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PREVALENCE OF ANEMIA IN INPATIENT GENERAL MEDICINE DEPARTMENT IN A TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT

Background: Despite all recent health-related improvements, anemia remains an extensive public health issue which is underdiagnosed or untreated, affecting the lives of about one-fourth of the world population in a geographically heterogeneous pattern. We, therefore, aimed to illustrate the prevalence, severity, most common types, treatment and major determinants of anemia among in-patients of a tertiary care hospital. **Objectives:** *To evaluate the prevalence of anemia in Inpatients general medicine department. *To estimate type of anemia among patients with hemoglobin value less than normal. *To identify the prevalence of anemia based on age and sex. *To evaluate the prevalence of anemia based on severity. *To assess the prevalence of anemia based on BMI, blood group and nutrition.

Methodology: This study was conducted at Chigateri hospital. For this study, data of patients were collected using the data collection form, once the patient had given the data voluntarily after signing the consent form or from the medical record department after their approval. **Inclusion criteria:** *Patients indicated by haemoglobin level ≤ 13 g/dL (males) and ≤ 12 g/dL (females). *Patients having with or without co-morbidities. *Only inpatients of general medicine ward. *Patients at least 18 years of age and above. *Patients who signed the informed consent. **Exclusion criteria:** *Patients age less than 18 years. *Females who are pregnant or breastfeeding. *Those patients who underwent recent surgery. *Patient who are not willing to participate in the study. *Outpatient department. After collecting the data, it was analysed and interpreted using MS Word. In this study, prevalence of anemia, types along with number of comorbidities based on age and gender were determined. **Results:** The prevalence of anemia was found to be 15.23%, in severity of anemia 35.9% were mild,

47.1% were moderate and 17.1% were severe. Compared to females males were more anemic i.e., 52.4% were male and 47.6% were female. Based on age prevalence of anemia was distributed and the study revealed that 18-50byears were 24.1% and more than 50 years of age were 75.9%. **Conclusion:** This study aided in assessing the prevalence of anemia of patient attending in-door department of a tertiary care hospital based on WHO criteria, which is a tool to assess the severity of anemia based on age and gender. The study revealed that prevalence of anemia was seen to be more in male patients than female patients and more than 60% patients were of age 51 years and above. So we can conclude that, as the age increases both genders are in risk of developing anemia.More than half of the mild anemic patients were untreated/underdiagnosed, mild is not a serious issue but the condition can become serious if left untreated. To improve the assessment, diagnosis and treatment of mild anemia future research should explore provider level and other strategies.

KEYWORDS: Hemoglobin, Prevalence, BMI, Age, Gender, Blood, MCV.

INTRODUCTION

Blood is defined as a fluid that moves through the vessels of a circulatory system. The components of human blood includes plasma (The liquid portion), blood cells (Which come in both red and white varieties), and cell fragments called platelets.[1]

- Plasma is the main component of blood and generally consists of water, with proteins, ions, nutrients, and wastes mixed in.
- Red Blood Cells are accountable for carrying oxygen and carbon dioxide.
- Platelets are liable for blood clotting.
- White Blood Cells are the key players of immune system and function in immune response.[1]

Cells and platelets make up about 45% of human blood, and the remaining 55% of human blood is plasma. The diagram given below shows red blood cells, white blood cells of different types (Large, Purple cells), and platelets.[1]

Plasma is the liquid component of blood which can be isolated through centrifugation by spinning a tube of whole blood at high speed. By the centrifugation process the denser cells and platelets fall to the bottom of the tube, forming red and white layers, while the lighter plasma float to the top, forming a yellow layer.[1]

The plasma contains 90% of water by volume, and the remaining 10% made up of ions, proteins, nutrients, wastes, and dissolved gases. The ions, proteins and other molecules found in plasma is essential for maintaining blood pH and osmosis balance, with albumin (the main protein in plasma) playing a remarkable role.[1]

Red blood cells, or erythrocytes, are specialized cells that pass through the body and supply oxygen to the tissues. The red blood cells are small and biconcave (Thinnest in the centre, 7-8μm in size) in humans, and it does not contain mitochondria or a nucleus when mature.[1]

These properties allows the red blood cells to effectively perform their task of oxygen transport. Small size and biconcave shape increase the surface area to volume ratio, improving gas exchange, while absence of nucleus makes additional space for haemoglobin, an essential protein used in oxygen transport. Deficiency of mitochondria keeps the red blood cells away from using any of the oxygen they are carrying, maximizing the amount delivered to tissues of the body.[1]

The red blood cells are responsible for transporting oxygen from lungs to rest of the body's tissues. Red blood cells also plays a vital role in transport of carbon dioxide, a waste product, from the tissues back to the lungs. Some of these carbon dioxide binds directly to haemoglobin, and red blood cells also bear an enzyme that converts carbon dioxide into bicarbonate. The bicarbonate liquefy in plasma and are transported to the lungs, where it is converted back into carbon dioxide for you to exhale.[1]

Normal human red blood cells have an average life span of about 120 days. Old or impaired red blood cells are broken down in the liver and spleen, and the fresh ones are produced in the bone marrow. Red blood cell production takes place in the bone marrow under the control of the hormone erythropoietin. Erythropoietin is produced by juxtaglomerular cells in the kidney which releases when there is decreased oxygen levels. This negative feedback loop make sure that the number of red blood cells in the body remains relatively constant over time.[1]

Platelets, or thrombocytes, are cell fragments responsible for blood clotting. They are formed when large cells called megakaryocytes break into pieces, each one making 2000-3000 platelets as it comes apart. Platelets are roughly disc-shaped and tiny, about 2-4μm in diameter.[1]

When the lining of a blood vessel is disrupted (for instance, if you cut your finger deeply enough for it to bleed), platelets are attracted to the wounded site, where the activated platelets clump together to form a sticky plug. The activated platelets release signals, which not only attract other platelets and make them become sticky, but also activate a signalling cascade that eventually converts fibrinogen, a water-soluble protein available in blood plasma, into fibrin (a non-water-soluble protein). The fibrin forms threads that reinforce the platelet plug, making a clot that prevents additional loss of blood.[1]

White blood cells, or leukocytes, are less common than red blood cells and make up less than 1% of the cells in blood. Their task also differ from that of red blood cells: they are primarily involved in immune responses, recognizing and defends the body from invaders such as bacteria, viruses and foreign bodies.[1]

White blood cells are bigger than red blood cells, and unlike red blood cells, they have a normal nucleus and mitochondria. White blood cells are classified into five major types, and these are further divided into two different groups, named for their appearance under a microscope.[1]

- One group, the granulocytes, includes neutrophils, basophils, and eosinophils, all of which have granules in their cytoplasm when stained and examined under a microscope.
- Other group, the agranulocytes, includes monocytes and lymphocytes, which lack granules in the cytoplasm.[1]

Each type of white blood cell plays a particular role in defending the body against various infections. For example, some white blood cells are involved in engulfing and breaking down pathogens, while others recognize specific microorganisms and initiate immune responses against them. Different types of white blood cells have different lifespan, varies from hours to years, bone marrow is a spongy tissue which is the primary site of new blood cell production (despite the fact that some are formed or mature in the thymus, lymph nodes, and spleen).[1]

Hemoglobin is the oxygen-carrying protein of blood that transports oxygen from the lungs to tissues. Each hemoglobin molecule is a tetramer composed of four polypeptide globin chains. Each globin subunit accommodate a heme moiety formed of an organic protoporphyrin ring and a central iron ion in the ferrous state (Fe^{2+}). The iron molecule in each heme moiety can bind and unbind oxygen, facilitating oxygen transport in the body. The most frequent form of

hemoglobin in the adult is HbA, which constitute two alpha-globin and two beta-globin subunits. Different globin genes encode for different type of globin subunit.[6]

Globin production and heme synthesis are the two major components of hemoglobin synthesis. Globin chain production takes place in the cytosol of erythrocytes and occurs by genetic transcription and translation.[6]

Many different types of normal hemoglobin exist in human blood. The percent prevalence of each hemoglobin type depends upon the phase of development.[6]

In patients with an abnormal complete blood count (CBC), signs and symptoms of hemolytic anemia (increase in unconjugated bilirubin, a decrease in hemoglobin levels, weakness, fatigue, jaundice and hemoglobinuria), or family history of a hemoglobinopathy, further testing screens for, and diagnosis, hematologic disorders.[6]

CBC includes measurement of hemoglobin level in the blood. Normal hemoglobin concentrations are approximately 13.5 to 18.0 g/dL in men and 11.5 to 16.0 g/dL in women. CBC also measures the size of erythrocytes through the mean corpuscular volume (MCV). Low MCV, also known as microcytosis, is often the first indicator of thalassemia or thalassemia trait. A peripheral blood smear can also detect suspected hematologic disorders. Providers can see sizes, colors, and variations in the shape of erythrocytes. Peripheral smears can detect nuclei in erythrocytes, which are abnormal and signify pathology.[6]

Mean corpuscular volume (MCV) is a laboratory value that measures the average size and volume of a red blood cell. It has utility in helping determine the etiology of anemia—calculation of the value is by multiplying the percent hematocrit by ten divided by the erythrocyte count. Along with the hemoglobin and hematocrit, MCV can determine the classification of anemia as either microcytic anemia with MCV below the normal range, normocytic anemia with MCV within the normal range, macrocytic anemia with MCV above the normal range. Furthermore, it is useful for calculating the red blood cell distribution width (RDW).[8]

A typical adult MCV level is 80-100 fl.[9]

When a person has an MCV level below 80 fl, it suggests they have microcytic anemia. Microcytic anemia is a type of anemia in which red blood cells are smaller than usual.[9]

If a person has high MCV level, their red blood cells are larger than usual, and they have macrocytic anemia. Macrocytosis occurs in people with MCV level higher than 100 fl.[9]

Anemia is described as reduction in the proportion of the red blood cells. Anemia is not a diagnosis, but a presentation of an underlying condition. Whether or not a patient becomes symptomatic depends on the etiology of anemia, the acuity of onset, and the presence of other comorbidities, especially the presence of cardiovascular disease. Most patients experience some symptoms related to anemia when the hemoglobin drops below 7.0 g/dL.[10]

Anemia can result from decreased erythrocyte production or increased blood loss, either through hemolysis, bleeding or both. These are determined by nutritional, infectious or genetic factors. Genetic factors are responsible for hemoglobinopathies, such as sickle cell anemia and thalassemia, while in some settings infectious diseases like malaria, soiltransmitted helminths and schistosomiasis are major contributors to anemia. Nutritional anemia results from insufficient nutrients that are needed during Hb synthesis and erythropoiesis. These particularly include iron deficiency (assumed to be responsible for 50% of all anemias), folic acid deficiency and vitamin B_{12} deficiency, vitamin A deficiency and protein-energy malnutrition. In addition, exposure to toxic heavy metals such as lead and low levels of trace elements such as zinc and copper can contribute to anemia. Recent literature also suggests that lower levels of vitamin D can increase the risk of anemia in school children.[11]

Erythropoietin (EPO), which is made in the kidney, is the major stimulator of red blood cell (RBC) production. Tissue hypoxia is the major stimulator of EPO production, and levels of EPO are generally inversely proportional to the hemoglobin concentration. In other words, an individual who is anemic with low hemoglobin has elevated levels of EPO. However, levels of EPO are lower than expected in anemic patients with renal failure. In anemia of chronic disease (AOCD), EPO levels are generally elevated, but not as high as they should be, demonstrating a relative deficiency of EPO. Normal hemoglobin specific laboratory cut-offs will differ slightly, but in general, the normal ranges are as follows:[10]

- 13.5 to 18.0 g/dL in men
- 12.0 to 15.0 g/dL in women
- 11.0 to 16.0 g/dL in children
- Varied in pregnancy depending on the trimester, but generally greater than 10.0g/dL.[10]

Table 1: Hemoglobin concentrations (g/dL) for the diagnosis of Anemia and Assessment of severity according to World Health Organization (WHO).[12]

Population	Non-Anemia	Mild anemia	Moderate Anemia	Severe anemia
6-59 months of age	≥ 11	10-10.9	7-9.9	<7
5-11 years of age	≥ 11.5	11-11.4	8-10.9	<8
12-14 years of age	≥ 12	11.11.9	8-10.9	<8
Non-pregnant women (≥ 15 years)	≥ 12	11-11.9	8-10.9	<8
Pregnant women	≥ 11	10-10.9	7-9.9	<7
Men (≥ 15 years)	≥ 13	11-12.9	8-10.9	<8

Need for study

The topic of prevalence of anemia has received a great deal of recent attention from the regulatory scientific and health care communities world wide. Anemia affects one quarter of the world's population and is concentrated in men and women,making it global public health problem. It is most common and widespread disorders in the world, is a public health problem in both industrialized and non industrialized countries.[3]

The present study has found high prevalence of anemia in 18-70 years of age group in all over world. The prevalence of anemia among males was 44.3% and females was 50%. According to the WHO if the prevalence of anemia at community level is more than 40% it is considered as problem of high magnitude.[4]

This study also highlights the fact that prevalence of anemia was more in individuals belonging to low socioeconomic status group and individuals who were illiterate regional estimates of anemia prevalence and number of persons affected in the total population and by the population subgroup.

AIMS AND OBJECTIVE

Aim

Investigating the prevalence of anemia in in-patients general medicine department in a tertiary care teaching hospital to describe the level of appropriate management.

Primary objective

- To evaluate the prevalence of anemia in inpatients general medicine department.

Secondary objective

- To estimate type of anemia in inpatients having hemoglobin value less than normal.
- To identify the prevalence of anemia based on age and sex.
- To evaluate the prevalence of anemia based on severity.
- To assess the prevalence of anemia based on BMI, blood group and nutrition.

Review of literature

1) **IK. Rohisha *et al.,*** The healthy citizen contributes to the development of a country. Tribes are considered as the primitive groups who are backward and have a shyness to contact with the community for their health services. Hence, there is a need to look into their health status. The study aimed to assess the prevalence of anemia among tribal women of Kasaragod district, Kerala. e study found that the majority (89%) of the tribal women had anemia in which 62% and 11% of tribal women had moderate and severe anemia, respectively.[15]

2) **Misganaw Birhaneselassie Mengesha *et al.,*** Anemia is responsible for significant morbidity and mortality, particularly in less developed countries. Anemia causes many complications and has been related to reduced work capacity, reduced ability to execute activities of daily living, reduced cognitive function and fatigue among others. The overall prevalence of anemia in the study was 13%. Majority of cases had mild anemia 58.5%, while 19.0%, and 22.5% of the patients had moderate and severe anemia respectively.[16]

3) **Alexandra Jablonka *et al.,*** A cohort was assessed to improve care taking strategies, prevalence, severity and types of anemia in a large refugee in Western Europe in 2015. The study showed more females than males were anemic. The majority of affected migrants had mild anemia (86.2%) of either normocytic/normochromic (55.9%) or microcytic/hypochromic (20.9%) type.[17]

4) **Katharina da Silva Lopes *et al.,*** The study included reviews of randomised controlled trials (RCTs) in anaemic or non-anaemic. The study followed standard Cochrane methodology, extracting GRADE ratings, 75 systematic reviews were included of which (Adolescent children - 11 to 18 years) three reviews found five types of iron supplementation may increase Hb levels and reduce the risk of anaemia. (Non- pregnant women of reproductive age 19 to 49 years) Two reviews suggested that iron therapy (oral,

intravenous (IV), intramuscular (IM)) increased Hb levels; one showed that iron folic acid supplementation reduced anaemia incidence; and another that daily iron supplementation with or without folic acid or vitamin C increased Hb levels and reduced the risk of anaemia and ID. (Mixed population-all ages) four reviews suggested Iron supplementation versus placebo or control increased Hb levels in healthy children, adults, and elderly people.[18]

5) **Shivani Jatin Gandhi *et al.*,** Anemia is associated with increased all-cause hospitalization and mortality in community- dwelling individuals above age 65 years. Our aim was to determine the prevalence and severity of anemia in adult patients in our primary care office and to determine the relationship between anemia and medical comorbidities. About one-fifth (21.1%) of the patients had anemia. The mean age of patients with anemia was 62.6 years. Among all patients with anemia, 20.3% were males and 79.6% were females. Of these patients, 60.1% had mild anemia (hemoglobin 11 - 12.9 g/dL) and 39.8% had moderate anemia (hemoglobin 8 - 10.9 g/dL).[19]

6) **A STYSZYNSKI *et al.*,** Anemia is an independent risk factor for functional decline and mortality among older adults. Since mild anemia in older people are often under-diagnosed and ignored, its prevalence needs precise determination and recognition of predisposing factors. Anemia was diagnosed in 17.4% of older persons (n = 695) and only in 3.1% of younger respondents aged 55 – 59 years (n = 19; P < 0.001). Among elderly, anemia was more frequent in men than in women (20.8% versus 13.6%; P <0.001).[20]

7) **Birsen Karaca Saydam *et al.*,** This descriptive study was conducted at the outpatient clinics of the Department of Internal Medicine, Ege University Medical School. The study results showed an anemia prevalence of 27.8% in the study sample. Among all anemia diagnoses among the participants, 56.0% were determined to have iron deficiency, 37.1% iron-deficiency anemia, and 6.9% severe anemia.[21]

8) **Amare Workus Tadesse et al.,** Anemia remains a public health challenge in Ethiopia, affecting an estimated 56% of children under age 5 years, 23% of women of reproductive age and 18% of adult men. However, anemia etiology and the relative contribution of underlying risk factors for anemia remains unclear and has hindered implementation of anemia control programs.[22]

9) **Aishatu L. Adamu** e***t al*., Population Health Metrics (2017)** The global burden of anemia is large especially in sub-Saharan Africa, where HIV is common and lifestyles are changing rapidly with urbanization. A large population-wide cross-sectional survey was conducted in two sites by the Malawi Epidemiology and Intervention Research Unit (MEIRU) from 2013 to 2015. Studies of anemia usually focus on pregnant women or children, among whom the burden is greatest. Anemia prevalence was assessed among 8,926 men (age range 18–100 years) and 14,978 women (age range: 18–103 years). Weighted prevalence levels for all, mild, and moderate-to-severe anemia were 8.2, 6.7 and 1.2% in rural men; 19.4, 12.0 and 7.4% in rural women; 5.9, 5.1 and 0.8% in urban men; and 23.4, 13.6 and 10.1% in urban women.[23]

10) **Melat Belay Zeleke *et al*.,** Adolescents (10–19 years) are at an increased risk of developing anemia due to increased iron demand during puberty, menstrual losses, limited dietary iron intake, and faulty dietary habits. A school-based comparative crosssectional study was conducted from 14th May to 1st June 2018 among school adolescents. Out of the total 742 respondents, 377 (50.8%) were males and 365 (49.2%) were females. The overall prevalence of anemia was 21.1%, and the prevalence of anemia was 22.5% among male adolescents and 19.7% among females.[24]

11) **Elham Akbarpour et al.,** Anemia is regarded as the most prevailing micronutrient deficiency disorder worldwide, mainly in the poor socioeconomic strata of societies and as a result of poverty. Data on 29,550 (96.87%) males and non-pregnant females between 20–65 years of age (mean age: 41.90 ± 11.88 years; female sex: 63.58%; Arab ethnicity: 48.65%), whose HGB level was available, were included in the study. The mean ± SD HGB concentration was 13.75 ± 1.65 g/dL. The age- and sex-standardized prevalence rate of anemia was 10.86% (95% CI: 10.51–11.23%). The most prevalent degree was mild anemia (7.71%, 95% CI: 7.40–8.03%) and only 0.17% were severely anemic. Of those considered anemic, the highest proportion was related to normochromic/ microcytic (50.65%), followed by hypochromic/microcytic (30.29%).[25]

12) **Nora AlFaris *et al*.,** The data collected showed that 28.40% of the respondents had low hemoglobin (Hb) level while 68.40 had sufficient Hb and 3.20% had a high level. Ferritin is one of the factors that causes anemia. Among the respondents, 36% suffered from low ferritin level (iron depletion), 55.20% had a moderate level and only 8.80% had high level. Hematocrit (Hct) percent varied between respondents with 28% had a lower level

and 72% had a higher level than the normal. The analysis of red blood cells showed that 1.20% had a smaller number of blood cells (microcytic) than normal, 88.40% had the normal numbers and 10.40% had a higher level than the normal (macrocytic).[26]

13) **Ahmadou Musa Jingi *et al.*,** Anemia is a public health problem worldwide, with the greatest burden in low income settings. This high burden contrasts with the paucity of community data, with few studies involving only children and women. This crosssectional descriptive and analytic study was carried-out in a specialist Cardiology clinic between October and November 2016, in Yaounde—the Capital city of Cameroon, SSA.A total of 236 participants were screened, of whom 137 (58.1%) were males. Their mean age was 45.4±10.6 years. The mean Hb was 12.7±1.5 g/L. Anemia was seen in 93 (39.3%) participants—38 (27.7%) males, and 55 (55.6%) females. The prevalence of anemia was significantly higher in women ≤40 years of age. Anemia was mild in 72 (30.5%), moderate in 19 (8.1%), and severe in 2 (0.8%) participants. Female sex was associated with a high odd of having anemia (OR: 3.3; P<0.001), while tobacco use (OR: 0.3; P=0.018) and high atherogenicity index (OR: 0.5; P=0.054) appeared to be protective against anemia. After adjusting for sex, tobacco use was not associated with a lower odd of anemia (aOR: 0.5; P=0.094).[27]

14) **Oliver Didzun *et al.*,** Population-based studies on anaemia in India have mostly focused on women and children, with men with anaemia receiving much less attention despite anaemia's adverse effect on health, wellbeing, and economic productivity. 106 298 men and 633 305 women were included in our analysis. In this nationally representative cross-sectional study, we analysed data from India's fourth National Family Health Survey (NFHS-4), which was carried out from Jan 20, 2015, to Dec 4, 2016, in all 29 states and seven Union Territories of the country and is available in the public domain. In men, the prevalence of any anaemia was 23·2% (95% CI 22·7-23·7), moderate or severe anaemia was 5·1% (4·9-5·4), and severe anaemia was 0·5% (0·50·6). An estimated 21·7% (20·9-22·5) of men with any degree of anaemia had moderate or severe anaemia compared with 53·2% (52·9-53·5) of women with any anaemia. Men aged 20-34 years had the lowest probability of having anaemia whereas anaemia prevalence among women was similar across age groups. State-level prevalence of any anaemia in men varied from 9·2% (7·7-10·9) in Manipur to 32·9% (31-34·7) in Bihar.[28]

15) **S Maria Awaluddin *et al.*,** This study aimed to determine the prevalence of anemia and factors associated with anemia among men in Malaysia. This study was conducted using data from the National Health and Morbidity Survey (NHMS) 2015, a nationwide, cross-sectional survey evaluating the overall health status, health needs, and health expenditure in the Malaysian population The majority of them (87.2%) were men aged 15–59 years, referred to as the younger age group in this study. The prevalence of anemia among men was 12.6% (95% confidence interval (CI): 10.9, 14.5). The prevalence was higher among older men (30.7%; 95% CI: 26.6, 35.1) than younger men (10.0%; 95% CI: 8.2, 12.2). Anemia among men was associated with older age (adjusted odds ratios (aOR) = 3.1; 95% CI: 2.1, 4.4) and those with diabetes (aOR = 1.5; 95% CI: 1.2, 2.1) via a logistic regression analysis. In conclusion, older men were more affected by anemia than younger men in this study.[29]

16) **Abhishek Pathania *et al.*,** Anemia is a common morbidity in elderly persons (aged 60 years or above). In India, in recent years, the number of old age homes (OAHs) and the residents living in them has increased significantly. This was a cross-sectional survey conducted among elderly persons aged 60 years and above living in OAHs of the National Capital Territory (NCT) of Delhi, India. Data were collected from May 2015 to October 2015. The study included 334 elderly persons, with a mean (standard deviation [SD]) age of 75.2 (8.6) years and mean (SD) Hb of 11.6 (1.7) g/dL. The mean (SD) Hb in men was 12.1 (1.7) g/dL compared to 10.9 (1.5) g/dL among women ($P < 0.0001$). The overall prevalence of anemia was 68.7% (95% confidence interval 63.9, 73.4); among those who were anemic, 47.4% had mild anemia, 47.0% had moderate anemia, and 5.6% had severe anemia. The prevalence of mild anemia was 45% in men compared to 24.8% in women. The odds of anemia among ≥80 years was 2 times that among 60-69 years ($P < 0.029$).[30]

17) **Damtew Solomon *et al.*,** Anemia found in diabetes patients is often unrecognized like many other chronic diseases. The occurrence of anemia is also an additional burden to the micro vascular complications of patients with diabetes. A cross-sectional study design was conducted from September 2020–to January 2021 GC among adult diabetic patients who had follow-up at Bale zone hospitals. In this study anemia among adult diabetic patients is 18.1% (95% CI (13.2, 23.0%). Multivariable logistic regression analysis revealed that the sex of the study participants and the type of diabetes mellitus were found

to be statistically significant to associate with anemia. The odds of having anemia among females are nearly three times higher when compared with males (AOR 2.78, 95% CI 1.40–5.52). In addition, the odds of having anemia among adult diabetic patients who had type II diabetes mellitus (AOR 2.18, 95%CI 1.04–4.54) were 2.18 times higher than those who had type I diabetes mellitus patients.[31]

18) **Mahmood Alsaeed *et al.,*** A retrospective study was conducted on 227 consecutive elderly patients admitted under general internal medicine in the biggest tertiary hospital in Bahrain. Anemia was highly prevalent among hospitalized elderly patients (71.6%). Males were significantly more affected than females ($p = 0.031$). In terms of severity, the most common type was moderate anemia (56.1%); with regards to etiology, the most common type was anemia associated with chronic disease (48.1%). Anemia was as common as other comorbidities, including hypertension (71.4%) and diabetes mellitus (53.7%). When comparing anemic to non-anemic patients, the length of hospital stay was significantly longer ($p < 0.001$) and inversely correlated to the level of hemoglobin; furthermore, 1-year mortality was significantly higher ($p < 0.001$). When compared to those with mild anemia, patients with moderate/severe anemia were more likely to die (odds ratio [OR] = 2.2, 95% confidence interval [CI]: 1.27–4.92).[32]

19) **E. Karoopongse *et al.,*** Anemia is one of the most common health problems in the elderly in low- and middle-income countries. Evidence from studies in high income countries suggests that the presence of anemia may predict mortality. Data from 8,935 subjects were obtained. The mean age of participants was 69.2 years (SD 6.8). 3446 (38.2%) of subjects had anemia; 1931(56%) of these were classified as mild and normocytic. With a total 51,268 person-year of follow up, 753 participants with anemia died, and the cumulative all-cause mortality was 38.5 per 1,000 person-years. The presence of anemia was associated with an increased risk of mortality with HR of 1.66 (95% CI = 1.50–1.84 , $p < 0.001$). Among subjects with low MCV, hemoglobin level < 10 g/dl in men and < 9 g/dl in women significantly increased the risk of mortality (HR of 2.71, 95% CI = 1.88–3.91 and HR of 3.14, 95%CI = 2.11–4.67, respectively) Persons with anemia and normal MCV, the association with mortality was evident at hemoglobin levels below 11 g/dl for both males and females. (HR of 1.98, 95% CI = 1.67–2.35).[33]

20) **Guiying Cao *et al.,*** Anemia is the most frequent hematologic abnormality among people living with human immunodeficiency virus (HIV) (PLWHIV) and is associated with HIV

disease progression and higher risk of mortality of the patients. We included 63 observational studies covering 110,113 PLWHIV. The pooled prevalence of anemia was 39.7% (95% CI: 31.4%-48.0%) for children living with HIV aged <15 years, 46.6% (95% CI: 41.9%-51.4%) for adults (men and non-pregnant women) living with HIV aged ≥15 years, and 48.6% (95% CI: 41.6%-55.6%) for pregnant women living with HIV. Among adults living with HIV, the pooled prevalence of severity of anemia was 21.6% (95% CI: 19.9%-23.3%), 22.6% (95% CI: 14.8%-30.4%), and 6.2% (95% CI: 4.4%-8.1%) for mild, moderate and severe anemia, respectively. Compared with East Africa, anemia prevalence among adults living with HIV was higher in Southern Africa (p = 0.033).[34]

21) **Carlos H. Orces et al.,** The present study was based on data from the National Survey of Health, Wellbeing, and Aging. Hemoglobin concentrations were adjusted by participants' smoking status and altitude of residence, and anemia was defined according to the World Health Organization criteria . A total of 2,372 subjects with a mean age of 71.8 (SD 8.2) years had their hemoglobin measured, representing an estimated 1.1 million older adults. The crude prevalence of anemia was 20.0% in women and 25.2% in men. However, higher anemia prevalence rates were seen with advancing age among black women and subjects residing in the urban coast. Likewise, certain health conditions such as hypoalbuminemia, cancer in men, chronic kidney disease, iron deficiency, and lowgrade inflammation were associated with increased odds of having anemia.[35]

22) **John P Mechenro *et al.*,** The prevalence of anemia in India is moderately high, leading to a thrust toward iron fortification of commonly used dietary cereals. We undertook a study to determine the prevalence of anemia in a rural population in Tamil Nadu and to evaluate its association with social, cultural, and dietary practices. Anemia was found in 91 of 244 (37.3%) female respondents and in 17 of 179 (9.5%) male respondents. In univariate analysis, anemia exhibited associations with marital status, level of education, occupation, and socioeconomic status. The prevalence of anemia was higher in diabetics, and in those who had no awareness of anemia. Anemia was less prevalent in those who frequently consumed milk, fish, beef, or dates. In multivariate analysis, when gender was eliminated, consumption of dates, socioeconomic class, frequent milk consumption, and alcohol consumption were independently associated with anemia.[36]

23) **Nupura A. Vibhute *et al.*,** Anemia is a global public health problem affecting both developing and developed countries. According to the World Health Organization, the

highest number of individuals affected by anemia is observed in nonpregnant women aged 15–49.99 years. Anemia prevalence in our population is 86 (28.6%). Based upon the severity of anemia, about 54 (18%) has mild anemia and 32 (10.6%) has moderate anemia. No case of severe anemia is noted in our study sample.[37]

24) **Sylwia Sulimiera Michalak *et al.*,** Anemia represents a common condition among the elderly; however, its prevalence and causes are not well known. This retrospective analysis was performed on 981 patients aged ≥60 in Poland over 2013–2014. The prevalence of anemia was 17.2% and increased with age. The predominant causes of anemia were the following: anemia of chronic disease (33.1%), unexplained anemia (28.4%), deficiency anemia (22.5%, including iron deficiency 13%), and chemo/radiotherapy-induced anemia (8.9%). In the multivariate logistic regression model, factors increasing the risk of anemia were the following: age ≥80 years (OR 2.29; 95%CI 1.19–4.42; $P = 0.013$), the number of comorbidities (two diseases OR 2.85; 95%CI 1.12–7.30; $P = 0.029$, three diseases OR 6.28; 95%CI 2.22–17.76; $P = 0.001$, four diseases OR 4.64; 95%CI 1.27–17.01; $P = 0.021$), and hospitalizations (OR 1.34; 95%CI 1.13– 1.58; $P = 0.001$). After a 2-year follow-up, the cumulative survival among patients without anemia in relation to the group with anemia was 90.76 vs. 78.08% ($P < 0.001$). In the multivariate model, anemia (HR 3.33, 95%CI 1.43–7.74, $P = 0.005$), heart failure (HR 2.94, 95%CI 1.33–6.50, $P = 0.008$), and cancer (HR 3.31, 95%CI 1.47–7.49, $P < 0.004$) were all significantly correlated with mortality. In patients ≥60 years, the incidence of anemia increases with age, number of comorbidities, and frequency of hospitalizations and has an adverse impact on survival.[38]

25) **Eric T Wittbrodt *et al.*,** Long- term clinical outcome data from patients with nondialysis-dependent (NDD) Chronic kidney disease (CKD) are lacking. We characterized patients with NDD-CKD and anemia using real-world data from the USA. Comprising 22,720 patients (57.4% female, 63.9% CKD stage 3, median hemoglobin 12.5 g/dL), median (interquartile range) follow-up for patients with and without anemia were 2.9 (1.5-4.4) and 3.8 (2.2-4.8) years, respectively. The most prevalent comorbidities were dyslipidemia (57.6%), type 2 diabetic mellitus (38.8%) and uncontrolled hypertension (20.0%). Overall, 23.3% of patients had anemia, of whom 1.9% and <0.1% received erythropoiesis-stimulating agents (ESAs) or intravenous iron, respectively. Anemia prevalence increased with CKD stage from 18.2% (stage 3a) to 72.8% (stage 5). Patients

with anemia had a higher incidence rate of hospitalizations for heart failure (1.6 versus 0.8 per 100 patient-years), CKD stage advancement (43.5 versus 2.75 per 100 patientyears), and a 40% eGFR decrease (18.1 versus 7.3 per 100 patient-years) versus those without anemia.[39]

26) **Tinsae Shemelise Tesfaye *et al.,*** Anemia is the most frequent micronutrient deficiency; globally it has an impact on more than 2 billion people. Different studies have indicated that the prevalence of anemia varies between rural areas and urban centers. The overall prevalence of anemia was 40.9%. Anemia was higher among rural residents (46.6%) than urban residents (20.1%). In urban centers, being male (AOR = 2.15, 95% CI: [1.03, 4.50]) and illiterate (AOR = 5.76, 95% [CI: 1.27, 26.07]) were significantly associated with anemia. In rural areas, being female (AOR = 1.78, 95% CI: [1.27, 2.52]), presence of heart disease (AOR = 2.63, 95% CI: [1.09, 6.33]), central obesity (AOR = 1.83, 95% CI: [1.31, 2.57]), illiteracy (AOR = 3.62, 95% CI: [1.57, 8.35]), and primary school completion (AOR = 2.69, 95% CI: [1.08, 6.73]) were significantly associated with anemia.[40]

27) **Matthew Little *et al.,*** To determine the prevalence and determinants of blood haemoglobin level and mild, moderate, and severe anemia in a sample of adults from rural Tamil Nadu, India. A total of 753 individuals (412 women and 341 men) participated in this study. The prevalence of anemia was 57.2% among women and 39.3% among men (P<0.001). Prevalence of anemia increased with age among men (P<0.001) but not women (P>0.05). Iron intake was low; 11.7% women and 24.1% of men reported iron intakes above recommended dietary allowances (P<0.001). Factors (OR (95% CI)) associated with mild or moderate anemia among women included television ownership (0.27 (0.13, 0.58)), livestock ownership (0.46 (0.28, 0.75)), refined grain consumption (1.32 (1.02, 1.72)), meat consumption (0.84 (0.71, 0.99)), and commercial agriculture production (mild: 4.6 (1.1, 18.8); moderate: 6.8 (1.98, 23.1)). Factors associated with mild, moderate, or severe anemia among men included rurality (0.50 (0.25, 0.99)), sugar consumption (1.04 (1.01, 1.06)), egg consumption (0.80 (0.65, 0.99)), and high caste (7.3 (1.02, 52.3)).[41]

28) **Charutha Retnakumar *et al.,*** Anemia is common among the elderly and it is the reason behind their poor survival. Anemia among the elderly is consistently disregarded, which can even incite cardiovascular complexities. The prevalence of anemia among the elderly

was observed to be 60.6%, out of which 66% were females and 49% were males. The elderly females were found to be more vulnerable to anemia.[42]

29) **Halimatou Alaofè *et al.*,** To identify the magnitude of anaemia and deficiencies of Fe (ID) and vitamin A (VAD) and their associated factors among rural women and children. In women, the overall prevalence of anaemia, ID, Fe-deficiency anaemia (IDA) and VAD was 47·7, 18·3, 11·3 and 17·7 %, respectively. A similar pattern for anaemia (82·4 %), ID (23·6 %) and IDA (21·2 %) was observed among children, while VAD was greater at 33·6 %. Greater risk of anaemia, ID and VAD was found for low maternal education, maternal farming activity, maternal health status, low food diversity, lack of fruits and vegetables consumption, low protein foods consumption, high infection, anthropometric deficits, large family size, poor sanitary conditions and low socioeconomic status. Strong differences were also observed by ethnicity, women's group participation and source of information. Finally, age had a significant effect in children, with those aged 6–23 months having the highest risk for anaemia and those aged 12–23 months at risk for ID and IDA.[43]

30) **Md Kamruzzaman et al.,** Anemia is another critical public health threat, prevalent predominantly among women and children. Undernutrition is linked with a higher risk of anemia, and lower dietary iron intake might be the possible reason. Chi-square test reveals significant association, though not intense, among BMI and anemia categories of women (15–49 years) ($\chi 2 \geq 99$, $p<2.2e-16$ and Cramér's V = 0.0799–0.1357). From ANOVA analysis, a significant difference in blood hemoglobin level was found among women (total sample and nonpregnant) with different BMI categories ($p \leq 0.05$). Binary (Severely Underweight: OR 1.2680, 95% CI 0.755–2.161; Obese: OR 0.4038, 95% CI 0.120–1.177), Ordinal logistic regression (Severely Underweight: OR 1.337, 95% CI 0.842–2.115; Obese: OR 0.504, 95% CI 0.153–1.411) and restricted cubic spline regression (Severely Underweight: OR >1.5; Obese: OR ~0.5) reveal that the risk of anemia was higher among underweight and lower among obese/overweight women compared to normal women. Lower anemia risk among richest women indicates probable higher dietary iron intake among obese/overweight women.[44]

31) **Maryam Kohsari *et al.*,** Subjects in the fourth quartiles of RBC count, hematocrit (HCT), hemoglobin (HGB), and red cell distribution width (RDW) had a higher risk for obesity-related diseases compared to the first quartiles. However, individuals with the

mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) in fourth quartiles had lower ORs of obesity-related diseases. While BMI reduced the effect of RBC count, HCT, HGB, and RDW on the incidence risk of obesity-related disease, it increased the impact of MCV, MCH, and MCHC. There was a negative association between BMI and RBC indices except for RDW. The BMI effect on RBC indices was different in normal and obese individuals. BMI in mild anemia lowered the risk of metabolic diseases, but it increased the risk of metabolic diseases for moderate anemia.[45]

32) **Melvin H.Seid *et al.*,** An open-label, randomized study was conducted at 130 sites and consisted of a screening visit and 2 study visits at day 0 and day 30. Of 2045 subjects enrolled (FCM:1023 ; SMC:1022), 996 received FCM and 1022 received SMC. At least 1 serious adverse event (AE) was reported by 0.6% and 2.2% of subjects in the FCM and SMC groups, respectively; none were considered treatment related. The difference in serious AEs was primarily due to higher rates of uterine leiomyoma, uterine hemorrhage, and menorrhagia in SMC subjects with heavy menstrual bleeding. Common AEs were generally predictable, with higher rates of infusion site reactions in FCM subjects and gastrointestinal AEs in SMC subjects. Mean hemoglobin increases were greater in the FCM group than the SMC group.[46]

33) **Verma Pratima, Singh Shraddha *et al.*,** Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. The overall frequencies of the various hemoglobin ABO blood groups in this study of the 609-subject screened,13.3 % were of blood group A,39.24 % blood group B,5.25 % blood group AB, and 42.20 % group O. The prevalence of Anaemia is higher in blood group B and blood group O which is 18.88% and 22.18% respectively.[47]

METHODOLOGY

Study site

- Chigateri District Hospital, Davanagere (tertiary care teaching hospital)

Study design

- Prospective and Cross-sectional study.

Study period

- The study will be conducted for a period of 6 months.

Proposed sample size

- More than one hundred and seventy cases of inpatient in the general medicine department.

Study criteria

Inclusion criteria

- Patients with hemoglobin level ≤ 13 g/dL (males) and ≤ 12 g/dL (females)
- Patients of either sex.
- Only inpatients of general medicine ward.
- Pateints having with or without co-morbidities.
- Patients at least 18 years of age and above.
- Patients who signed the informed consent.

Exclusion criteria

- Patients age less than 18 years.
- Females who are pregnant or breastfeeding.
- Those patients who underwent recent surgery.
- Patient who are not willing to participate in the study.
- Outpatient department.

Materials used

- Patient case sheet.
- Laboratory investigation charts.
- Data collection form.
- Informed consent form.
- MS Word (software).

Sources of data

- Prescription of patient / medication chart
- Patient data collection form

- Patient case sheet
- Laboratory data

Phases of study

Phase-1

- Reviewing of literature.
- Obtaining Institutional Ethics Committee clearance.
- Obtaining information from inpatient department from hospital.
- Designing the data collection form.

Phase-2

- A data collection form was prepared containing demographic details of patient such as age, gender, bodyweight, severity, nutrition, diet, blood group, region of anemia patients and laboratory parameters.

Phase-3

Data collected will be analyzed by using MS Word.

Method of data collection

- A Prospective Cross-sectional study will be conducted in the inpatients of general medicine ward with Prevalence of Anemia in Chigateri District Hospital, Davangere.
- The data required for the study will be collected from the patient case sheets, previous records of hospitalization and from laboratory investigation reports.
- Inpatients in general medicine ward with or without co-morbidities, meeting the inclusion criteria will be enrolled in the study.
- The demographic details age, gender, bodyweight, height, social history, duration of anemia and laboratory data will be collected using a suitably designed data collection form.

Statistical method

Data will be represented graphically and analysed using statistical method like computer software MS Word.

Has ethical clearance been obtained from your institution for the study?

The Protocol will be submitted to the Institutional Ethical Committee of S.C.S College of Pharmacy, Harapanahalli for obtaining ethical committee clearance before starting the study.

RESULTS

1) Prevalence

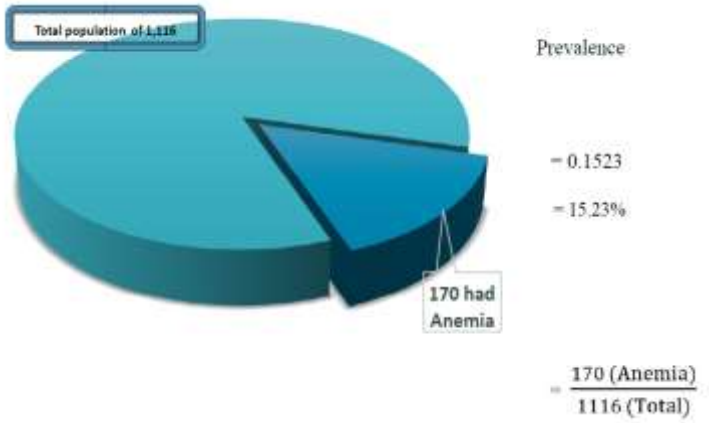

Figure 1: Prevalence of anemia.

Table 2: Prevalence of anemia in inpatients of a tertiary care hospital.

Prevalence of Anemia		Prevalence Rate (%)
Yes	No	15.23
170	946	
Total = 1,116		

- A cross-sectional study was conducted for a period of 6 months in patients who were attending in inpatient general medicine department of a tertiary care hospital to identify the prevalence of anemia.
- By considering the inclusion and exclusion criteria, a total of 1,116 respondents were included in the study out of which 170 patients were identified to be anemic.
- Thus, an overall prevalence rate of anemia was found to be 15.23%.

2) Gender

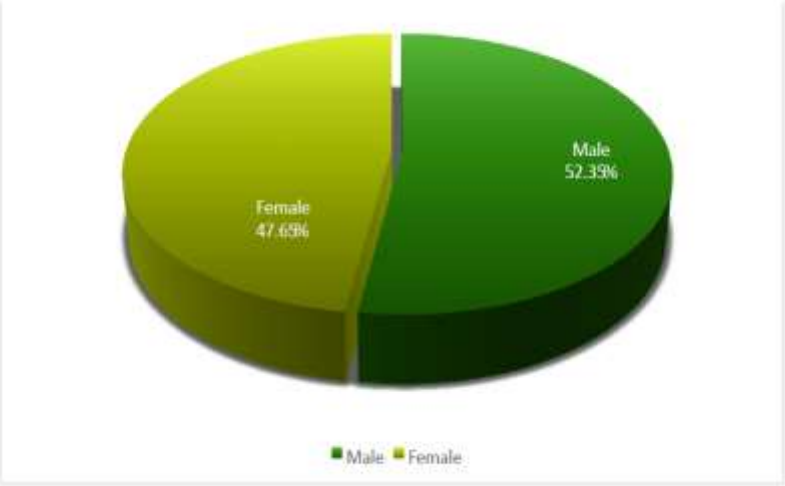

Figure 2: Prevalence of anemia in males compared to females.

Table 3: Gender wise distribution of anemic patients.

Gender	No. of Cases	Percentage (%)
Male	89	52.35
Female	81	47.65
Total	170	100

- Out of total 170 anemic patients, 89 (52.35%) were males and 81 (47.65%) were females.
- The comparative assessment revealed that males (52.35%) were slightly more anemic than females (47.65%).
- This might be due to certain difference in the population included in the study conducted in patients attending in inpatient general medicine department of a tertiary care hospital.

3) Age

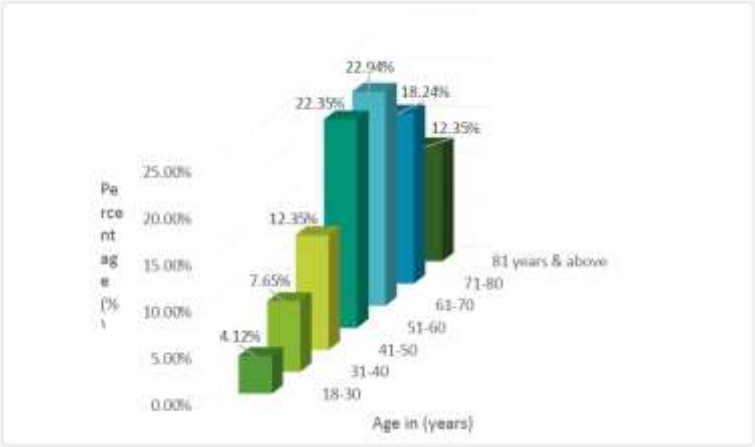

Figure 3: Prevalence of anemia in each age groups.

Table 4: Prevalence of anemia among different age group.

Age (Years)	No. of Cases	Percentage (%)
18-30	7	4.12
31-40	13	7.65
41-50	21	12.35
51-60	38	22.35
61-70	39	22.94
71-80	31	18.24
81 years & above	21	12.35
Total	170	100

- Among all age groups, young adulthood patients (18-30 years) had the lowest prevalence of anemia (4.12%).
- Moreover, anemia was least common in quadragenarian (41-50 years, 12.35%) and older elderly (81 years and above, 12.35%).
- The age group of 61-70 years had the highest proportion of anemia (22.94%).

4) Severity

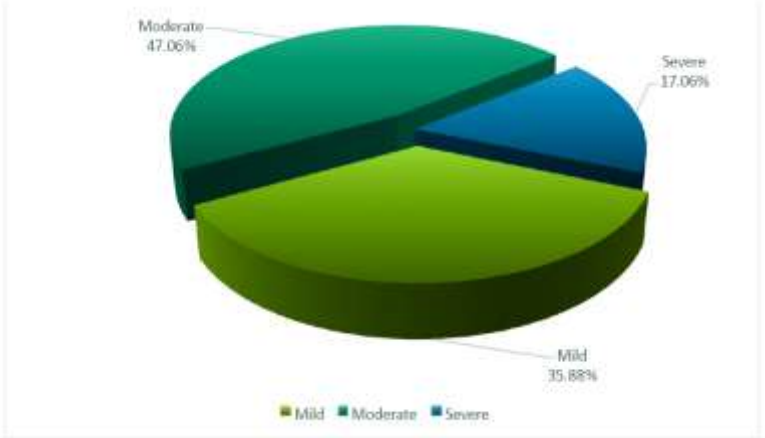

Figure 4: Severity of anemia.

Table 5: Prevalence of severity of anemia.

Severity	No. of Cases	Percentage (%)
Mild	61	35.88
Moderate	80	47.06
Severe	29	17.06
Total	170	100

- Out of total 1,116 patients, nearly 170 subjects which are 15.23% were anemic with varying degrees ranging from mild, moderate and severe which were 35.88%, 47.06% and 17.06% respectively.
- Majority of cases had moderate anemia 47.06%, while 35.88% were mildly anemic and 17.06% were severely anemic.

5) Types of anemia

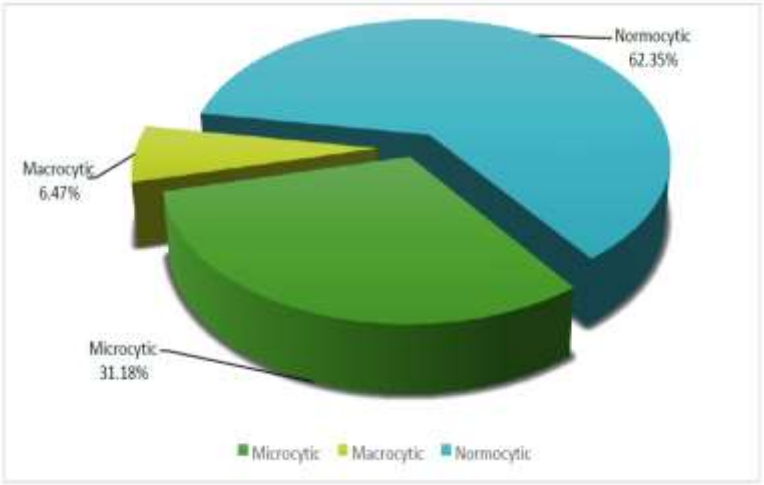

Figure 5: Types of anemia.

Table 6: Grading of types of anemia among patients.

Types of anemia	No. of cases	Percentage (%)
Microcytic	53	31.18
Normocytic	106	62.35
Macrocytic	11	6.47
Total	170	100

- The common type of anemia was normocytic anemia occurring in 62.35% of total population attending the in inpatient general medicine department of a tertiary care hospital, which mostly occur in the elderly (61-70) years of age.
- Followed by this 31.18% were with microcytic anemia.
- Only 11 (6.47%) of 170 anemic patients had macrocytic anemia.

6) Region

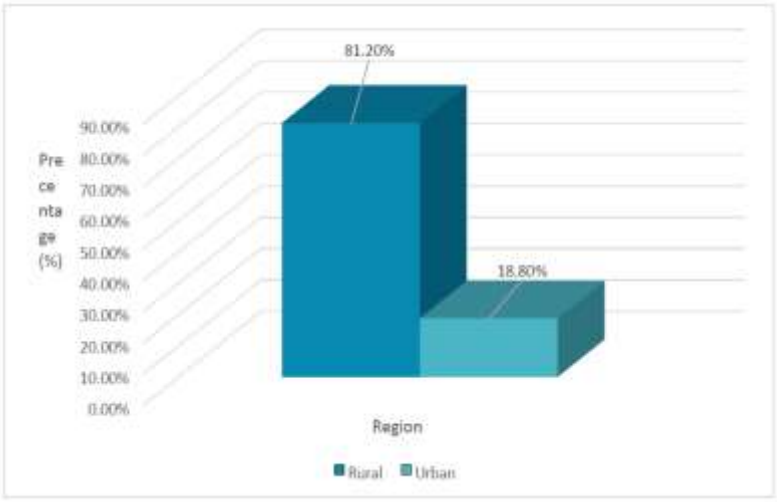

Figure 6: Prevalence of Anemia among Rural and Urban population.

Table 7: Rural-urban disparities in prevalence of anemia.

Region	No. of Cases	Percentage (%)
Rural	138	81.20
Urban	32	18.80
Total	170	100

- Anemia was higher among rural residents (81.20%) and urban residents (18.80%).
- The difference in the prevalence of anemia between rural and urban areas was attributed to the difference in the respondent's characteristics.

7) Bmi

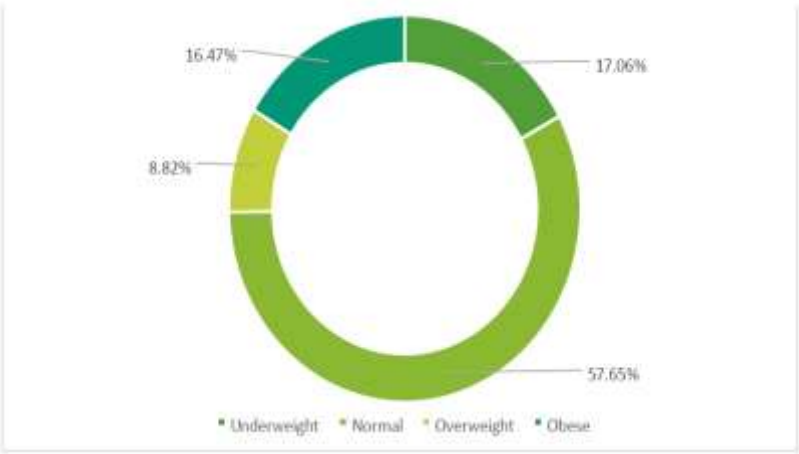

Figure 7: Prevalence of Anemia based on BMI.

Table 8: Correlation of Anemia with BMI of patients.

BMI	No. of Cases	Percentage (%)
Underweight	29	17.06
Normal	98	57.65
Overweight	15	8.82
Obese	28	16.47
Total	170	100

- Majority of the patients BMI was found to be normal (57.65%).
- About 17.06% of patients were underweight, while others were obese (16.47%) and overweight (8.82%) respectively.
- The correlation of BMI in anemic patients with obesity/overweight from in-door patients of a tertiary care hospital were shown to have lower likelihood of being anemic while underweight patients were more likely to be anemic.

8) Nutrition

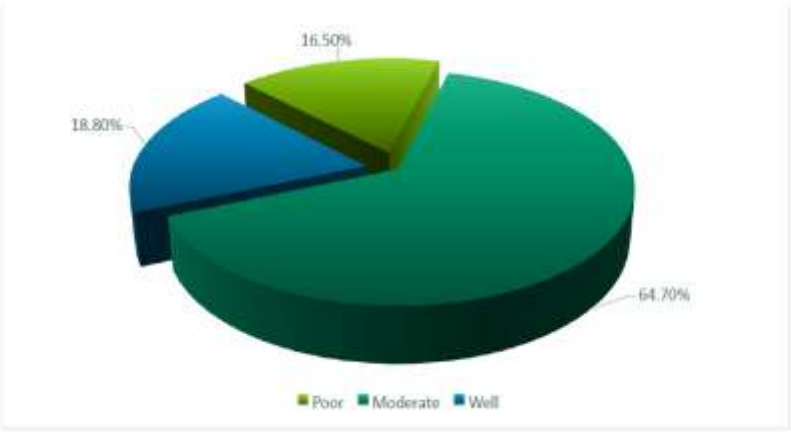

Figure 8: Prevalence of anemia based on nutritional status.

Table 9: Nutrition status among anemic patients.

Nutrition status	No. of cases	Percentage (%)
Poor	28	16.50
Moderate	110	64.70
Well	32	18.80
Total	170	100

- A larger prevalence of anemia is attributed to be seen in patients with moderate nutrition status (64.70%) followed by well (18.80%) and poor (16.50%) nutrition level.
- Well nutrition is a leading multifactorial origin for overweight, with important genetic and environmental factors such as inadequate eating habits, the preference for quick meals, consisting mostly the high-calorie foods like snacks and soft drinks.
- Poor nutrition status could be linked with overall low diet quality like low intake of animal source foods and fruits.

9) Social habit

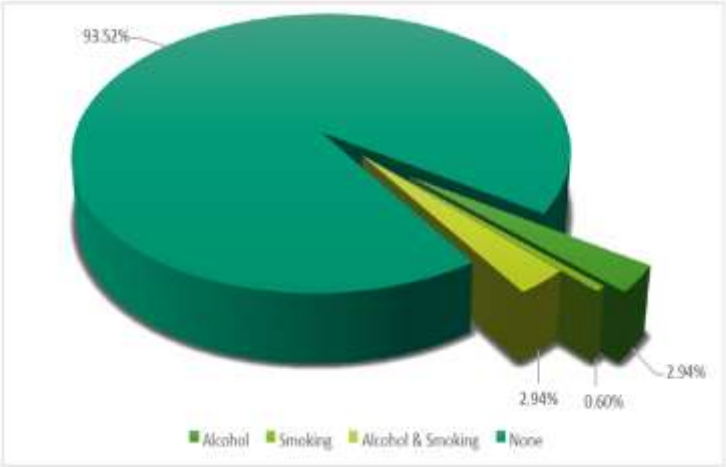

Figure 9: Prevalence of anemia based on social habit.

Table 10: Prevalence of anemia associated with social habit.

Social habit	No. of cases	Percentage (%)
Alcohol	5	2.94
Smoking	1	0.60
Alcohol & Smoking	5	2.94
None	159	93.52
Total	170	100

- Alcohol and smoking is seen to be the most important contributor in the prevalence of anemia.

- The patients who are consuming both alcohol and are smoking showed prevalence of (2.94%) are believed to be at high risk where as those who only consume alcohol showed (2.94%) respectively.
- Only 1 i.e., (0.60%) patient with smoking habit was associated with prevalence of anemia.

10) Diet

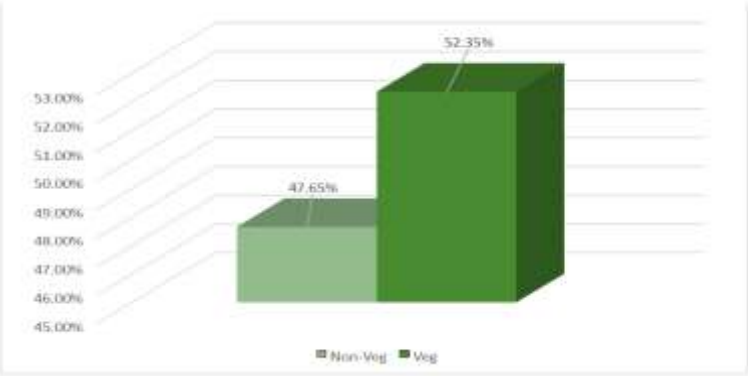

Figure 10: Prevalence of Anemia on basis of diet.

Table 11: Relationship of anemia with diet.

Diet	No. of Cases	Percentage (%)
Non-Veg	81	47.65
Veg	89	52.35
Total	170	100

- More than half i.e., 89 (52.35%) of the anemic patients were found to be vegetarians. Other 81 patients (47.65%) were non-vegetarians and found to be less anemic.
- In majority of times the association of vegetarian diet has shown statistically significant association with the severity of anemia.

11) Blood group

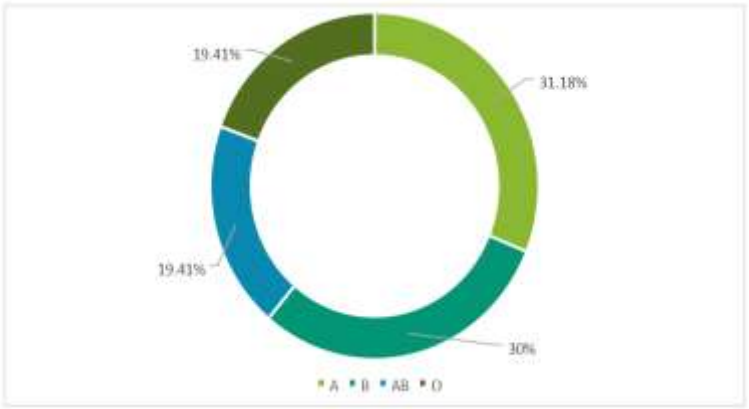

Figure 11: Anemia association with blood groups.

Table 12: Blood Group and Anemia relationship.

Blood group	No. of cases	Percentage (%)
A	53	31.18
B	51	30
AB	33	19.41
O	33	19.41
Total	**170**	**100**

- In our study we found that patients with blood group A (31.18%) are more prone for anemia, followed by B (30%), AB (19.41%) and blood group O (19.41%).
- Moreover, anemia was found to be least common in patients having blood group AB (19.41%) and blood group O (19.41%).
- However, group A showed predominant association with increasing risk for anemia.

DISCUSSION

Despite all recent health-related improvements, anemia remains an extensive public health issue which is underdiagnosed or untreated, affecting the lives of about one-fourth of the world population in a geographically heterogeneous pattern. We, therefore, aimed to illustrate the prevalence, severity, most common types, treatment and major determinants of anemia among in-patients of a tertiary care hospital.

The present study provided a particularly valuable description of prevalence of anemia and its pharmacological interventions in patients admitted to a tertiary care hospital as per WHO criteria.

Over a 6 months of period data was collected using a specialized designed data collection form. Out of 1,116 patients analysed, 170 were found to be anemic and the prevalence rate was found to be 15.23%.

Out of 170 anemic patients, 89 (52.35%) were males and 81 (47.65%) were females, the comparative assessment revealed that males were slightly more prevalent than females. This observation is supported by the results of the study conducted by Melat Belay Zeleke *et al.*, which showed that out of 742 respondents 50.8% were males and 49.2% were females i.e., males were slightly more prevalent than females.

Among the enrolled age groups, the age group of 61-70 years had the highest proportion of anemia (22.94%) followed by 51-60 years (22.35%), 71-80 years (18.24%), 41-50 years

(12.35%), 81 years and above (12.35%), 31-40 years (7.65%) and 18-30 years (4.12%). In the age group less than 40 years females are highly prevalent to anemia and in the age group greater than 40 years male are highly prevalent to anemia. This observation is supported with the results of the study conducted by Aishatu L Adamu *et al.*, which showed that the increasing age was associated with higher anemia prevalence in men.

Out of 170 anemic patients, majority of the patients had moderate anemia i.e., 47.06% while 35.88% were mildly anemic and 17.06% were severely anemic. A similar study was conducted by Elham Akbarpour *et al.,* demonstrated that, the most prevalent degree was mild anemia and least proportion of patients were severely anemic. The commonest type of anemia was normocytic anemia occurring in 62.35% of total anemic population i.e., 170 followed by 31.18% were with microcytic anemia and only 6.47% were with macrocytic anemia.

In our study, it was observed that out of 170 anemic patients, anemia was higher among rural residence (81.20%) than urban residence (18.80%), as the study site is situated in urban region the distribution of patients among rural and urban cannot be generalized.

Out of 170 anemic patients majority of the patients BMI was found to be normal (57.65%). About 17.06% patients were underweight, 16.47% were obese and 8.82% were overweight. Out of 170 anemic patients nutritional status 64.70% were moderate, 16.50% were poor and 18.80% were at well nutrition level.

Out of 170 anemic patients, majority of patients were not associated with any social habit i.e. 93.52%, 2.94% of patients were consuming alcohol, 0.60% of patients were smoking tobacco and 2.94% of patients were associated with both consuming alcohol and smoking tobacco.

Out of 170 anemic patients, more than half of the patients i.e. 89 (52.35%) patients were found to be vegetarians and 81 (47.65%) patients were found to be non-vegetarians and were less prevalent to anemia when compared to vegetarians. In majority of times vegetarian diet has shown statistically significant association with the severity of anemia.

In our study, it was observed that out of 170 anemic patients, patients with blood group A were more prevalent to anemia i.e., 31.18% followed by blood group B (30%) then blood group AB (19.41%) and blood group O (19.41%). Similar study was conducted by Verma Pratima, Singh Shraddha *et al.*, which showed that, the prevalence of anemia was higher in

blood group O which is 39.24% followed by blood group B which is 42.20%, then blood group A 13.3% and blood group O 5.25%.

The management of anemia was done through various non-pharmacological (Blood transfusion), pharmacological and combined (pharmacological and non-pharmacological) interventions. More than half of the mild anemic patients 55.74% and 28.75% of moderate anemic patients were left untreated. Mild anemia was mostly treated through pharmacological interventions. Moderate anemia was mostly treated by pharmacological interventions i.e., 50% and 17.50% of moderate anemic patients by combined (pharmacological and non-pharmacological) therapy. About 13.80% of severe anemic patients were treated by blood transfusions, 13.80% were treated by pharmacological interventions and 72.40% patients were treated by both blood transfusion and pharmacological interventions.

CONCLUSION

This study aided in assessing the prevalence of anemia of patient attending in inpatient department of a tertiary care hospital based on WHO criteria, which is a tool to assess the severity of anemia based on age and gender. The study revealed that overall prevalence rate of anemia was 15.23% and the prevalence of anemia was 52.35% in males and 47.65% in females thus the prevalence of anemia was seen to be more in male patients compared to female patients. More than 60% patients were of age 51 years and above. In patients of age 18-40 years females have higher anemia prevalence and from age 4181 years and above males have slightly higher anemia prevalence than females. So we can conclude that, as the age increases both the genders are at the risk of developing anemia.

More than half of the mild anemic patients and 28.75% moderate anemic patients were untreated/underdiagnosed, mild anemia is not a serious issue but the condition can become serious if left untreated.

The study revealed more than half of the anemic patients were vegetarians. In majority of times the association of vegetarian diet has shown statistically significant association with the severity of anemia.

Future research should explore provider-level and other strategies for improving assessment and diagnosis of anemia and effective public education about iron rich and vitamin rich

(vitamin B12, vitamin B9) sources of plant-based and animal based foods are effective strategies for reducing the prevalence of anemia among population.

Limitations

- This is a single site study as samples were collected only from one hospital therefore, the results obtained cannot be used to generalize the prevalence of anemia.
- This study was conducted among Inpatients only and in a very short period of time.
- As the hospital is situated in urban region we cannot estimate the precise distribution of prevalence of anemia between urban and rural region.
- We were unable to determine the cause of anemia due to data limitations.
- Finally, people who were not included in the study or with a missing Hb measurement might have had a different anemia prevalence than those included in the study which would bias our results.

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