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Iron deficiency anemia: a hematological disorder influencing reproductive age women

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ABSTRACT

Anemia is a leading public health problem that contributes substantially to women's health even today. Prevalence of anemia is very high in vulnerable groups especially in children and women of reproductive age. However, it is more evident in pregnant women and young girls. Reproductive age is a period where remarkable growth changes occurs necessitating optimum nutrition requirement. Anemia has been known to be responsible for a number of maternal and fetal complications. Iron deficiency anemia (IDA) is one of the most common anemia with high prevalence rate. In India, national and regional surveys, estimates that the prevalence of anemia could be as high as 74 per cent in children below three years of age, 85% in expectant mothers and 90 per cent among adolescent girls in some population groups. Anemia is the second most common cause of maternal death in India accounting for 20% of total maternal deaths. Due to IDA, women are at increased risk of preterm delivery and low birth weight which eventually leads to behavioural and affective disorder in children. The aim of this review focuses on the prevalence of IDA and its influence on young women and maternal health.

INTRODUCTION

The word "Anemia" comes from the Ancient Greek meaning "lack of blood." It is a decrease in the normal number of red blood cells (RBCs), or less than the normal quantity of hemoglobin (the protein in RBCs that transports oxygen to tissues) in the blood (Fig. 1).

An estimated 2000 million people suffer from anemia making it the world's most common nutritional disorder. It is a common medical disorder contributing maternal morbidity, mortality and also prenatal mortality. The most common cause of anemia in the world is iron deficiency. Iron-deficiency anemia has particular negative consequences on women in their childbearing years, and its prevention is a high priority in most health systems. In spite of the fact, that the etiology of Anemia is multi factorial, it extensively results when iron demands are not met by iron absorption for varied reasons. Individuals with Anemia may have inadequate intake of iron due to poor quantity and/or quality of diet, impaired absorption or transport of iron, or chronic blood loss due to secondary diseases. Due to the physiological demand, women have extra needs of iron requirement from puberty to menopause. This demand arises from menstruation, pregnancy and lactation and that is why iron deficiency is most common in women of reproductive age.

The pathological stages are;

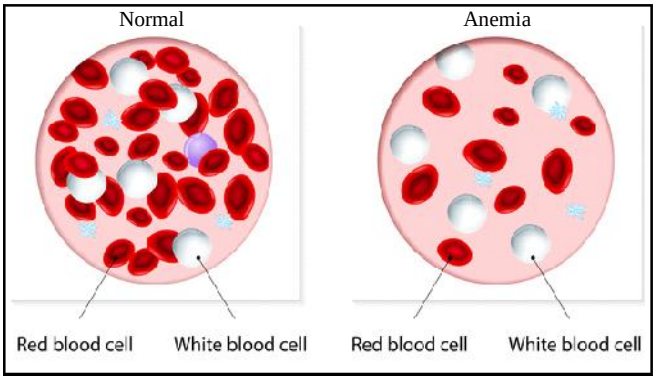

Fig. 1 : Protein in RBCs'

Pre-latent deficiency:

Liver (Hepatocytes and macrophages), spleen and bone marrow show reduced iron stores (reduced-bone marrow iron and serum ferritin).

Latent deficiency:

With very low or absent bone marrow iron stores there is progressive reduction in plasma iron; the bone marrow receives little iron for hemoglobin regeneration (bone marrow iron is absent, serum ferritin is <12ug/l, transferrin saturation is <16% and free erythrocyte porphyrin is increased); however, hemoglobin concentration remains normal.

Iron deficiency anemia:

This is a very late stage of iron deficiency with progressive fall in hemoglobin levels and means corpuscular volume (Ingle *et al.*, 2011).

The iron deficiency can lead not only to anemia but to decreased work capacity; abnormal neuron-transmitter function and altered immunological and inflammatory defenses (Rose, 2002).Iron deficiency at any time in life may disrupt metabolic processes and subsequently change cognitive and behavioural functioning. Women of reproductive age are among those most vulnerable to iron deficiency and may be at high risk for cognitive alterations due to iron deficiency (Beard and Murray-Kolb, 2007). World Health Organization (WHO) report on maternal health and safe motherhood programme reveals an alarming rate of anemia among pregnant women in developing countries, like India (Mittal *et al.*, 2013).

Iron requirements :

A dietary intake of iron is needed to replace iron lost in the stools and urine and through the skin. These basal losses represent approximately 14 *pg* per kg of body weight per day, or approximately 0.9 mg of iron for an adult male and 0.8 mg for an adult female. The iron lost in menstrual blood must be taken into consideration for women of reproductive age.

Assessing anemia :

Hb concentration is the most reliable indicator of anemia at the population level, as opposed to clinical measures which are subjective and therefore have more room for error. Measuring Hb concentration is relatively easy and inexpensive, and this measurement is frequently used as a proxy indicator of iron deficiency. However, anemia can be caused by factors other than iron deficiency. In addition, in populations where the prevalence of inherited haemoglobinopathies is high, the mean level of Hb concentration may be lowered. This underlines that the etiology of anemia should be interpreted with caution if the only indicator used is Hb concentration. The main objective for assessing anemia is to inform decision-makers on the type of measures to be taken to prevent and control anemia. This implies that in addition to the measurement of Hb concentration, the causes of anemia need to be identified considering that they may vary according to the population (McLean *et al.*, 2008).

The diagnosis of iron deficiency anemia (IDA) is usually indicated firstly by appropriate history (e.g., anemia in a menstruating woman), and secondly, confirmed by such basic diagnostic tests as Hb estimation and RBC count. Globally, the most common method of screening individuals or populations for iron deficiency involves determining the prevalence of anemia by measuring blood hemoglobin. Risk for iron deficiency is a function of iron loss, iron intake, iron absorption, and physiological demand. In the Table 1, anemia has been classified according to its public health significance. The division of ranges defines its severity.

Table 1 : Classification of anemia as a public health problem

Prevalence of anemia (%)	Category of public health significance
≤ 4.9	No public health problem
5.0-19.9	Mild public health problem
20.0-39.9	Moderate public health problem
≥ 40.0	Severe public health problem

Source: adapted from reference 5

Maternal morbidity and mortality :

Maternal anemia results in morbidity and mortality in both the mother and the unborn child. According to the World Health Organization (WHO) the estimates of the global burden of deaths that is attributable to anemia in women of reproductive age ranges from 16800 to 28000 annually with a greater risk of anemia-related death in younger women. Anemia is estimated to contribute to 591000 prenatal deaths globally per year. A cycle of deteriorating health from pregnancy to pregnancy occurs when these women are unable to replace blood loss during child birth and their anemia became exacerbated by the demand of breastfeeding.

Each year about four million new-born die in the first week of life worldwide and an estimated 358,000 mothers die due to pregnancy-related causes with maternal mortality rate of 260 per 100,000 live births and a life time risk of 1 in every 140 was recorded in 2008 (Inyang *et al.*, 2015). Anemia contributes to unfavorable maternal and neonatal outcomes. In Asia, anemia (irrespective of severity) is the second leading cause of maternal death and accounts for 12.8% of maternal deaths independent of death due to postpartum hemorrhage. Maternal mortality and morbidity due to anemia either directly or indirectly is associated with the presentation of anemia in its acute or chronic state. For example, acute severe anemia during pregnancy leads to rapid cardiac decompensation and can be a primary cause of acute hemolysis resulting from an underlying disease such as sickle cell. Chronic anemia on the other hand may contribute to maternal mortality indirectly through increased risk of hemorrhage and infections. Indeed it was recently estimated that a 1g/dl increase in population mean hemoglobin could reduce the risk of maternal mortality by 25%. Table 2 gives a brief description about prevalence of anemia among pregnant and non-pregnant women within the WHO region. The South-East Asia region shares a large part among all.

In addition to poor outcomes for the mother, anemia contributes to neonatal complications such as small for gestational age, still births and neonatal deaths. IDA, specifically is also linked to poor pregnancy outcome such as preterm delivery, low birth weight infants and infants with poor iron stores. Further, IDA increases maternal susceptibility to infections thus indirectly increasing the risk of maternal morbidity and mortality.

In terms of global burden, iron deficiency is estimated to cause 115,000 maternal deaths globally per year. This amounts to 3 and 19 million DALYS lost from maternal and prenatal causes, respectively. In all women, regard-less of pregnancy status, anemia, including IDA, impairs concentration, attention span, and educational attainment, decreases work efficiency and physical stamina, and increases the risk of infection, morbidity and mortality.

Maternal anemia can cause many prenatal complications like low birth weight, preterm delivery, low APGAR score, suboptimal infant breastfeeding behaviour. SIBB in turn starts a vicious cycle in infant leading to decreased weight gain, malnutrition, leading to increased incidence of diarrheal diseases, URTI, otitis media etc., which in turn lead to increase under 5 morbidity and mortality.

The ability of women to command resources and make independent decisions about their fertility, their health and healthcare also has an impact on maternal anemia. Where women are afforded a low status in society their health needs are often neglected, and existing health facilities may not be accessed by women in need. In addition, lack of education and understanding

Table 2 : Women affected by anemia in each WHO region

Who region	Pregnant women		Non-pregnant women	
	Prevalence (%)	#Affected (millions)	Prevalence (%)	#Affected (millions)
Africa	57.1 (52.8-61.3)	17.2 (15.9-18.5)	47.5 (43.4-51.6)	69.9 (63.9-75.9)
Americas	24.1 (17.3-30.8)	3.9 (2.8-5.0)	17.8 (12.9-22.7)	39.0 (28.3-49.7)
South-East Asia	48.2 (43.9-52.5)	18.1 (16.4-19.7)	45.7 (41.9-49.4)	182.0 (166.9-197.1)
Europe	25.1 (18.6-31.6)	2.6 (2.0-3.3)	19.0 (14.7-23.3)	40.8 (31.5-50.1)
Eastern Mediterranean	44.2 (38.2-50.3)	7.1 (6.1-8.0)	32.4 (29.2-35.6)	39.8 (35.8-43.8)
Western Pacific	30.7 (28.8-32.7)	7.6 (7.1-8.1)	21.5 (20.8-22.2)	97.0 (94.0-100.0)
Global	41.8 (39.9-43.8)	56.4 (53.8-59.1)	30.2 (28.7-31.6)	468.4 (446.2-490.6)

#95% confidence interval
Source: adapted from reference 5

about health related issues can contribute to delays in seeking care when it is needed or to the inappropriate management of life threatening pregnancy complications (Dienye and Ndukwu, 2012).

Across the globe, the concern is generally targeted towards the reduction of maternal mortality. In 1987, the World Bank in collaboration with the WHO, the United Nations Fund for Population Activities (UNFPA) and leaders from 45 nations launched the Safe Motherhood Initiative. One of the key components of this initiative is the eradication of anemia during pregnancy. These strategies, it was hoped, would help in the management and control of anemia amongst pregnant women and reducing maternal mortality.

Indian scenario :

India is one of the countries with very high prevalence of anemia in the world. Nutritional anemia is a major public health problem in India and is primarily due to iron deficiency. The National Family Health Survey-4 (NFHS-4) data indicates that anemia is widely prevalent among all women age 15-49 is 53%, comprising 50.8% in urban areas and 54.2% in rural areas.

Around 96 per cent of the pregnant women in India are suffering from some degree of anemia. It includes 51 per cent of women who are suffering from mild anemia, 42 per cent from moderate anemia and 3 per cent from severe anemia. As the data suggest that prevalence of any anemia among women is almost universal in India, differentials could be seen only when data on moderate and severe anemia are examined. The prevalence of either moderate or severe anemia among pregnant women increases from 45 per cent among women aged 15-19 to 49 per cent among women aged 35-39. Pregnant women residing in urban areas are less likely to have either moderate or severe anemia (42 %) than their rural counterparts (47 %) (Mari *et al.*, 2006). The prevalence of moderate or severe anemia decreases steadily with the level of educational attainment of pregnant women. While 52 per cent of the non-literate women have either moderate or severe anemia, its prevalence is 35 per cent among those who have completed ten or more years of education.

According to National Nutrition Report (NNP, 2006), the prevalence of either moderate or severe anemia during pregnancy is found to be highest among Sikh women (60 %), followed by Buddhist women (52 %), while its prevalence is lowest among Christian women (25 %). Hindu women show higher level of anemia during pregnancy (46 %) than Muslim women (42 %). Women of scheduled tribes have higher level of anemia during pregnancy (56 %) than either SC women (49 %), or OBC women (44), or women belonging to other castes (41 %) (Mari *et al.*, 2006). As expected, standard of living is inversely associated with the anemia status of pregnant women. About half of the pregnant women belonging to poor families are either moderately or severely anemic compared to 39 per cent of women belonging to households with higher standard of living.

In most of the states, the prevalence of any anemia among pregnant women is over 90 per cent. However, in Jammu and Kashmir and in many north-eastern states (other than Assam) its prevalence is substantially low (30-60 %). Wider state–level differentials are seen when the percentages of women having either moderate or severe anemia are examined. The highest prevalence of either moderate or severe anemia is found in Assam (66 %), followed by Chhattisgarh (61 %). In Punjab, Haryana, Madhya Pradesh, Gujarat and Maharashtra, the combined prevalence of moderate and severe anemia is more than 50 per cent. In south India and West Bengal the combined prevalence of moderate and severe anemia is lower than 40 per cent. In Kerala, it is only 5 per cent. It is worth noting that states such as Punjab and Haryana, despite being economically and agriculturally more advanced than other states, show relatively high prevalence of moderate and severe anemia among pregnant women and adolescent girls.

Interventions for prevention and control of anaemia:

According to WHO, Global Nutrition Target 2025, below are the following points for intervention for prevention and control of anemia :

– A diet containing adequate amounts of bio-available iron should underpin all efforts for prevention and control of anemia.

– Malaria control: chemoprophylaxis/intermittent preventative treatment, insecticide-treated nets and vector elimination.

– Deworming: periodic treatment with anthelminthic (deworming) medicines, without previous individual diagnosis, for all women of childbearing age (including pregnant women in the second and third trimesters and breastfeeding women) living in endemic areas. For non-pregnant women, treatment should be given once a year when the prevalence of soil-transmitted helminth infections in the community is over 20%, and

twice a year when the prevalence of soil transmitted helminth infections in the community exceeds 50% (WHO, 2014).

– Delayed cord clamping (not earlier than 1 min after birth) is recommended for improved maternal and infant health and nutrition outcomes, including increased iron stores in term infants, reducing the need for blood transfusions for low blood pressure or anemia in preterm neonates.

– Early interventions targeting adolescent girls for prevention of iron deficiency anemia are critical, especially in areas with high adolescent birth rates and early marriages.

– Basic hygiene reduces the risk of infection; therefore, water and sanitation interventions can be integrated, in order to reduce nutritional losses incurred by infection, and also reducing inflammation.

– Education must encompass the component of reproductive health and family planning services for women and adolescent girls, to encourage dialogue and promote adequate birth spacing. Education will help promote gender equality and female empowerment.

Conclusion :

Anemia especially due to Iron deficiency is easily preventable and treatable. Despite the effort of the Government all over the world IDA is rampant. Such complications can be prevented to a large extent by simple correction of Hemoglobin% during antenatal period. Though often neglected, correct ante partum and post-partum diet plan and regular intake of iron tablets play a crucial role in preventing iron deficiency anemia. Educating and evaluating mother during the time of delivery and immediate post-partum will have long lasting positive impact on health. Nutritional education can improve knowledge of healthy nutrition and lifestyle choices. Focused nutritional education using available resources and correcting current dietary habits in a vulnerable group of young women may result in dietary changes that can ultimately improve iron intake and could reduce the incidence of iron deficiency and further iron deficiency anemia. Such measures would go a long way in improving maternal and fetal outcome.

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