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INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881(Print); IMPACT FACTOR :9.014(2025); IC VALUE:5.16; ISI VALUE:2.286
PEER REVIEWED AND REFEREED INTERNATIONAL JOURNAL
(Fulfilled Suggests Parametres of UGC by IJMER)
Volume:14, Issue:8(4), August, 2025
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: Reviewed : Accepted
Publisher: Sucharitha Publication, India
Online Copy of Article Publication Available : www.ijmer.in

ANAEMIA AND ITS IMPACT ON THE LIVES OF ADOLESCENT GIRLS: A RESEARCH REVIEW

[1]Priyanka Agarwal ,Dr. [2]Anil Kumar and [3]Dr Astuti Verma
[1]Research Scholar,Department of Public Health,Faculty of Humanities and social science,
Shri Ramswaroop Memorial University, Lucknow-Deva Road, Uttar Pradesh
[2]Assistant Professor (Political Science) ,Department faculty of Humanities and Social science
Shri Ramswaroop Memorial University Deva Road Barabanki Lucknow
[3]Assistant Professor,Department of Home Science,Ramabai Government Women Post Graduate College, Akbarpur,
Ambedkar Nagar (UP)

Abstract

Anaemia is one of the most prevalent nutritional disorders globally, disproportionately affecting adolescent girls due to increased physiological demands during growth and menarche. In India, more than half of adolescent girls are anaemic, posing serious implications for health, education, and future maternal outcomes.

Objectives:

This review aims to synthesize existing research on the prevalence, causes, and consequences of anaemia among adolescent girls, and to evaluate the impact of anaemia on physical, cognitive, psychosocial, and reproductive health.

Methods:

A narrative review approach was adopted by examining peer-reviewed articles, national health surveys (e.g., NFHS-5), and WHO/UNICEF reports published in the last two decades. Literature was critically analysed to identify prevalence patterns, risk factors, health effects, and the effectiveness of current interventions.

Results:

Findings indicate that the prevalence of anaemia among adolescent girls remains alarmingly high, with India reporting 59.1% prevalence (NFHS-5, 2019–21). Major determinants include dietary iron deficiency, menstrual blood loss, infections, and socio-cultural barriers.

Conclusion:

Anaemia among adolescent girls represents a critical public health issue with intergenerational consequences. Strengthening multi-sectoral interventions that integrate nutrition, education, reproductive health, and community engagement is essential to mitigate its impact. Addressing anaemia is both a health priority and a socio-economic necessity for achieving Sustainable Development Goal 3 on health and well-being.

Keywords: Anaemia; Adolescent girls; Iron deficiency; Nutrition; Cognitive performance; Reproductive health; Anemia Mukt Bharat; Public health interventions

Introduction

Anaemia, as defined by the World Health Organization (WHO), is a condition characterized by hemoglobin concentration below 12 g/dl in adolescent girls, reflecting insufficient oxygen-carrying capacity of the blood (WHO, 2011). It remains one of the most pressing global nutritional disorders, disproportionately affecting women and adolescent girls during critical periods of growth and development. Globally, approximately 29.9% of non-pregnant women aged 15–49 years and nearly 40% of adolescent girls are anaemic, with the highest prevalence observed in South Asia and sub-Saharan Africa (WHO, 2021).

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India bears a disproportionate share of this burden. Findings from the National Family Health Survey (NFHS-5, 2019–21) indicate that 59.1% of adolescent girls (15–19 years) are anaemic, reflecting an increase from 54% reported in NFHS-4 (2015–16). This trend underscores a persistent challenge despite decades of national programs such as the Weekly Iron and Folic Acid Supplementation (WIFS) scheme and the Anemia Mukt Bharat (AMB) campaign. The high prevalence among Indian adolescents highlights both nutritional inadequacies and systemic gaps in healthcare delivery.

The etiology of anaemia during adolescence is multifactorial. Nutritional deficiencies, particularly of iron, folate, and vitamin B12, represent the most common cause, compounded by diets low in animal protein and high in phytates that inhibit iron absorption. Additional contributors include menstrual blood loss, which significantly increases iron requirements, and parasitic infections such as hookworm and malaria, which exacerbate blood loss and nutritional depletion. Socio-economic disparities, gender-based discrimination in intra-household food allocation, and inadequate access to preventive and curative healthcare further intensify the risk.

The consequences of anaemia among adolescent girls extend beyond clinical symptoms of fatigue, weakness, and pallor. At the biological level, anaemia impairs linear growth, immune function, and physical endurance. At the cognitive level, iron deficiency is associated with reduced concentration, impaired learning capacity, and poor academic outcomes. At the social and economic level, anaemic girls are less likely to participate actively in educational and recreational activities, which in turn diminishes their opportunities for empowerment and future employability. Importantly, anaemia during adolescence has profound implications for reproductive health, predisposing women to complications such as maternal mortality, preterm delivery, and low birth weight in infants, thereby perpetuating an intergenerational cycle of poor health.

Given the scale of the problem and its multi-dimensional impact, anaemia in adolescent girls must be recognized as both a public health emergency and a socio-economic development challenge. This review seeks to synthesize existing research on the prevalence, causes, and consequences of anaemia among adolescent girls, while also evaluating intervention strategies and identifying gaps for future research. By integrating evidence from global and national perspectives, the paper aims to contribute to the discourse on adolescent health and support policy frameworks aligned with the Sustainable Development Goals (SDG 3: Good Health and Well-being).

Pathophysiology and Etiology

Etiology of Anaemia in Adolescent Girls

Anaemia in adolescence is predominantly attributed to iron deficiency, resulting in impaired hemoglobin synthesis and reduced oxygen-carrying capacity of red blood cells. Several studies highlight the complex interplay of nutritional, physiological, and socio-cultural factors. Kaur et al. (2015) reported that inadequate dietary intake of iron-rich foods, coupled with high consumption of phytate-containing cereals, significantly reduces iron bioavailability among Indian adolescents. Similarly, Gupta et al. (2016) emphasized that deficiencies of folate and vitamin B12, in addition to iron, contribute to impaired erythropoiesis.

The adolescent growth spurt and onset of menarche increase physiological demands. According to Beard (2000), iron requirements in adolescent girls nearly double during puberty, placing them at higher risk of anaemia compared to boys. Menstrual blood loss further exacerbates the condition; McLean et al. (2009) found that heavy or prolonged menstruation is a major predictor of anaemia prevalence in adolescent populations worldwide.

Infectious diseases also play a role. Brooker et al. (2008) demonstrated that hookworm infections significantly contribute to iron-deficiency anaemia in tropical regions, while Menendez et al. (2000) linked malaria to higher anaemia prevalence among adolescent girls in sub-Saharan Africa. Socio-cultural practices further worsen vulnerability. Kapil and Bhadoria (2014) highlighted that early marriage, gender-based food discrimination, and cultural taboos surrounding menstruation are major barriers to adequate nutrition in adolescent girls in India.

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Prevalence and Burden

Epidemiological studies consistently highlight the global and national burden of anaemia. WHO (2021) reported that 30–40% of adolescent girls in low- and middle-income countries are anaemic, with South Asia bearing the highest prevalence. In India, the National Family Health Survey (NFHS-5, 2019–21) reported 59.1% prevalence among adolescent girls aged 15–19 years, up from 54% in NFHS-4 (2015–16). This rising trend has been corroborated by Pasricha et al. (2018), who emphasized the persistence of anaemia despite decades of supplementation programs.Regional disparities are well documented. Anand et al. (2014) observed significantly higher anaemia prevalence in rural and tribal populations compared to urban areas, largely due to poor dietary diversity, lower socio-economic status, and limited access to health services. Rawat et al. (2016) similarly found that adolescent girls in tribal districts of Madhya Pradesh and Chhattisgarh exhibited prevalence rates above 65%, underscoring the compounded effect of poverty, cultural practices, and geographical isolation.

Effects of Anaemia on Adolescent Girls' Lives

1. Physical Health and Growth

Anaemia negatively influences adolescent growth and immune function. Brabin et al. (2001) demonstrated that anaemia is associated with delayed physical maturation and impaired linear growth. Shill et al. (2014) reported that anaemic adolescents exhibited greater susceptibility to infections due to weakened immune defenses. Moreover, Zimmermann and Hurrell (2007)

highlighted reduced physical endurance and work productivity among iron-deficient adolescents, directly affecting daily activities and long-term economic potential.

2. Cognitive and Educational Outcomes

Iron deficiency is strongly linked to cognitive impairment. Pollitt (1993) found that anaemia reduces attention span, impairs memory, and leads to poor concentration in school-aged children and adolescents. Grantham-McGregor and Ani (2001) further demonstrated that anaemic adolescents performed significantly worse on educational tests compared to their non-anaemic peers. In India, Seshadri (1993) reported higher school absenteeism and lower academic performance among anaemic adolescent girls, reflecting the direct educational burden of the condition.

3. Psychosocial and Emotional Well-being

The psychosocial consequences of anaemia are often overlooked. Balarajan et al. (2011) observed that persistent fatigue and reduced school performance contributed to low self-esteem and social withdrawal among anaemic adolescents. Fatigue-induced limitations in extracurricular participation further hindered peer interactions and social confidence.

4. Reproductive and Intergenerational Health

Anaemia during adolescence has profound reproductive implications. Ramakrishnan et al. (2004) found that anaemic adolescent girls were at greater risk of adverse pregnancy outcomes, including preterm births and low-birth-weight infants. Bhutta et al. (2013) noted that maternal anaemia significantly contributes to neonatal mortality, thereby perpetuating an intergenerational cycle of malnutrition and anaemia.

3. Psychosocial Well-being

Anaemia exerts a substantial influence on the psychosocial health of adolescent girls, often in subtle but far-reaching ways. Persistent fatigue and physical weakness reduce participation in sports, extracurricular activities, and routine social engagements, limiting opportunities for holistic adolescent development (Brabin et al., 2001). School absenteeism is frequently linked not only to diminished physical stamina but also to the stigma and lack of awareness surrounding menstrual health (Patel et al., 2010). This combination of biological and socio-cultural barriers contributes to low self-esteem,

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decreased confidence, and social withdrawal. Balarajan et al. (2011) observed that anaemic adolescents often report higher levels of stress and psychological distress, stemming from both poor school performance and reduced peer interactions. These psychosocial repercussions can have long-term effects, constraining academic achievement, social mobility, and empowerment in adulthood.

4. Reproductive Health and Maternal Outcomes

The implications of anaemia extend beyond adolescence, profoundly influencing reproductive health and maternal outcomes. Anaemic adolescent girls are at elevated risk of obstetric complications such as maternal mortality, preterm birth, intrauterine growth restriction, and low birth weight infants (Ramakrishnan et al., 2004). Bhutta et al. (2013) emphasized that maternal anaemia is a significant contributor to neonatal morbidity and mortality, perpetuating an intergenerational cycle of malnutrition. Early marriage and adolescent pregnancy, prevalent in many low- and middle-income settings, exacerbate this vulnerability by increasing iron demands during a period when girls themselves are still growing (Kapil & Bhadoria, 2014).

Evidence also suggests that anaemia during adolescence compromises reproductive capacity by impairing fertility and increasing susceptibility to postpartum complications (Sukrat et al., 2013). This establishes a vicious cycle: anaemic mothers are more likely to give birth to undernourished children who, in turn, face heightened risks of anaemia and developmental deficits. Addressing anaemia in adolescent girls is therefore a critical intergenerational health investment, with potential to break cycles of malnutrition, enhance maternal survival, and improve neonatal outcomes.

Intervention Strategies

Given the high prevalence and multifactorial etiology of anaemia among adolescent girls, interventions must adopt a multi-sectoral and evidence-based approach. Research highlights the importance of combining nutritional supplementation, dietary improvements, health education, infection control, and policy-level initiatives to achieve sustainable reduction.

1. Nutritional Interventions

Iron and Folic Acid (IFA) Supplementation

The World Health Organization (WHO, 2011) recommends weekly iron and folic acid supplementation (WIFS) for adolescent girls in high-prevalence regions. Evidence from controlled trials has demonstrated significant improvements in hemoglobin concentrations and reduction in anaemia prevalence with IFA supplementation (Pasricha et al., 2014). In India, the Weekly Iron and Folic Acid Supplementation (WIFS) program, launched in 2012, targets both school-going and out-of-school girls through distribution of IFA tablets and biannual deworming. While evaluations indicate moderate success, Vir et al. (2008) note that compliance remains a major challenge due to side effects, irregular supply, and poor awareness.

Dietary Diversification

Long-term anaemia control requires sustainable dietary changes. Promotion of iron-rich foods such as meat, legumes, green leafy vegetables, and fortified cereals, combined with vitamin C to enhance iron absorption, has shown positive outcomes (Zimmermann & Hurrell, 2007). However, cultural food habits and economic barriers often limit dietary diversification in rural and tribal populations. School meal programs and food fortification initiatives (e.g., iron-fortified wheat flour, double fortified salt) represent promising avenues to improve dietary iron intake at the population level (Bhutta et al., 2013).

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2. Health and Education Programs

School-Based Interventions

Schools provide a strategic platform for anaemia prevention through nutrition education, health screenings, and supplementation. Kotecha et al. (2009) demonstrated that school-based iron supplementation and nutrition education significantly reduced anaemia prevalence among Indian adolescents. Integrating health literacy into curricula enhances awareness of nutrition, hygiene, and menstrual health, fostering lifelong healthy behaviors.

Menstrual Hygiene Management (MHM)

Improving menstrual hygiene is critical for addressing both the physical and psychosocial consequences of anaemia. Lack of access to sanitary products and inadequate awareness contribute to absenteeism and poor adherence to supplementation programs. Sommer et al. (2016) emphasized that comprehensive MHM programs in schools reduce stigma, enhance confidence, and indirectly support anaemia prevention efforts by encouraging regular supplement intake and reducing menstrual-related blood loss complications.

3. Public Health Approaches

Parasitic Infection Control

Helminthic infections such as hookworm are major contributors to anaemia. WHO recommends biannual deworming for school-age children and adolescents in endemic regions. Evidence from Brooker et al. (2008) shows that deworming programs significantly improve iron status and reduce anaemia prevalence when combined with supplementation.

Community Engagement

Community-based approaches empower families and peer groups to influence adolescent health behaviors. Studies by Galloway et al. (2002) demonstrate that engaging mothers, teachers, and community health workers improves adherence to supplementation and enhances sustainability. Peer-led interventions, especially in tribal populations, have shown promise in overcoming cultural barriers.

Policy-Level Actions

At the policy level, integration of anaemia reduction into national programs has been critical. India's flagship Anemia Mukt Bharat (AMB) strategy (2018) targets a 3% annual reduction in anaemia prevalence across all age groups. It employs a 6x6x6 approach: six beneficiaries (children, adolescents, women, men), six interventions (supplementation, deworming, dietary diversification, behavior change, testing, and treatment), and six institutional mechanisms. Initial evaluations indicate improvements in supply chains and awareness, though coverage gaps remain (Bharati et al., 2021).

Conclusion

Anaemia among adolescent girls remains one of the most pressing global public health challenges, with profound implications for physical growth, cognitive function, psychosocial well-being, and reproductive health outcomes. The disproportionately high prevalence in low- and middle-income countries, particularly in South Asia and sub-Saharan Africa, underscores the intersection of nutritional deficiencies, socio-cultural barriers, and systemic health inequities. Evidence consistently demonstrates that anaemia in adolescence not only impairs immediate health and educational attainment (Grantham-McGregor & Ani, 2001; Pasricha et al., 2014), but also perpetuates an intergenerational cycle of malnutrition, adversely affecting maternal and neonatal outcomes (Bhutta et al., 2013).

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From a policy perspective, addressing adolescent anaemia is both a medical necessity and a socio-economic imperative. Initiatives such as Anemia Mukt Bharat (AMB) represent a commendable step toward integrated intervention, yet effective implementation requires sustained efforts in supply chain management, health education, and community engagement. School-based iron and folic acid supplementation, deworming, and nutrition education have proven effective, but their impact is limited without complementary strategies such as menstrual hygiene management, dietary diversification, and cultural sensitization (Vir et al., 2008; Sommer et al., 2016).

Looking forward, the path to reducing adolescent anaemia lies in a multi-sectoral, evidence-driven framework that integrates healthcare systems, educational institutions, and community networks. Policy action must be complemented by research innovations, including fortified food interventions, context-specific behavior change strategies, and strengthened monitoring systems to ensure accountability and impact. Ultimately, improving the health of adolescent girls is not only critical to achieving global nutrition and health targets (SDGs 2 and 3) but also to ensuring women's empowerment, economic productivity, and healthier future generations.

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