Original Research Article

Prevalence and determinants of anemia among hospitalized patients: a cross-sectional study

Amresh Bahadur Singh[1], Nitin Ranjan Gupta[2], Seema Singh[3]*

[1]DGM, NCD, SPMU, National Health Mission, Uttar Pradesh, India
[2]Department of Internal Medicine, Hind Institute of Medical Sciences and Research, Sitapur, Uttar Pradesh, India
[3]Department of Physiology, Era's Lucknow Medical College and Hospital, Lucknow, Uttar Pradesh, India

*Correspondence:
Dr. Seema Singh,
E-mail: drseemasingh2013@gmail.com

ABSTRACT

Background: Anemia is a prevalent comorbidity among hospitalized patients, often exacerbating the burden of underlying chronic illnesses. Understanding its prevalence, severity, and determinants is critical for improving patient care and outcomes.
Methods: This cross-sectional study, conducted at two hospitals in Uttar Pradesh, India, investigated anemia among 372 hospitalized patients aged 15 years and above. Sociodemographic, nutritional, and lifestyle factors were recorded using structured questionnaires, and anemia was classified based on WHO hemoglobin thresholds. Morphological subtypes were determined through hematological analysis. Logistic regression analysis identified factors associated with anemia.
Results: Anemia prevalence was 64.2%, with moderate anemia being the most common (34.1%), followed by severe (15.3%) and mild anemia (14.8%). Normocytic normochromic anemia (32.8%) was the predominant type, followed by microcytic hypochromic anemia (28.2%). Significant predictors of anemia included daily alcohol consumption (AOR: 3.75, CI: 1.69-8.27), underweight BMI (AOR: 9.23, CI: 2.87-30.23), malnutrition (AOR: 2.59, CI: 1.15-5.83), and chronic kidney disease (AOR: 11.15, CI: 4.06-30.60).
Conclusions: Anemia is highly prevalent among hospitalized patients, driven by chronic diseases, malnutrition, and lifestyle factors. Normocytic normochromic anemia was most common, highlighting the contribution of chronic illnesses like kidney and liver diseases. These findings emphasize the need for targeted interventions addressing nutritional support and management of chronic conditions to mitigate anemia's burden in hospitalized populations.

Keywords: Anemia, Chronic disease, Cross-sectional study, Hospitalized patients, Malnutrition, Normocytic anemia

INTRODUCTION

The majority of hospital-admitted patients are adults and older individuals (aged 15 years and above), often presenting with chronic diseases and multiple comorbidities, leading to frequent hospitalizations.[1] One of the most common comorbidities observed in these patients is anemia.[2-6] Anemia is characterized by a lower-than-normal count of red blood cells (RBCs) or hemoglobin (Hb) levels. It is diagnosed in non-pregnant women aged 15 and older with hemoglobin levels below 12.0 gm/dl and in men of the same age group with levels below 13.0 gm/dl.[7,8] Anemia in hospitalized patients arises from nutritional deficiencies, blood loss, chronic conditions, hemoglobin disorders, infections like malaria, tuberculosis, HIV, parasitic infections, and other unidentified causes.[9]

Hospitalized patients tend to experience a higher prevalence of anemia compared to the general population. It is estimated that anemia affects between 30% and 90% of newly admitted patients throughout the course of their

illnesses.[2-6] Its occurrence is particularly high among females from adolescence into adulthood and in elderly patients (over 80 years old), with around 42% of these individuals being affected.[10] Globally, the most common type of anemia is iron deficiency anemia (IDA).[11] However, multifactorial anemia, which includes anemia of chronic diseases (ACD), chronic kidney disease (CKD), nutritional deficiencies, bleeding, and inflammation related to iron metabolism, is also prevalent.[10,12] Recent findings have highlighted the role of altered iron metabolism in both IDA and ACD, conditions that are characterized by low iron stores. Hepcidin, a hormone produced by the liver in response to chronic inflammation, inhibits ferroportin activity, leading to reduced iron absorption in the gut and iron sequestration in macrophages and enterocytes.[13] Previous research conducted in Ethiopia has demonstrated a higher prevalence of anemia among hospitalized patients.[14] However, despite the significant presence of anemia in these patients, limited studies have been carried out in our setting.

The objective of this study was to investigate the prevalence, severity, and morphological types of anemia among hospitalized patients aged 15 years and above in Uttar Pradesh, India, and to identify the associated sociodemographic, nutritional, and clinical determinants.

METHODS

Study design, area, and period

This study employed a hospital-based, prospective, cross-sectional design conducted between September 2014 and October 2015 at in Hind Institute of Medical Sciences and Research, Sitapur, India and The Era's Lucknow Medical College and Hospital, Lucknow. The study protocol was approved by the institutional health research ethics review committee.

Sample size

The study included a total of 372 hospitalized patients aged 15 years and above who met the inclusion criteria and consented to participate.

Population, inclusion, and exclusion criteria

The study population consisted of all patients aged 15 years and older who were admitted to the hospital during the study period and who consented to participate. Patients' diagnoses were obtained through a review of their medical charts. Pregnant women and individuals who were unable to communicate effectively were excluded from the study.

Data collection and measurement

A structured questionnaire was developed from various literature sources to capture participants' socio-demographic characteristics, clinical history, lifestyle habits, and nutritional status. Nine data collectors-comprising one senior clinical nurse, one senior medical resident, and one senior medical laboratory professional from each hospital- were trained to gather data.

The weight and height of participants were measured using a digital weight scale with an attached height gauge, and the BMI was calculated as weight (kg) divided by height (m^2). BMI was categorized into underweight (<18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), and obese (≥30 kg/m^2). Nutritional status was also assessed using the middle upper arm circumference (MUAC), with a MUAC <22 cm indicating malnutrition.

Lifestyle factors, including alcohol consumption, cigarette smoking, and khat chewing, were recorded. A standard alcohol drink was defined as a beverage containing approximately 10 gm of ethanol, while cigarette smoking was recorded if the participant smoked at least one stick of cigarettes per day in the preceding month. Khat chewing was documented if the participant had chewed khat in the 30 days prior to data collection.

Sample collection and laboratory analysis

Four milliliters of venous blood were collected from each participant using venipuncture under aseptic conditions, following the World Health Organization (WHO) protocol. Blood samples were placed into ethylene diamine tetra acetic acid (EDTA) tubes and mixed to prevent clotting. Hemoglobin (Hb), mean cell volume (MCV), mean cell hemoglobin (MCH), and mean cell hemoglobin concentration (MCHC) were analyzed using the UniCel DxH 800 Coulter hematology analyzer (Beckman Coulter, Inc.).

Diagnosis of anemia

Anemia was diagnosed according to WHO criteria, with Hb levels <13 gm/dl in males and <12 gm/dl in females. Anemia severity was classified into mild (Hb 11-12.9 gm/dl for males and 11-11.9 gm/dl for females), moderate (Hb 7-10.9 gm/dl for both males and females), and severe (Hb ≤7 gm/dl). The types of anemia were further classified based on MCV and MCHC values into normocytic normochromic, microcytic hypochromic, and macrocytic normochromic anemia.

Data processing and analysis

Data were analyzed using SPSS version 26. Categorical variables were presented using frequencies and percentages. Continuous data were tested for normality using the Kolmogorov-Smirnov test. Bivariable logistic regression was conducted to determine the relationship between independent variables and anemia status, with results presented as crude odds ratios (COR) and 95% confidence intervals (CI). Variables with p values <0.25 were included in a multivariable logistic regression model

to control for confounders. The model's goodness-of-fit was confirmed using the Hosmer-Lemeshow test, and statistical significance was set at p<0.05.

RESULTS

Sociodemographic characteristics of hospital admitted patients

Table 1 presents the basic demographic data of 372 hospital-admitted patients. The majority of the participants fall in the 25-34 age group (30.6%), followed by those aged 55-64 (17.2%). Slightly more than half (54.3%) of the participants were female. Most patients (58.6%) resided in rural areas. In terms of education, 21.2% had completed secondary school, and 18.3% had attended college or higher, indicating a diverse educational background among the admitted patients (Table 1).

Table 1: Sociodemographic characteristics of hospital admitted patients.

Variables	Category	Admitted patients N (%)
Age in years	15-24	63 (16.9)
	25-34	114 (30.6)
	35-44	60 (16.1)
	45-54	52 (14.0)
	55-64	64 (17.2)
	Above 65	29 (7.8)
Sex	Female	202 (54.3)
	Male	170 (45.7)
Residence	Urban	154 (41.4)
	Rural	218 (58.6)
Educational status	Unable to read and write	72 (19.4)
	Able to read and write	78 (20.9)
	Preparatory school	76 (20.4)
	Secondary school	79 (21.2)
	College or above	68 (18.3)

Nutritional and behavioral-related factors of admitted patients

The Table 2 highlights patient behaviors: 29.6% were underweight, 15.6% obese, and 45.2% malnourished (MUAC). Daily alcohol consumption was reported by 35.5%, with 23.7% drinking 1-4 days weekly. Khat chewing was common (54.8%), and 64.5% smoked cigarettes, 33.1% smoking five or more sticks daily (Table 2).

Admission diagnosis of hospital admitted patients

Table 3 provides the primary diagnoses of the admitted patients. The most common admission diagnosis was CKD, which accounted for 23.7% of cases, followed by chronic liver disease (15.3%) and chronic obstructive pulmonary disease (COPD) (14.2%). Other conditions made up 46.8% of the admissions, showing a wide variety of health conditions being treated in the hospital (Table 3).

Table 2: Nutritional and behavioral-related factors of admitted patients.

Variables	Categories	N (%)
Body mass index	Underweight	110 (29.6)
	Normal weight	113 (30.4)
	Overweight	91 (24.5)
	Obese	58 (15.6)
MUAC	Malnourished	168 (45.2)
	Normal	204 (54.8)
Amount of alcohol	No	155 (40.9)
	1-4 days per week	88 (23.7)
	Daily	132 (35.5)
Khat chewing habit	No	168 (45.2)
	<300 g per day	118 (31.7)
	≥300 g per day	86 (23.1)
Cigarette smoking	No	132 (35.5)
	<5 sticks per day	118 (31.7)
	≥5 sticks per day	123 (33.1)

Admission diagnosis of hospital admitted patients

Table 3 provides the primary diagnoses of the admitted patients. The most common admission diagnosis was CKD, which accounted for 23.7% of cases, followed by chronic liver disease (15.3%) and chronic obstructive pulmonary disease (COPD) (14.2%). Other conditions made up 46.8% of the admissions, showing a wide variety of health conditions being treated in the hospital (Table 3).

Table 3: Admission diagnosis of hospital admitted patients.

Admission diagnosis	N (%)
Chronic kidney disease	88 (23.7)
Chronic liver disease	57 (15.3)
Chronic obstructive pulmonary disease (COPD)	53 (14.2)
Others	174 (46.8)

Table 4: Severity of anemia among admitted patients.

Severity of anemia	N (%)
Mild anemia	55 (14.8)
Moderate anemia	127 (34.1)
Severe anemia	57 (15.3)

Severity of anemia among admitted patients

The Table 4 outlines the severity of anemia among the hospital-admitted patients. Of the 239 anemic patients, 34.1% had moderate anemia, 15.3% had severe anemia, and 14.8% had mild anemia. Moderate anemia was the most prevalent, indicating a significant proportion of the

patients experienced moderate impairment in hemoglobin levels (Table 4).

Morphological types of anemia

The morphological classification of anemia based on blood characteristics is shown in this table. Normocytic normochromic anemia, which indicates normal-sized red blood cells with normal hemoglobin concentration, was the most common form (32.8%). Microcytic hypochromic anemia, associated with smaller, paler red blood cells, followed closely at 28.2%. The least common type was macrocytic normochromic anemia, at 7.9%, which suggests enlarged red blood cells but normal hemoglobin concentration (Table 5).

Table 5: Morphological types of anemia.

Morphological type	N (%)
Normocytic normochromic anemia	122 (32.8)
Microcytic hypochromic anemia	105 (28.2)
Macrocytic normochromic anemia	29 (7.9)

Factors associated with anemia (multivariable logistic regression)

Table 6 presents the factors significantly associated with anemia, using adjusted odds ratios (AOR) from multivariable logistic regression analysis. Patients who consumed alcohol daily were 3.75 times more likely to develop anemia than non-drinkers. Underweight patients were 9.23 times more likely to be anemic, while obese patients were 2.30 times more likely to develop anemia compared to those with a normal weight. Additionally, patients who were malnourished (based on MUAC) had 2.59 times higher odds of being anemic.

Table 6: Factors associated with anemia (multivariable logistic regression).

Variables	Categories	AOR (95% CI)
Alcohol consumption	1-4 days per week	2.88 (1.45, 5.70)*
	Daily	3.75 (1.69, 8.27)*
Body mass index (BMI)	Underweight	9.23 (2.87, 30.23)*
	Obese	2.30 (1.00, 5.27)*
MUAC	Undernourished	2.59 (1.15, 5.83)*
Admission diagnosis	Chronic liver disease	3.20 (1.21, 8.47)*
	Chronic kidney disease	11.15 (4.06, 30.60)*
	Deep vein thrombosis	6.21 (1.98, 19.51)*
	Infectious disease	9.70 (2.77, 34.02)*

Note: *Statistically significant at p<0.05.

Specific medical conditions, such as chronic liver disease, chronic kidney disease, deep vein thrombosis, and infectious diseases, were also strongly associated with increased odds of anemia, with CKD patients being 11.15 times more likely to suffer from anemia (Table 6).

DISCUSSION

Anemia is a global health issue, particularly among hospitalized patients, often linked to chronic diseases, malnutrition, and lifestyle factors like alcohol use and smoking. This study examines the prevalence, types, and contributors to anemia, focusing on conditions like chronic kidney and liver diseases. Comparing findings with international studies, it offers insights for targeted interventions to improve outcomes in clinical settings.

The sociodemographic, nutritional, and behavioral characteristics of hospital-admitted patients in this study reflect significant trends in anemia prevalence and its associated factors. When compared to international findings, the overall prevalence of anemia in this study aligns with reports from countries such as Germany (60%), Benin (61.8%) and Uganda (64.3%).[4,5,15] However, it is lower than the higher rates observed in studies conducted in Pakistan (71%), Bahrain (72.2%) and Tanzania (79.5%).[2,3,16] These variations in prevalence may be attributed to differences in healthcare access, nutrition, and socioeconomic factors in different regions. The study's results also reveal that anemia prevalence here is higher than those found in countries like Italy (48%), Germany (54.2%), and Tanzania (44%), indicating that regional factors, possibly linked to healthcare disparities and malnutrition, influence anemia rates.[6,17,18]

In terms of the types of anemia, normocytic normochromic anemia (32.8%) was the most prevalent form observed in this study, which is consistent with findings from India, Pakistan, Malaysia, Saudi Arabia and Benin.[4,19-22] This type of anemia, characterized by normal-sized red blood cells with normal hemoglobin concentrations, is often seen in patients with CKD and other chronic non-communicable diseases (NCDs).[21,23] These conditions are typically associated with reduced erythropoiesis rather than hemolysis or iron deficiency, particularly in the early stages. The study also reported microcytic hypochromic anemia in a significant proportion of patients, indicating the presence of iron deficiency anemia, which is common in populations with nutritional deficits or chronic blood loss.

Several factors were found to be significantly associated with anemia in this study, including alcohol consumption, BMI, malnutrition, and specific medical conditions. Patients who consumed alcohol daily were found to be 3.75 times more likely to develop anemia compared to non-drinkers, which is consistent with studies conducted in Taiwan, Finland and Japan.[24,25] The relationship between chronic alcohol consumption and anemia can be attributed to a range of factors, including poor nutrition, liver disease, and ineffective erythropoiesis.[26] Alcoholics often suffer from multiple deficiencies that impair red blood cell production, leading to various forms of anemia.

The study also identified BMI as a key predictor of anemia. Underweight patients were 9.23 times more likely to be anemic, while obese patients had 2.30 times higher odds compared to those with normal BMI. These findings align with research from the United States, Pakistan, Iran and Austria.[27-30] Malnutrition and underweight status often result in iron, folate, or vitamin B_{12} deficiencies, which are critical for red blood cell production. On the other hand, obesity is associated with chronic inflammation, which can increase serum hepcidin levels and impair iron absorption, thus contributing to anemia. The link between obesity and anemia is well documented, with inflammation and reduced iron utilization being central mechanisms in this process.[31]

Malnutrition, as measured by the middle upper arm circumference (MUAC), was also strongly associated with anemia, with malnourished patients 2.59 times more likely to develop the condition. This finding is supported by similar research from the United States, India, and Bangladesh.[32-34] Malnutrition hampers the body's ability to produce red blood cells, leading to a higher risk of anemia, poorer treatment outcomes, and increased healthcare costs. Patients suffering from malnutrition often exhibit symptoms such as loss of appetite and poor nutrient absorption, further exacerbating the risk of anemia.[35]

Regarding the medical conditions associated with anemia, CKD emerged as a significant risk factor. Patients with CKD were found to be 11.15 times more likely to develop anemia, a finding corroborated by studies from the United States, Korea, Indonesia.[36-38] In CKD patients, anemia is typically caused by reduced production of erythropoietin, a hormone essential for red blood cell production. As kidney function deteriorates, the ability to produce erythropoietin diminishes, leading to normocytic normochromic anemia. This type of anemia is common in the early stages of CKD and reflects the progressive nature of the disease.[39]

Chronic liver disease (CLD) was another condition significantly associated with anemia in this study. This is consistent with findings from Bangladesh and other regions, where gastrointestinal bleeding, impaired iron absorption, and poor clotting factor production contribute to anemia in CLD patients.[34,40] These patients often exhibit signs of iron deficiency due to the liver's role in regulating iron homeostasis, which becomes impaired in advanced liver disease.

This study has certain limitations. First, it was conducted in two hospitals within Uttar Pradesh, which may limit the generalizability of the findings to other regions. Second, the study relied on cross-sectional data, which precludes establishing causal relationships between identified risk factors and anemia. Third, detailed dietary intake and micronutrient levels, such as iron and vitamin B_{12}, were not assessed, which could provide deeper insights into nutritional deficiencies contributing to anemia.

CONCLUSION

In conclusion, the results of this study align with findings from numerous international studies, particularly in identifying chronic conditions such as CKD and CLD, malnutrition, and alcohol consumption as key contributors to anemia. The study highlights the significant burden of anemia in hospitalized patients and underscores the importance of addressing underlying conditions such as malnutrition, alcohol use, and chronic disease management to reduce anemia prevalence. Understanding these associations can inform targeted interventions to improve anemia outcomes in vulnerable populations.

REFERENCES

1. Fonseca C, Araújo M, Moniz P, Marques F, Araújo I, Costa L, et al. Prevalence and prognostic impact of anemia and iron deficiency in patients hospitalized in an internal medicine ward: the Pro-Iron study. Eur J Haematol. 2017;99(6):505-13.
2. Alsaeed M, Ahmed S, Seyadi K, Ahmed A, Alawi S, Abulsaad K. The prevalence and impact of anemia in hospitalized older adults: a single center experience from Bahrain. J Taibah Univer Med Sci. 2022;17(4):587-95.
3. Bashir F, Nageen A, Kidwai S, Zulfikar S, Shiraz S, Ara J. Anemia in hospitalized patient: prevalence, etiology and risk factors. J Liaq Univer Med Health Sci. 2017;16:2.
4. Dovonou CA, Alassani A, Attinsounon CA, Ade S, Sake K, Degla J, et al. Epidemiology of anemia at the internal medicine department in Borgou Departmental Hospital Center (DHC) in Parakou (Benin). Open J Inter Med. 2018;8(2):123-30.
5. Kuule J, Seremba E, Freers J. Anemia among patients with congestive cardiac failure in Uganda- its impact on treatment outcomes. South Afr Med J. 2009;99(12):876-80.
6. Migone De Amicis M, Poggiali E, Motta I, Minonzio F, Fabio G, Hu C, et al. Anemia in elderly hospitalized patients: prevalence and clinical impact. Intern Emerg Med. 2015;10:581-6.
7. World Health Organization. Nutritional Anemias: Tools for Effective Prevention and Control. World Health Organization; 2017.
8. World Health Organization. aemoglobin concentrations for the diagnosis of anaemia and assessment of severity. In: Vitamin and Mineral Nutrition Information System. Geneva: World Health Organization; 2011.
9. Halawi R, Moukhadder H, Taher A. Anemia in the elderly: a consequence of aging? Expert Rev Hematol. 2017;10(4):327-35.

10. Kassebaum N, Collaborators GA. The global burden of anemia. Hematol Oncol Clin North Am. 2016;30(2):247-308.
11. Randi ML, Bertozzi I, Santarossa C, Cosi E, Lucente F, Bogoni G, et al. Prevalence and causes of anemia in hospitalized patients: impact on diseases outcome. J Clin Med. 2020;9(4):950.
12. Girelli D, Marchi G, Camaschella C. Anemia in the elderly. HemaSphere. 2018;2:e40.
13. Busti F, Marchi G, Ugolini S, Castagna A, Girelli D. Anemia and iron deficiency in cancer patients: role of iron replacement therapy. Pharmaceuticals. 2018;11(4):94.
14. Bekele A, Teji K, Egata G, Gebremichael B. Anemia and associated factors among type-2 diabetes mellitus patients attending public hospitals in Harari Region, Eastern Ethiopia. PLoS One. 2019;14(12):e0225725.
15. Geisel T, Martin J, Schulze B, Schaefer R, Bach M, Virgin G, et al. An etiologic profile of anemia in 405 geriatric patients. Anemia. 2014;2014(1):932486.
16. Chamba C, Nasser A, Mawalla WF, Masamu U, Budodi Lubuva N, Tebuka E, et al. Anaemia in the hospitalized elderly in Tanzania: prevalence, Severity, and micronutrient deficiency status. Anemia. 2021;2021(1):9523836.
17. Röhrig G, Klossok W, Becker I, Benzing T, Schulz R. Prevalence of anemia among elderly patients in an emergency room setting. Eur Geriatr Med. 2014;5(1):3-7.
18. Munenguni E, Huda A, Jaffer T, Zimbeiya A, Henke O. Anemia in hospitalized patients in A referral hospital in Northern Tanzania. East Afr Med J. 2021;98:5.
19. Aithal K, Meti K, Jain S. A study of pattern and causes of anaemia in elderly patients admitted at tertiary centre. Sch J Appl Med Sci. 2017;5(4D):1483-6.
20. Ashraf A. Frequency of anaemia in patients presenting to a tertiary care hospital in Lahore, Pakistan. Medicine. 2018;4(19):12.
21. Idris I, Tohid H, Muhammad NA, Rashid MR, Ahad AM, Ali N, et al. Anaemia among primary care patients with type 2 diabetes mellitus (T2DM) and chronic kidney disease (CKD): a multicentred cross-sectional study. BMJ Open. 2018;8(12):e025125.
22. Elsayid M, Al-Qahtani A, Alanazi A, Qureshi S. Determination of the most common morphological patterns of anemia among Saudi anemic patients attending King Abdul-Aziz Medical City-Riyadh. Intern J Med Public Health. 2015;5:4.
23. Abdulqadir A, Polus R. Prevalence of anemia of chronic disease and iron deficiency anemia among adult diabetic patients in Erbil City. Zanco J Med Sci. 2014;18:1.
24. Latvala J, Parkkila S, Niemelä O. Excess alcohol consumption is common in patients with cytopenia: studies in blood and bone marrow cells. Alcohol Clin Exp Res. 2004;28(4):619-24.
25. Yokoyama A, Yokoyama T, Brooks PJ, Mizukami T, Matsui T, Kimura M, Matsushita S, Higuchi S, Maruyama K. Macrocytosis, macrocytic anemia, and genetic polymorphisms of alcohol dehydrogenase-1 B and aldehyde dehydrogenase-2 in Japanese alcoholic men. Alcoholism: Clin Exp Res. 2014;38(5):1237-46.
26. Colman N, Herbert V. Hematologic complications of alcoholism: overview. Semin Hematol. 1980;17(3):164-76.
27. Yanoff LB, Menzie CM, Denkinger B, Sebring NG, McHugh T, Remaley AT, et al. Inflammation and iron deficiency in the hypoferremia of obesity. Int J Obes. 2007;31(9):1412-9.
28. Khan A, Khan W, Ayub M, Humayun M, Haroon M. Ferritin is a marker of inflammation rather than iron deficiency in overweight and obese people. J Obes. 2016;2016:1-7.
29. Arshad M, Jaberian S, Pazouki A, Riazi S, Rangraz M, Mokhber S. Iron deficiency anemia and megaloblastic anemia in obese patients. Rom J Intern Med. 2017;55(1):3-7.
30. Aigner E, Feldman A, Datz C. Obesity as an emerging risk factor for iron deficiency. Nutrients. 2014;6(9):3587-600.
31. Saad R, Qutob H. The relationship between anemia and obesity. Expert Rev Hematol. 2022;15(10):911-26.
32. Tseng F, Gou G, Wang S, Shyu J, Pan R. Chronic liver disease and cirrhosis increase morbidity in geriatric patients treated surgically for Hip fractures: analysis of the US Nationwide Inpatient Sample. BMC Geriatr. 2022;22(1):150.
33. Rauf A, Gupta V, Bansal R, Shah V, Mohammad N, Matin A, et al. Anemia profile in patients of chronic liver disease from North Indian tertiary hospital. J Clin Exp Hepatol. 2014;4:S41-2.
34. Nuruddin A, Sultana A, Akter F, Ahmed E, Dutta B. Prevalence and pattern of anemia among the hospitalized patients of chronic liver disease in a tertiary care hospital. J Chittagong Med Coll Teach Assoc. 2017;28(2):111-5.
35. van Bokhorst-de van der Schueren M. Nutritional support strategies for malnourished cancer patients. Europ J Oncol Nurs. 2005;9:S74-83.
36. Stauffer M, Fan T. Prevalence of anemia in chronic kidney disease in the United States. PLoS One. 2014;9(1).
37. Lee YG, Chang Y, Kang J, Koo DH, Lee SS, Ryu S, et al. Risk factors for incident anemia of chronic diseases: A cohort study. PloS One. 2019;14(5):e0216062.
38. Suega K, Bakta M, Dharmayudha TG, Lukman J, Suwitra K. Profile of anemia in chronic renal failure patients: comparison between predialyzed and dialyzed patients at the division of nephrology, department of internal medicine, Sanglah Hospital, Denpasar, Bali, Indonesia. Dep Intern Med Sanglah Hosp Denpasar Bali Indonesia Inflam. 2005;1:6-9.
39. Ryu SR, Park SK, Jung JY, Kim YH, Oh YK, Yoo TH, et al. The prevalence and management of anemia in chronic kidney disease patients: result from the KoreaN Cohort Study for Outcomes in Patients With

Chronic Kidney Disease (KNOW-CKD). J Korean Med Sci. 2017;32(2):249-56.

40. Farrell G, Larter C. Nonalcoholic fatty liver disease: from steatosis to cirrhosis. Hepatology. 2006;43(S1):S99-112.

Cite this article as: Singh AB, Gupta NR, Singh S. Prevalence and determinants of anemia among hospitalized patients: a cross-sectional study. Int J Res Med Sci 2025;13:1087-93.