16.53	33.53	40.09
TG	28.00	464.00	436.00	130.66	114.50	70.83	116.61	144.71

The above table shows various factors that are considered as numerical variables (age, hemoglobin, RBS, cholesterol, LDL, HDL and TG) as shown in the above table 22.

DISCUSSION

In the study which we conducted at KLEH, out of 100 patients of anemia in comparison with fasting lipid profile with various factors like age, sex, severity of anemia, type of anemia, the following results were observed.

In our present study, the age of patients ranged from 22 to 91 years. The maximum number of patients ranged from 41 to 60 years i.e., 43 patients (43%), 35 patients (35%) in the age group of 61-80 years, 18 patients (18%) were in the age group of less than 40 years, and only 4 patients were there the age group of more than 81 years. the mean age was 55.58±14.90 years. In a study by Antappanavar VB et al.,[55] in their study group they observed more patients in age group of 18 to 35 years with mean age of 25.34± 6.27years. Another study by Venkateshwarlu Nandyala et. al.,[58] in their study group, patient age ranged from from 18 to 35 years with a mean age of 28.9 ± 6.82 years.

We observed 37 patients were female (37%) in our study group and the remaining 63 patients (63%) were male patients with a M:F ratio of 1.7:1. A slight male preponderance was observed in our study. This is in sharp contrast to the studies done by Antappanavar VB et al.,[55] (63 females) and Venkateshwarlu Nandyala et. al.,[58] (62 females) in which there was a female preponderance.

In the present study of 100 patients we observed 41 patients had one or the other habit and 25 patients had habit of both alcohol and tobacco. 59 patients didnit have any habits. A study by Anandha Lakshmi.S et al.,[60] had smokers in their study group. Similarly, Berad A et al.,[61] had alcoholics in their study groups.

In present study of 100 patients, we observed slightly more vegetarian patients (51 patients i.e., 51%) as compared to 49 patients of non-vegetarian diet (49%). In a study Goel et. al.,[62] observed in their study both vegetarians and non-vegetarians.

In our present study majority of our patients had generalized weakness as presenting symptom (79 patients, 79%), followed by easy fatigability (61 patients, 61%), dizziness (33 patients, 33%) and chronic blood loss was seen in 9 patients (9%) and all 9 patients were females due to excessive per vaginal bleeding. This is similar to a study by CH Manoj Kumar et al.[63] who found generalized weakness as main presenting complaint in their study group.

Majority of our patients had palor as physical sign (75 patients i.e., 75%), koilonychia in 33 patients (33%) and pale bald tongue in 32 patients (32%). Another study by Parlapally RP et al.,[64] found majority palor in their study group and also koilonychia and pale bald tongue.

We attempted to catogorise all our patients base on WHO Criteria of anemia and found to have moderate anemia in 51 patients (51%), mild in 35 patients (35%) and severe only in 14 patients (14%). A study by Chowta NK et al.[59] found severe anemia patients more in their study group.

Similarly, we tried to categorise our patients based on types of anemia on peripheral smear and found to have different types of anemia as depicted in Table 8. A study by Chowta NK et al.[59] in their study group of of 200 patients 50% (100 patients) had different types of anemia with a slight variation in percentage when compared to our study group and found to have patients with pancytopenia in their study group. In our study group none had pancytopenia.

All our 100 patients were subjected to routine hemoglobin estimation, peripheral smear study, RBS and fasting lipids and same way compared with different variables. Almost 50% of our study population had moderate anemia (Hb% ranging from 8 to 10.9 g/dl), remaining 49 patients of which 35 were mild (Hb% of 11 to 12.9 g/dl) and only 14 patients of less than 8% (severe anemia). The mean hemoglobin concentration was 9.73±1.90 g/dl in our study. This is in sharp contrast to the study by Shirvani M et al.,[56] who observed mean hemoglobin of 14.17±1.08 g/dl in their study group in men and 12.02±1.11 g/dl in their study group in women. In our present study we have not studied separately the mean hemoglobin percentage in men and women. Also, they had control group in their study which we did not have in our study.

All 100 patients were subjected to fasting lipid estimation and the results observed were shown in table 11. Majority of our patients, 92 patients (92%) had total cholesterol of <200 mg%, 6 patients in 200 to 250 mg% (6%) and one each in more than 250 mg% and more than 300 mg% groups respectively with a mean cholesterol of 138.70±44.11. Again, LDL estimation revealed majority of our patients had less than 100 mg% (78 patients i.e., 78%), remaining 22 patients (22%) had LDL levels of more than 100 mg% with a mean of 75.17±36.48. Similarly, HDL estimation revealed majority of patients had levels below 40 mg%, 25 were in the group of 40 to 60 mg% and remaining 7 patients had more than 60 mg% with a mean of 36.81±16.53. Finally, triglyceride estimation revealed majority of the patients had less than 150 mg% with 70 patients (70%). Out of remaining 30 patients, 15 patients were in the group of 150 to 199 mg% and 15 patients in more than 200 mg% group with a mean of 130.0±70.85. A study by Antappanavar VB et al.,[55] is almost similar to our study who studied 100 patients and the results obtained of fasting lipids is almost similar to our study but for in their study they have done estimation of fasting lipids before

treatment of anemia and after treatment of anemia and observed significant reduction of triglyceride levels with treatment of anemia. Whereas we have done estimation at arrival to the hospital (pre-treatment lipid estimation). Another study by Chowta NK et al.[59] who has studied 200 patients out of which 50% were anemics and 50% controls. In their study they have also found lower levels of cholesterol, LDL, HDL and triglyceride in patients with anemia. When this group was compared to the control group, they found low levels of lipid in anemic patients when compared to healthy control group which was significant in their study. The probable explanation of low levels of lipids in patients with anemia could be hemodilution because of anemia to compensate for anemia, increased erythropoiesis could increase the cholesterol demand, may be because of activation of macrophage system and reticuloendothelial cells may contribute hypocholesterinemia in patients with anemia. It could be because of, as we all know liver is the main site of interaction of lipids and iron metabolism which is a common site of both these metabolic pathways (iron and lipid). Iron plays an important role in hepatic lipogenesis, iron being an important component of some enzymes and transporters in lipid metabolism and they exert a direct effect on hepatic lipid metabolism. Further the iron deficiency may influence transcriptional/post-transcriptional mechanisms which may interfere with lipid metabolism. Since iron acts as a cofactor which may also influence the kinetics/activity of enzymes in lipid metabolism.

All our patients the RBS was below 140 mg/dl, except for one patient with RBS of 136 mg/dl who was non diabetic. A study by Elhabbash M. et. al.,[65] who subjected their patients for fasting blood sugars estimation and all had normal fasting blood sugars in their study.

Similarly, we attempted to compare various factors with severity of anmeia and types of anemia. First, we compared the age of our patients with severity of anemia and found to have no positive correlation between age group of patients and severity of anemia. A study by Vetrivel S et. al.,[54] who found anemia more common in younger age group as compared to older groups in their study. The probable explanation for anemia in younger age group could be explained on the basis of worm infestation in younger age group, in female gender it can be due to menstrual blood loss during their active reproductive lives may be upto age of 40 to 50 years. Thereafter the attain menopause so the blood loss stop.

There was no significant correlation of anemia with gender in our study. In a study by Vetrivel S et. al.,[54] also found no difference in anemia with gender.

In our study of 100 patients, we had significant correlation between peripheral smear and severity of anemia (p value statistically significant). To best of our knowledge most of the authors have not compared peripheral smear with severity of anemia.

When habits were taken into account in our study, it did not have any influence on severity of anemia and types of anemia. Again, here we find difficulty in comparing the finding of our study with others. The reason being most of the studies did not compare habits with severity of anemia and types of anemia.

We found in our study all grades of anemia more common in vegetarian group as compared to non-vegetarian group except for mild anemia which was common in non-vegetarian group (18 in non-vegetarian group and 17 in vegetarian group). This is in sharp contrast to a study by Rammohan A et. al.,[66] who found significant anemia

(moderate to severe anemia) in their non-vegetarian group. Another study by Mahajani K et.al.,[67] observed anemia more common in vegetarian group than non-vegetarian group. Similarly, in another study by Dhanuka A et.al.,[68] who found iron with folic acid deficiency in their non-vegetarian group of patients. Probably this could be explained on the basis of non-vegetarian diet being poor source if iron and folic acid. Further it is extrapolated by this study, these group did not have vitamin B_{12} deficiency again because non-vegetarian diet being good source of vitamin B_{12}.

When we compared the diet of patients with peripheral smear (different tyopes of anemia) we found a significant correlation with all types of anemia with diet, specially, with vegetarian diet. However, there was no significant correlation with non-vegetarian diet and peripheral smear study. p value was statistically significant with peripheral smear study and vegetarian diet. A study by Qingxue dbpm et. al.,[69] who observed in their study a similar observation of macrocytic hypochromic anemia in patients with either vegetarian or pure vegan as compared to people with mixed diet (omnivorous diet). The reason in their study group for this observation can be due to excessive alcohol intake in their study population which ahs lead to macrocytosis. Another probable mechanism could be lack of essential nutrients in vegetarians and pure vegans.

We did not find any correlation between severity of anemia and fasting lipis (p value was insignificant), whereas Vetrivel S et. al.,[54] found correlation in their study for association between moderate to severe anemia and fasting lipids as have explained the probable mechanisms in the earlier paragraphs.

We used simple Karl Pearson's method for correlation of hemoglobin percentage and fasting lipids, there are positive correlation with different grades of

anemia (severity of anemia) with fasting lipids as depicted in table 19. To best of our knowledge most of the studies have not done this comparison to know whether or not the correlation between hemoglobin percentage and lipids exists (r value as shown in table 19).

Further to our knowledge severity of anemia with mean lipid profile did not have any correlation in our study. a study by Vetrivel S et. al.,[54] found a correlation exists between different grades of anemia (severity of anemia) with lipids (cholesterol, LDL, HDL and triglycerides). However, they did not find correlation of lipids with different types of anemia.

We observed a positive correlation with peripheral smear (all types) with lipids especially the total cholesterol. However, there was no correlation of peripheral smear with other fraction of cholesterol (LDL-c, HDL-c including triglycerides). This is in sharp contrast to study by Vetrivel S et. al.,[54] who did not find any correlation with peripheral smear with lipids.

Finally, we attempted to summarize all our variables numerically as depicted in table 23. Most of the authors have not done this.

In our present study of 100 patients, age ranged from 22 to 91 years. The number of male patients were slightly more. The commonest symptom of patients presenting was generalised weakness, easy fatiguability and some patients had overlapping of symptoms. Most of our patients, commonest physical sign was palor, koilonychia and pale bald tongue. Most of our patients had mild to moderate anemia (86 patients; Table 7) and severe anemia was observed in few (14 patients; Table 7). We observed different types of anemia in our study population. The commonest type

of anemia found was normocytic normochromic anemia followed by microcytic hypochromic anemia. The probable cause for normocytic normochromic anemia, we could not ascertain. As diabetes and other co-morbidities were exclusion criteria our study, the routine random blood sugar estimation was found to be normal in all our patiemts. In most of the studies by different authors, the female patients were more in number as compared to our study where we observed slight male preponderance. Most of the studies found correlation with lipids and iron deficiency. In our study different types of anemia was observed which did not have any correlation. Some authors have included co-morbidities (hypertension, diabetes) where as we have excluded these co-morbidities. They found there exists a correlation between lipids and anemia in their study. pure vegetarians in our study group had positive correlation with types of anemia. Some authors have found similar findings in their study too. Most of the studies revealed lower lipid levels with anemia however we did not find lower lipid levels except for total cholesterol which was lower in our study group. We feel its worth taking different variables like age, sex, severity of anemia, types of anemia, diet and habits to see whether there is an influence of these factors on lipid levels. In our small study of 100 patients we did not follow up our patients to see the effect of treatment of anemia om lipids. Some authors found tha the treatment of anemia influenced the lipid levels.

CONCLUSION

In our present study of 100 anemic patients, we observed insignificant correlation with various factors. Prominent features of our study are mentioned as follows

- Among the patients who presented with anemia, majority of our patients were in age group of 41 to 60 years and 61 to 80 years.
- Age did not have an influence on lipid levels.
- Sex of the patients did not influence the lipid levels.
- Males were slightly more in number compared to females in our study.
- The commonest clinical symptoms were generalised weakness, easy fatigability, dizziness and some had overlapping symptoms.
- The most common physical sign noted were pallor, koilonychia, pale bald tongue.
- Majority of our patients were mild to moderately anemic and few were severely anemic.
- We observed low levels of total cholesterol in our anemic patients.
- We had different types of anemia, the commonest being normocytic normochromic anemia.
- We found diet had influence on peripheral smear in our study (vegetarian diet).

  We feel that it is worthwhile to take large sample size with confounding factors like age, sex, habits, treatment of anemia to see whether there is a true correlation between these variables and anemia inter effect on the lipids.

SUMMARY

In the present study of 100 anemic patients, admitted in the Department of General Medicine of KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi, with the study period extending from January 2019 to December 2019 was conducted to know whether severity of anemia or types of anemia has any influence of these various variables like age, sex, diet, habits on lipid levels.

The results observed were all inconclusive except for anemia except for anemia which was observed in vegetarian diet groups and slightly lower levels of total cholesterol in anemic patients. So we feel, with a large sample size these issues have to be addressed, comparing different grades of anemia, types of anemia on lipid levels. We also feel that there is necessary to follow up the patients with treatment of anemia patients and its effect on lipid levels. We did not find any positive correlation with variables like age, sex, habits, types of anemia and severity of anemia.

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ANNEXURE I – CONSENT FORM

Dear Mr./Mrs./Dr. _____, you are kindly requested to enroll yourself in a research study tilted, "Correlation Of Serum Lipid Profile In Patients With Anemia - A One Year Cross Sectional Study In KLE's Dr. Prabhakar Kore Hospital & MRC "being conducted by _____, a post graduate student in M.D. General Medicine and the study will be carried out under the direct supervision and guidance of _____, Professor and Unit Chief, Department of General Medicine, Jawaharlal Nehru Medical College, Belgaum.

You have been requested to participate in this as you fit into the laid out criteria for a study 'subject'/ participant.

Your participation in study is voluntary. During the study you will be undergoing few routine blood investigations. Your decision whether or not to participate in the study will not affect your treatment in any form. If you decide to participate you are free to withdraw at any time.

TITLE OF THE STUDY:"Correlation Of Serum Lipid Profile In Patients With Anemia - A One Year Cross Sectional Study In KLE's Dr. Prabhakar Kore Hospital & MRC"

PURPOSE OF THE STUDY: To study the correlation between the severity of anaemia and the derangement of lipid profile levels in an adult anemic population

PROCEDURES INVOLVED: If you agree to enroll yourself in my study, you will be clinically examined in detail and investigated for the below said investigations accordingly.

1) CBC
2) Peripheral smear for morphology
3) Random blood sugar
4) Serum creatinine
5) Liver function tests
6) Fasting lipid profile

RISKS AND BENEFITS: There are no potential risks involved in this study.

Benefits of taking part in this research:

- To establish a proven relationship between anemia and serum lipid profile levels.

VOLUNTARY PARTICIPATION / WITHDRAWAL FROM THE STUDY: Taking part in the study is voluntary. You may choose not to enroll yourself in this study and may choose to leave the study anytime in between.

ALTERNATIVES: Your decision regarding participation in study will not change present or future health care services offered to you at KLES Dr.

Prabhakar Kore Hospital and Medical Research Centre, Belgaum. You would simply be excluded from the study if you wish to, and all your details shall be kept confidential and you will get the routine line of management.

PRIVACY AND CONFIDENTIALITY: All data collected or disclosed by you during the course of participation of study, will be kept fully confidential. If however during the course it becomes necessary for the progress of the course to disclose the identity, it would be done so only after your informed & written consent.

The only people to know that you are a research subject are members of the research team. No information about you will be disclosed to other without your written permission except:

- In emergency to protect your rights AND welfare.
- If required by law.

AUTHORIZATION TO PUBLISH RESULT: The results of the study may be used to publish an article.When the results of research published or discussed, in a conference, no information will be displayed that would disclose your identity. Any information obtained in connection with this study and that can be identified with you will remain confidential.

FINANCIAL INCENTIVES FOR PARTICIPATION: No additional costs shall be incurred upon you for the purpose of this study.

It is purely being done with the idea of research and all the cost of

study will be borne by the investigator.

COMPENSATION:

In the event that you become injured as a result of taking part in this study, treatment will be offered to you at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum, or you will be given information about where to receive medical care. However, no reimbursement, compensation or free medical care will be given.

QUESTIONS/CONTACT DETAILS:

You shall be free to contact the below mentioned name & addresses anytime during the study period for any clarification or help as you may desire for.

In case of the queries during study or in future you may contact following persons,

1. Dr.Roopa M Bellad, Chairman,
J.N.M.C Ethical Committee for
Human Research
9448113403

CONSENT FORM

I voluntarily agree to take part in this study by signing below. I may withdraw at any time. I am not giving up any of my legal rights by signing this form. My signature below indicates that I have read this consent form, or it has been read to me, this consent form and have had all the questions answered

Signature / Left Thumb print of the Participant or legally authorized representative

Participant's name :……...

Signature / Left thumb impression:……...

of the participant

Name of the legally authorized :……...

representative / guardian

Signature / Left thumb impression :……...

Witness' name :……...

Signature / Left thumb impression :……...

Investigator's name and signature :……...

Date:

Place:

ANNEXURE-II

PROFORMA

"Correlation Of Serum Lipid Profile In Patients With Anemia - A One Year Cross Sectional Study In KLE's Dr.PrabhakarKore Hospital & MRC"

PROFORMA

CASE NO	
NAME	
IP NO	
AGE	**YEARS**
SEX	**MALE FEMALE**
ADDRESS	
OCCUPATION	

Complaints at presentation	
Past history	
Family history	
Personal history	
Treatment history	

Vitals	
Temperature	
Pulse	
Respiratory rate	
Blood pressure	

Clinical Symptoms		**Clinical Signs**	
Generalised Weakness		**Pallor**	
Easy Fatigability		**Koilonychia**	
Dizziness		**Bald tongue**	
Blood Loss			

INVESTIGATIONS:

Hemoglobin		**Serum Creatinine**		**Cholesterol**	
Total Count		**Total Bilirubin**		**LDL**	
Neutrophils		**Direct Bilirubin**		**HDL**	
Lymphocytes		**Total Protein**		**Triglycerides**	
Eosinophils		**Albumin**		**Peripheral Smear**	
Monocytes		**A/G ratio**		1. **Dimorphic anemia** 2. **Macrocytic anemia** 3. **Microcytic hypochromic anemia** 4. **Normocytic Hypochromic anemia** 5. **Normocytic normochromic anemia**	
Basophils		**SGOT**			
ESR		**SGPT**			
RBS		**ALP**			

ANNEXURE-III-ETHICAL CLEARANCE LETTER

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed – to- be- University)
Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI)
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
Website: http//www.jnmc.edu
E-Mail : dome@jnmc.edu
Phone: (+91-(0)831 Office : 2472550
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ \ ** **Date: 24/11/2018

To.

REG NO. BG0118012

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"CORRELATION OF SERUM LIPID PROFILE IN PATIENT WITH ANEMIA – A ONE YEAR CROSS SECTIONAL STUDY IN KLE'S DR. PRABHAKAR KORE HOSPITAL & MRC",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Arathi Darshan)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Roopa M Bellad)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

ANNEXURES IV - MASTER CHART

	NAME	IP NUMBER	OPD NUMBER	AGE	SEX	ALCOHOL	TOBACCO	DIET	Clinical Presentation				Clinical Signs			HEMOGLOBIN	TOTAL WBC COUNT	NEUTROPHILS	LYMPHOCYTES	EOSINOPHILS	MONOCYTES	BASOPHILS	ESR	RBS	S.Creatinine	TOT BIL	DIR BIL	TOT PROT	ALBUMIN	AG RATIO	SGOT	SGPT	ALP	CHOLESTROL	LDL	HDL	TG	PS STUDY
									Generalised Weakness	Easy Fatigability	Dizziness	Blood Loss	Pallor	Koilonychia	Bald Tongue																								
1	HOUSABAI	973298	4609720	67	F	N	N	NV	Yes	Yes	No	No	Yes	Yes	No	5.7	8.6	59	23	10	8	0	98	98	0.61	0.18	0.05	6.7	3.5	1.1	11	10	95	189	105	61	161	MICROCYTIC HYPOCHROMIC ANEMIA
2	REBECCA MANI	972678	3697985	52	F	N	Y	NV	Yes	Yes	Yes	No	Yes	Yes	Yes	5.4	5.3	73	20	2	5	0	30	110	1.11	0.51	0.16	6.5	3	2.1	11	10	95	104	47	47	49	NORMOCYTIC HYPOCHROMIC ANEMIA
3	DHAREPPA	973909	5437213	54	M	Y	Y	NV	No	No	Yes	No	No	No	No	11.6	2.7	52	37	5	5	1	69	98	0.8	0.98	0.25	5.2	2.8	1.2	217	64	101	79	26	18	173	NORMOCYTIC NORMOCHROMIC ANEMIA
4	KAVERI	973605	5435346	37	F	N	N	NV	Yes	No	No	No	Yes	No	No	11.7	7.3	55	34	5	6	0	49	108	0.6	0.22	0.1	6.2	3.8	1.6	16	15	73	134	65	51	92	NORMOCYTIC NORMOCHROMIC ANEMIA
5	BASAPPA	973440	5433960	78	M	N	N	NV	Yes	Yes	Yes	No	Yes	Yes	Yes	10	7.3	86	7	7	0	0	89	113	1.11	0.68	0.41	6.2	2.2	0.6	33	13	65	80	41	14	126	DIMORPHIC ANEMIA
6	NARMADA	973434	5433955	85	F	N	N	V	Yes	No	No	No	Yes	No	Yes	8	11.9	87	7	2	4	0	52	121	0.81	0.34	0.05	7.1	3.8	1.2	34	21	143	137	74	32	156	MICROCYTIC HYPOCHROMIC ANEMIA
7	MARUTI DESAI	972048	5425409	54	M	Y	Y	V	Yes	Yes	No	Yes	Yes	Yes	Yes	8.2	6	80	11	1	8	0	120	99	1.29	0.8	0.4	5	2.7	1.2	48	14	161	82	44	20	90	DIMORPHIC ANEMIA
8	MADHUKAR HONGEKAR	973200	5432268	54	M	Y	Y	V	Yes	Yes	No	No	No	No	No	9.8	6.2	58	31	1	10	0	66	108	0.83	1.27	0.5	5.7	3.1	1.2	39	21	53	97	57	26	70	DIMORPHIC ANEMIA
9	MAHADEV TELI	973777	4997993	65	M	Y	N	NV	Yes	Yes	No	No	Yes	No	Yes	9.6	8.1	70	23	2	5	0	33	100	1.11	0.23	0.1	4	1.2	0.4	49	33	142	65	37	17	54	NORMOCYTIC NORMOCHROMIC ANEMIA
10	NAGESH SALUNKE	973637	4867570	53	M	Y	Y	V	Yes	Yes	No	No	Yes	Yes	Yes	10.8	5.9	70	20	2	8	0	105	121	0.76	1	0.5	5.5	2.5	0.8	29	32	147	50	28	14	40	DIMORPHIC ANEMIA
11	VIJAYA LAKSHMI	973093	5432110	71	F	N	Y	V	No	No	No	No	No	No	No	11.5	5.4	75	16	1	8	0	48	104	0.63	0.64	0.22	5.4	3.3	1.6	34	27	57	155	78	46	155	MICROCYTIC HYPOCHROMIC ANEMIA
12	SHARAD RAUL	973473	5433991	56	M	N	N	NV	Yes	Yes	Yes	No	Yes	No	No	10.6	7.4	83	15	0	2	0	38	108	1.03	0.64	0.2	7.2	4.3	1.5	90	29	49	135	101	57	58	DIMORPHIC ANEMIA
13	SHOBHA SHINDE	974350	4548619	47	F	N	Y	V	No	No	No	No	Yes	Yes	No	10.2	7.2	56	37	1	6	0	66	102	0.53	0.29	0.11	7.2	4.1	1.3	10	12	99	127	78	36	80	NORMOCYTIC HYPOCHROMIC ANEMIA
14	MALLAPPA MIRAJE	974738	5375260	80	M	N	N	NV	No	No	No	No	No	No	No	11.4	7.4	82	12	0	6	0	56	108	1.27	0.54	0.15	5.5	3.1	1.3	27	45	105	106	56	26	121	NORMOCYTIC HYPOCHROMIC ANEMIA
15	SAROJANI RAMESH	990503	5542578	38	F	N	N	NV	Yes	Yes	Yes	No	Yes	Yes	No	10.9	11.2	86	10	0	4	0	55	63	0.5	0.24	0.01	6.1	3.2	1.1	16	10	184	204	121	56	135	MICROCYTIC HYPOCHROMIC ANEMIA
16	KAMALA	978055	5293068	62	F	N	N	NV	Yes	No	No	No	Yes	No	No	11.4	6.4	79	17	0	4	0	39	98	0.63	0.45	0.05	6.8	4.2	1.6	20	14	85	191	121	48	110	NORMOCYTIC NORMOCHROMIC ANEMIA
17	VIJAYADEVI	978558	3444819	72	F	N	N	NV	No	No	Yes	No	Yes	No	Yes	8.6	5.9	45	46	1	8	0	105	104	0.85	0.63	0.1	6	3.1	1.1	11	16	65	173	98	25	110	MACROCYTIC ANEMIA
18	SHANTAMMA	978671	3405105	38	F	N	N	NV	Yes	Yes	Yes	No	Yes	Yes	No	9.6	10.2	85	14	0	1	0	48	97	0.66	0.3	0.11	7.5	3.8	1	15	17	133	210	146	52	60	MICROCYTIC HYPOCHROMIC ANEMIA
19	RAMASIDAPPA	978544	1168720	54	M	Y	Y	NV	Yes	Yes	Yes	No	Yes	No	No	10.1	6.2	50	36	4	10	0	55	95	0.82	0.25	0.11	6.9	4	1.4	27	25	78	140	86	41	66	MICROCYTIC HYPOCHROMIC ANEMIA
20	VIJAY	978949	5466986	35	M	Y	Y	NV	Yes	No	No	No	No	No	No	8.9	7	56	28	6	10	0	40	126	0.92	0.84	0.22	7.2	3.7	1.1	13	17	89	97	48	21	138	MICROCYTIC HYPOCHROMIC ANEMIA
21	SHRIPAL	978474	5419346	62	M	Y	Y	V	No	Yes	No	No	No	No	No	5.4	10.2	81	15	0	4	0	35	107	0.94	0.28	0.16	5.4	3.4	1.7	12	12	50	101	53	23	123	NORMOCYTIC HYPOCHROMIC ANEMIA
22	DAWAL BEE	978691	5415949	55	F	N	N	NV	No	No	No	No	No	No	No	10.5	12.1	86	11	0	3	0	40	98	0.63	0.44	0.23	5.5	3.2	1.4	30	31	82	107	50	46	55	NORMOCYTIC NORMOCHROMIC ANEMIA
23	SHOBHA	979094	5468134	46	F	N	N	NV	Yes	Yes	No	No	Yes	Yes	No	11	6.6	60	30	3	7	0	24	104	0.63	0.7	0.1	8.2	4.5	1.2	14	10	42	118	57	73	28	NORMOCYTIC NORMOCHROMIC ANEMIA
24	LAXMI	979321	3102764	25	F	N	N	V	Yes	No	Yes	No	Yes	Yes	Yes	8.6	7.2	66	29	0	5	0	56	97	0.55	0.45	0.08	8	4.1	1.1	16	6	60	127	68	31	142	MICROCYTIC HYPOCHROMIC ANEMIA
25	MAHANANDA	979142	4934222	33	M	Y	N	NV	No	No	No	No	Yes	No	No	8	7.6	65	30	0	4	1	38	99	0.57	0.3	0.1	8	3.8	0.9	15	11	129	185	119	46	100	NORMOCYTIC HYPOCHROMIC ANEMIA
26	BHUJANG	979727	5472885	47	M	N	N	NV	Yes	Yes	Yes	Yes	Yes	Yes	No	6.3	9.6	81	13	1	5	0	43	102	1.2	0.96	0.37	4.2	2	0.9	20	16	68	158	105	22	155	NORMOCYTIC NORMOCHROMIC ANEMIA
27	MAHAVEER SHARMA	979930	5474400	50	M	Y	N	V	Yes	No	No	No	Yes	No	No	10.1	7.8	70	19	1	10	0	44	106	0.72	1.4	0.8	6.2	2.4	0.6	40	35	191	78	47	16	74	NORMOCYTIC NORMOCHROMIC ANEMIA
28	SHIVANAND	980155	5474090	25	M	N	N	V	Yes	No	No	No	No	No	No	10.6	5	57	34	3	6	0	28	110	0.9	1.12	0.3	7.1	4.7	2	17	20	97	185	120	37	141	NORMOCYTIC NORMOCHROMIC ANEMIA
29	RAYAGOUDA	991983	5553665	50	M	N	N	V	Yes	Yes	No	No	No	No	No	11.3	7.6	59	32	3	6	0	28	106	1.19	0.48	0.8	7.5	4.3	1.3	22	16	66	183	107	34	211	NORMOCYTIC NORMOCHROMIC ANEMIA
30	LAZAR MADHI VANAN	991599	5551007	31	M	N	N	NV	Yes	Yes	Yes	Yes	Yes	No	No	10.3	7.6	72	20	2	6	0	28	104	0.62	1.9	0.79	6.2	3.8	6.2	3.8	1.6	65	173	124	31	92	MACROCYTIC ANEMIA
31	HUSSAIN BEE PEERSAB	991466	5549542	67	F	N	N	NV	No	No	No	No	No	No	No	11	9.9	89	5	0	6	0	30	100	0.94	0.15	0.07	6.5	3.6	1.2	16	18	77	198	84	86	140	NORMOCYTIC NORMOCHROMIC ANEMIA
32	MAHADEVI MADAR	992215	5129699	44	F	N	N	NV	Yes	Yes	No	No	Yes	No	No	11.5	6	82	13	1	4	0	38	98	1.4	0.24	0.1	6.5	2.3	0.5	41	11	101	153	79	17	285	NORMOCYTIC NORMOCHROMIC ANEMIA
33	KASTURI MAVINKATTI	992092	5554227	47	F	N	N	V	Yes	Yes	Yes	No	Yes	Yes	Yes	11.7	3.9	62	31	1	6	0	40	112	0.59	0.55	0.1	8	4.5	1.3	27	21	73	207	141	57	45	NORMOCYTIC HYPOCHROMIC ANEMIA
34	VEERABHADRA HALLIJOL	992083	868801	62	M	Y	Y	V	Yes	Yes	No	No	Yes	No	Yes	10	6.6	88	10	0	2	0	39	98	1.07	0.62	0.17	6.6	4.3	1.9	16	13	127	182	123	34	126	NORMOCYTIC NORMOCHROMIC ANEMIA
35	BASAPPA HALLADAVAR	992223	5555713	56	M	Y	Y	V	No	No	No	No	No	No	No	11.8	6.2	68	22	4	6	0	40	105	1.4	0.44	0.1	7.2	4.1	1.3	15	14	126	165	87	36	209	NORMOCYTIC NORMOCHROMIC ANEMIA
36	EARANNA MATAMARI	973035	5430926	71	M	N	N	V	Yes	Yes	No	No	Yes	Yes	No	8.7	13.5	85	6	1	8	0	38	98	0.83	0.62	0.17	6.5	2.3	0.5	40	29	101	151	67	37	98	NORMOCYTIC HYPOCHROMIC ANEMIA
37	RAJIYA PANHALI	972758	2921012	40	F	N	N	V	Yes	No	No	No	No	No	No	6.9	9.5	59	33	4	4	0	26	103	0.67	1.1	0.8	6.6	4.3	1.3	27	21	75	165	78	54	89	MICROCYTIC HYPOCHROMIC ANEMIA
38	HANUMANTAPPA KURI	970833	5418171	66	M	N	N	V	No	Yes	No	No	Yes	No	No	3.8	5.4	64	21	13	2	0	25	98	0.84	0.87	0.33	6.5	3.8	1.4	18	13	84	160	76	58	90	MICROCYTIC HYPOCHROMIC ANEMIA
39	SUSHILA BATAKURKI	970868	35244676	69	F	N	Y	V	No	No	No	No	Yes	No	No	7	7.21	82	14	0	4	0	68	101	0.7	0.5	0.2	5.9	3.2	1.1	19	9	156	152	80	34	89	MICROCYTIC HYPOCHROMIC ANEMIA
40	MANOHAR SANKESHWARI	990969	2926927	69	M	N	N	NV	Yes	Yes	Yes	No	Yes	No	No	5.8	5.9	85	13	1	1	0	48	106	1.01	0.71	0.22	6.4	4.2	1.9	68	49	37	119	68	27	121	MACROCYTIC ANEMIA
41	SUMAN SONAJI	940226	3545423	69	M	Y	Y	V	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9.5	10.3	77	18	0	5	0	61	98	0.69	0.56	0.18	5.9	3.3	1.3	11	12	71	151	103	25	113	NORMOCYTIC HYPOCHROMIC ANEMIA
42	BASANGOUDA HADIMANI	989970	4635417	65	M	Y	Y	V	Yes	No	No	No	No	No	No	9.6	6.5	54	35	10	1	0	89	107	1.19	1.17	0.35	5.8	3	1.1	34	14	74	87	38	38	57	NORMOCYTIC HYPOCHROMIC ANEMIA
43	NINGAPPA TULAJI	990365	5055740	42	M	N	N	V	Yes	No	No	No	Yes	No	Yes	11.5	6.5	75	19	1	5	0	36	90	1.04	1	0.65	7.6	4.2	1.2	25	9	58	96	50	23	116	NORMOCYTIC HYPOCHROMIC ANEMIA
44	SHIVAJI CHAVAN	987622	4503084	68	M	N	N	NV	Yes	Yes	Yes	No	Yes	Yes	No	8.6	12.4	73	23	1	3	0	44	109	0.83	0.86	0.51	6	2.3	0.6	35	24	198	91	33	20	190	NORMOCYTIC HYPOCHROMIC ANEMIA
45	BASAVVA INCHAL	993971	5567994	42	F	N	N	NV	Yes	No	No	No	No	No	No	10.4	10.9	68	23	3	6	0	45	99	0.6	0.35	0.1	7	3.8	1.2	11	12	96	147	93	25	97	NORMOCYTIC HYPOCHROMIC ANEMIA
46	SANJAY NEGINHAL	992714	1011673	41	M	Y	Y	V	Yes	Yes	No	No	Yes	Yes	Yes	6.5	4.9	43	50	2	5	0	119	111	0.9	2.2	1.1	7.1	3.8	1.2	53	17	65	140	80	38	99	DIMORPHIC ANEMIA
47	IRAWWA NAIK	992515	4013100	51	F	N	Y	NV	Yes	Yes	Yes	Yes	Yes	No	Yes	9.4	6.4	64	29	1	6	0	56	116	0.54	0.23	0.03	6.5	3.6	1.2	15	11	38	109	63	35	50	NORMOCYTIC HYPOCHROMIC ANEMIA

48	DEEPA RAGHOCHE	991325	5549171	39	F	N	N	NV	Yes	No	No	No	Yes	No	No	11.6	3.9	86	10	0	4	0	63	99	0.8	1.24	0.72	6.6	3.2	0.9	60	38	480	121	63	36	97	MACROCYTIC ANEMIA
49	DHANESH PILLAI	924658	4267092	22	M	N	N	NV	Yes	Yes	No	No	Yes	No	No	11.3	9.8	55	27	8	10	0	28	109	0.89	1.27	0.39	7.5	4.5	1.5	32	44	70	160	105	37	90	MICROCYTIC HYPOCHROMIC ANEMIA
50	GUNDU GAWADE	919481	5077444	48	M	Y	N	NV	Yes	Yes	Yes	No	Yes	Yes	No	10.4	10.3	60	33	0	7	0	59	98	1.3	0.72	0.19	5.6	3.2	1.3	23	13	53	140	76	21	217	MICROCYTIC HYPOCHROMIC ANEMIA
51	MADHURI BADMANGI	952464	5293929	45	F	N	N	V	Yes	Yes	No	No	Yes	Yes	No	11.1	14.7	71	18	1	10	0	28	98	0.87	0.83	0.24	6.9	4	1.4	15	12	58	176	114	30	162	NORMOCYTIC HYPOCHROMIC ANEMIA
52	KALLAPPA GUDAGERI	985237	4411419	54	M	N	N	NV	Yes	No	Yes	No	Yes	No	No	10.6	5.6	53	42	2	3	0	98	109	0.79	1	0.75	6.8	4.5	2	36	34	68	93	34	18	205	MACROCYTIC ANEMIA
53	ANIL KUMAR CHANDRASHEKAR	1005323	5651128	37	M	N	N	NV	Yes	Yes	No	No	Yes	No	Yes	11	12.9	70	24	0	6	0	36	90	0.67	0.47	0.13	8.3	4.9	1.4	19	60	236	164	85	31	330	NORMOCYTIC NORMOCHROMIC ANEMIA
54	SANJEEV WALIKAR	1006402	5659454	26	M	Y	Y	V	No	No	No	No	No	No	Yes	10.9	4.3	62	28	0	10	0	20	109	1.06	1.4	0.45	6.9	4.1	1.5	33	29	81	106	44	29	164	NORMOCYTIC NORMOCHROMIC ANEMIA
55	NEELAVATI TOTAGI	1007285	5666445	65	F	N	Y	V	Yes	Yes	No	No	No	No	Yes	11.6	4.9	48	43	0	9	0	63	98	0.81	0.3	0.11	6.7	3.7	1.2	27	23	34	133	71	28	168	NORMOCYTIC NORMOCHROMIC ANEMIA
56	MAHADEV KHOT	1007700	5669641	65	M	N	N	NV	Yes	Yes	No	No	Yes	No	No	11.1	13.5	85	6	1	8	0	15	116	0.76	0.65	0.23	8.4	4	0.9	19	16	78	145	94	31	102	NORMOCYTIC HYPOCHROMIC ANEMIA
57	RAJU AGARWAL	1005238	5650642	45	M	N	N	V	Yes	Yes	Yes	No	Yes	No	Yes	10.2	10.6	72	19	2	7	0	40	108	0.92	0.55	0.26	6.9	4.5	1.9	17	17	78	141	61	72	39	NORMOCYTIC NORMOCHROMIC ANEMIA
58	SUSHILA PAMMAR	1003904	5641155	63	F	N	N	V	Yes	Yes	No	No	Yes	Yes	No	8.5	12.8	72	19	2	7	0	56	98	1.3	0.72	0.19	5.6	3.2	1.3	23	13	53	140	76	21	217	MICROCYTIC HYPOCHROMIC ANEMIA
59	SANJEEV KALE	970855	5078813	40	M	Y	Y	NV	Yes	No	No	No	No	No	No	3.3	4.2	59	33	1	7	0	120	98	0.83	0.17	0.03	5.9	3.7	1.7	12	13	82	122	58	28	178	DIMORPHIC ANEMIA
60	BHIMAPPA DABBANAVAR	988908	5475820	58	M	Y	Y	V	No	No	No	No	No	No	No	11.2	13.8	65	20	6	9	0	20	120	0.68	0.72	0.24	6.5	3.4	1.1	15	14	110	115	57	40	90	NORMOCYTIC NORMOCHROMIC ANEMIA
61	PARASHURAM SALUNKE	991178	5547664	40	M	Y	Y	V	Yes	Yes	No	Yes	Yes	Yes	No	8.1	16.8	85	11	2	2	0	27	116	0.99	1.3	0.39	7.3	4.3	1.4	25	17	100	146	87	45	68	MICROCYTIC HYPOCHROMIC ANEMIA
62	VILASMATI HALLUR	991056	5547386	55	F	N	Y	NV	Yes	Yes	Yes	No	Yes	No	Yes	10.4	10.3	60	33	0	7	0	59	108	1.6	1.8	0.93	5.9	3	1	46	40	385	127	58	16	264	MICROCYTIC HYPOCHROMIC ANEMIA
63	IMAM HUSSAIN SANADI	990737	5530203	51	M	Y	Y	NV	Yes	Yes	No	No	No	No	No	11.6	7.1	56	34	3	7	0	16	98	0.91	0.65	0.2	7.7	4.7	1.6	34	32	65	116	56	38	108	NORMOCYTIC NORMOCHROMIC ANEMIA
64	USMANSAB BHAVIKATTI	990474	5542552	61	M	N	N	V	Yes	Yes	No	No	Yes	No	No	8.7	14.1	89	7	0	4	0	95	108	1.38	0.6	0.2	7	3	1.3	34	32	89	131	71	42	89	NORMOCYTIC NORMOCHROMIC ANEMIA
65	HANJABAI VARDARIYA	988901	5250622	72	F	N	N	V	Yes	Yes	Yes	No	Yes	Yes	Yes	7.6	19	90	6	0	4	0	23	102	1	0.85	0.38	6.3	3.9	1.6	14	12	55	103	53	26	122	NORMOCYTIC NORMOCHROMIC ANEMIA
66	DHARMARAO GOURGONDA	989747	5537216	78	M	N	N	NV	Yes	Yes	No	Yes	Yes	No	Yes	8.8	13.1	87	6	1	6	0	95	110	1.02	2.96	1.75	5.7	2.3	0.7	120	56	105	99	48	31	101	DIMORPHIC ANEMIA
67	VILAS NASHI	989595	4410142	57	M	N	N	NV	Yes	No	No	No	No	No	No	7.1	7.9	63	29	2	6	0	35	121	0.88	0.3	0.1	6.3	3.8	1.5	19	18	68	80	32	27	107	MICROCYTIC HYPOCHROMIC ANEMIA
68	SHOBHA CHINDAK	985803	5508572	57	F	N	N	NV	No	No	No	No	No	No	No	11.9	7.8	53	35	6	6	0	53	106	0.49	0.62	0.17	7.5	4.4	1.4	13	15	92	125	46	27	262	NORMOCYTIC NORMOCHROMIC ANEMIA
69	TEJPALSINGH RAJPUROHIT	979753	5389668	44	M	Y	N	V	No	No	Yes	Yes	Yes	No	Yes	9.5	4.1	68	24	2	6	0	38	100	0.71	0.59	0.21	4.3	2.5	1.4	16	11	42	139	54	29	109	DIMORPHIC ANEMIA
70	KALLAVATTI HONDAPPANAVAR	943127	5235020	22	F	N	N	V	No	No	No	No	No	No	No	10.5	9.4	85	5	0	10	0	57	106	0.46	0.25	0.1	6.3	3.6	1.3	16	13	44	135	56	55	121	MICROCYTIC HYPOCHROMIC ANEMIA
71	PANDURANG GURAV	992097	766332	74	M	N	N	NV	Yes	Yes	Yes	No	Yes	Yes	Yes	10	16	78	17	0	5	0	20	110	1.3	1.08	0.22	7.5	4.4	1.4	24	22	65	146	73	46	133	NORMOCYTIC HYPOCHROMIC ANEMIA
72	SIDDAPPA KAMATGI	991613	5380531	53	M	Y	Y	V	Yes	Yes	No	No	Yes	Yes	No	11.3	4.8	57	31	3	9	0	26	119	0.83	1.4	0.37	6.9	4.2	1.6	34	50	43	178	111	35	162	NORMOCYTIC NORMOCHROMIC ANEMIA
73	RATNAPPA KHATEDAR	991780	912253	67	M	N	N	V	Yes	Yes	No	No	Yes	No	No	12.2	19.4	83	9	0	8	0	61	100	0.87	0.53	0.12	6.7	3.9	1.4	33	28	101	154	56	77	107	NORMOCYTIC NORMOCHROMIC ANEMIA
74	SHANKARRAO GIDAGAR	988300	5526698	83	M	Y	Y	NV	Yes	No	No	No	Yes	No	No	7.2	19	93	4	0	3	0	69	109	1.14	0.44	0.16	7.2	3.8	1.1	44	13	97	164	85	64	74	MICROCYTIC HYPOCHROMIC ANEMIA
75	VIRUPAXAPPA JIGAJINNI	991346	5549275	81	M	N	N	V	Yes	Yes	Yes	No	Yes	No	No	11.9	7.6	66	23	7	4	0	69	98	1.3	0.29	0.1	6.1	3.5	1.3	10	7	76	101	41	49	54	NORMOCYTIC NORMOCHROMIC ANEMIA
76	CHANDRAHAS DESHPANDE	991683	5027151	73	M	N	N	V	Yes	Yes	No	No	Yes	Yes	Yes	11.7	11.2	74	10	10	6	0	67	96	1.47	0.53	0.18	7	4	1.3	19	10	72	161	100	35	128	NORMOCYTIC NORMOCHROMIC ANEMIA
77	SHEKHARGOUDA SANAGOUDAR	991081	5537215	52	M	Y	N	NV	Yes	Yes	No	No	Yes	Yes	Yes	11.2	7.5	63	25	2	10	0	16	130	0.95	1.24	0.29	7.2	4.5	1.7	18	26	90	149	110	14	123	NORMOCYTIC NORMOCHROMIC ANEMIA
78	MAHESH RUDREGOUDA	991720	5551460	45	M	Y	Y	NV	Yes	No	No	No	Yes	No	No	11.1	7.8	46	36	11	7	0	45	111	0.66	1.3	0.39	7.2	4.3	1.5	22	24	95	151	54	33	130	NORMOCYTIC NORMOCHROMIC ANEMIA
79	ABDUL AZIZ CHONCHE	979618	5471459	75	M	Y	Y	V	No	No	No	No	No	No	No	10.8	5.7	68	22	2	8	0	48	98	1.4	1.27	0.53	8.1	4.3	1.1	25	16	116	147	28	107	60	NORMOCYTIC NORMOCHROMIC ANEMIA
80	GANGAPPASHETR DANDIGANAHALLI	991521	5549562	69	M	N	N	V	No	No	Yes	No	Yes	No	No	9	8.7	58	32	2	8	0	46	97	0.98	0.55	0.1	6	3.7	1.6	20	11	57	219	145	30	220	NORMOCYTIC NORMOCHROMIC ANEMIA
81	SAROJANI JAKKAPPANAVAR	1004293	5542578	38	F	N	N	V	Yes	Yes	No	No	Yes	No	No	8.2	6	80	11	1	8	0	120	126	0.61	0.2	0.1	6.9	4.2	1.6	23	15	48	139	78	29	160	MICROCYTIC HYPOCHROMIC ANEMIA
82	SHANKAR HADAGINAHAL	982882	5490367	57	M	N	N	NV	Yes	Yes	Yes	No	Yes	No	Yes	11.6	11.7	71	18	3	8	0	48	98	1.15	0.8	0.1	8	4.5	1.3	17	19	89	278	225	45	149	NORMOCYTIC NORMOCHROMIC ANEMIA
83	APPANNA PATIL	992383	4971133	91	M	Y	Y	V	Yes	Yes	No	No	Yes	Yes	No	11	14.9	91	4	0	5	0	28	99	1.3	1.2	0.8	6.4	3.3	1.1	38	18	64	76	34	21	107	NORMOCYTIC NORMOCHROMIC ANEMIA
84	VINAYAK BANDAGE	991915	1406154	37	M	Y	N	V	Yes	Yes	Yes	No	Yes	No	No	7.1	3.3	75	15	0	10	0	70	98	0.86	1.1	0.69	7.5	3.5	1.1	40	39	104	73	43	17	63	DIMORPHIC ANEMIA
85	JAHARABI HASANWALE	992679	5558044	65	F	N	N	NV	No	No	No	No	No	No	No	11	9.4	54	37	0	9	0	75	95	1.41	0.3	0.1	7.3	3.9	1.1	15	13	54	205	82	30	464	NORMOCYTIC NORMOCHROMIC ANEMIA
86	KRISHNABAI KUSHAPPANAVAR	992634	5558044	60	F	N	N	V	Yes	Yes	No	No	Yes	Yes	Yes	11.1	8.7	45	48	1	6	0	51	82	0.65	0.3	0.1	5.9	3.6	1.6	12	10	52	172	85	52	176	NORMOCYTIC NORMOCHROMIC ANEMIA
87	RAYAGOUDA KELAGINAMANI	991983	5553665	50	M	N	N	NV	Yes	Yes	No	No	Yes	No	No	9.8	7.6	59	32	3	6	0	20	78	1.09	0.48	0.08	7.5	4.3	1.3	22	16	66	183	107	34	211	NORMOCYTIC HYPOCHROMIC ANEMIA
88	PAWADI PATTANASHETTI	990242	5540358	55	F	N	N	V	Yes	Yes	No	No	Yes	No	No	9.3	13	64	24	4	8	0	51	90	0.49	0.23	0.16	6.3	2.3	0.6	18	15	158	79	17	41	106	NORMOCYTIC NORMOCHROMIC ANEMIA
89	SATAPPA TELASANGI	991909	5552863	70	M	N	N	NV	Yes	Yes	Yes	Yes	Yes	Yes	No	11.5	10.5	72	21	0	7	0	58	86	1.04	0.33	0.07	6.2	3.7	1.5	16	10	52	141	89	37	77	NORMOCYTIC NORMOCHROMIC ANEMIA
90	NEELAMMA PATIL	988872	5530196	68	F	N	Y	V	No	No	Yes	No	No	No	No	8.9	11.1	89	7	0	4	0	25	63	0.5	0.24	0.01	6.1	3.2	1.1	16	10	184	204	121	56	135	NORMOCYTIC NORMOCHROMIC ANEMIA
91	LAILA BEE SANDI	1007969	5200095	66	F	N	N	NV	Yes	Yes	No	No	Yes	No	Yes	10.3	7.9	79	15	0	6	0	30	136	0.75	0.89	0.4	6.9	4.5	1.9	24	19	114	121	52	60	46	MICROCYTIC HYPOCHROMIC ANEMIA
92	PARASHURAM ILAGER	1007113	5173232	61	M	N	N	V	Yes	Yes	No	No	Yes	Yes	No	11.7	8.7	60	10	1	3	0	58	131	1.8	0.8	0.45	5.7	3.1	1.2	26	22	43	105	49	30	132	NORMOCYTIC NORMOCHROMIC ANEMIA
93	RAVINATH KRISHNAMURTHY	1005456	5330445	57	M	Y	Y	V	Yes	Yes	Yes	No	Yes	Yes	Yes	9.6	5.1	87	11	0	2	0	72	103	1.54	1.4	1.1	6.9	3.1	0.8	28	32	66	130	73	40	111	MICROCYTIC HYPOCHROMIC ANEMIA
94	SANJAY PATIL	1006469	5659748	52	M	Y	N	V	Yes	Yes	Yes	No	Yes	Yes	No	11.5	12.1	60	15	0	1	0	44	108	0.99	1.34	0.37	7.4	4.5	1.6	20	27	61	308	215	50	217	MICROCYTIC HYPOCHROMIC ANEMIA
95	YASEENBI TASHILDAR	1006424	5659691	74	F	N	N	NV	Yes	No	No	No	Yes	No	Yes	8.3	12.4	60	30	0	10	0	54	119	0.66	1.04	0.33	7.6	4.1	1.2	22	9	110	158	89	46	113	MICROCYTIC HYPOCHROMIC ANEMIA
96	PRABHAVATI SHIRALKAR	1005914	5656209	56	F	N	N	V	Yes	No	No	No	Yes	No	No	9	7.7	77	20	1	2	0	58	121	0.44	0.25	0.12	7.3	4.3	1.4	13	14	100	167	90	34	217	NORMOCYTIC NORMOCHROMIC ANEMIA
97	SOMNATH PATIL	1005925	5655928	80	M	Y	Y	V	Yes	Yes	Yes	No	Yes	No	No	11.8	10.3	87	9	0	4	0	38	95	1.4	0.96	0.38	7.3	3.9	1.1	32	12	84	50	1	16	164	NORMOCYTIC HYPOCHROMIC ANEMIA
98	AJIT KHANAPURE	1004454	5645678	48	M	Y	Y	NV	Yes	Yes	No	No	Yes	Yes	Yes	10.7	15	70	10	4	3	0	8	87	1.36	0.65	0.33	6.4	3.4	1.1	78	49	71	121	46	40	192	MACROCYTIC ANEMIA
99	NAGAVENI CHIKAMATH	1005548	5652857	58	F	N	N	V	Yes	Yes	Yes	No	Yes	Yes	Yes	9	12.2	90	4	0	6	0	38	117	1.5	0.38	0.13	5.7	2.9	1	116	66	43	108	13	24	356	NORMOCYTIC NORMOCHROMIC ANEMIA
100	MARUTI ANNAPA	1004686	5425409	54	M	N	N	NV	Yes	No	No	No	Yes	No	No	8.2	6	80	11	1	8	0	120	99	1.29	0.8	0.4	5	2.7	1.2	48	14	161	82	44	20	90	DIMORPHIC ANEMIA

ANNEXURE-V

KEY TO MASTER CHART

1) SEX:

   M – MALE

   F - FEMALE

2) DIET

   V – VEGETARIAN

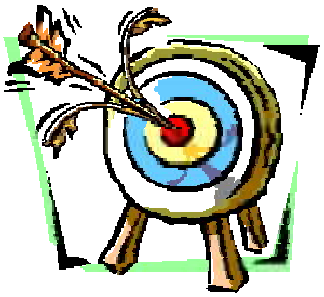
   NV – NON VEGETARIAN

3) ALCOHOL AND TOBACCO

   Y – YES

   N – NO

Introduction



Objectives

Review of Literature

Methodology

Results

Discussion

Conclusion

Summary

Bibliography

Annexure-I

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Annexure-II

Annexure-III

Annexure-IV