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Addressing anemia: A systematic review on prevalence, causes, and ethnomedicinal practices among the indigenous communities in India

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Abstract

Background: Anemia is a pervasive public health challenge among tribal women in India, particularly in states like Chhattisgarh, where malnutrition and limited healthcare access exacerbate the issue. Prevalence rates among tribal women remain alarmingly high, with studies reporting figures as high as 95.3% in some communities. This review investigates anemia prevalence, its socio-cultural and nutritional causes, and the use of ethnomedicinal practices for its treatment.

Research Methodology: A systematic review approach was employed to analyze peer-reviewed articles, government reports (e.g., NFHS-4), and ethnobotanical studies. Data were extracted based on inclusion criteria, focusing on tribal populations and anemia treatment. Thematic analysis was used to identify patterns in prevalence rates, causes, and ethnomedicinal practices.

Results and Findings: Findings reveal that anemia prevalence ranges from 55% to 96.5% among tribal women. Contributing factors include poor dietary intake, irregular iron and folic acid supplementation, and cultural taboos. Ethnomedicinal practices such as using *Ficus carica* (Dumar fruit) and *Cynodon dactylon* (Dub grass) offer accessible and sustainable remedies. However, regional disparities persist, with tribes like the Bhunjia and Baiga facing higher risks.

Conclusion: Anemia remains a critical concern among India's tribal women. Integrating traditional ethnomedicinal practices with modern healthcare interventions and improving awareness of nutrition can help reduce anemia prevalence and improve overall health outcomes in these communities.

Keywords: Anemia, tribal women, ethnomedicinal practices, nutritional deficiency, Chhattisgarh tribes, hemoglobin levels, iron deficiency, public health

1. Introduction

Maternal mortality remains one of the leading causes of death among women of reproductive age in developing countries. In 2015 alone, an estimated 303,000 maternal deaths occurred globally, with approximately 99% of these deaths taking place in developing regions (World Health Organization, 2015) [30]. Anemia, a prevalent nutritional problem worldwide, disproportionately affects young children, pregnant women, and women of childbearing age. Despite longstanding policies and programs aimed at addressing this issue, anemia continues to afflict over 70% of young children in parts of India and Asia (NFHS-4, 2015-16). This condition can cause irreversible damage to a child's development, rendering the persistence of anemia unacceptable in an era focused on achieving global health goals such as Millennium Development Goal 5.

Nutritional anemia is defined as a pathological condition wherein blood hemoglobin levels drop abnormally due to deficiencies in essential nutrients, particularly iron, folic acid, and vitamin B12. Among these, iron deficiency is the most prevalent cause of nutritional anemia globally, followed by folic acid deficiency, which often coexists with iron deficiency, and vitamin B12 deficiency, which is rarer (McLean *et al.*, 2009) [16]. In India, the prevalence of iron deficiency anemia among women aged 15–49 years is approximately 52% (World Health Organization, 2001) [29]. Globally, over two billion people, representing more than 30% of the world's population, are anemic due to iron deficiency, a condition often exacerbated by malaria and parasitic worm infections. This deficiency affects more than 3.5 billion people in developing countries, impairing the cognitive development of children and reducing productivity among adults (NFHS-4, 2015-16) [17]. Among women of reproductive age, anemia has a global prevalence of 42% during pregnancy and approximately 30%

in non-pregnant women aged 15–49 years (McLean *et al.*, 2009)^[16].

Programs aimed at preventing and controlling anemia often face challenges due to misconceptions about the effectiveness of available interventions. Poor implementation, rather than a lack of viable solutions, has hindered progress. Anemia imposes a significant burden on health systems, affecting school performance, adult productivity, and overall public health. Nevertheless, iron-deficiency anemia is preventable at a low cost, with public health initiatives demonstrating a high benefit-to-cost ratio. This recognition has spurred the need for more effective and widespread implementation of anemia prevention programs (NFHS-4, 2015-16)^[17].

In India, the government has implemented several initiatives for screening and treating anemia among children, adolescents, and women of reproductive age. For instance, the National Nutritional Anemia Control Program, established in 1970 and later re-designated in 1991, focuses on reducing anemia prevalence, particularly among vulnerable groups such as pregnant and lactating women and young children. Despite these efforts, challenges remain. The consumption of iron and folic acid (IFA) supplements among certain tribal populations, such as the Kamar, Baiga, and Bhunjia tribes in Chhattisgarh, has been low. For example, only 14% of women in the Bhunjia tribe had completed the recommended doses of IFA tablets, while 98% of Baiga women consumed incomplete doses (Kosariya & Chakravarty, 2017; Chakravarty & Venugopal, 2020)^[13, 4]. Reasons for non-compliance include side effects, fear of delivering large babies, and cultural beliefs.

To address the gaps, the government has revised its policies. Current recommendations include providing children aged six to sixty months with iron and folic acid syrup for 100 days annually, with each milliliter containing 20 mg of elemental iron and 100 micrograms of folic acid. Similarly, pregnant women are advised to consume at least 90 IFA tablets during pregnancy. Recent studies have also highlighted the potential role of medicinal plants, such as *Arjuna*, *Rakt vikar*, *Lal punarnava*, *Mahua*, *Anantmool*, *Tejraj*, *Aonla*, *Sonthi*, *Satavar*, *Safed musli*, *Van kundru*, in treating anemia, underscoring the significance of traditional medicine in complementing existing interventions (Koné *et al.*, 2011)^[12].

By integrating traditional remedies with public health initiatives, India aims to mitigate the burden of anemia and ensure healthier outcomes for women and children. This comprehensive approach emphasizes not only treatment but also the importance of addressing cultural and implementation barriers to improve adherence to anemia prevention programs.

Aims and Objectives of the Research Project

1. To identify women of reproductive age with low hemoglobin levels and assess those at high risk due to anemia.
2. To provide fortified foods enriched with iron and folic acid to the identified high-risk group.
3. To evaluate the impact of fortified food interventions by measuring changes in hemoglobin levels after one month of implementation.

2. Research Methodology

This study employs a qualitative and descriptive research approach to review the prevalence, causes, and treatment practices for anemia among tribal populations in India, particularly in Chhattisgarh. The methodology is structured into the following key components:

Research Design

The research design is a **systematic literature review**, focusing on studies that address anemia prevalence, associated factors, and ethnomedicinal practices in tribal populations. The study consolidates findings from diverse sources to identify patterns, gaps, and recommendations for addressing anemia in tribal communities.

2. Data Sources

The data for this review were collected from peer-reviewed journals, books, government reports, and reliable online repositories. Key sources include:

Journal Articles: Studies published in indexed journals such as *Journal of Human Ecology*, *Indian Journal of Public Health*, and *IOSR Journal of Environmental Science, Toxicology, and Food Technology*.

Government Reports: Data from the *National Family Health Surveys (NFHS-2, NFHS-3, and NFHS-4)* and World Health Organization (WHO) publications.

Books and Reports: Relevant books documenting ethnomedicinal practices in India and Chhattisgarh, such as works by Agrawal and Pati (2010)^[1].

Online Databases: ResearchGate, PubMed, and other academic repositories.

3. Inclusion and Exclusion Criteria

Inclusion Criteria

- Studies focusing on anemia prevalence in tribal populations.
- Research related to the causes, severity, and treatment of anemia among tribal women.
- Ethnomedicinal practices specific to anemia treatment.
- Studies published between 2000 and 2023 to ensure recent and relevant findings.

Exclusion Criteria

- Studies focusing on non-tribal populations.
- Articles unrelated to anemia or ethnomedicinal practices.
- Non-peer-reviewed literature or studies lacking sufficient data on methodology.

4. Data Collection and Analysis

A structured approach was used to extract data from selected studies:

1. **Keyword Search:** Relevant keywords such as “anemia in tribal women,” “ethnomedicinal practices for anemia,” “Chhattisgarh tribes,” and “nutritional anemia” were used to retrieve relevant studies.
2. **Data Extraction:** Information on study population, location, sample size, anemia prevalence rates, and

ethnomedicinal treatments was extracted.

- 3. Thematic Analysis:** Extracted data were categorized into themes, including prevalence rates, severity, socio-cultural causes, and ethnomedicinal remedies. Comparisons across different tribal groups and regions were conducted to identify similarities and differences.

5. Tools and Techniques

Review Framework: A PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was employed to systematically review and organize the selected literature.

Data Synthesis: The findings from various studies were synthesized qualitatively to draw meaningful conclusions.

6. Limitations

Lack of primary data collection limits the study to secondary data analysis.

Regional disparities in tribal health data availability may influence the comprehensiveness of findings.

Limited studies specifically addressing hemoglobin levels in certain tribes, such as the Birhor, restrict in-depth analysis.

7. Ethical Considerations

Since the study is based on secondary data, ethical approval was not required. However, proper citation and acknowledgment of all sources were ensured to maintain academic integrity.

8. Scope of the Study

The methodology allows for an in-depth understanding of anemia in tribal populations, focusing on Chhattisgarh and other Indian states. The findings aim to provide insights for researchers, healthcare professionals, and policymakers in addressing anemia and improving tribal health outcomes.

9. Results and Discussion

This structured methodology ensures a comprehensive review of anemia among Indian tribal populations, particularly emphasizing the role of ethnomedicinal practices in managing the condition.

Review of literature anemia

The state of Chhattisgarh identifies five tribes as Particularly Vulnerable Tribal Groups (PVTG), among which malnutrition remains a significant challenge, especially for tribal children and women. Nutritional anemia is a pervasive issue among rural and tribal women in India. According to the World Health Organization (WHO, 2001) [29], anemia prevalence ranges from 37.7% to 41.5% among non-pregnant women and 38.9% to 48.7% among pregnant women in developing countries. Specifically, Galhotra *et al.* (2014) [7] reported that 57.6% of women in Chhattisgarh suffer from anemia. Similarly, data from the National Family Health Survey-4 (NFHS-4, 2015-16) [17] indicated that anemia affects 53.1% of women of reproductive age in India. Despite extensive research on tribes such as the Kamar, Baiga, and Bhunjia, limited studies have been conducted to assess hemoglobin levels among the Birhor tribe, highlighting the need for further investigation.

Agrawal *et al.* (2007) [2] studied 1,751 women (1,148 pregnant and 603 lactating) from various states in India, finding significantly higher anemia prevalence compared to

NFHS-2 data. Among these women, 84% of pregnant women and 92.2% of lactating women were anemic, with severe anemia affecting 9.2% and 7.3%, respectively. Singh *et al.* (2009) [2] conducted a cross-sectional study in Dehradun and reported anemia prevalence rates of 65.5% among pregnant women and 66.0% among lactating women. Older age groups (35–49 years) exhibited higher anemia prevalence than younger women (20–34 years).

In tribal populations, anemia prevalence remains alarmingly high. Joshi (2011) [9] reported a 95.3% prevalence of anemia among tribal women, while Jai Prabhakar and Gangadhar (2009) found a 77.1% prevalence rate among the Jenukuruba tribe of Karnataka. Balgir *et al.* (2003) observed that anemia prevalence was higher in the Bhuyan tribe (89.9%) than in the Kharia tribe (73.8%) in Odisha. Similarly, Srinivas *et al.* (2012) noted that women in Visakhapatnam district suffered from nutritional anemia due to irregular consumption of iron and folic acid (IFA) tablets. Sreelakshmi *et al.* (2012) conducted a study among 346 tribal women of reproductive age in Kerala and found that 78.32% were anemic, with 48.3% experiencing mild anemia, 48.0% moderate anemia, and 3.7% severe anemia. Kamath *et al.* (2013) studied 170 tribal women in Udupi, Karnataka, and reported an anemia prevalence rate of 55.9%, with 3.5% classified as severe cases. The mean hemoglobin level in the study was 11.3 g/dl, with diet and socio-cultural factors contributing to anemia prevalence.

Kosariya and Chakravarty (2017) [13] examined the Bhunjia tribe in Chhattisgarh, revealing that 90.17% of lactating women and 87.76% of pregnant women were anemic. Similarly, Shrinivas *et al.* (2014) found anemia prevalence rates of 96.5% among tribal women in Wayanad, Kerala, with 30.5% having mild anemia, 55.9% moderate anemia, and 10.1% severe anemia. Dabral and Kothiyal (2015) reported anemia prevalence rates of 64.28% among women in Uttarakhand, with most cases being moderate (58.33%).

In Chhattisgarh, Kumar, Goel, and Verma (2015) found high anemia rates among women of the Kamar tribe, with one-fourth of the sample also reporting night blindness. Nayak and Sreegiri (2016) observed a 60.9% anemia prevalence among tribal women in Visakhapatnam, exceeding the national average of 55% for women of reproductive age according to NFHS-3.

Joshi *et al.* (2011) [9] conducted a descriptive study among 200 pregnant women in Bhopal and found that 21% had mild anemia, 57% moderate anemia, and 1% severe anemia. These findings emphasize the urgent need for interventions to address anemia in tribal populations.

Anemia, commonly referred to as "lack of blood," is addressed through various ethnomedicinal practices by the tribal communities of Chhattisgarh. One such remedy involves the use of the Dumar fruit (*Ficus carica*), a plant belonging to the Moraceae family. According to Dubey (2010) [6], tea spoonsful of warm juice extracted from ripe Dumar fruits are consumed to treat anemia effectively.

This practice exemplifies the indigenous knowledge of tribal communities in utilizing locally available medicinal plants to address health issues like anemia. Such treatments are valued for their simplicity, accessibility, and effectiveness in primary healthcare. The ethnobotanical practices of these tribes underline the importance of preserving traditional knowledge for societal benefit and further scientific validation.

Dubey, V. (2010) ^[6]. Exploring indigenous knowledge medicinal plants: Appraisal. In S. C. Agrawal & R. N. Pati (Eds.), *Folk medicine, folk healers, and medicinal plants of Chhattisgarh* (pp. 34–39). New Delhi: Sarup Book Publishers.

World Health Organization. (2001) ^[29]. *Iron deficiency anemia: Assessment, prevention, and control: A guide for program managers*. Geneva: WHO.

The determination of iron content in various parts of eight plants traditionally used for the treatment of anemia in East Africa was investigated by Omolo, Chhabra, and Nyagah (1997) ^[19]. Using atomic absorption spectrophotometry, the researchers analyzed plant extracts prepared through both wet and dry oxidation methods. The results from the two methods were consistent, and the average of both measurements was considered as the final iron content for each plant part.

The study revealed that, in most cases, the root bark exhibited higher iron content compared to the leaves and stem bark. Notably, the root bark of *Bridelia cathartica* and *Lannea stuhlmannii* contained prominent iron levels of 35.69 mg/100 g and 35.21 mg/100 g, respectively. However, decoctions prepared in the traditional manner showed relatively low iron concentrations. The authors emphasized that the therapeutic efficacy of these herbs cannot be solely determined by their iron content, as other factors, such as iron bioavailability and absorption, play a crucial role in addressing anemia (Omolo *et al.*, 1997) ^[19].

To engage in a comparative discussion of the research provided with similar studies, let's examine the approach to maternal mortality, anemia prevalence, and public health interventions, focusing specifically on the effectiveness of anemia prevention programs, the challenges they face, and the cultural dynamics that influence their success.

Comparative Analysis with Other Research Papers Maternal Mortality and Anemia in Developing Countries

Maternal mortality, as highlighted in the study, remains a major health challenge in developing countries, especially in regions like India. A key finding from this study is the high incidence of maternal deaths, with 99% of the global maternal deaths occurring in developing countries (World Health Organization, 2015) ^[30]. This corresponds with findings from other studies that emphasize how maternal mortality is often compounded by anemia. For example, a study by Sharma *et al.* (2014) ^[25] found that anemia significantly contributes to the high rates of maternal mortality in India, with anemia being a risk factor for complications such as hemorrhage, infection, and pre-eclampsia.

Similar to the research in the provided paper, studies by Patel *et al.* (2016) ^[21] in rural India reveal that anemia, particularly iron deficiency, is widespread among women of reproductive age. These findings underscore the importance of addressing anemia as a key factor in reducing maternal mortality. Both studies emphasize the need for improved public health measures, including iron supplementation programs. However, while the paper focuses on government efforts in Chhattisgarh, Patel *et al.* (2016) ^[21] further explore the barriers to effective implementation, such as inadequate healthcare infrastructure, poor awareness, and cultural resistance.

Anemia Prevalence and Public Health Programs

The provided study mentions that over 70% of young children in parts of India and Asia are affected by anemia (NFHS-4, 2015-16) ^[17]. This statistic aligns with similar research conducted by Khera *et al.* (2015) ^[11], which found high anemia prevalence rates in children under five in India, particularly among marginalized groups. Khera *et al.* (2015) ^[11] also examine the effectiveness of India's National Nutritional Anemia Control Program (NNACP), which was also mentioned in the provided paper. They note that despite the government's long-standing efforts, the program's success has been hampered by poor implementation, inconsistent supply of supplements, and insufficient health education.

On the other hand, the research conducted by McLean *et al.* (2009) ^[16] on global anemia prevalence corroborates the notion that iron deficiency remains the most widespread cause of anemia, both in India and globally. McLean *et al.*'s study provides a broader perspective, confirming that the issue is not confined to any specific region but is a significant global health concern. Like the Indian context, the global situation is marked by cultural misconceptions and insufficient policy enforcement, which hinder effective anemia prevention programs.

Challenges in Iron Supplementation Programs

The provided study highlights low adherence to iron and folic acid (IFA) supplementation among certain tribal populations in Chhattisgarh. For instance, only 14% of Bhunjia tribal women completed the recommended doses of IFA tablets. This finding is in line with Chakravarty and Venugopal (2020) ^[4], who observed that tribal populations in Chhattisgarh often reject or underutilize health interventions due to cultural beliefs and side effects associated with IFA supplementation. This challenge has been widely reported in other studies, such as by Saini *et al.* (2019) ^[24], who found that misconceptions about the effects of IFA, such as fears of large babies or side effects, were common among rural and tribal communities in India. Additionally, Saini *et al.* (2019) ^[24] also discuss the need for a more culturally sensitive approach to address these concerns.

While the paper suggests integrating traditional remedies with public health initiatives, studies like that of Koné *et al.* (2011) ^[12] on medicinal plants for anemia treatment in Côte d'Ivoire indicate that there is a potential benefit in combining modern medicine with traditional healing practices. The potential of medicinal plants in addressing anemia, as highlighted in the research, is consistent with findings in other regions where traditional knowledge is increasingly being integrated into formal healthcare systems to improve compliance with health interventions (Koné *et al.*, 2011) ^[12].

Impact of Medicinal Plants on Anemia Treatment

The research paper suggests a potential role for medicinal plants, such as Arjuna, Mahua, and Aonla, in addressing anemia. This finding echoes studies like that of Koné *et al.* (2011) ^[12], who examined the use of various medicinal plants for anemia treatment in Côte d'Ivoire. Both studies highlight the promise of traditional medicine in addressing public health challenges like anemia. However, there is a critical need for further clinical validation of these remedies

to assess their effectiveness in contemporary healthcare systems. Koné *et al.* (2011) ^[12] discuss the bioactive compounds in plants like *Adansonia digitata* and *Amaranthus spinosus* that could potentially support iron absorption and overall hematological health. However, their integration into formal health systems is still in its early stages and requires rigorous testing.

Review of Literature: Treatment of Anemia (Lack of Blood) Among Tribes in India

Anemia, a widespread condition among tribal populations in India, has been managed traditionally using various ethnomedicinal plants. Indigenous practices offer affordable and accessible solutions for treating anemia in resource-constrained tribal settings. Studies highlight the extensive use of locally available plants by different tribes to combat anemia through remedies that integrate their cultural and ecological knowledge.

Use of Dumar Fruit (*Ficus carica*)

Dubey (2010) ^[6] reported that tribes in Chhattisgarh, such as the Baiga, use the fruit of *Ficus carica* (locally called Dumar) to treat anemia. The ripe fruit juice is consumed warm in small quantities to enhance blood production. This practice demonstrates the reliance on natural, nutrient-rich plants by tribal communities to manage hematological deficiencies.

Palas (*Butea monosperma*)

The Baiga tribe also utilizes the bark and root of *Butea monosperma* (Palas tree) to address anemia and related health conditions (Shrivastava, 2013) ^[27]. The dried bark powder is often mixed with honey and consumed daily as a tonic to boost hemoglobin levels.

Dub Grass (*Cynodon dactylon*)

Cynodon dactylon (Dub grass), a plant widely recognized for its medicinal properties, is utilized by the Baiga tribe during pregnancy to address bleeding and anemia. Fresh grass collected before sunrise is ground into a paste and consumed with sugar, providing nutrients and improving hemoglobin levels (Dubey, 2010) ^[6].

Neem (*Azadirachta indica*) and Dried Fruits

Among the tribes in Gujarat, the Neem tree (*Azadirachta indica*) and dried fruits, such as dates and gooseberries, are traditionally used as blood purifiers and to treat anemia (Patel, 2012) ^[20]. These plants are rich in iron and essential vitamins, helping in the regeneration of red blood cells.

Anantmul (*Hemidesmus indicus*)

The tribes of Bastar in Chhattisgarh utilize the roots of *Hemidesmus indicus* (Anantmul) to improve blood health. The root extract is consumed regularly to alleviate symptoms of anemia and promote overall vitality, particularly among postpartum women (Mahant, 2015) ^[15].

Ragi (Finger Millet) Consumption

Studies by Acharya *et al.* (2010) ^[1] revealed that tribes in Odisha and Andhra Pradesh frequently consume ragi (*Eleusine coracana*), a millet rich in iron and calcium, as a staple food to address anemia. This dietary practice reflects

the tribes' adaptation to available natural resources for health improvement.

Synthesis and Discussion

The use of plants like *Ficus carica*, *Butea monosperma*, and *Cynodon dactylon* reflects the deep understanding tribal communities have of their local ecosystems. These plants not only serve as nutritional sources but also contain bioactive compounds that improve iron absorption and hemoglobin synthesis. Tribal ethnomedicinal practices are sustainable and culturally rooted, offering affordable solutions for anemia management.

10. Conclusion

Both the provided research and the comparative studies underscore the critical need for more effective implementation of public health programs, especially in rural and marginalized communities. While government initiatives like the National Nutritional Anemia Control Program have made strides in addressing anemia, challenges remain due to poor implementation, cultural resistance, and a lack of awareness. Incorporating traditional remedies, as suggested in the provided research, could offer an innovative solution, but this approach must be carefully evaluated and integrated with modern healthcare systems to maximize its potential.

Tribal knowledge of plants for anemia treatment provides invaluable insights into natural remedies for managing iron deficiencies. However, there is an urgent need to validate these practices scientifically to integrate them into mainstream healthcare systems. Documenting and preserving this knowledge are critical for promoting sustainable and inclusive healthcare solutions in tribal communities.

Conflict of Interest

Not available

Financial Support

Not available

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