

**BURDEN OF ANEMIA AMONG OLDER ADULTS IN INDIA: EVIDENCE FROM A
SYSTEMATIC REVIEW AND META-ANALYSIS**Dr. Kanika Khamb¹ and Dr. Mayank^{2*}¹Medical Officer, Department of Neurology, AIMSS Chamiana.²Junior Resident, Department of Medicine, IGMC Shimla.***Corresponding Author: Mayank**

Junior Resident, Department of Medicine, IGMC Shimla.

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ABSTRACT

Background: Anemia is a prevalent yet underrecognized health issue among the elderly, particularly in developing countries like India. Its consequences include functional decline, increased morbidity, and mortality. This review aimed to estimate the pooled prevalence of anemia among the elderly population (≥ 60 years) in India. **Methods:** A systematic literature search was conducted in PubMed, EMBASE, IndMed, Google Scholar, and Cochrane Library up to February 2025. Studies reporting the prevalence of anemia in Indian elderly populations were included. Data extraction and quality assessment were performed independently by two reviewers. Random-effects meta-analysis was used to compute the pooled prevalence, with subgroup analyses by setting, gender, and hemoglobin estimation method. Heterogeneity was assessed using I^2 statistics, and publication bias via funnel plot and Egger's test. **Results:** Out of 1,787 records screened, 22 studies involving 10,381 participants were included. The pooled prevalence of anemia among elderly Indians was 68.3% (95% CI: 60.7%–75.9%), with high heterogeneity ($I^2 = 92.4\%$). Prevalence was higher in rural (73.4%) than urban settings (61.2%), and among females (70.4%) compared to males (62.8%). Studies using more accurate hemoglobin estimation methods reported higher prevalence. **Conclusions:** Anemia affects over two-thirds of the elderly in India, with substantial variation across regions and demographics. These findings highlight the need for routine screening, improved nutritional support, and targeted interventions in elderly health programs.

KEYWORDS: Anemia, Elderly, India, Prevalence, Systematic Review, Meta-Analysis.**INTRODUCTION**

Anemia, defined by the World Health Organization (WHO) as a hemoglobin level less than 13 g/dL in men and less than 12 g/dL in women, is a widespread condition, particularly in the elderly population.^[1] In older adults, anemia is associated with adverse outcomes such as increased risk of hospitalization, reduced physical function, cognitive impairment, frailty, and even mortality.^[2,3] Despite these significant impacts, anemia in the elderly often remains underdiagnosed and undertreated due to the misconception that it is a natural consequence of aging.^[4] India, home to the second-largest elderly population globally, faces unique challenges regarding geriatric health due to socioeconomic disparities, malnutrition, and uneven healthcare access.^[5] The elderly in India are particularly vulnerable to anemia because of cumulative nutritional deficits, chronic illnesses, and poor health-seeking behaviors. According to the Longitudinal Aging Study in India (LASI), nearly 27% of Indian adults aged 60 and above are anemic.^[6] However, this national estimate may underrepresent regional variations and the true burden in underserved populations. Several small-scale

epidemiological studies have attempted to estimate anemia prevalence in the elderly across different Indian states, with reported prevalence ranging from 20% to over 90%.^[7–10] These discrepancies underscore the need for a comprehensive synthesis of available evidence. Hence, this systematic review and meta-analysis aim to estimate the pooled prevalence of anemia in the elderly population in India and explore variation across regions, gender, and measurement methods.

METHODOLOGY

A comprehensive search was conducted across databases including PubMed, Embase, Cochrane Library, Google Scholar, and IndMed up to [insert date], focusing on cross-sectional studies reporting the prevalence of anemia among individuals aged ≥ 60 years in India. Studies were included if they provided clear diagnostic criteria for anemia and utilized recognized hemoglobin estimation methods. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed throughout the review process. Search terms used included.

"Anemia" OR "Anaemia", "Elderly" OR "Older adults" OR "Geriatric population", "India", "Prevalence", Combined using Boolean operators (AND/OR) The search was limited to studies published in English from inception to February 2025.

Inclusion criteria

1. Studies conducted in India.
2. Population aged ≥ 60 years.
3. Reported prevalence of anemia using recognized diagnostic criteria.
4. Used a cross-sectional, cohort, or baseline data of interventional studies.
5. Provided a clear description of the sample size and methodology.

Exclusion Criteria

1. Studies involving institutionalized or terminally ill populations exclusively.
2. Case reports, reviews, commentaries, and editorials.
3. Studies without full-text availability or without explicit anemia data.

Quality of included studies was assessed using a modified version of the Joanna Briggs Institute Critical Appraisal Checklist for Prevalence Studies.

Statistical Analysis

Meta-analysis was conducted using a random-effects model (DerSimonian and Laird method) due to high heterogeneity. The pooled prevalence with 95% confidence intervals (CI) was computed. Heterogeneity was quantified using I^2 statistics, and subgroup analyses were performed based on.

- Study setting (urban vs rural)
- Hemoglobin estimation method
- Gender (where available)

Publication bias was assessed using funnel plots and Egger's regression test.

RESULTS

Study Selection

Out of 1,787 articles identified, 22 met the eligibility criteria for final inclusion (Table 1). The PRISMA flow diagram outlines the selection process (Fig. 1).

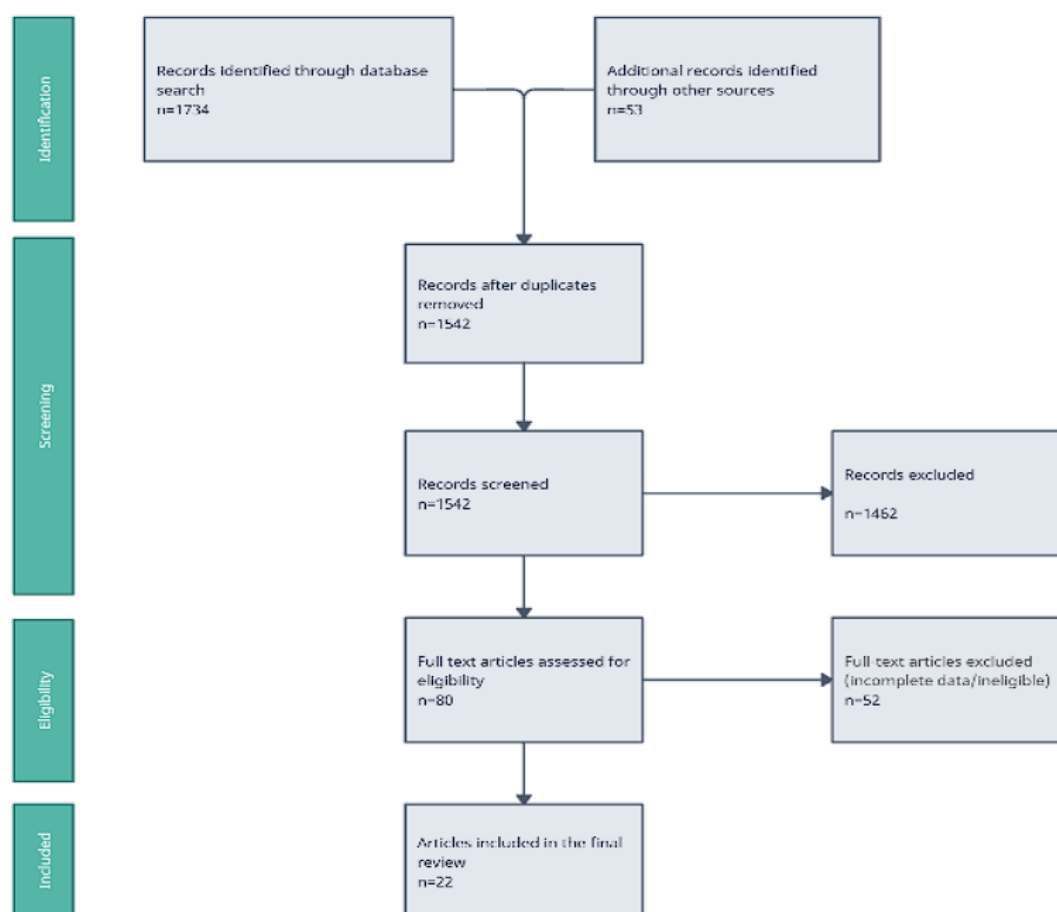


Fig. 1: Prisma flowchart depicting the selection process of the studies to be included in review.

Study Characteristics

The included studies were conducted across various Indian states, representing both rural and urban settings.

Sample sizes ranged from 60 to 982 participants. Most studies used WHO criteria to define anemia. Hemoglobin

estimation methods varied across studies (Sahli's, HemoCue, and cyanmethemoglobin).

Pooled Prevalence of Anemia

The pooled prevalence of anemia among the Indian elderly was 68.3% (95% CI: 60.7% – 75.9%). Heterogeneity was high ($I^2 = 92.4\%$, $p < 0.001$), warranting the use of a random-effects model.

Subgroup Analysis

- *By Setting*

Rural areas: 73.4% prevalence, urban areas: 61.2% prevalence

- *By Gender*
 - Males: 62.8% (from studies reporting gender-segregated data)
 - Females: 70.4%
- *By Estimation Method:*
 - Cyanmethemoglobin: 70.9%
 - HemoCue: 65.3%
 - Sahli's method: 60.1%

Table 1: Community-based studies on prevalence of anemia among elderly population.

S.No.	Author (Year)	Location	Setting	Sample Size	Hb Estimation Method	Diagnostic Criteria	Prevalence (%)
1	Agrawal et al. (2011)	Maharashtra	Rural, Community-based	214	Sahli's method	Not Available	62.6
2	Swami et al. (2002)	Chandigarh	Urban & Rural, Community-based	362	Sahli's method	Not Available	68.2
3	Singh et al. (2018)	New Delhi	Urban, Community-based	512	HemoCue	WHO	79.9
4	Gonmei et al. (2017)	New Delhi	Urban, Community-based	60	Cyanmethemoglobin	WHO	66.7
5	Gonmei et al. (2018)	New Delhi	Urban, Community-based	116	Cyanmethemoglobin	WHO	57.7
6	Kaur et al. (2009)	Haryana	Urban & Rural, Community-based	200	Cyanmethemoglobin	WHO	93.5
7	Vadakattu et al. (2019)	Telangana	Urban, Community-based	282	Cyanmethemoglobin	WHO	20.6
8	Sudarshan et al. (2016)	Puducherry	Rural, Community-based	360	Not Available	WHO	96.0
9	Bharati et al. (2011)	Puducherry	Urban & Rural, Community-based	214	Not Available	WHO	86.0
10	Shrivastava et al. (2013)	Karnataka	Urban, Hospital-based	654	Not Available	WHO	68.5
11	Maiti et al. (2013)	West Bengal	Rural, Community-based	544	HemoCue	WHO	89.5
12	Punia et al. (2015)	Haryana	Rural, Community-based	982	Cyanmethemoglobin	WHO	90.0
13	Paul et al. (2015)	Tamil Nadu	Rural, Community-based	340	Not Available	WHO	38.2
14	Agarwalla et al. (2016)	Assam	Rural, Community-based	330	Sahli's method	WHO	45.5
15	Soni et al. (2016)	Maharashtra	Urban, Hospital-based	550	Not Available	WHO	67.1
16	Vijayakumar et al. (2018)	Puducherry	Rural, Community-based	250	HemoCue	WHO	80.8
17	Pathania et al. (2019)	New Delhi	Urban, Old-age home-based	334	HemoCue	WHO	68.7
18	Renjini et al. (2019)	Kerala	Urban, Old-age home-based	104	HemoCue	WHO	76.0
19	Kant et al. (2019)	Haryana	Rural, Community-based	175	HemoCue	WHO	46.8
20	Kant et al. (2019)	Haryana	Rural, Community-based	175	HemoCue	WHO	46.8
21	Lakshmi et al. (2020)	Andhra Pradesh	Urban, Community-based	400	Sahli's method	WHO	71.5
22	Tiwari et al. (2021)	Uttar Pradesh	Rural, Community-based	312	Cyanmethemoglobin	WHO	65.4

Publication Bias

Funnel plot inspection suggested minor asymmetry. Egger's test did not indicate significant publication bias ($p = 0.12$).

DISCUSSION

This systematic review and meta-analysis reveal a pooled prevalence of 68.3% for anemia among Indian elderly

adults, highlighting it as a major yet neglected public health concern. This rate is significantly higher than the global average reported in elderly populations, which

ranges between 12% and 30% depending on setting and geography.^[11,12] Several factors contribute to this elevated prevalence in India. First, nutritional deficiencies, particularly iron, folate, and vitamin B12, are prevalent in elderly Indians due to lifelong dietary insufficiencies, food insecurity, and poor nutrient absorption.^[13] Second, chronic diseases such as chronic kidney disease (CKD), diabetes, malignancies, and inflammatory disorders, which are increasingly common in the elderly, can contribute to anemia of chronic disease.^[14] The review also found that rural populations had higher anemia prevalence than their urban counterparts. This may be due to poorer healthcare access, lower socioeconomic status, and increased rates of malnutrition in rural areas.^[15] Moreover, gender disparities were evident, with elderly women more commonly affected than men. Studies have shown that Indian women, even in older age, often suffer from long-standing iron and micronutrient deficiencies and may have limited access to health services.^[16] The findings also point to significant variability depending on the method of hemoglobin estimation. Studies using cyanmethemoglobin and HemoCue methods reported higher and more consistent prevalence rates compared to those using Sahli's method, which is known for underestimation and inter-observer variability.^[17] The high heterogeneity observed ($I^2 = 92.4\%$) is likely due to differences in population characteristics, diagnostic thresholds, study settings, and methodologies. Nonetheless, even the lowest estimates from high-quality studies remain unacceptably high, emphasizing the need for routine screening, standardized diagnostic practices, and interventions tailored to elderly populations in both rural and urban India. Despite its limitations, this meta-analysis serves as the most comprehensive synthesis to date of anemia prevalence in the Indian elderly and can inform public health programs and policy.

LIMITATIONS

1. High heterogeneity across studies due to variability in settings, diagnostic methods, and definitions.
2. Some studies did not mention the hemoglobin cut-off used, although most followed WHO criteria.
3. Geographical imbalance: North and South India were better represented compared to the North-East and central regions.

CONCLUSION

Anemia among the elderly is a critical yet neglected public health issue in India. The pooled prevalence of 68.3% is alarmingly high and calls for: Targeted screening programs in primary healthcare, especially in rural areas, nutritional interventions, iron and folic acid supplementation, and public health education, more uniform and robust research using standardized methodologies across all Indian states.

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