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RESEARCH ARTICLE

PREVALENCE OF ANEMIA IN INDIA AND ITS MULTIFACTORIAL AETIOLOGY : A COMPHRENSIVE REVIEW

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- Widespread Prevalence:
- Multifaceted approach
- Holistic Strategies:
- Strengthening Healthcare System:
- Rising awareness:

Abstract

Anemia is characterized by a decrease in the number of red blood cells or hemoglobin levels in the blood, leading to reduced oxygen-carrying capacity. Anemia is a global health concern with significant global impacts on individuals and populations worldwide. The prevalence of anemia worldwide varies across regions and populations, highlighting its multifactorial etiological factors. According to the World Health Organization (WHO), anemia affects approximately one-fourth of the global population, with the highest prevalence observed in low- and middle-income countries, particularly among women, children, and elderly individuals. The burden of anemia extends beyond individual health, impacting economic productivity, cognitive development, and overall well-being. Methods: This review was conducted through a systematic literature search of articles published in Google Scholar, PubMed, and the National Family & Welfare Society Govt. Of India. This study explores the scope of anemia as a public health issue and delves into the diverse range of factors contributing to its prevalence.

Introduction:-

Anemia, a condition characterized by a lower-than-normal number of red blood cells or hemoglobin in the blood, is a significant public health concern in India.[1] The optimal level of hemoglobin required to meet physiologic requirements varies by age, sex, elevation of habitation, smoking habits, and pregnancy status. [2] Anemia is a serious public health challenge in India, with more than 50% prevalence across vulnerable groups such as pregnant women, infants, young children, and adolescents. Anemia has adverse effects on health, physical, and mental productivity, affecting quality of life.[3] Anemia may be caused by several factors like nutrient deficiencies through inadequate diets or inadequate absorption of nutrients, infections (e.g. malaria, parasitic infections, tuberculosis, HIV), inflammation, gynecological and obstetric conditions, chronic disorders,[4,5] and inherited red blood cell diseases. The most common nutritional cause of anemia is iron deficiency, although deficiencies in folate, vitamins B12 and vit. A are also important causes.[6,7]

The findings state that in 2019, the global prevalence of anemia was 30% (571 million) in women aged 15–49 years, 37% (32 million) in pregnant women, and 40% (269 million) in children aged 6–59 months, with the WHO African Region and South-East Asia Region being the most affected.[8,9]

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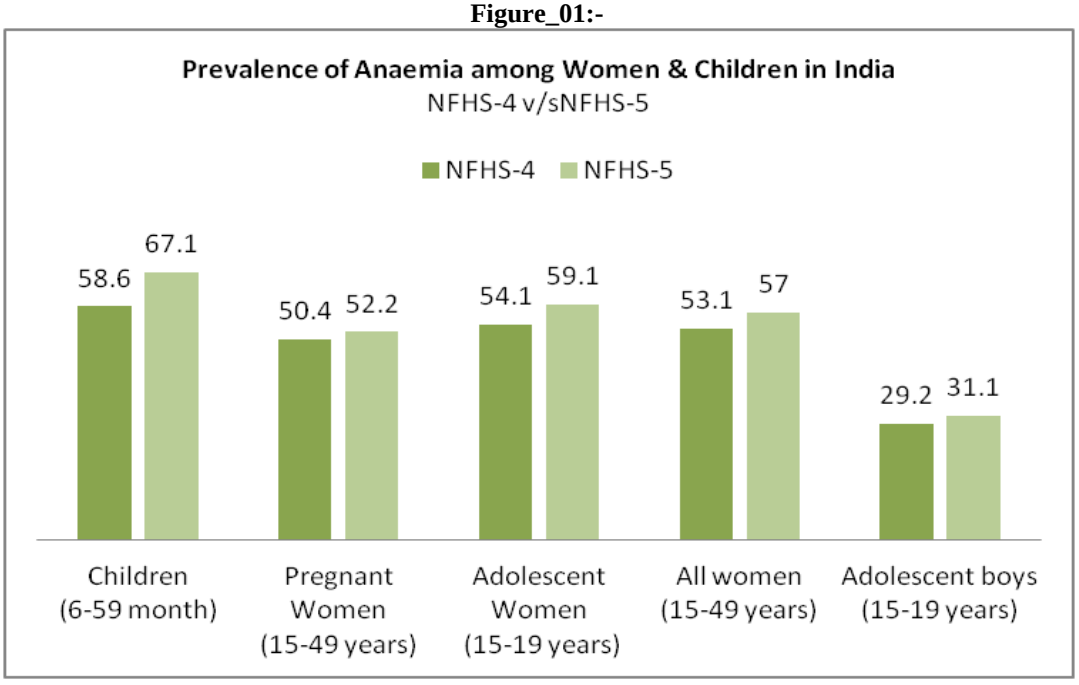
The Union Health Ministry of India recently released the key findings of both phases of the National Family Health Survey, which was conducted between 2019 and 2021. This is the fifth edition of the NFHS, covering 6.1 Lakh sample households across the country. The sample size for the survey varied from state to state because of differences in population and age composition. The representative survey also recorded the prevalence of anemia among men, women, and children by collecting blood samples from all men (15 to 54 years of age) and women (15 to 49 years of age) who freely permitted the testing. For children (6 to 59 months), parents or guardians will have to give concurrence. [10]

Table 1:- The NFHS's classification of anemia is as follows : [10]

Classificatin	Normal	Mild	Moderate	Severe
Men	13 gm/dL & more	12 - 12.9g/dL	9 - 11.9g/dL	<9g/dL
Women(Not Pregnant)	12 gm/dL & more	10 - 11.9g/dL	7 - 9.9g/dL	<7g/dL
Pregnant Women	11 gm/dL & more	10 - 10.9g/dL	7 - 9.9g/dL	<7g/dL
Children	11 gm/dL & more	10 - 10.9g/dL	7 - 9.9g/dL	<7g/dL

The prevalence of anemia among women and children has increased in the last five years.

Figure_01:-



Source NFHS_5

In Figure 01. At the national level, the findings of the NFHS-5 revealed an increase in the frequency of anemia among women and children compared with the former NFHS-4 survey that was conducted in 2015-16, which included children aged approximately 4 years. The increase in anemia was 1.8% among pregnant women, 1.8% among all women in reproductive age was 3.9%, and among adolescent women was 5%. Among children, the increase was the highest at 8.5% and is now near to the situations recorded in NFHS- 3 from 2005-06 when the prevalence was 70%.

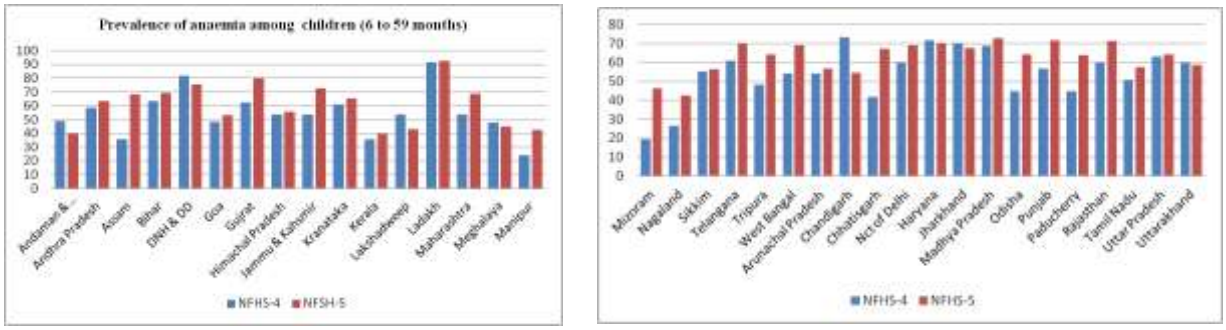
InFigure 02. shows In Gujarat, out of all the larger states, anemia is most common in children aged 6–59 months; almost 80% of these children have been diagnosed with the condition. The prevalence in Gujarat increased by 17.1% compared with 62.6% recorded in NFHS- 4. [10]

Madhya Pradesh, Rajasthan, Punjab, Haryana, and Telangana are the major states with a prevalence of further than 70% among children. Kerala is the only state to have a prevalence of lower than 40% (39.4%), although it has registered an increase of 3.7% compared to NFHS- 4. [11]

The prevalence in four southern Indian states except for Telangana and 6 northeastern states (except Assam), was below the national average as per NFHS- 5.

Prevalence of Anemia in Children (6 to 59 months) NFHS-4 vs. NFHS-5

Figure_02:-



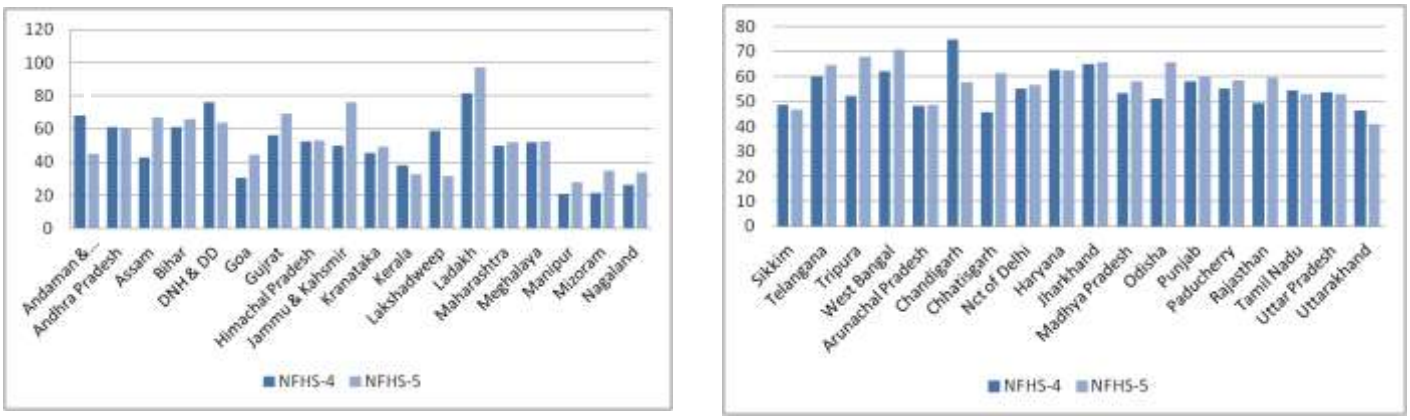
Source NFHS_5

The increase in the prevalence of anemia was highest in Assam, where the prevalence increased from 35.7 in NFHS-4 to 68.4 in NFHS- 5, representing an increase of 32.7%.

Both Mizoram and Chhattisgarh have also recorded an increase of more than 25 % each. A slight decrease in prevalence was observed in just four states. These are Uttarakhand (by 1%), Haryana(1.3%), Jharkhand(2.4%), and Meghalaya(2.9%).[11]

Prevalence of Anemia Among Adolescent Women (15 to 49 years) NFHS-4 vs. NFHS-5

Figure_03:-



Source NFHS_5

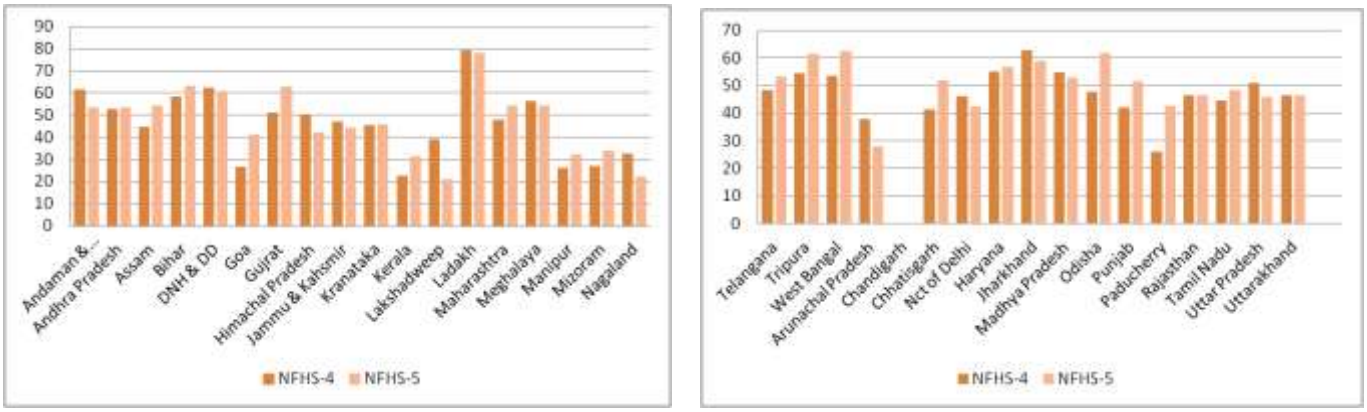
Ladakh, West Bengal, Odisha, and Gujarat have the highest prevalence of anemia among adolescent girls.
In Figure 03 shows almost 97% of adolescent women in Ladakh aged 15 to 19 years were found to be anemic, an increase from 81.6% during NFHS-4. Among the large states, West Bengal had the highest percentage, at 70.8%, up from 62.2% during NFHS-4, followed by Gujarat at 69%.

Mizoram (34.9%), Nagaland (33.9%), Kerala (32.5%), and Manipur (27.9%) had a prevalence of less than 40%

Assam, with a prevalence of 67%, showed an increase of 24.3% from 42.7% recorded during NFHS-4, whereas the states of Haryana, UP, Andhra Pradesh, Tamil Nadu, Sikkim, Delhi, Kerala, and Uttarakhand showed a decline in prevalence.

Prevalence of Anemia in Pregnant Women NFHS-4 vs. NFHS-5

Figure_04:-



Source NFHS_5

More than 60% of pregnant women were anemic in Ladakh, Bihar, Gujarat, West Bengal, Odisha, and Tripura.

In Figure 04 shows the prevalence of anemia among pregnant women was highest in Ladakh among the large states (78.1%, followed by Bihar, Gujarat, and West Bengal, with more than 62% each. Tripura and Odisha had a prevalence of >60%. On the other hand, Mizoram (34%), Manipur (32.4%), Kerala (31.4%), Arunachal Pradesh (27.9%), and Nagaland (22.2%) recorded less than 40% prevalence. [10]

Delhi, Rajasthan, Madhya Pradesh, Maharashtra, Uttar Pradesh, Jharkhand, Himachal Pradesh, Meghalaya, Arunachal Pradesh, Uttarakhand, and Nagaland have recorded a decrease in prevalence as per NFHS-5 compared with NFHS-4, while Sikkim, Odisha, and Gujarat have recorded a higher prevalence by more than 10 % each. In India, social groups such as Schedule Caste (SC), Schedule Tribe (ST), and other backward classes (OBC) play a major role in living standards.[12]

Almost 19.7% of the population belongs to SC, 8.5% belongs to ST, and they are exposed to poor living conditions, poor diet and limited healthcare, and OBC consists of 41.1% of the total Indian population.[13]

The National Family Health Survey (NFHS) was conducted in three rounds in 2005-2006 (NFHS-3), 2015-2016 (NFHS-4), and 2019-2021 (NFHS-5), revealing this through surveys. During 2005-2006 out of 28 states, 16 states (i.e., more than 55% of the states had the highest prevalence of anemia among SC and ST women, followed by OBC women with a prevalence rate of more than 55% in 14 states and general women with only 10 states.[14,15,16]

In 2015-2016, only 6 states had the highest prevalence of anemia among OBC and general women, whereas 12 states had a prevalence of anemia among SC and ST women. In the 2019-2021 period, the prevalence rate progressively rose in 16 states, particularly among SC, ST, and OBC communities, and in 13 states among the general female population. According to the NFHS-5, West Bengal had the highest percentage of anemia prevalence in SC and ST (76.14%), and general (68.65%) women, and Kerala experienced the lowest rate.[15,16]

The NFHS data reveals that anemia remains a prevalent health issue in India, with a heavy burden across different demographic segments. The prevalence of anemia is substantial among children aged 5 years, affecting their growth and development. Iron deficiency is a primary cause of anemia in children, often resulting from inadequate dietary intake of iron-rich foods.

In adolescents, especially girls, the prevalence of anemia is alarmingly high. The onset of menstruation increases the iron requirements in girls, increasing their risk of developing anemia if their nutritional needs are not adequately met. Iron deficiency anemia in adolescents can lead to fatigue, reduced cognitive function, and impaired physical growth.

Among women of reproductive age, anemia is a critical issue with far-reaching consequences. Pregnancy increases the demand for iron in women, and an insufficient dietary intake can lead to maternal anemia, posing risks such as preterm birth, low birth weight, and maternal mortality.

The NFHS data highlights the substantial prevalence of anemia in this age group, indicating the need for targeted interventions to improve iron status and reduce the burden of anemia.[17]

Prevalence of Anemia in COVID-19 Patients:
Several studies have reported varying prevalence rates of anemia among patients with COVID-19. For instance, a study published in Scientific Reports found that the overall prevalence of anemia among hospitalized patients with COVID-19 was 45.1% [18]. Another study indicated a prevalence of 61%, which was significantly higher than that of a control group.[19]

The variability in prevalence rates can be attributed to differences in study populations, geographical regions, and diagnostic criteria. For example, a meta-analysis highlighted a pooled prevalence rate of 25.6% among COVID-19 patients.[20] Additionally, a study in Iran reported a prevalence of anemia of 49.3% among hospitalized patients.[21]

Multifactorial Etiology of Anemia:
Anemia, a condition characterized by a deficiency in the number or quality of red blood cells, has a multifactorial etiology. This complex medical condition is influenced by various factors, including nutritional deficiencies, chronic diseases, genetic disorders, and environmental factors.

Nutritional deficiencies and anemia:
Nutritional deficiencies are a primary cause of anemia, particularly iron deficiency anemia (IDA). Iron deficiency is often caused by inadequate dietary intake, increased requirements during pregnancy, and blood loss.[22] Folate and vitamin B12 deficiencies are also significant contributors, particularly in specific populations such as those with celiac disease, where malabsorption issues are prevalent.[23]

Chronic Diseases and Anemia:
Chronic diseases, such as chronic kidney disease (CKD), cancer, and autoimmune disorders, often lead to anemia. The anemia of chronic disease (ACD) is characterized by a reduced lifespan of red blood cells, impaired iron metabolism, and inadequate erythropoietin response. This type of anemia is prevalent in patients with chronic inflammatory conditions.[24]

Genetic Disorders and Anemia:
Genetic disorders, including hemoglobinopathies and inherited red blood cell disorders, are significant causes of anemia. Conditions such as sickle cell anemia and thalassemia result from genetic mutations that affect hemoglobin production and function. These genetic factors require specific and targeted therapeutic approaches.

Infectious Diseases and Anemia:
Infectious diseases, such as malaria, HIV, and parasitic infections, are critical contributors to anemia, particularly in low- and middle-income countries. These infections can cause hemolysis, chronic inflammation, and nutrient malabsorption, leading to significant decreases in hemoglobin levels.[25]

Environmental and Socioeconomic Factors:
Environmental factors, including exposure to toxins and pollutants, and socioeconomic conditions, such as poverty and healthcare access, play essential roles in the etiology of anemia. Studies have shown that air pollution can intensify anemia by causing systemic inflammation and reducing hemoglobin levels. Additionally, socioeconomic factors such as poor sanitation and limited access to nutritious food contribute to the prevalence of anemia.[26]

The Government of India has introduced numerous policies aimed at operationalizing multi-sectoral solutions to the undernutrition/malnutrition issue to manage anemia. A National Nutrition Mission has been established under the oversight of the Ministry of Women and Child Development (MWCD) with a mission-focused strategy to tackle nutrition-related concerns. Supplemental. Nutrition is offered to expectant and nursing women under the Integrated Child Development Services (ICDS) Plan of the MWCD at a cost of Rs. 5 per day per woman. This should include

18–20 grams of protein and 600 Kcal. Children aged between 0 and 6 years receive extra nutrition, vaccinations, and preschool instruction. Primary school students are also given extra meals through the National Nutritional Support Program. Some MWCD programs, like SABLA, offer supplemental nutrition to adolescent girls (AGs) through hot-cooked meals or take-home rations (THR). For 300 days a year at a cost of Rs. 5 per beneficiary per day, each AG will receive at least 600 calories, 18–20 grams of protein, and the required daily intake of micronutrients under SABLA. One of the objectives of the 12th Five-Year Plan is to achieve a 50% reduction in the incidence of anemia among girls and women.[27,28]

Methods:-

Search strategy :

Google Scholar and PubMed were systematically searched for terms such as: anemia, anemia in chronic illness, iron deficiency anemia, nutritional anemia, malaria, parasitic infections, hemoglobinopathies, red cell enzymopathies and many combinations in India. Many english articles were included to identify missing articles, a "similar articles" search was conducted, and the selection of these articles was determined by consensus. Data pertinent to details such as sample size, sample design, study setting, and area were extracted from the selected articles. Most data were obtained from the NFHS-5 and NFHS-4, which was conducted by the Govt. of India.

Disscusion:-

Overall, anemia affects a substantial portion of the population in India, with rates being notably higher among women and children than among men. The prevalence has seen an increasing trend as per NFHS 5 data as compared to prevalence trends in NFHS 4. The data provided in this paper highlights the critical need for continued public health interventions to address anemia across all age groups in the country.

Conclusion:-

The global prevalence of anemia is a complex public health issue influenced by multiple multifactorial etiological factors. Nutritional deficiencies, infectious diseases, gender disparities, and social determinants of health all contribute to the global burden of anemia. Efforts to combat anemia require a holistic approach that addresses these factors through comprehensive public health strategies, preventive interventions, and equitable access to healthcare services. Efforts to address the prevalence of anemia in India require a multi-faceted approach. Enhancing awareness about the importance of iron-rich diets, promoting iron supplementation, especially for vulnerable groups like pregnant women, and strengthening healthcare systems to provide early diagnosis and treatment are vital strategies for combating anemia.

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