Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

A cross-sectional study on the prevalence of different types of anemias in pregnant women in a rural tertiary care center.

Ms. Harika Peethambaram[1], Dr. Hiranmaye Mokhasunavisu[2], Dr. Ramya Sindhura Tammireddi[3]*, Dr. Anusha Kollapu[4], Dr. Jhansi Rani.L[5], Dr. Bhagyalakshmi Atla[6]

[1] *IIIrd Year MBBS, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India*
[2] *Assistant Professor, Department of Obstetrics and Gynecology, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India*
[3] *Assistant Professor, Department of Pathology, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India*
[4] *Post Graduate, Department of Obstetrics and Gynecology, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India*
[5] *Professor, Department of Obstetrics and Gynecology, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India*
[6] *Professor and Head of Department, Department of Pathology, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India*

Abstract

Background:

Anemia during pregnancy is a major public health concern, especially in rural areas of developing countries, and is associated with adverse maternal and fetal outcomes. Iron deficiency anemia (IDA) is the most common type, though folate and vitamin B12 deficiencies also contribute. This study assessed the prevalence and distribution of different anemia types among pregnant women in a rural tertiary care setting.

Materials and Methods:

A cross-sectional study was conducted over 12 months (June 2024–May 2025) at the Department of Pathology and Department of Obstetrics and Gynecology, NRI Institute of Medical Sciences, Visakhapatnam. A total of 150 pregnant women aged 18–40 years with anemia were included. Data were collected from complete blood picture profiles, hemoglobin levels, and nutritional markers, including serum iron, ferritin, folate, and vitamin B12. Statistical analysis was performed using SPSS.

Results:

Most participants were aged 21–25 years (46%), followed by 26–30 years (24%), 18–20 years (20%), and 31–35 years (9.3%). Iron deficiency anemia was the predominant type (85.23%), followed by vitamin B12 deficiency (10.72%) and folate deficiency (4.69%). Severe anemia (Hb <7 g/dL) was exclusively due to IDA, while B12 and folate deficiencies were more frequent in mild anemia cases. Hematological and biochemical findings were consistent with these nutritional deficiencies. Higher prevalence was observed in women with greater parity and lower socioeconomic status.

Conclusion:

Iron deficiency overwhelmingly dominates anemia among pregnant women in rural India, with vitamin B12 and folate deficiencies contributing mainly to mild cases, particularly in multiparous women and those of lower socioeconomic status.

Recommendations:

Strengthened antenatal screening, nutritional counseling, and timely supplementation with iron, vitamin B12, and folate are essential to reduce maternal anemia and improve pregnancy outcomes.

Keywords: *Anemia, Pregnancy, Iron deficiency, Vitamin B12 deficiency, Folate deficiency.*
Submitted: *June 19, 2025* ***Accepted:*** *August 10, 2025* ***Published:*** *September 29, 2025*

Corresponding Author: *Dr. Ramya Sindhura Tammireddi*
Email: ***sindhuratammireddi@gmail.com***
Assistant Professor, Department of Pathology, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India

INTRODUCTION

Anemia mainly affects those living in rural areas, from poorer backgrounds, and those without a formal education, and is thus a major public health concern [1]. About 37% of pregnant women are affected by anemia.1 Anemia during pregnancy carries many risks and, therefore, can lead to many

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

adverse outcomes. Due to the socioeconomic and nutritional differences, it is a known fact that pregnant women in developing countries usually have higher rates of anemia than women in developed countries. Maternal anemia is a state with a Hemoglobin level <11 mg/dL during pregnancy [2]. Many types of anemias can be seen in pregnant women, Including Iron deficiency anemia, Folate deficiency anemia, and Vitamin B12 deficiency anemia. Iron deficiency anemia in pregnancy has been linked to increased maternal and perinatal morbidity and mortality rates. [3,9].

Folate deficiencies in pregnancy have serious implications and are caused by inadequate dietary intake, increased requirements, and malabsorption [4]. Vitamin B12 deficiency during pregnancy has been linked to long-term developmental issues in children and is known to be the highest in India [5]. Other types of anemia commonly seen during pregnancy include sickle cell anemia, thalassemia, and other hemoglobinopathies. Sickle cell anemia has been associated with an increased risk of perinatal mortality, premature labor, and fetal growth restriction in pregnancy. Some studies also described an increase in spontaneous miscarriage, antenatal hospitalization, maternal mortality, delivery by C-section, and antepartum hemorrhage [6]. Maternal anemia and the risk of hypertensive disorders are increased by Thalassemia traits in pregnant women [7]. Thalassemia trait carriers tend to have higher rates of unfavorable pregnancy outcomes, as changes in the maternal circulation may lower the hematocrit level and exacerbate the severity of their anemia [8]. Parasitic infections are a public health concern, especially among pregnant women in developing countries, as they can lead to Iron deficiency anemia, stunted growth, poor nutritional status, and many more. They are common in tropical and subtropical regions, where environmental factors tend to favor their survival and spread.

This study is thus going to check for the prevalence of these types of anemias in rural areas.

Objectives

To determine the different types of anemias in pregnant women in a rural area

To estimate the prevalence of these different types of anemia among the study population.

To evaluate the etiology of the different anemias in the study group.

METHODOLOGY

Study Design and Setting

This cross-sectional study was conducted in the Department of Pathology and the Department of Obstetrics and Gynecology at NRI Institute of Medical Sciences (NRIIMS), Sangivalasa, Visakhapatnam, Andhra Pradesh, India, over 12 months from June 2024 to May 2025. NRIIMS is a rural tertiary care teaching hospital catering to a predominantly low- to middle-income population from surrounding villages, offering both outpatient and inpatient services. The study population comprised pregnant women attending the obstetrics outpatient department (OPD) of NRIIMS.

Sample size: Various studies across India, including those from the southern regions, have reported a wide range in the prevalence of iron deficiency anemia, varying from 40% to 65%, with it being the most common form of anemia.10,11 Based on an estimated prevalence of 45% in the study population, with a 20% relative error and 95% confidence interval, the sample size was calculated using the formula:

$n=4pq/l^2$, where:

$p = 45$ (prevalence),

$q = 100 - p = 55$,

$l = 20\%$ of $p = 9$,

$n = (4 \times 45 \times 55) / 9^2 = 9900 / 81 \approx 122$

Thus, the minimum required sample size for the study was calculated to be 122.

Inclusion criteria:

Pregnant women between the ages of 18 and 40 years who are willing to participate, pregnant women who have anemia and/or any hemoglobinopathies.

Data Collection: Data were collected from patient case records and laboratory reports. Complete blood counts (CBC) were analyzed using an automated hematology analyzer (Sysmex), providing hemoglobin, RBC count, MCV, MCH, MCHC, and RDW values. Nutritional parameters were measured using standard assays: serum iron and total iron-binding capacity (TIBC) were determined by colorimetric methods, ferritin by chemiluminescent immunoassay, vitamin B12 by electrochemiluminescence assay, and folate by enzyme immunoassay. All laboratory investigations were performed in the NRIIMS central diagnostic laboratory, which participates in routine internal and external quality assurance programs.

Parameters Assessed:

The parameters assessed include the distribution of participants based on Age, Type of Anemia, Distribution of Anemias according to Hemoglobin Values, CBC Parameters, Nutritional Parameters, Age, Parity, and Socioeconomic Status.

Bias and quality control

To reduce potential sources of bias, consecutive eligible participants were recruited to avoid selection bias. Laboratory investigations, including CBC and nutritional assays (serum iron, ferritin, folate, vitamin B12), were performed using standardized methods in the central clinical laboratory to

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

minimize measurement bias. Data entry was cross-checked by two independent investigators to reduce transcription errors, and statistical analysis was independently verified to minimize interpretation bias.

Statistical analysis:

After obtaining written informed consent from the participants, data is collected from their Hemogram/ CBC profile and, if necessary, their HPLC test results. The data is then entered and stored in Google Sheets and analyzed using SPSS. This shows us the prevalence of varying anemias and/or any hemoglobinopathies present.

Ethical considerations:

The study was conducted following approval from the Institutional Ethics Committee of NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam, Andhra Pradesh, India. Written informed consent was obtained from all participants before their inclusion in the study.

RESULTS

A total of 172 pregnant women aged 18–40 years attending the antenatal outpatient department were screened for anemia during the study period. Of these, 12 women did not meet the inclusion criteria (normal hemoglobin values), and 7 declined participations. Thus, 153 women were confirmed eligible. Three participants were excluded due to incomplete laboratory investigations, resulting in 150 women being included in the final analysis (Figure 1).

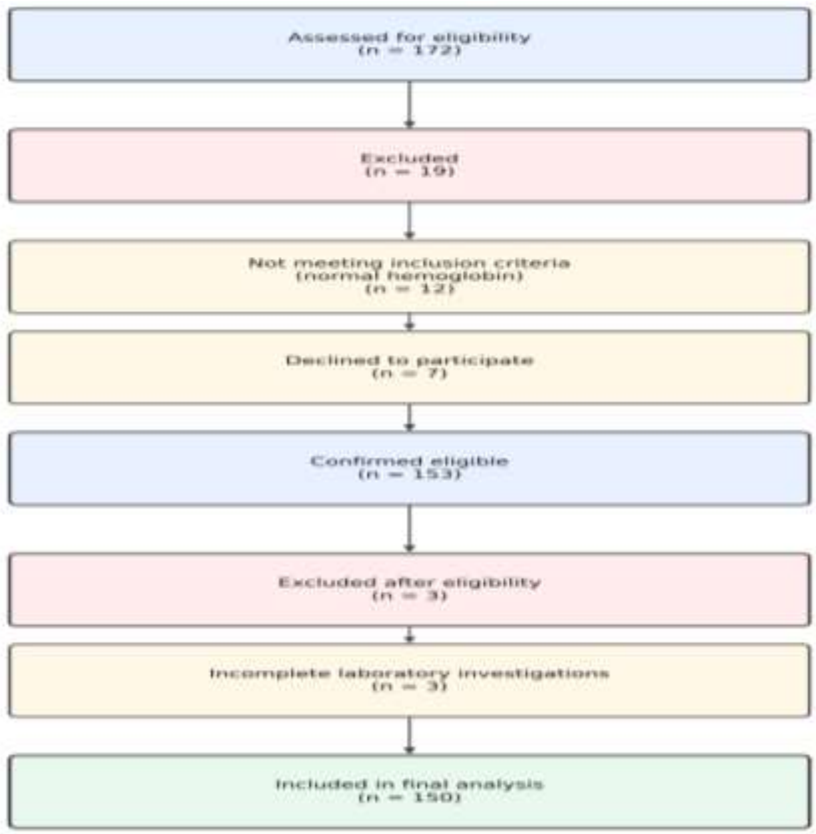

Figure 1: Participant Flow Diagram

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

Distribution of participants based on Age

According to the study protocol and inclusion criteria, a total of 150 pregnant women were recruited for the present study during the specified period at the Department of Obstetrics and Gynecology. The age of the participants ranged from 18 years to 35 years, with the majority belonging to the 21–25 years age group, comprising 69 participants (46.0%). This was followed by the 26–30 years group with 36 participants (24.0%), and the 18–20 years group with 31 participants (20.7%). The smallest proportion was in the 31–35 years group, with 14 participants (9.3%) (Table 1). This indicates that most participants were young adults, predominantly in their early to mid-twenties.

Table 1: Distribution of participants by age

Age Group (yrs)	n	%
18–20	31	20.7
21–25	69	46.0
26–30	36	24.0
31–35	14	9.3

Type of Anemia

Table 2 presents the distribution of different types of anemia among 150 pregnant women. Iron deficiency anemia was the most prevalent, accounting for 127 cases (85.23%), indicating it as the leading cause of anemia in the study population. B12 Deficiency Anemia was observed in 16 cases (10.72%), while Folate Deficiency Anemia was seen in 7 cases (4.69%). Notably, there were no reported cases of Thalassemia or Sickle Cell Anemia. These findings suggest that nutritional deficiencies, particularly iron, are the primary contributors to anemia in this cohort.

Table 2: Frequency of Different Types of Anemia

Type of Anemia	No. of Cases	Percentage (%)
Iron Deficiency Anemia	127	85.23%
Folate Deficiency Anemia	7	4.69%
B12 Deficiency Anemia	16	10.72%
Thalassemia	0	0.00%
Sickle Cell Anemia	0	0.00%
Total	150	100%

Distribution of Anemias according to Hemoglobin

Table 3 presents the distribution of different types of anemia across various hemoglobin (Hb) levels. In the severe anemia category (Hb <7 g/dL), all 19 cases (100%) were due to iron deficiency, with no instances of folate or B12 deficiency, thalassemia, or sickle cell anemia.

Among pregnant women with moderate anemia (Hb 7–9.9 g/dL), iron deficiency anemia remained predominant with 95 cases (86.36%), followed by B12 deficiency in 11 cases (10%) and folate deficiency in 2 cases (1.82%). In the mild anemia group (Hb10–10.9g/dL), iron deficiency was still the leading cause with 13 cases (59.09%), but B12 deficiency (22.73%) and folate deficiency (13.64%) were also notable. Interestingly, in individuals with normal hemoglobin levels (≥11 g/dL), only 2 cases of folate deficiency anemia (100%) were observed. Thalassemia and sickle cell anemia were not detected in any Hb category. Overall, iron deficiency was the most common type of anemia across all levels, especially in more severe cases, while B12 and folate deficiencies appeared more frequently in milder forms or with near-normal Hb levels.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

Table 3: Distribution of Anemias according to Hemoglobin value

Hb Value(g/dL)	Iron Deficiency Anemia	Folate Deficiency Anemia	B12 Deficiency Anemia
Severe Anemia (<7)	19 (100%)	0 (0%)	0 (0%)
Moderate Anemia (7–9.9)	95 (86.36%)	2 (1.82%)	11(10.00%)
Mild Anemia (10–10.9)	13 (59.09%)	3 (13.64%)	5 (22.73%)
Normal (≥11)	0 (0%)	2 (100%)	0 (0%)

Complete Blood Count Parameters

Table 4 presents the mean values of complete blood count (CBC) parameters across different types of anemia. Participants with Iron Deficiency Anemia showed a low mean hemoglobin (Hb) level of 8.5 g/dL, low RBC count (2.4 million/mm³), and microcytic hypochromic indices, including reduced MCV (76.3 fL), MCH (21.3 pg), and MCHC (29.3 g/dL), along with an elevated RDW (16.7%), indicating significant anisocytosis. In Folate Deficiency Anemia, the mean Hb was higher at 10.6 g/dL, with a moderately reduced RBC count of 2.9 million/mm³. The red cell indices—MCV (87.7 fL), MCH (26.9 pg), and MCHC (32.1g/dL)—were within or slightly above the normal range, consistent with normocytic or mildly macrocytic anemia. RDW was mildly elevated (15.9%). B12 Deficiency Anemia showed a mean Hb of 9.6 g/dL, RBC count of 3.1 million/mm³, and markedly elevated MCV (103.8 fL), indicating macrocytosis. MCH and MCHC were also elevated (28.4 pg and 31.6 g/dL, respectively), and RDW was slightly raised at 16.1%, reflecting variation in red cell size due to megaloblastic changes.

Table 4: Complete Blood Count Parameters (Mean±SD)

CBC, Parameters	Iron deficiency anemia	Folate deficiency anemia	B12 deficiency anemia
Hb (g/dl)	8.5 ±1.352	10.6 ±2.350	9.6 ±2.811
RBC, (million/mm³)	2.4 ±3.451	2.9 ±4.731	3.1 ±3.631
MCV (fL)	76.3 ±7.252	87.7 ±6.482	103.8 ±7.322
MCH (pg)	21.3 ±5.311	26.9 ±4.382	28.4 ±5.902
MCHC (g/dl)	29.3 ±3.866	32.1 ±2.744	31.6 ±3.905
RDW (%)	16.7 ±7.207	15.9 ±6.491	16.1 ±5.499

Nutritional Parameters

In iron deficiency anemia, serum iron levels are markedly low (48 µg/dL), with a high total iron-binding capacity (TIBC) of 470 µg/dL and reduced ferritin (15ng/mL), indicating depleted iron stores. In contrast, folate deficiency anemia presents with a significantly reduced folate level (2 ng/mL), while iron parameters remain relatively normal, and vitamin B12 is mildly decreased (180 ng/L). B12 deficiency anemia is characterized by low serum B12 (138 ng/L) along with moderately reduced folate (6 ng/mL), and near-normal iron (65 µg/dL) and ferritin (35 ng/mL) levels. These distinct nutritional profiles aid in differentiating the type of anemia and guiding appropriate treatment (Table 5).

Table 5: Nutritional Parameters (Mean ±SD)

Parameter	Iron Deficiency Anemia	Folate Deficiency Anemia	B12 Deficiency Anemia
SerumIron (µg/dL)	48 ±2.481	70 ±2.122	65 ±3.156
TIBC (µg/dL)	470 ±7.533	310 ±6.329	308 ±6.712
Ferritin (ng/mL)	15 ±1.255	28 ±1.976	35 ±2.422
VitaminB12(ng/L)	228 ±8.384	180 ±7.427	138 ±6.254
Folate (ng/mL)	15 ±1.399	2 ±1.032	6 ±1.002

Age

In all age groups, Iron Deficiency Anemia was the most prevalent. It accounted for 83.87% of cases in the 18–20 age group, 85.51% in the 21–25 group, 86.11% in the 26–30 group, and 78.57% in the 31–35 group. B12 Deficiency Anemia was more common in the younger age groups, comprising 16.13%of cases in the 18–20 group and 11.59% in the 21–25 group, while its proportion decreased in older groups. Folate Deficiency Anemia appeared relatively

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

infrequently but was slightly more represented in the 26–30 (8.33%) and 31–35 (14.29%) age groups (Table 6).
The Chi-square test yielded a p-value of 0.256, indicating no statistically significant association between age group and type of anemia in this study population. The findings suggest that iron deficiency remains the predominant anemia type across all age groups studied, with no strong age-dependent variation in anemia patterns.

Table 6: Distribution of anemia type by Age

Age Group	Iron Deficiency Anemia	Folate Deficiency Anemia	B12 Deficiency Anemia
18–20	26 (83.87%)	0 (0.0%)	5 (16.13%)
21–25	59 (85.51%)	2 (2.90%)	8 (11.59%)
26–30	31 (86.11%)	3 (8.33%)	2 (5.56%)
31–35	11(78.57%)	2 (14.29%)	1 (7.14%)

Parity

Iron Deficiency Anemia was the most common across all parity groups, ranging from 68.75% to 96%, highest among women with parity >3. B12 Deficiency was most notable in parity 3 (25%), while Folate Deficiency remained low across all groups, peaking at 7.5% in parity 1. The data indicate a consistent predominance of iron deficiency regardless of parity, with some variation in B12 deficiency (Table 7).

Table 7: Distribution of anemia type by Parity

Parity	Iron Deficiency Anemia	Folate Deficiency Anemia	B12 Deficiency Anemia
0	16 (76.19%)	1 (4.76%)	3 (19.05%)
1	34 (85.00%)	3 (7.50%)	2 (5.00%)
2	42 (82.35%)	2 (3.92%)	6 (11.76%)
3	11(68.75%)	1 (6.25%)	4 (25.00%)
>3	24 (96.00%)	0 (0.00%)	1 (4.00%)

Socioeconomic Status

Table 8 presents the distribution of anemia types, Iron Deficiency, Folate Deficiency, and B12 Deficiency across different socioeconomic status groups. Iron Deficiency Anemia is the most prevalent in all categories, accounting for 90% of cases in the high socioeconomic group, 80% in the middle, 85.06% in the low, and 70.59% in the poverty group.

B12 Deficiency Anemia shows a modest increase in the lower socioeconomic strata, with14.71% in the poverty group and 12% in the middle group, compared to 10% in the high group. Folate Deficiency Anemia remains low across all groups, with a slight increase (8.82%) in the poverty group. The data suggest that while iron deficiency is consistently the most common anemia, B12 deficiency is relatively more frequent among individuals from lower socioeconomic backgrounds.

Table 8: Distribution of anemia type by Socioeconomic Status

Socioeconomic Status	Iron Deficiency Anemia	Folate Deficiency Anemia	B12 Deficiency Anemia
High	9 (90.0%)	0 (0.0%)	1 (10.0%)
Middle	20 (80.0%)	1 (4.0%)	3 (12.0%)
Low	74 (85.06%)	3 (3.45%)	8 (9.20%)
Poverty	24 (70.59%)	3 (8.82%)	5 (14.71%)

DISCUSSION

This study highlights the predominance of Iron Deficiency Anemia (IDA) among anemic patients, accounting for 85.23% of cases, consistent with global and national data identifying IDA as the most common type of anemia, particularly in low- and middle-income countries [12]. The high prevalence reflects dietary insufficiency, increased iron demand during reproductive age, and potential blood loss. Vitamin B12 deficiency anemia (10.72%) and folate deficiency anemia (4.69%) were significantly less common but clinically relevant, aligning with findings from similar studies in South Asia [13,14].

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

The distribution of anemia types according to hemoglobin (Hb) levels further reinforces the severity correlation, with severe anemia (<7 g/dL) being entirely attributed to iron deficiency. As anemia severity decreased, the presence of B12 and folate deficiency became more evident, especially in mild anemia (Hb 10–10.9 g/dL) and individuals with normal Hb levels (≥11 g/dL), which is consistent with the nature of megaloblastic anemia presenting with macrocytosis before overt hemoglobin drop [15].

The CBC profiles provided distinct hematological patterns. IDA was associated with microcytic hypochromic indices, low MCV, MCH, MCHC, and elevated RDW, reflecting anisocytosis, a classical finding [16]. B12 deficiency showed macrocytosis (MCV: 103.8 fL) and elevated MCH, indicating megaloblastic erythropoiesis, while folate deficiency presented with normocytic or mildly macrocytic indices. These findings align with established hematological characteristics of nutritional anemias [17].

Nutritional parameters support the diagnosis, with IDA patients exhibiting low serum iron (48 µg/dL), high TIBC (470 µg/dL), and reduced ferritin (15 ng/mL), all hallmark indicators of iron depletion. Folate-deficient individuals had markedly low folate levels (2 ng/mL), while B12-deficient individuals had correspondingly low vitamin B12 (138 ng/L). These biochemical profiles corroborate the hematological findings and are in line with WHO diagnostic criteria and previous clinical research [18,19].

Age-wise, IDA was prevalent across all groups, most notably in the 26–30 age group (86.11%), without a statistically significant association between age and anemia type ($p = 0.256$). This uniform distribution suggests the influence of shared dietary and physiological factors across age ranges. Parity analysis revealed increasing IDA prevalence with higher parity, peaking at 96% in women with more than three children, likely due to cumulative nutritional depletion during repeated pregnancies [20]. B12 deficiency was relatively higher in parity 3 (25%), indicating a potential link between parity and cobalamin status.

Socioeconomic status analysis revealed a gradient in anemia type distribution. Iron deficiency was the most common across all socioeconomic groups, but B12 deficiency was more frequent in the poverty group (14.71%), suggesting dietary inadequacy of animal-source foods. Folate deficiency showed a slight rise in low-income groups. These observations align with previous studies that establish a strong correlation between lower socioeconomic status and micronutrient deficiencies [21].

Generalizability

The findings are generalizable to similar populations of reproductive-aged women in low- and middle-income settings, where nutritional deficiencies, particularly iron, predominate. However, variations in dietary practices, healthcare access, and socioeconomic conditions may limit wider applicability, underscoring the need for context-specific interpretation and validation in diverse demographic groups.

Conclusion

Anemia continues to be a major public health problem in rural areas, with our study revealing a high prevalence of Iron deficiency anemia among pregnant women. This indicates a necessary need for strategies to prevent and treat anemia during pregnancy. This study provides valuable insights into the prevalence of anemia and associated micronutrient deficiencies in the rural Indian population. These findings contribute significantly to understanding anemia and pave the way for future research and improved interventions in this area.

Limitations

Limitations of this study include its cross-sectional design, single-center rural setting, limited sample size, and exclusion of longitudinal maternal-fetal outcome assessment.

Recommendations

India was the first developing country to initiate a National Nutritional Anemia Prophylaxis Program (NNAPP) to combat anemia among pregnant women. Unfortunately, these programs are not reaching rural women to the expected extent. Measures such as health education, screenings, effective medication, diets containing all nutrients, cooking in iron utensils, food fortification, and appropriate birth spacing through birth control can significantly improve maternal and fetal outcomes.

Strengthening iron, folic acid, and micronutrient supplementation programs is critical, especially for pregnant women from disadvantaged backgrounds. Additionally, community-based interventions to improve the uptake of micronutrients should also be promoted.

Acknowledgement

The authors sincerely thank the Institutional Ethics Committee of NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam, for approving the conduct of this study. We extend our gratitude to the Department of Pathology and the Department of Obstetrics and Gynecology for their invaluable support throughout the research. We are deeply grateful to all the participants who consented to be part of the study. Their cooperation made this research possible. Finally, we acknowledge our colleagues and staff for their assistance.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

Abbreviations

Hb – Hemoglobin
IDA – Iron Deficiency Anemia
CBC – Complete Blood Count
MCV – Mean Corpuscular Volume
MCH – Mean Corpuscular Hemoglobin
MCHC – Mean Corpuscular Hemoglobin Concentration
RDW – Red Cell Distribution Width
RBC – Red Blood Cell
TIBC – Total Iron Binding Capacity
OPD – Outpatient Department
HPLC – High-Performance Liquid Chromatography
WHO – World Health Organization.

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

HP-Concept and design of the study, results interpretation, review of literature, and preparation of the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript. **HM**-Concept and design of the study, results interpretation, review of literature, preparing the first draft of the manuscript, and revision of the manuscript.**RST-**Review of literature and preparing the first draft of the manuscript. Statistical analysis and interpretation. **AK-**Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript**.JRL-**Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript.**BA-**Concept and design of the study, results interpretation, review of literature, and preparing the first draft of the manuscript.

Data availability

Data available on request

Author Biography

Ms. Harika Peethambaram is a third-year MBBS student at NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam, Andhra Pradesh, India. She is actively involved in academic research and clinical training as part of her undergraduate medical education. Her areas of interest include pathology and community medicine, and she aspires to contribute to evidence-based healthcare through research and clinical practice.

Dr. Hiranmayee Mokhasunavisu obtained her MBBS degree from Kalinga Institute of Medical Sciences, Bhubaneswar, and completed her MS in Obstetrics and Gynecology at SDM College of Medical Sciences and Hospital, Dharwad. She is currently serving as an Assistant Professor in the Department of Obstetrics and Gynecology at NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India. Her academic and clinical interests include high-risk obstetrics, gynecological surgeries, and women's reproductive health.

Dr. Ramya Sindhura Tammireddi completed her MBBS at Maharajah's Institute of Medical Sciences and pursued her MD in Pathology at Alluri Sitarama Raju Academy of Medical Sciences. She is currently serving as an Assistant Professor in the Department of Pathology at NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India. With a strong academic background and clinical expertise in diagnostic pathology, she is actively engaged in teaching, research, and diagnostic services. Her areas of interest include hematopathology and oncopathology, and she is committed to advancing evidence-based medical education and patient care. ORCID ID: https://orcid.org/0009-0002-5493-9497

Dr. Anusha Kollapu completed her MBBS from GSL Medical College, Rajahmundry, Andhra Pradesh, and pursued her MS in Obstetrics and Gynecology at NRI Institute of Medical Sciences, Sangivalasa, Visakhapatnam. She is actively engaged in clinical practice and academic training in women's health, with particular interests in high-risk pregnancy management and reproductive health.

Dr. L. Jhansi Rani (MBBS, MS Obstetrics and Gynecology) is a Professor in the Department of Obstetrics and Gynecology at NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India. She completed her MBBS in 1983 from Andhra Medical College under Andhra University and her MS in Obstetrics and Gynecology in 1990 from the same institution under Dr. NTR University of Health Sciences, Vijayawada. With over 30 years of teaching experience, she has made significant contributions to medical education, clinical training, and women's health care.

She is a Life Member of the Indian Medical Association (IMA) and an Annual Member of FOGSI. She has published five research papers in reputed journals, focusing on sterilization techniques, infertility evaluation, ovarian tumors, vertical transmission of HIV, and hepatitis B in antenatal women. Dr. Jhansi Rani has delivered guest lectures, chaired scientific sessions at state and national conferences, and was honored with the **Best Doctor Award (2020)** by the District Collector of Visakhapatnam. Her academic and clinical interests include infertility management, gynecologic oncology, and maternal-fetal medicine.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 9 (2025): September 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i9.2043
Original Article

Dr. A. Bhagyalakshmi is Professor and Head of the Department of Pathology at NRI Institute of Medical Sciences, Visakhapatnam. She holds an MBBS (1982) and an MD in Pathology (1992) from Andhra Medical College, Visakhapatnam, and has over 37 years of teaching and professional experience. She previously served as Professor and Head, and Vice Principal (Admin), Andhra Medical College, Visakhapatnam, and retired from government service in 2021 after distinguished contributions to medical education and research.
She has held numerous leadership positions, including Vice Chairman of the Scientific and Research Committee and Coordinator of the PG Medical Education Committee at NRIIMS, Executive Council Member of Dr. NTR University of Health Sciences (2021–2024), Chairperson of the AMC Research Forum, and PhD guide in pathology under Dr. NTRUHS. She has also served as Chairperson of undergraduate and postgraduate examination boards, MCI assessor for UG/PG courses, and nodal officer of the Multidisciplinary Research Unit (MRU), AMC, where she was principal investigator for four funded projects.
Dr. Bhagya Lakshmi has published over 150 research papers in reputed national and international journals and has served as a reviewer and editorial board member for several indexed journals. She is a life member of the Indian Medical Association, Indian Association of Pathologists and Microbiologists, Indian Association of Cytologists, and NJBMS. She has received multiple awards, including two Certificates of Merit from the District Collector for exemplary service (1998 and 2011). Her major academic interests include oncopathology, hematopathology, and translational research in pathology.ORCID: http://orcid.org/0009-0007-0606-7301

References

1. World Health Organization: WHO, World Health Organization: WHO. Anaemia.2023. Available from:https://www.who.int/news-room/fact-sheets/detail/anaemia
2. Suryanarayana R, Chandrappa M, Santhuram AN, Prathima S, Sheela SR. Prospective study on the prevalence of anemia in pregnant women and its outcome: A community-based study. J Family Med Prim Care. 2017;6(4):739-43. https://doi.org/10.4103/jfmpc.jfmpc_33_17
3. Benson CS, Shah A, Frise MC, Frise CJ. Iron deficiency anaemia in pregnancy: A contemporary review. Obstet Med. 2021 Jun;14(2):67-76. https://doi.org/10.1177/1753495X20932426
4. Mamme NY, Roba HS, Fite MB, Asefa G, Abrahim J, Yuya M, et al. Serum folate deficiency and associated factors among pregnant women in Haramaya District, Eastern Ethiopia: a community-based study. BMJ Open. 2023 May 8;13(5): e068076. Available from:https://pubmed.ncbi.nlm.nih.gov/37156586/ https://doi.org/10.1136/bmjopen-2022-068076
5. Finkelstein JL, Fothergill A, Krisher JT, Thomas T, Kurpad AV, Dwarkanath P. Maternal vitamin B12 deficiency and perinatal outcomes in southern India. PLoS One. 2021;16(4):e0248145. Available from: https://pubmed.ncbi.nlm.nih.gov/33822790 https://doi.org/10.1371/journal.pone.0248145
6. Jain D, Atmapoojya P, Colah R, Lodha P. Sickle cell disease and pregnancy. Mediterr J Hematol Infect Dis. 2019;11(1):e2019040. Available from: https://pubmed.ncbi.nlm.nih.gov/31308916/ https://doi.org/10.4084/mjhid.2019.040
7. Ruangvutilert P, Phatihattakorn C, Yaiyiam C, Panchalee T. Pregnancy outcomes among women affected with thalassemia traits. Arch Gynecol Obstet. 2023 Feb;307(2):431-8. Available from: https://pubmed.ncbi.nlm.nih.gov/35347380/ https://doi.org/10.1007/s00404-022-06519-y
8. Tay SCK, Nani EA, Walana W. Parasitic infections and maternal anaemia among expectant mothers in the Dangme East District of Ghana. BMC Res Notes. 2017 Jan 3;10(1):3. Availablefrom: https://pubmed.ncbi.nlm.nih.gov/28057071/ https://doi.org/10.1186/s13104-016-2327-5
9. Pathak P, Kapil U, Yajnik CS, Kapoor SK, Dwivedi SN, Singh R. Iron, folate, and vitamin B12 stores among pregnant women in a rural area of Haryana State, India. Food Nutr Bull. 2007 Dec;28(4):435-8. doi: 10.1177/156482650702800409. PMID: 18274171. https://doi.org/10.1177/156482650702800409
10. Iron Deficiency Anaemia in Pregnancy: Developed Versus Developing Countries.EMJ Hematol. 2018;6[1]:101-109. https://doi.org/10.33590/emjhematol/10314911
11. Available from: https://www.emjreviews.com/wp-content /uploads /2018 /07/Iron-Deficiency-Anaemia-in-Pregnancy.pdf.
12. Finkelstein JL, Kurpad AV, Duggan C, etal. Anaemia and iron deficiency in pregnancy and adverse perinatal outcomes in Southern India. Eur J Clin Nutr. 2020;74(4):721-31. PMCID: PMC10122513.
13. Anaemia in women and children. [cited 2025 Aug 11]. Available from: https://www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children
14. Sood, S. K. et al.(2020).Prevalence and determinants of anemia among Indian women.

15. Indian Journal of Public Health, 64(3), 224-229.
16. Gupta, P.M., et al. (2019).Micronutrient deficiencies and anemia in the Indian context.
17. The Lancet Global Health, 7(9), e1140-e1148.
18. Green, R.,&Kinsella, L.J.(2022).Current concepts in the diagnosis of megaloblastic anemias. Blood Reviews, 46, 100742.
19. Camaschella C. Iron-deficiency anemia. N Engl J Med. 2015 May 7;372(19):1832-43. doi: 10.1056/NEJMra1401038. PMID: 25946282. https://doi.org/10.1056/NEJMra1401038
20. O'Leary F, Samman S. Vitamin B12 in health and disease. Nutrients. 2010 Mar;2(3):299-316. doi: 10.3390/nu2030299. Epub 2010 Mar 5. PMID: 22254022; PMCID: PMC3257642. https://doi.org/10.3390/nu2030299
21. World Health Organization. (2017). Assessing the iron status of populations: including literature reviews (2nd ed.).
22. Antony,A.C.(2018).Megaloblastic anemias in Hematology: Basic Principles and Practice (7th ed.). https://doi.org/10.1016/B978-0-323-35762-3.00039-1
23. Toteja GS, Singh P, Dhillon BS, Saxena BN, Ahmed FU, Singh RP, Prakash B, Vijayaraghavan K, Singh Y, Rauf A, Sarma UC, Gandhi S, Behl L, Mukherjee K, Swami SS, Meru V, Chandra P, Chandrawati, Mohan U. Prevalence of anemia among pregnant women and adolescent girls in 16 districts of India. Food Nutr Bull. 2006 Dec;27(4):311-5. doi: 10.1177/156482650602700405. PMID: 17209473. https://doi.org/10.1177/156482650602700405
24. Balarajan Y, Ramakrishnan U, Özaltin E, Shankar AH, Subramanian S. Anaemia in low-income and middle-income countries. The Lancet. 2011 Dec [cited 2025 Aug 11];378(9809):2123-35. Availablefrom: https://linkinghub.elsevier.com/retrieve/pii/S0140 67361062304 https://doi.org/10.1016/S0140-6736(10)62304-5

PUBLISHER DETAILS:

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa