



Anemia among Scheduled Tribes in India: Gaps in Health, Nutrition, and Services: A Narrative Review

Pavan Kumbar¹, Nikhita Malasamudra²

^{1,2}Final year master of Public Health, Jawaharlal Nehru Medical College, Belagavi, Karnataka, India

E-mail: pavankumbar1431@gmail.com

ABSTRACT

Anemia among Scheduled Tribes (STs) in India remains a major public health concern, with prevalence rates significantly higher than national averages—72.4% in children and 64.6% in women. The burden is attributed to nutritional deficiencies (iron, folate, vitamin B12), genetic disorders (such as sickle cell disease and G6PD deficiency), and infectious diseases (malaria, helminths), compounded by poor dietary diversity, food insecurity, cultural practices, and limited access to healthcare due to geographic isolation, weak infrastructure, and socio-cultural barriers. Despite various government initiatives, implementation challenges have hindered effective outreach in tribal regions. This narrative review aims to synthesize existing knowledge on the prevalence, determinants, and health system challenges related to anemia in ST populations. Literature was sourced from PubMed, Google Scholar, ResearchGate, NFHS-5, and Press Information Bureau (PIB) reports, and was thematically reviewed to identify trends, risk factors, and gaps in service delivery. Findings highlight the multifactorial nature of anemia in tribal communities and emphasize the urgent need for integrated, community-based interventions that address nutrition, infection control, and culturally sensitive healthcare delivery to reduce disparities and improve health outcomes.

Keywords: Anemia, Scheduled Tribes, India, Health Disparities, Nutrition, Healthcare Access

1. INTRODUCTION

Anemia represents a profound public health crisis disproportionately affecting Scheduled Tribes (STs) in India. This review synthesizes national data and specific studies to highlight the pervasive nature of anemia within these communities, revealing a burden consistently higher than the national average and, in some cases, worsening over time. The etiology of anemia among STs is multifactorial, stemming from a complex interplay of chronic nutritional deficiencies, prevalent genetic hemoglobinopathies, and a high incidence of infectious and parasitic diseases, often compounded by co-morbidities.

A significant challenge lies in the under-recognition of the full extent and complexity of anemia among STs. Despite alarming prevalence rates, granular, comprehensive data on specific tribal groups and their unique determinants often remains limited (EzeRx, 2024; Seshadri et al., 2020). This absence of detailed, disaggregated information can obscure the nuanced picture of the problem, hindering the formulation of truly targeted policies and the allocation of appropriate resources.

Furthermore, anemia in STs is not merely an isolated health concern but rather a manifestation of a deeper, self-reinforcing cycle of vulnerability. Socio-economic disadvantages, including poverty and limited access to education, perpetuate poor nutritional status and food insecurity, which in turn exacerbate anemia (EzeRx, 2024; Rakesh et al., 2025; Newsreel Asia, 2025; Gupta et al., 2022). The impaired physical and cognitive development resulting from anemia, particularly in women and children, further reduces productivity and educational attainment, thereby entrenching poverty and poor health across generations (EzeRx, 2024; Kumar & Singh, 2023; Continental Hospitals, 2025). Addressing this requires a comprehensive, culturally sensitive, and integrated approach that tackles not only the immediate health needs but also the underlying socio-economic and systemic deficiencies in health, nutrition, and service delivery.

2. METHODS

The information for this narrative review was compiled through a systematic search strategy across multiple prominent databases and government repositories. The primary objective was to gather relevant literature pertaining to anemia prevalence, causes, and interventions specifically within Scheduled Tribe populations in India. The detailed flow of this search and selection process is illustrated in Figure 1.

2.1. Sources of Information Key databases consulted included:

- Google Scholar: Utilized for broad coverage of academic literature, including journal articles, conference papers, and theses.

- PubMed: Focused on biomedical and health-related research, offering access to peer-reviewed articles.
- ResearchGate: Accessed for preprints, research papers, and studies, including those not yet formally published in journals.
- Government Reports and Publications: Essential data and policy documents were retrieved from official sources such as the Press Information Bureau (PIB) of the Government of India and the National Family Health Surveys (NFHS-5, NFHS-4) published by the Ministry of Health and Family Welfare.

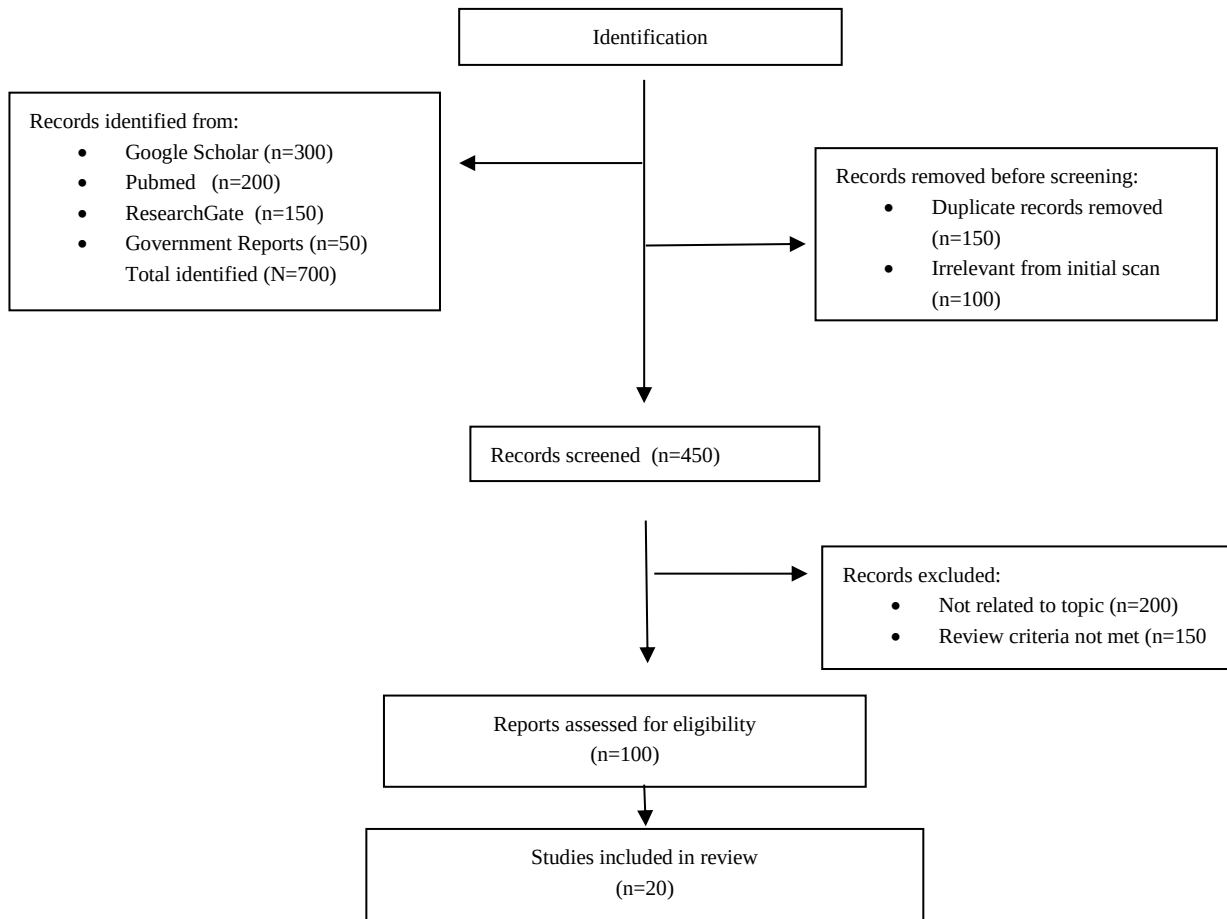


Figure 1 - Search Strategy Flowchart for Narrative Review

2.2. Search Strategy:

The search strategy employed a combination of core keywords and Boolean operators to ensure comprehensive retrieval of relevant literature. Initial keyword brainstorming identified central themes. The main search terms included:

- "Anemia"
- "Scheduled Tribes" OR "Tribal Population" OR "Indigenous People"
- "India"
- "Health Disparities" OR "Healthcare Access" OR "Service Delivery" OR "Health Initiatives"
- "Nutrition" OR "Nutritional Status" OR "Food Security" OR "Malnutrition" OR "Dietary Practices"

These terms were combined using "AND" and "OR" operators to create structured search queries (e.g., "Anemia AND (Scheduled Tribes OR Tribal Population) AND India AND (Health Disparities OR Healthcare Access)"). Additionally, relevant Medical Subject Headings (MeSH) terms were incorporated where appropriate, such as "Anemia," "Indigenous Population," "Health Status Disparities," "Nutrition," "Food Security," and "Health Services Accessibility" to refine searches in databases like PubMed.

2.3. Information Integration, Analysis, and Synthesis:

Following the initial search, titles and abstracts of the retrieved results were screened for relevance to the review's scope. Full-text articles and reports that met the initial criteria were then obtained and thoroughly reviewed for eligibility. Data points, statistics, forecasts, comparisons, process flows, relationships, and qualitative analyses were meticulously extracted from the selected documents.

The extracted information was then integrated and synthesized through thematic analysis. This involved identifying recurring themes, categorizing information into logical sections (e.g., prevalence, causes, gaps in health, nutrition, and services, and government initiatives), and recognizing interconnected factors contributing to anemia among STs. The aim was to build a coherent narrative that explains the complexity of the issue and highlights critical areas requiring intervention.

3. REVIEW

3.1 Prevalence and Burden of Anemia among Scheduled Tribes:

The burden of anemia among Scheduled Tribes in India is significantly higher than the national average, revealing a critical health disparity that demands urgent attention. Analysis of recent national health surveys underscores this disproportionate impact across various demographic groups within ST communities.

3.1.1. National and Tribal-Specific Prevalence (NFHS-5 Data):

According to the National Family Health Survey-5 (NFHS-5, 2019-21), anemia prevalence among children aged 6-59 months at the national level was 67.1 percent. However, this figure rose significantly to 72.4 percent among Scheduled Tribe children, indicating a notable disparity (Government of India Ministry of Health and Family Welfare, n.d.). Similarly, for women aged 15-49 years, the national prevalence of anemia was recorded at 57.0 percent, but it reached a higher 64.6 percent among Scheduled Tribe women (Government of India Ministry of Health and Family Welfare, n.d.). The national prevalence of anemia among Women of Reproductive Age (WRA) also saw an increase from 53 percent in NFHS-4 to 57 percent in NFHS-5 (Ghosh & Pal, 2024). More critically, anemia prevalence specifically among ST women (15-49 years) increased from 59.9 percent in NFHS-4 to 64.6 percent in NFHS-5, a rise that outpaced the all-India increase of 53.1 percent to 57 percent (Kumar, 2025). This trend indicates a widening gap in health equity for tribal women. Earlier data from NFHS-2 (1998) had already highlighted the severity, showing that anemia affected 69 percent of adolescent girls in tribal communities (Ministry of Health and Family Welfare, Government of India, 2025).

The consistently higher prevalence of anemia among Scheduled Tribes compared to the national average, and the observed increase in anemia rates for ST women between NFHS-4 and NFHS-5, point to a persistent and worsening disparity. This suggests that while national efforts to combat anemia are underway, they may not be adequately reaching or effectively addressing the specific, complex challenges faced by these particularly vulnerable groups. This widening gap underscores a systemic issue in achieving equitable health outcomes for tribal populations, necessitating a re-evaluation of current strategies.

Table 1 - Anemia Prevalence in India (NFHS-5): National vs. Scheduled Tribes (Children and Women)

Category	National Anemia Prevalence (%)	Scheduled Tribe Anemia Prevalence (%)	Scheduled Caste Anemia Prevalence (%)	Other Backward Class Anemia Prevalence (%)
Children (6-59 months)	67.1	72.4	69.5	65.2
Women (15-49 years)	57.0	64.6	59.2	54.6
Source: (Government of India Ministry of Health and Family Welfare, n.d.)				

3.1.2. Age and Gender Disparities in Anemia Prevalence:

Anemia has a disproportionate impact on women and children within tribal populations (EzeRx, 2024; Continental Hospitals, 2025). Pregnant women suffering from anemia face elevated risks of complications, and children affected by anemia may experience stunted growth, chronic fatigue, and compromised academic performance (Continental Hospitals, 2025). Significant variations in anemia prevalence are also observed across districts, with areas like Simdega and Udagiri recording exceptionally high rates among Women of Reproductive Age (WRA) in both NFHS-4 and NFHS-5, reaching 78.2 percent and 81.5 percent, respectively (Ghosh & Pal, 2024).

A study conducted in Telangana revealed that 32 percent of females (105 out of 328) were anemic, a figure substantially higher than the 15.5 percent observed in males (24 out of 155). Among anemic females, the majority of cases were mild (80 percent) or moderate (18 percent), with a smaller proportion (1.9 percent) classified as severe. In contrast, males primarily presented with moderate anemia (Rakesh et al., 2025). Another study in Kerala reported anemia prevalence of 64.6 percent in females and 33.3 percent in males (Newsreel Asia, 2025). Furthermore, increasing age, particularly within the geriatric population (those aged 60 years and above), is associated with a higher prevalence of anemia, reaching 67 percent in this demographic

(Newsreel Asia, 2025). Menorrhagia, or heavy menstrual bleeding, was identified as a significant risk factor for anemia in women, with one study indicating that 85 percent of women suffering from menorrhagia were anemic (Newsreel Asia, 2025).

The significantly higher prevalence and severity of anemia in tribal women, especially those of reproductive age and pregnant individuals, highlights a critical gender-specific health crisis. This situation necessitates targeted interventions that extend beyond general nutritional programs. The observed patterns, including the impact of menorrhagia, indicate that the issue encompasses biological factors related to female reproductive health, which exacerbate their vulnerability. Public health programs must therefore incorporate gender-specific strategies, focusing on comprehensive reproductive health, consistent iron and folic acid (IFA) supplementation adherence, and awareness campaigns specifically tailored to women's unique health needs.

3.1.3. State-Specific Variations and Severity of Anemia:

While comprehensive overall data for India's tribal population remains limited, state-specific studies offer crucial insights into the high prevalence and regional variations of anemia. For instance, a study in Kerala found that 89 percent of tribal women were anemic, with 62 percent experiencing moderate anemia and 11 percent suffering from severe anemia (EzeRx, 2024). Another study in the Wayanad district of Kerala reported an even higher prevalence, with 96.5 percent of tribal women in the reproductive age group being anemic (EzeRx, 2024). In Southern Rajasthan, a survey revealed that 85.7 percent of tribal women were anemic, predominantly with moderate cases (EzeRx, 2024). Similarly, a study in Andhra Pradesh found that 63.82 percent of tribal lactating mothers were anemic (EzeRx, 2024).

Nationally, India has seen a decline in severe anemia (defined as a hemoglobin level below 7 g/dL) from 11.3 percent in 2008-09 to 3.29 percent in 2017-18 (Poojary & Naik, 2014). However, the incidence of severe anemia varies widely across different Indian states (Poojary & Naik, 2014). A community-based study conducted in Odisha reported a significant prevalence of severe anemia, affecting 36.5 percent of individuals above the age of 20 (Rakesh et al., 2025).

The significant variation in anemia prevalence and severity across different states and even districts within tribal communities suggests that broad national strategies alone may not be sufficient. Effective interventions require localized, context-specific approaches. This pronounced heterogeneity implies a need for granular, district- or state-level data collection and tailored programs that account for local dietary patterns, specific genetic predispositions, unique environmental factors, and the nuances of healthcare access in each region. A targeted approach, prioritizing regions with the highest burden and customizing solutions, could significantly enhance the impact and efficiency of resource allocation.

Table 2 - State-Specific Anemia Prevalence and Severity among Tribal Women

State/Region	Prevalence of Anemia among Tribal Women (%)	Severity Breakdown (Moderate%, Severe%)	Source Study/Year
Kerala	89%	62% Moderate, 11% Severe	Journal of Family Medicine and Primary Care (EzeRx, 2024)
Kerala (Wayanad district)	96.5%	Not specified	International Journal of Health & Allied Sciences (EzeRx, 2024)
Southern Rajasthan	85.7%	Most moderate	Indian Journal of Public Health (EzeRx, 2024)
Andhra Pradesh (Lactating Mothers)	63.82%	Not specified	Dove Press (EzeRx, 2024)

3.2. Multifactorial Causes and Contributing Factors

The high prevalence of anemia among Scheduled Tribes is not attributable to a single cause but rather to a complex interplay of nutritional deficiencies, genetic predispositions, infectious diseases, and co-existing health conditions. Understanding these interconnected factors is crucial for developing effective interventions.

3.2.1. Nutritional Deficiencies (Iron, Vitamin B12, Folate, etc.):

Nutritional deficiencies are a primary driver of anemia in tribal communities. Approximately 50 percent of anemia cases are attributed to iron deficiency, although this proportion can vary based on specific population groups and local conditions (Government of India Ministry of Health and Family Welfare, n.d.). A significant contributing factor is the limited access to nutritious food and a lack of iron-rich dietary components such as green leafy vegetables, pulses, eggs, and meats (Negi et al., 2024; Sarma, 2013; Continental Hospitals, 2025). Insufficient intake and poor absorption or utilization of essential micronutrients like iron, vitamin B12, and folic acid directly contribute to the development of anemia (Negi et al., 2024).

The staple diets of many tribal communities predominantly consist of rice, maize, and millets, often lacking diversity and sufficient animal-based food sources (Negi et al., 2024; Hazra et al., 2024; Sarma, 2013; Yadav et al., 2025). This dietary pattern significantly contributes to iron and vitamin B12 deficiencies. Furthermore, the consumption of foods common in the tribal diets, such as grains and legumes, contains compounds like phytates and tannins (also found in tea) that can inhibit iron absorption (Negi et al., 2024; Sarma, 2013). A study in some tribal areas observed a significant vitamin B12 deficiency in 62.89 percent of participants, with 9.43 percent experiencing severe deficiency, largely linked to limited access to animal-based foods (Negi et al., 2024). Deficiencies in other micronutrients, including folate (B9), cobalamin (B12), pyridoxine (B6), Vitamin A, and Vitamin D, may also contribute to anemia, although their precise mechanisms require further investigation (Kumar & Singh, 2023; Press Information Bureau, 2025).

3.2.2. Genetic Hemoglobinopathies (Sickle Cell Disease, Thalassemia, G6PD Deficiency)

Genetic hemoglobinopathies pose significant health challenges for tribal populations in India, with varying distributions across different groups (Tamil Nadu Health Systems Project, n.d.). These conditions, particularly hemoglobin S (HbS), hemoglobin E (HbE), and β -thalassemia, are important contributors to anemia.

Sickle Cell Disease (SCD): This condition is notably more prevalent among tribal populations, especially in regions where *Plasmodium falciparum* malaria is hyperendemic (Continental Hospitals, 2025). The heterozygous state (Hb-AS) of the sickle cell gene offers a protective advantage against malaria, a historically deadly disease in these areas. However, individuals inheriting the homozygous state (Hb-SS) develop sickle cell anemia, which can be fatal (Continental Hospitals, 2025). Madhya Pradesh and Chhattisgarh exhibit particularly high rates of the sickle cell trait among tribal groups, ranging between 10 percent and 30 percent, in contrast to lower rates observed in states like Odisha and Maharashtra (Kumar & Singh, 2023). SCD is recognized as a major cause of illness and death in tribal populations (Continental Hospitals, 2025).

β -thalassemia: This genetic disorder is also prevalent in tribal communities, with a higher incidence observed in the Bhil community in certain regions (Continental Hospitals, 2025). Interactions between β -thalassemia genes and HbS, HbE, and α -thalassemia genes are frequently noted in tribal populations, influencing the clinical presentation of anemia (Tamil Nadu Health Systems Project, n.d.).

G6PD Deficiency: Glucose-6-Phosphate Dehydrogenase (G6PD) deficiency is the most common enzyme deficiency globally, with a higher prevalence in malaria-endemic populations (Ghosh & Pal, 2024). Its prevalence in Indian tribal populations varies widely, from 2.3 percent to 27.0 percent, with an overall reported prevalence of 7.7 percent in different tribal groups (Gupta et al., 2022). Overall, G6PD deficiency is reported at 17 percent among tribal populations, with high frequencies in specific tribes such as Ao (22.15 percent) and Angami (22 percent) Naga, Bodo (19 percent), Mizo (17.5 percent), Garasiya (15.2 percent), and Santhal (14.03 percent) (Ghosh & Pal, 2024). Interestingly, high frequencies are found in Northeast India (Nagaland, Mizoram, Manipur) where malaria is *not* endemic, suggesting that factors like a strong preference for clan endogamous marriages may contribute to its prevalence in these areas (Ghosh & Pal, 2024). The irrational use of antimalarial drugs can lead to drug-induced hemolysis in G6PD deficient individuals, further exacerbating anemia (Gupta et al., 2022).

The high prevalence of genetic hemoglobinopathies like Sickle Cell Disease and G6PD deficiency among Scheduled Tribes is a consequence of evolutionary adaptation to malaria. This protection, however, comes at a significant cost: increased susceptibility to severe anemia when these genes are present in homozygous or deficient states. This creates a complex situation where a natural selection mechanism for malaria resistance simultaneously leads to a profound vulnerability to severe forms of anemia. This finding implies that public health interventions must be meticulously designed to account for these specific genetic predispositions, emphasizing genetic counseling, comprehensive screening (as exemplified by the National Sickle Cell Anaemia Elimination Mission (Press Information Bureau, 2025)), and personalized care, rather than a generic approach to anemia.

Table 3 - Prevalent Hemoglobinopathies and their Distribution in Indian Tribal Populations

Hemoglobinopathy Type	Key Regions/States of High Prevalence	Associated Clinical Implications/Impact
Sickle Cell Disease (SCD)	Madhya Pradesh, Chhattisgarh (10-30% trait); Central India, Eastern Odisha, Jharkhand, Western Rajasthan, Gujarat, Maharashtra, Nilgiri Hills (South India), Wayanad (Kerala)	Heterozygous (Hb-AS) protects against malaria; Homozygous (Hb-SS) causes fatal anemia; major cause of morbidity and mortality.
Beta-Thalassemia	Variably distributed; Bhil community (higher prevalence); Odisha (interactions with HbS, HbE, alpha-thalassemia)	Important challenge; interacts with other hemoglobinopathies, influencing clinical presentation.
G6PD Deficiency	Nagaland (22.08%), Mizoram (17.5%), Manipur (13.89%); Ao (22.15%), Angami (22%) Naga, Bodo (19%), Mizo (17.5%), Garasiya (15.2%), Santhal (14.03%); Gujarat (Gamits 31.4%, Dhankas 20.4%); Chhattisgarh (Kawars 21.5%, Oraons 13.4%)	Protection against malaria in heterozygous state (debated); increased risk of severe malarial anemia in hemizygotes/homozygotes; drug-induced hemolysis from antimalarials.

Source: (Kumar & Singh, 2023; Tamil Nadu Health Systems Project, n.d.; Continental Hospitals, 2025; Ghosh & Pal, 2024; Gupta et al., 2022)

3.2.3. Infectious and Parasitic Diseases (Malaria, Intestinal Worms, Chronic Infections):

Infectious and parasitic diseases are highly prevalent in tribal areas and significantly exacerbate anemia. Conditions such as malaria, intestinal worms (e.g., hookworm infections), and chronic infections (e.g., tuberculosis, diarrheal diseases) are common (Sarma, 2013; Press Information Bureau, 2025; Continental Hospitals, 2025). These diseases contribute to anemia by impairing the body's ability to absorb nutrients, causing direct blood loss, or leading to the destruction of red blood cells (Sarma, 2013; Continental Hospitals, 2025).

Tribal populations account for a disproportionately high number of malaria cases, contributing over 80 percent of total cases in India. This is largely due to their proximity to forested regions where malaria vectors are prevalent, concentrating the disease burden in rural and tribal areas (Seshadri et al., 2020; Newsreel Asia, 2025). Poor sanitation and hygiene practices, which are unfortunately common in many tribal communities, directly increase their exposure and susceptibility to these infections (EzeRx, 2024; Sarma, 2013).

Anemia in Scheduled Tribes is rarely caused by a single factor; instead, it is a complex web where chronic nutritional deficiencies weaken the body, making it more susceptible to infectious diseases. These infections, in turn, worsen nutrient absorption and red blood cell production, all compounded by underlying genetic predispositions. For example, a child with poor nutrition is more vulnerable to malaria or worm infections, and these infections further deplete vital nutrients, creating a vicious cycle of worsening anemia. Genetic conditions like Sickle Cell Disease can predispose individuals to chronic anemia, which is then exacerbated by inadequate nutrition and recurrent infections. This intricate interplay necessitates integrated health and nutrition interventions that address all contributing factors simultaneously, rather than fragmented, siloed programs.

3.2.4. Co-morbidities and Other Health Conditions:

Anemia is closely linked to increased mortality and morbidity rates and can diminish the effectiveness of medical treatments (Poojary & Naik, 2014). Among hospitalized anemic patients, common underlying health conditions include anemia of chronic disease (36.47 percent), infection (30.94 percent), gastrointestinal (GI) bleeding (9.95 percent), nutritional deficiencies (9.39 percent), hemoglobinopathies (3.31 percent), and malignancy (2.2 percent) (Poojary & Naik, 2014). Chronic anemia itself can lead to secondary organ damage, such as congestive heart failure (Newsreel Asia, 2025).

The co-occurrence of anemia and cardiometabolic disease risk factors, such as hypertension and diabetes mellitus, is increasingly observed, with a notably higher prevalence of this "double burden" among women (Kumar, 2025). Type 2 diabetes and hypertension are growing health concerns in tribal populations, with their rise largely attributed to changing dietary patterns and sedentary lifestyles (Seshadri et al., 2020; Newsreel Asia, 2025). Excessive alcohol consumption and tobacco use are prevalent habits among tribal populations, significantly contributing to hypertension and potentially exacerbating anemia through various mechanisms (Rakesh et al., 2025; Negi et al., 2024; Newsreel Asia, 2025; Vajiram & Ravi, 2025).

While communicable diseases and malnutrition remain highly prevalent, tribal communities are increasingly facing a "double burden" of disease. This involves rising rates of non-communicable diseases (NCDs) like hypertension and diabetes co-occurring with persistent anemia. This epidemiological shift complicates diagnosis and treatment, as healthcare systems historically designed for acute infectious diseases may be ill-equipped to manage chronic NCDs and their complex interplay with anemia. This situation is further compounded by existing limitations in healthcare access, awareness, and financial constraints within these communities.

3.3 Gaps in Nutrition and Food Security

Significant gaps in nutrition and food security are central to the high prevalence of anemia among Scheduled Tribes, driven by inadequate dietary diversity, persistent food insecurity, and the influence of certain cultural practices and addictive behaviors.

3.3.1. Inadequate Dietary Diversity and Traditional Food Practices:

Tribal families frequently rely on forest-based diets or locally grown crops, which often lack essential iron-rich foods such as green leafy vegetables, pulses, eggs, and meats (Continental Hospitals, 2025). The staple diets of many tribal communities primarily consist of rice, maize, and tubers, providing limited access to vital vegetables, fruits, and proteins (Negi et al., 2024; Hazra et al., 2024; Sarma, 2013; Yadav et al., 2025). These traditional dietary patterns, while culturally significant, often lack the necessary diversity to provide sufficient amounts of key nutrients like iron and vitamin B12, which are crucial for red blood cell production (Negi et al., 2024).

A significant concern is the consumption of foods common in the tribal diet, such as grains and legumes, which contain compounds like phytates and tannins. These compounds, also found in tea, can inhibit the absorption of iron (Negi et al., 2024; Sarma, 2013). The limited access to animal protein, often due to poverty, cultural preferences, and availability constraints, severely restricts the intake of heme iron (a more easily absorbed form) and vitamin B12 (Negi et al., 2024; Sarma, 2013). While traditional food practices emphasize seasonal and locally sourced produce, their nutritional completeness may be insufficient in modern contexts without greater dietary diversification (Sarma, 2013).

The lack of dietary diversity among tribal communities leads to a form of "hidden hunger," where, even if caloric intake is sufficient, there is a pervasive deficiency in essential micronutrients. This directly contributes to chronic anemia. The problem is not solely about insufficient caloric intake, although food insecurity is also present; it is fundamentally about the quality and variety of food consumed, which is inadequate for optimal nutrient absorption and hemoglobin synthesis.

Table 4 - Key Nutritional Deficiencies and Associated Dietary Patterns in Tribal Communities

Nutritional Deficiency	Associated Dietary Patterns/Practices	Impact on Anemia
Iron Deficiency	Staple-based diet (rice, maize, millets); lack of green leafy vegetables, pulses, eggs, meats; consumption of phytate/tannin-rich foods (grains, legumes, tea).	Primary contributor to anemia; impaired hemoglobin production.
Vitamin B12 Deficiency	Limited access to animal-based foods (meat, fish, eggs, dairy); predominantly vegetarian diet.	Crucial for red blood cell production; deficiency leads to anemia.
Folic Acid Deficiency	Insufficient intake; poor absorption.	Essential for red blood cell synthesis.
Other Micronutrient Deficiencies (Vitamin A, D, B6)	Lack of diverse, nutrient-rich foods.	Can contribute to anemia, though mechanisms may vary.
Source: (Kumar & Singh, 2023; Negi et al., 2024; Sarma, 2013; Press Information Bureau, 2025; Continental Hospitals, 2025)		

3.3.2. Impact of Food Insecurity and Malnutrition on Anemia:

Many tribal communities in India grapple with persistent food insecurity and malnutrition, despite the existence of government welfare programs (Hazra et al., 2024; Yadav et al., 2025). Financial constraints and poverty severely limit their ability to afford sufficient and healthy food, leading directly to malnutrition and associated health problems, including anemia (EzeRx, 2024; Yadav et al., 2025). Data from NFHS-5 (2019-21) for Koraput, Odisha, starkly illustrates the severe impact of food insecurity, revealing alarming rates of malnutrition: 43 percent of children are stunted, 33 percent are underweight, and 50 percent are anemic (Hazra et al., 2024; Yadav et al., 2025).

The consumption of mango kernels, a waste product, serves as a stark indicator of extreme food insecurity, with historical instances of illnesses and deaths in tribal areas of Odisha linked to this practice (Hazra et al., 2024; Yadav et al., 2025). Furthermore, small land holdings often confine tribal families to subsistence farming, resulting in seasonal food shortages and restricting their access to diverse, nutrient-rich crops (Yadav et al., 2025).

Extreme food insecurity, evidenced by the consumption of non-food items like mango kernels, directly correlates with severe malnutrition and anemia. This highlights a fundamental failure in ensuring basic food security for the most vulnerable tribal communities. This situation indicates that beyond issues of dietary quality, the sheer quantity and consistent access to any safe and sufficient food are fundamental challenges. Initiatives like the Koraput Model, which focuses on diversified farming and community involvement, aim to address this, suggesting that improving local food production and ensuring consistent access are direct and critical pathways to reducing severe malnutrition and anemia.

3.3.3. Influence of Cultural Practices and Addictive Behaviors on Nutrient Absorption:

Cultural practices and habits within tribal communities can inadvertently exacerbate the risk of anemia by limiting diverse nutrient intake or inhibiting nutrient absorption. In some tribal cultures, dietary restrictions or taboos against consuming certain animal products can further restrict iron intake (Sarma, 2013).

Addictive behaviors, such as the consumption of multiple cups of tea or coffee, tobacco chewing, or beetle nut chewing, are prevalent and introduce compounds that interfere with the absorption of essential nutrients, including iron (Negi et al., 2024). Tea, for instance, contains tannins that can bind to iron in the stomach and intestines, preventing its absorption, particularly when consumed with or immediately after meals (Negi et al., 2024). Tobacco and beetle nut chewing habits are linked to other health problems that can contribute to anemia and directly impede nutrient absorption (Negi et al., 2024). Irregular food timing, often influenced by these addictive habits, can also lead to nutrient deficiencies as the body may not receive adequate nutrients from food (Negi et al., 2024).

Excessive alcohol consumption is prevalent among tribal populations and contributes to anemia through various mechanisms, including nutritional deficiencies, gastrointestinal bleeding, and reduced red blood cell production (Rakesh et al., 2025; Negi et al., 2024; Newsreel Asia, 2025; Vajiram & Ravi, 2025). A significant challenge in addressing these issues is the low awareness among many tribal communities regarding balanced diets and available nutrition programs (Hazra et al., 2024; Sarma, 2013; Continental Hospitals, 2025).

While traditional food practices and cultural habits are integral to tribal identity and sustainable living, they can, without modern nutritional knowledge or adaptation, inadvertently exacerbate anemia risk. This implies that nutrition education and interventions must be culturally sensitive, working with

existing traditions to introduce diverse, nutrient-rich foods and mitigate harmful habits, rather than imposing external dietary changes that might be rejected or misunderstood.

3.4 Challenges in Healthcare Access and Service Delivery

Tribal populations in India face profound and multifaceted challenges in accessing and utilizing healthcare services, stemming from geographical isolation, inadequate infrastructure, human resource shortages, and significant socio-cultural barriers.

3.4.1. Geographical Remoteness and Inadequate Infrastructure:

India's tribal population, numbering over 104 million, typically resides in hilly, rural, and remote areas characterized by poor health infrastructure and limited resources (Seshadri et al., 2020; Yadav et al., 2025; Newsreel Asia, 2025). These remote and often inaccessible regions, including mountainous terrains, dense forests, or areas with insufficient transportation infrastructure, make it exceptionally difficult to establish and maintain healthcare facilities and ensure the timely delivery of medical supplies and services (Yadav et al., 2025).

The absence of nearby healthcare facilities necessitates that individuals often travel long distances to receive medical attention, a factor cited by 17.45 percent of respondents as a reason for not utilizing services (Yadav et al., 2025; Newsreel Asia, 2025). This challenge is particularly acute during medical emergencies. Poor or non-existent roads, coupled with a lack of public or private transport and ambulance services, constitute significant logistical barriers to healthcare access (Seshadri et al., 2020; Newsreel Asia, 2025). Even with somewhat liberal norms for increasing access to care centers in tribal areas, Primary Health Centers (PHCs) remain much harder to reach due to the challenging terrain (Newsreel Asia, 2025).

The geographical isolation and inadequate infrastructure create a profound "last mile" problem in healthcare delivery. This makes it incredibly difficult for essential healthcare services, medical supplies, and qualified personnel to consistently reach tribal communities effectively. This points to a fundamental logistical challenge that undermines the efficacy of any health intervention, regardless of its design or intent. This situation suggests that innovative delivery models such as mobile medical units, telemedicine, and potentially drone-based delivery are not just supplementary but essential strategies to overcome this persistent physical barrier and ensure equitable access (Yadav et al., 2025; Newsreel Asia, 2025).

3.4.2. Shortage of Healthcare Professionals and Essential Resources:

Healthcare facilities in tribal areas are frequently severely under-resourced and lack adequate staff (EzeRx, 2024; Newsreel Asia, 2025). There is a chronic shortage of qualified health workers, including doctors, specialists (e.g., pediatricians), and technicians, at all levels of healthcare, from Primary Health Centers to Community Health Centers (Yadav et al., 2025; Newsreel Asia, 2025).

The reluctance of staff to work in remote tribal areas stems from various factors. These include equal salary structures (or even less due to lower House Rent Allowance), limited educational opportunities for their children, and social and family isolation resulting from a lack of entertainment facilities (Newsreel Asia, 2025). This inadequate availability of skilled healthcare providers creates a critical gap in service delivery, leading to delayed diagnoses, inappropriate treatment, and limited access to specialized medical care (Yadav et al., 2025). Additionally, healthcare facilities in these regions often lack suitable equipment, further compromising the quality of care (Yadav et al., 2025; Newsreel Asia, 2025).

The chronic shortage of healthcare professionals in tribal areas is not solely due to a lack of recruitment but also a systemic issue of poor motivation, inadequate incentives, and insufficient support structures for staff willing to serve in these challenging environments. This "human resource drain" means that even when infrastructure is present, the lack of qualified personnel renders services ineffective or unavailable. Addressing this requires not only increased recruitment but also comprehensive strategies to improve working conditions, provide attractive incentives, offer professional development opportunities, and ensure personal and family support to retain healthcare workers in these underserved regions.

3.4.3. Financial, Linguistic, and Cultural Barriers to Healthcare Utilization:

Beyond geographical and infrastructural challenges, tribal populations face significant financial, linguistic, and cultural barriers that impede their access to and utilization of healthcare services.

Financial Factors: Tribal populations often live below the poverty line, severely limiting their ability to afford healthcare (EzeRx, 2024; Yadav et al., 2025; Newsreel Asia, 2025). This financial constraint frequently compels many to forgo necessary medical treatment, leading to untreated illnesses and prolonged health issues (EzeRx, 2024). Lack of money was cited as a barrier by 1.43 percent of respondents for not utilizing services (Yadav et al., 2025).

Linguistic and Cultural Barriers: These barriers significantly obstruct effective communication between healthcare providers and tribal patients, often resulting in misunderstandings and suboptimal healthcare outcomes (Yadav et al., 2025). Limited access to health information in native languages prevents tribal community members from making informed decisions about their health (Yadav et al., 2025). A lack of cultural sensitivity and competence among healthcare professionals further exacerbates these challenges, hindering the delivery of quality healthcare services (Yadav et al., 2025; Continental Hospitals, 2025). Traditional beliefs or a general lack of education can prevent tribal individuals from seeking timely medical help (Continental Hospitals, 2025). A notable percentage (5.64 percent) of respondents opted for local traditional practitioners instead of formal healthcare facilities (Yadav et al., 2025; Gupta et al., 2022). Cultural resistance (e.g., to vaccination) and a strong reliance on traditional birth practices over institutional childbirth are also

observed, influenced by factors like lack of education, poverty, and cultural beliefs (Kumar, 2025; Yadav et al., 2025). The extended family often plays a crucial role in healthcare decision-making, and cultural taboos (e.g., against dying at home) can complicate care planning (Hazra et al., 2024).

The challenges in healthcare access and utilization are further compounded by a pervasive "trust deficit" stemming from historical neglect, cultural insensitivity, and a lack of understanding of tribal health beliefs and practices. This lack of trust, cited by 4.57 percent of respondents as a reason for non-utilization (Yadav et al., 2025), extends beyond mere communication issues to a deeper reluctance to engage with formal healthcare systems. This situation necessitates a fundamental shift towards building trust through culturally competent care, involving community leaders, respecting traditional healing systems where appropriate, and ensuring that health programs are perceived as genuinely beneficial and aligned with tribal values. Without addressing this underlying deficit, even improved infrastructure and staffing may not lead to optimal health outcomes.

Common reasons for non-utilization of services reported in a study include:

- Distance (17.45%) (Yadav et al., 2025)
- Lack of Trust (4.57%) (Yadav et al., 2025)
- Lack of Transport (6.51%) (Yadav et al., 2025)
- Non-availability of Doctors (3.87%) (Yadav et al., 2025)
- Non-availability of Drugs (0.96%) (Yadav et al., 2025)
- Lack of Facilities (3.22%) (Yadav et al., 2025)
- Long Waiting Hours/Longer Queues (0.86%) (Yadav et al., 2025)
- Loss of Wages (0.08%) (Yadav et al., 2025)
- Lack of Money (1.43%) (Yadav et al., 2025)
- Availability of Local Practitioners (5.64%) (Yadav et al., 2025)

3.5 Government Initiatives and Their Challenges

The Government of India has launched several initiatives aimed at addressing anemia and improving the health status of tribal communities, demonstrating a commitment to their welfare. However, the implementation and effectiveness of these programs face various challenges.

3.5.1. Overview of Key Programs:

The government's focused efforts towards tribal development date back to the implementation of the Tribal Sub-Plan (TSP) in 1974-75, which evolved into the Scheduled Tribe Component (STC) and the Development Action Plan for Scheduled Tribes (DAPST) (Press Information Bureau, 2022). These plans ensure that various ministries coordinate efforts for tribal welfare.

Key programs specifically targeting anemia and tribal health include:

- **Anaemia Mukht Bharat (AMB):** Launched in 2018, AMB is India's ambitious public health campaign against anemia, targeting six beneficiary age groups: children (6-59 months, 5-9 years), adolescents (10-19 years), pregnant and lactating women, and women of reproductive age (15-49 years) (Ministry of Health and Family Welfare, Government of India, 2025; Continental Hospitals, 2025). The strategy includes prophylactic Iron Folic Acid (IFA) supplementation, periodic deworming, intensified year-round Behavior Change Communication (BCC) campaigns, testing and treatment of anemia using digital methods, mandatory provision of IFA-fortified foods in government-funded health programs, and intensified awareness, screening, and treatment of non-nutritional causes of anemia, with a special focus on malaria and hemoglobinopathies (Continental Hospitals, 2025). AMB aims to disrupt the intergenerational cycle of malnutrition (Ministry of Health and Family Welfare, Government of India, 2025).
- **National Sickle Cell Anaemia Elimination Mission (NSCEM):** Launched by the Prime Minister in Shahdol, Madhya Pradesh, on July 1, 2023, the NSCEM aims to eliminate Sickle Cell Anaemia by 2047 (Press Information Bureau, 2022; Press Information Bureau, 2025). This mission prioritizes the health of tribal communities, combining screening and awareness strategies for early detection and treatment (Press Information Bureau, 2025). It targets screening approximately 7.0 crore (70 million) people under 40 years of age in 17 high-focus states over three years (FY 2023-24 to 2025-26) (Press Information Bureau, 2025). The mission also includes the distribution of Sickle Cell Genetic Status Cards and the release of guidelines and training modules for healthcare professionals and the public (Press Information Bureau, 2025).
- **Integrated Child Development Services (ICDS):** This centrally sponsored scheme, launched in 1975, provides nutrition to children under 6 years, pregnant women, and nursing mothers through Anganwadi centers (Sarma, 2013; Continental Hospitals, 2025). Services include supplementary nutrition, pre-school education, health check-ups, immunization, referral services, and nutrition & health education (Sarma, 2013; Continental Hospitals, 2025). ICDS is designed to improve nutritional status and reduce child mortality and malnutrition, particularly in backward, rural, urban, and tribal areas (Sarma, 2013; Continental Hospitals, 2025).

- **Weekly Iron and Folic Acid Supplementation (WIFS):** This program provides weekly iron and folic acid tablets to school-going children and adolescents, also incorporating deworming and awareness on hygiene and nutrition (Continental Hospitals, 2025).
- **Mid-Day Meal Scheme:** This program offers free lunch to students in government schools, designed to include iron-rich foods and boost children's nutrition (Continental Hospitals, 2025).
- **Tribal Health and Nutrition Programs:** Under the Ministry of Tribal Affairs, special programs are run in tribal-dominated districts, focusing on providing health kits, conducting health camps, and improving food diversity (Continental Hospitals, 2025).
- **Particularly Vulnerable Tribal Groups (PVTGs) Development Program:** This program targets the most vulnerable tribal communities, focusing on improving access to healthcare, education, clean water, and electricity (Hazra et al., 2024; Press Information Bureau, 2022).
- **Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana (PMJAY):** This scheme aims to provide equitable access to quality treatment for the poor, ensuring they can access healthcare without fear of expense (Press Information Bureau, 2025).
- **National Tribal Health Conclave 2025:** Organized by the Ministry of Tribal Affairs in collaboration with the Ministry of Health and Family Welfare, this conclave aimed to address critical health challenges, explore innovative healthcare delivery models, identify policy priorities, and develop culturally appropriate health strategies for tribal regions (Press Information Bureau, 2025).

3.5.2. Implementation Challenges and Gaps in Program Effectiveness:

- Despite these extensive initiatives, significant challenges persist in the effective implementation and impact of government programs in tribal areas.
- **IFA Supplementation Challenges:** While NFHS 2019-21 indicates that 88 percent of women received IFA supplements during their last pregnancy, only 44 percent consumed them for more than 100 days (Gupta et al., 2022). Low compliance levels are a major concern contributing to persistently high anemia prevalence during pregnancy (Gupta et al., 2022). Reasons for ineffective programs include sporadic or inadequate supply, poor quality tablets, problems with delivery and distribution systems, poorly trained and uncommitted health providers, and ineffective communication materials to promote behavior change (Gupta et al., 2022). Misconceptions about side effects, such as yellow urine, also lead to low acceptance and consumption of IFA tablets (Kumar, 2025).
- **Deworming Program Implementation:** While deworming is a crucial strategy, the program continues to face challenges, including low coverage (Gupta et al., 2022). Common hurdles include misconceptions and misinformation about deworming, limited and difficult access to remote areas, logistical problems, and limited support from some stakeholders (Gupta et al., 2022). Children with disabilities, for instance, are less likely to receive school-based deworming treatment, highlighting disparities in coverage (Gupta et al., 2022).
- **Broader Program Effectiveness and Policy-Practice Gap:** A fundamental challenge is the gap between policy intent and on-ground implementation. Despite policies designed to increase access to care centers in tribal areas, these centers remain difficult to reach due to challenging terrain, poor roads, and lack of transport (Newsreel Asia, 2025). There is a severe shortage of qualified health workers, including doctors and specialists, in tribal areas, partly due to poor motivation and lack of incentives for staff to serve in remote locations (Newsreel Asia, 2025).
- The consistent presence of a "policy-practice gap" is evident, where well-intentioned government initiatives often struggle to translate into tangible health improvements for tribal communities due to systemic implementation failures. This gap is characterized by inadequate last-mile delivery, human resource shortages, and a lack of cultural adaptation in program design. This situation indicates that policy formulation alone is insufficient; robust implementation mechanisms, continuous monitoring, and adaptive strategies are crucial to bridge the divide between national health goals and the lived realities of tribal populations.
- Furthermore, many government programs, while addressing specific health issues, often operate in "vertical program silos," failing to achieve the necessary synergy and comprehensive impact required to tackle the multifactorial nature of anemia. For example, a program focusing solely on IFA supplementation might overlook the co-existing challenges of genetic hemoglobinopathies, parasitic infections, or food insecurity. This fragmented approach can lead to inefficiencies, duplication of efforts, and a failure to address the interconnected determinants of anemia holistically. An integrated, multi-sectoral approach, coordinating efforts across health, nutrition, education, and tribal affairs ministries, is essential for a more effective and sustainable impact.
- Finally, the long-term sustainability of interventions remains a critical concern, particularly given the deep-rooted socio-economic vulnerabilities and geographical isolation of tribal communities. While programs like the National Sickle Cell Anaemia Elimination Mission have ambitious targets for 2047 (Press Information Bureau, 2025), achieving such long-term goals requires sustained political will, consistent funding, and robust community engagement that builds capacity within tribal communities themselves. Without ensuring the durability of these efforts, gains made in the short term may prove ephemeral, emphasizing the need for strategies that foster self-reliance and community ownership beyond the lifespan of specific projects.

4. LIMITATIONS

This narrative review synthesizes existing literature and data to provide a comprehensive overview of anemia among Scheduled Tribes in India. However, it is important to acknowledge certain limitations. The review is subject to the availability and quality of published research and governmental reports. While efforts were made to include relevant evidence, the scope of a narrative review does not allow for the systematic rigor of a meta-analysis or systematic review, particularly regarding comprehensive search strategies and risk of bias assessment for individual studies. Furthermore, the granularity of data at a tribe-specific level is often limited, which might obscure unique challenges and specific determinants of anemia for various tribal groups within India. The interpretation and synthesis of information are based on the available data and the author's analytical framework, acknowledging that different interpretations might exist.

5. CONCLUSION

Anemia among Scheduled Tribes in India is a complex public health challenge driven by high prevalence, multifactorial causes, and significant health, nutrition, and service gaps. Addressing this requires integrated, multi-sectoral, and culturally sensitive interventions to bridge the policy-practice gap and ensure equitable health outcomes.

REFERENCES:

1. Government of India Ministry of Health and Family Welfare. (n.d.). *Anaemia among Women and Children*. LOK SABHA UNSTARRED QUESTION N. New Delhi.
2. EzeRx. (2024). *Anemia in Tribal Population*.
3. Poojary, B., & Naik, R. K. (2014). Prevalence of Anemia among Tribal Women of Reproductive Age in Udupi Taluk, Karnataka. *Indian Journal of Public Health*, 58(1), 55–58.
4. Kumar, A., & Singh, S. (2023). *High burden of anemia and malnutrition in two tribal populations of Northeast India*. ResearchGate.
5. Kumar, A. (2025). *Why Tribal Indians See Worse Maternal, Child Health*. IndiaSpend.
6. Rakesh, N., Raja, M., & Suresh, K. (2025). *Understanding The Health Disparities: A Study Of Tribal Communities In Telangana*. ResearchGate.
7. Seshadri, T., Velho, N., Narasimhamurti, N. S., & Srinivas, P. N. (2020). Examining tribal health inequalities around three forested sites in India: Results of a cross-sectional survey. *Journal of Primary Care & Community Health*, 11, 2150132720912193.
8. Negi, S., Jagre, A., & Negi, R. S. (2024). A Study on the Health and Nutritional Status of Mawasi Tribal Women in Villages of Chitrakoot Region in Madhya Pradesh, India. *Advances in Research*, 25(2), 81–92.
9. Hazra, S., Bhowmik, S., Mahato, R. K., & Barman, S. (2024). Nutritional Status of Adult Tribal Ho Women of Paschim Medinipur district, West Bengal, India: A Comparative Study. *International Journal of Current Research*, 16(12), 27717–27721.
10. Sarma, M. K. (2013). Nutritional Status of Tribal Children in India: An Overview. *International Journal of Development Research*, 3(5), 29–32.
11. Yadav, K., Kumar, P., Singh, A., Pandey, P., & Chaudhary, V. (2025). *Access to Healthcare Among Tribal Population in India: A Cross-Sectional Household Survey*. ResearchGate.
12. Newsreel Asia. (2025). *Tribals in India Still Struggle for Basic Healthcare*. Newsreel Asia.
13. Press Information Bureau. (2022). *Initiatives for ensuring healthcare in tribal areas*. New Delhi: Ministry of Tribal Affairs.
14. Ministry of Health and Family Welfare, Government of India. (2025). *India's Fight Against Anemia*. New Delhi: MoHFW.
15. Press Information Bureau. (2025). *National Tribal Health Conclave 2025 under DhartiAabaJanjatiya Gram Utkarsh Abhiyan - Advancing Holistic Healthcare for Tribal Communities*. New Delhi: Ministry of Tribal Affairs.
16. Tamil Nadu Health Systems Project. (n.d.). *Tribal Healthcare*. TNHSP.
17. Editorial Team. (2025). *Anaemia in Tribal India: Challenges and Government Initiatives*. Continental Hospitals.
18. Vajiram & Ravi. (2025). *Problems faced by Tribal Communities in India*. Vajiram & Ravi.
19. Ghosh, M., & Pal, S. (2024). Who is Anaemic in India? Intersections of class, caste, and gender. *Journal of Biosocial Science*, 56(3), 335–351.
20. Gupta, A., Kollimarla, M., Reddy, B. V., Shaik, Y. N., Kakkar, R., & Aravindakshan, R. (2022). Exploring Unknown Predictors of Maternal Anemia Among Tribal Lactating Mothers, Andhra Pradesh, India: A Prospective Cohort Study. *Journal of Blood Medicine*, 13, 627–637.