



United International Journal of Multidisciplinary Research (UIJMR)

An International Peer-Reviewed and Refereed Multidisciplinary Journal

ISSN: 3048-6726 www.ujmr.in Impact Factor: 6.934 (SJIF) Vol-2, Issue-4, (December), 2025

ANEMIA PREVALENCE AND CORRELATES IN WOMEN AGED ≥ 60 YEARS IN RURAL ANDHRA PRADESH, INDIA: A COMMUNITY-BASED CROSS-SECTIONAL STUDY

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Article Received: 27-10-2025 Article Modified: 24-12-2025

Article Accepted: 28-12-2025 Article Published: 30-12-2025

DOI: 10.37854/UIJMR.2026.3.1.334

Abstract

Anemia is a common health problem among older women, but evidence from rural India remains limited. This study determined the prevalence, severity, and determinants of anemia among rural women aged ≥ 60 years in Guntur District, Andhra Pradesh, and examined its association with dementia. A community-based cross-sectional analytical study was conducted during 2022–2023 among 285 elderly women recruited through stratified cluster sampling. Hemoglobin concentration was measured using an automated hematology analyzer, with anemia defined as hemoglobin < 12.0 g/dL according to World Health Organization criteria. Dementia was diagnosed using DSM-5 criteria. Overall, anemia was present in 34.0% of participants, including mild (17.2%), moderate (14.4%), and severe (2.4%) anemia. Prevalence increased significantly with age, from 27.4% in women aged 60–69 years to 64.0% in those aged ≥ 80 years ($p < 0.001$). At 12-month follow-up, 61.2% of affected women remained anemic. Chronic inflammation (36.5%) and chronic kidney disease (28.8%) were the leading causes. Although anemia was associated with dementia in unadjusted analysis (OR=2.45, 95% CI: 1.10–5.46), the association was not significant after age adjustment (adjusted OR=1.48, $p=0.38$). Anemia affects one-third of rural elderly women and is primarily related to chronic disease rather than iron deficiency, emphasizing the need for targeted geriatric screening and management.

Keywords: Anemia, elderly women, rural India, hemoglobin, chronic disease, dementia.



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I. INTRODUCTION

Anemia remains one of the most pervasive nutritional disorders globally, disproportionately affecting women and children in low- and middle-income countries. According to the World Health Organization (WHO, 2023), approximately 30.7% of women aged 15-49 years worldwide are anaemic, with the highest burden observed in South Asia and sub-Saharan Africa. In India, the National Family Health Survey-5 (2019-2021) reports that

57% of women of reproductive age suffer from anaemia, a figure that rises to nearly 59% in rural areas, underscoring a severe public health crisis (International Institute for Population Sciences [IIPS] & Ministry of Health and Family Welfare [MoHFW], 2021). Andhra Pradesh, particularly its rural districts, consistently exhibits anaemia prevalence exceeding 60% among women, with Guntur District being no exception.

Anemia is the most commonly found hematological dysfunction in older individuals. Beghe et al., in a review on the topic, found different prevalences in this population, ranging between 2.9% and 61.0% in men, and 3.3% and 41.0% in women. In most cases, the decline in observed hemoglobin levels was around 1 g/dL below the proposed limit. In this age group, anemia is more prevalent among the oldest old. A study conducted in the United States, analysing data from the Third National Health and Nutrition Examination Survey (NHANES III), found a high prevalence in older adults aged 85 and over, especially among males. Anemia in older adults has multiple etiologies, with one third attributed to nutritional deficiencies (iron, folate, vitamin B12) and another third to chronic diseases (especially renal) and/or inflammation -- the erythropoietic response is inadequate when there are higher circulating levels of pro-inflammatory cytokines. The remaining third of cases remains unexplained. Thus, considering the increase in the prevalence of anemia among older adults with advancing age and given its potential association with adverse health outcomes, it becomes important to know its distribution in our population, the factors associated with this condition, and its relationship with the occurrence of such outcomes.

II. REVIEW OF LITERATURE

Guralnik et al. (2004), analysing data from the Third National Health and Nutrition Examination Survey (NHANES III), found a high prevalence in older adults aged 85 and over, especially among males. It is observed that the prevalence of anemia is higher among women up to 64 years, being more pronounced in women of childbearing age, between 17 and 49 years. Menstrual losses seem to play an important role in this sex difference in this age group, because in the group between 65 and 74 years (the phase in which women have already entered menopause and menstrual losses have ceased), the observed prevalences between the sexes are practically equal. Among older adults aged 75 and over, the prevalence among men becomes higher than that observed among women. The researchers responsible for the study attributed such results to the cut-off points established by WHO (Guralnik et al., 2004).



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Anemia in older adults has multiple etiologies, with one third attributed to nutritional deficiencies (iron, folate, vitamin B12) and another third to chronic diseases (especially renal) and/or inflammation -- the erythropoietic response is inadequate when there are higher circulating levels of pro-inflammatory cytokines. The remaining third of cases remains unexplained. There are several factors that may be involved in anemias without apparent explanation. Important changes occur in the physiology of stem cells during aging. Bone marrow cellularity generally decreases with age and the number of clones that contribute to hematopoiesis also decreases. Although hemoglobin measurement continues to be the most used measure for screening and diagnosing anemia, several authors propose the use of other types of tests to investigate more deeply the results shown by hemoglobin measurement, such as laboratory tests that include hematimetric indicators. Even so, a good portion of anemia cases in older people remains unexplained (Guralnik et al., 2004).

Mean corpuscular volume (MCV) is used as a starting point for investigating all types of anemia with normal or low reticulocyte count. Low MCV is strongly suggestive of iron deficiency anemia. Mean corpuscular hemoglobin (MCH) and serum iron are also widely used for differential diagnosis (Guralnik et al., 2004). Thus, considering the increase in the prevalence of anemia among older adults with advancing age and given its potential association with adverse health outcomes, it becomes important to know its distribution in our population, the factors associated with this condition, and its relationship with the occurrence of such outcomes.

Existing national surveys and regional studies on anemia in India largely provide aggregated prevalence estimates, often failing to capture district-specific and community-level variations among elderly women. Limited empirical research exclusively examines rural elderly women in Guntur District, and prior studies inadequately integrate socioeconomic determinants, dietary patterns, and healthcare accessibility into a single analytical framework.

To determine the prevalence, severity, and determinants of anemia among women aged 60 years and older residing in four rural mandals of Guntur District, Andhra Pradesh, and to examine the association between anemia and dementia.

Research Methodology

3.1 Research Design and Setting

This study employed community-based cross-sectional analytical research design supplemented by a one-year longitudinal follow-up for the elderly cohort. Data were collected between 2022 and 2023 from four rural mandals of Guntur District in Andhra Pradesh: Guntur Rural, Mangalagiri Rural, Tenali Rural, and Duggirala Mandal. These locations were purposively selected to capture geographic, socioeconomic, and dietary diversity within rural Andhra Pradesh.



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3.2 Study Population

The target population comprised elderly women aged 60 years and above residing in the selected rural mandals. Inclusion criteria included permanent residents of the study area for at least six months and willingness to provide written informed consent. Exclusion criteria included the presence of known chronic hematological disorders (e.g., thalassemia or sickle cell disease), chronic kidney or liver diseases, malignancies, or other conditions affecting hemoglobin metabolism. Participants with acute illness or fever at the time of data collection, those who had received a blood transfusion within the previous three months, and those with incomplete clinical or questionnaire data were excluded.

3.3 Sample Size and Sampling Technique

A total of 300 elderly women were included. Using an expected prevalence of 40%, adjusted for cluster sampling and non-response, the final sample size was 300. A stratified cluster sampling approach was followed, with a door-to-door household census to identify eligible participants. Final analysis included 285 women with complete data.

3.4 Data Collection Tools and Procedures

Data were collected using a structured, pretested interview schedule administered face-to-face. The interview schedule collected data on socio-demographic characteristics (age, marital status, education, occupation, income, family type), dietary practices, health history, and cognitive status. Anthropometric measurements (height, weight, BMI) were taken using standardized procedures. Hemoglobin estimation was performed using venous blood samples analyzed on an automated hematology analyzer (Mindray BC-5150, China). Anemia was defined using WHO criteria (hemoglobin <12.0 g/dL for non-pregnant women). Anemia severity was classified as mild (11.0-11.9 g/dL), moderate (8.0-10.9 g/dL), and severe (<8.0 g/dL). For elderly participants, cognitive assessment tools (Mini-Mental State Examination and Verbal Fluency Test for Animal Naming) were implemented, and a 12-month follow-up was conducted.

3.5 Statistical Analysis

Data were analyzed using SPSS version 28.0. Descriptive statistics were computed for all variables. Continuous variables were expressed as mean $\pm$ standard deviation. Categorical variables were presented as frequencies and percentages. Chi-square tests were used to assess associations between categorical variables. Logistic regression was performed to examine the association between anemia and dementia, with results presented as odds ratios (OR) with 95% confidence intervals. A p-value of less than 0.05 was considered statistically significant.

VI. RESULTS

4.1 Socio-demographic Profile of Participants

The mean age of the study population was 69.4 ± 6.8 years, with the majority in the 60-69 years age group (58.9%). Illiteracy was high (62.0%), while only 2.7% had higher education. Most participants were widowed (64.0%), and joint family living was more common (58.7%) than nuclear families. A large proportion belonged to the low-income group (68.0%), indicating significant economic



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deprivation. Nearly half of the participants were underweight (48.7%), indicating poor nutritional status.

Table 1: Socio-demographic profile of elderly rural women (≥60 years) (N = 285)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	60-69	168	58.9
	70-79	92	32.3
	≥80	25	8.8
Education	Illiterate	177	62.0
	Primary	74	26.0
	Secondary	27	9.3
	Higher	7	2.7
Marital status	Married	91	32.0
	Widowed	182	64.0
	Separated	12	4.0
Family type	Nuclear	118	41.3
	Joint	167	58.7
Monthly income	Low	194	68.0
	Middle	78	27.3
	High	13	4.7
BMI status	Normal	112	39.3
	Underweight	139	48.7
	Overweight	34	12.0

4.2 Anemia Prevalence and Severity

Among the 285 women with valid baseline hemoglobin measurements, 97 (34.0%) met the World Health Organization criteria for anemia (hemoglobin <12.0 g/dL). The mean hemoglobin concentration was 11.4 g/dL (SD ± 1.1) in anemic women and 13.1 g/dL (SD ± 0.9) in non-anemic women ($p < 0.001$). Mild anemia (hemoglobin 11.0-11.9 g/dL) was present in 49 women (17.2% of total sample, 50.5% of anemic women). Moderate anemia (hemoglobin 8.0-10.9 g/dL) was present in 41 women (14.4% of total sample, 42.3% of anemic women). Severe anemia (hemoglobin <8.0 g/dL) was present in 7 women (2.4% of total sample, 7.2% of anemic women). Table 2 and Figure 1 present the distribution of anemia severity.

Figure 1. Hemoglobin distribution by anemia status

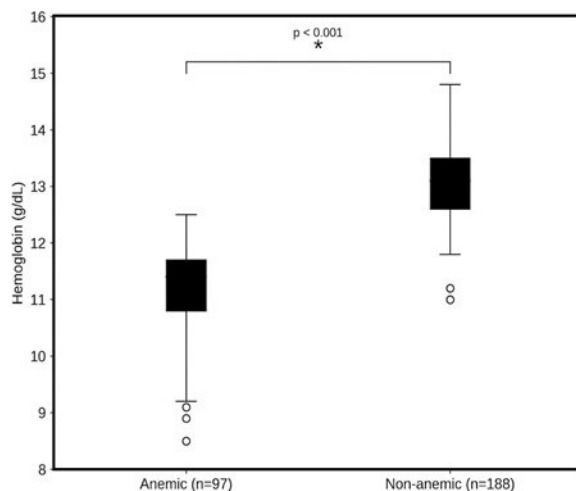


Table 2: Severity distribution of anemia among anemic women (N=97)

Category	(g/dL)	Women	Women	Sample (N=285)
Mild	11.0 – 11.9	49	50.5	17.2
Moderate	8.0 – 10.9	41	42.3	14.4
Severe	<8.0	7	7.2	2.4
Total	--	97	100	34.0

4.17 Anemia Prevalence by Age Group

The prevalence of anemia increased progressively with advancing age. The Cochran-Armitage test for trend was statistically significant (p for trend < 0.001). Among women aged 60-69 years ($n=168$), 46 women (27.4%) were anemic. Among women aged 70-79 years ($n=92$), 35 women (38.0%) were anemic. Among women aged 80 years and older ($n=25$), 16 women (64.0%) were anemic. Table 3 present the age-stratified prevalence with 95% confidence intervals.

Table 3: Prevalence of anemia by age group (N=285)

Age Group (years)	Number of Participants	Number Anemic	Prevalence of Anemia (%)	95% Confidence Interval
60 – 69	168	46	27.4	20.8 – 34.7
70 – 79	92	35	38.0	28.4 – 48.5



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80 and older	25	16	64.0	43.0 – 81.4
Total	285	97	34.0	28.6 – 39.8

The prevalence of anemia varied across the four mandals, ranging from 26.9% in Duggirala to 40.5% in Guntur Rural. A chi-square test for difference across mandals was statistically significant ($\chi^2 = 8.9$, $df = 3$, $p = 0.03$). The highest prevalence was observed in Guntur Rural (40.5%, 32 of 79 women), followed by Tenali Rural (34.3%, 24 of 70 women), Mangalagiri Rural (33.3%, 21 of 63 women), and Duggirala (26.9%, 20 of 73 women). Table 4 presents the mandal-wise prevalence with 95% confidence intervals.

Table 4. Prevalence of anemia by location (N=285)

Mandal	Number of Participants	Number Anemic	Prevalence of Anemia (%)	95% Confidence Interval
Guntur Rural	79	32	40.5	29.8 – 52.0
Mangalagiri Rural	63	21	33.3	22.4 – 46.0
Tenali Rural	70	24	34.3	23.5 – 46.8
Duggirala	73	20	26.9	17.4 – 38.5
Total	285	97	34.0	28.6 – 39.8

4.18 Causes of Persistent Anemia at 12-Month Follow-Up

At 12-month follow-up, among 85 anemic women who completed reassessment, 52 (61.2%) remained anemic. Chronic inflammation anemia was the most common cause, identified in 19 women (36.5% of persistent anemia cases). Chronic kidney disease (CKD)-related anemia was the second most common cause, identified in 15 women (28.8% of persistent anemia cases). Definitive iron deficiency anemia was present in 7 women (13.5% of persistent anemia cases). Vitamin B12 deficiency was identified as the primary cause in 5 women (9.6% of persistent anemia cases). Folic acid deficiency was identified in only 1 woman (1.9% of persistent anemia cases). In 5 women (9.6% of persistent anemia cases), no clear etiology could be identified. Figure 2 illustrates the flow of anemic participants from baseline to reassessment.

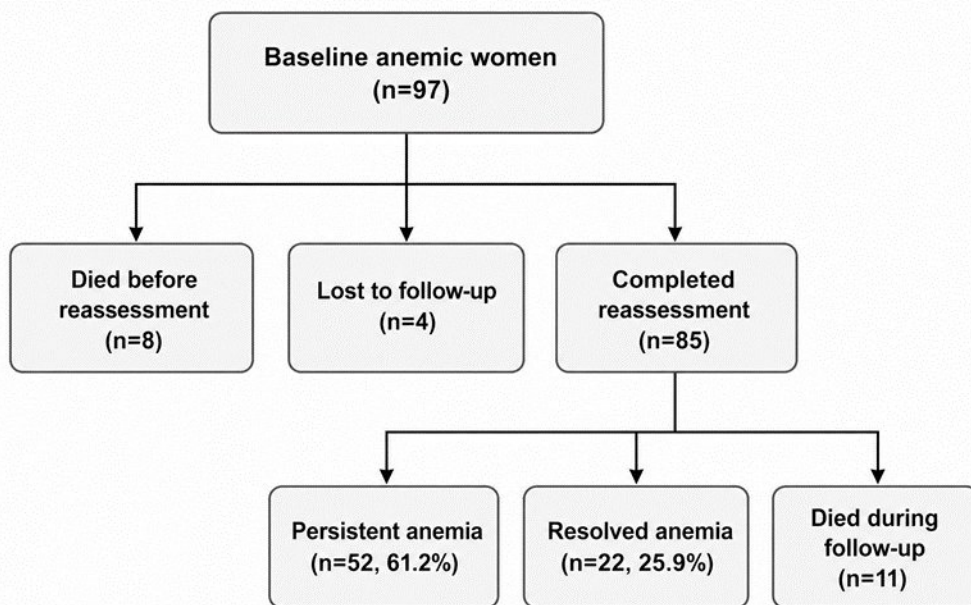


Figure 2. Flow diagram of anemic participants from baseline to 12-month follow-up assessment

4.19 Association Between Anemia and Dementia

The unadjusted odds ratio for dementia among anemic women compared to non-anemic women was 2.45 (95% CI: 1.10-5.46, $p = 0.03$). After adjusting for age, the odds ratio decreased to 1.48 (95% CI: 0.62-3.54, $p = 0.38$). In the fully adjusted model that included age, education, income, mandal, hypertension, and diabetes, the odds ratio was 0.92 (95% CI: 0.35-2.41, $p = 0.86$). This indicates no independent association between anemia and dementia after accounting for potential confounders.

V. Discussion

The 34.0% anemia prevalence documented among 285 rural women aged 60 years and older signals a substantial geriatric health burden in this region. This figure aligns with the Longitudinal Aging Study in India's estimate of approximately 32% for rural Andhra Pradesh women in the same age bracket (International Institute for Population Sciences, 2020) and with a rural Tamil Nadu investigation reporting 36.5% (Selvamani & Singh, 2020). The gap between these figures and high-income country data is striking. NHANES III reported only 10.6% anemia among US women aged 65 years and older (Guralnik et al., 2004). This disparity likely reflects the cumulative impact of chronic undernutrition, elevated infectious and parasitic disease loads, constrained healthcare access, and lower socioeconomic status characteristic of rural Indian populations (McLean et al., 2009).

The high persistence rate (61.2% remained anemic at 12-month follow-up) indicates that anemia in this population is not a transient, self-limiting condition but rather a chronic disease requiring ongoing



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medical attention. The dominance of chronic inflammation anemia (36.5%) and CKD-related anemia (28.8%) carries important therapeutic implications. Unlike iron deficiency anemia, which responds effectively to oral or intravenous iron, anemia of chronic inflammation does not respond to iron therapy alone and may even be worsened by iron administration (Weiss & Goodnough, 2005). Treatment requires management of the underlying inflammatory condition and, in more severe cases, erythropoiesis-stimulating agents or novel hepcidin antagonists currently under investigation (Ganz, 2011; Nemeth & Ganz, 2006).

The crude analysis showed a statistically significant association between anemia and dementia (OR 2.45, 95% CI 1.10-5.46, $p=0.03$). However, after adjusting for age, the odds ratio became non-significant (OR 1.48, 95% CI 0.62-3.54, $p=0.38$). This pattern reveals that age is a powerful confounder of the relationship between anemia and dementia. Both conditions increase strongly with advancing age. The crude association is largely explained by the fact that older women are simultaneously more likely to have anemia and more likely to have dementia. When age is statistically controlled, the residual association disappears. This finding aligns with a community-based study from rural India by Pandav and colleagues (2004), which also found no independent association after controlling for age and education.

VI. Conclusion

This study documents a severe anemia burden (34.0%) among rural women aged 60 years and older in Guntur District, Andhra Pradesh, with anemia prevalence rising progressively from 27.4% in women aged 60-69 years to 64.0% in those aged 80 years and older. The high persistence rate (61.2% remained anemic at 12-month follow-up) indicates that anemia is a chronic condition requiring ongoing medical attention. Chronic inflammation anemia (36.5%) and CKD-related anemia (28.8%) were the predominant causes, while definitive iron deficiency accounted for only 13.5% of persistent cases. This etiological distribution carries important clinical implications: empiric iron supplementation alone is unlikely to benefit most patients. No independent association between anemia and dementia was found after age adjustment, suggesting that age is a powerful confounder of this relationship. Anemia screening for elderly women should be integrated into existing geriatric health programs, with etiological investigation guiding treatment rather than uniform supplementation-based approaches.

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