

## Review Article

# Study of Anaemia in children and current update

Sanjeev Kumar Shukla<sup>1\*</sup>, Shubhra Shukla<sup>2</sup>, Rajesh Kumar Verma<sup>3</sup>, Lakshya Veer Singh<sup>4</sup>, Bashah J. Khan<sup>5</sup>, Vikas Gupta<sup>6</sup>, D.P. Saxena<sup>7</sup>, Shahaj Uddin Ahmed<sup>8</sup>, Anupam Dhasmana<sup>9</sup>, Naveen Sharma<sup>10</sup>

<sup>1</sup>Department of Biotechnology, Bundelkhand University, Jhansi, Uttar Pradesh, India

<sup>2</sup>Department of Bioscience, Integral University, Lucknow, Uttar Pradesh, India

<sup>3</sup>T.V.C.C, College of V.S & A.H., N.D. University of Agriculture and Technology, Kumarganj, Faizabad, India

<sup>4</sup>Tuberculosis Aerosol Challenge Facility Laboratory, ICGEB, New Delhi, India

<sup>5</sup>Bioinformatics Technologies of India, Bareilly, Uttar Pradesh, India

<sup>6</sup>Department of Biochemistry and Bioprocess Technology, SHIATS Allahabad University, Uttar Pradesh, India

<sup>7</sup>Department of Biotechnology, Vinayaka Missions University, Salem, Tamil Nadu 636308

<sup>8</sup>Department of Biotechnology, CGO Complex, New Delhi, India

<sup>9</sup>Himalayan School of Biosciences, Swami Rama Himalayan University, Dehradun, U.K., India

<sup>10</sup>Department of Health Research, IRCS Building, Red Cross Road, New Delhi, India

## ABSTRACT

Anaemia in children is a major public health problem throughout the biosphere. It is estimated that at least one-third of the populace has been at one-time anemic. It is often multifactorial, iron deficiency being the most frequent etiology and reasons like malaria endemicity, poor nutrition including micronutrient deficiency, haemoglobinopathies, frequent bacterial infections and high parasitic infestations have been given for these high prevalence rates. Chronic Anaemia may impair growth, cardiac function and cognitive development in infants but other consequences are rather poorly explored more thoroughly. Chronic disorders and iron deficiency were the most common causes of Anaemia. Anaemia was frequently diagnosed in this series of elderly patients. Partly treatable nutritional deficiencies, such as iron or folate deficiency, were identified as possible causes. A complex and heterogeneous interplay of chronic inflammation, functional iron deficiency, and renal impairment was identified in a large proportion of patients. Measures directed at prevention and control of anemia, include increased coverage of supplementation and fortification programs are strongly recommended.

**Key Words:** Anaemia; iron-deficiency hemoglobin; prevalence of Anaemia; haemoglobin

## Introduction

National Health and Nutrition Examination Survey (NHANES II) provide adequate data on which to base estimates of the prevalence of iron-deficiency Anaemia and the Anaemia of inflammatory disease (Mozaffarian et al. 2015). An edited data tape for the laboratory analyses that are relevant to iron deficiency (Dallman et al., 1980).

Values for serum ferritin on a subpopulation of 157 subjects were used in certain of the analyses. The prevalence of Anaemia is usually defined in terms of the percentage of individuals with Hb values below a 95% reference range (Hong et al., 2012).

Received: 01.07.2018, Revised: 13.07.2015, Accepted: 18.07.2018

\*Address for Correspondence: Department of Biotechnology, Bundelkhand University, Jhansi, Uttar Pradesh, India  
Tel.: +91-9457273980. E-mail: [sanjeevcloning@gmail.com](mailto:sanjeevcloning@gmail.com)

95% reference ranges for Hb concentration was taken from NHANES II because this large and carefully conducted survey offered the prospects of providing a stronger basis for reference values than previously available. For this purpose, we included only those subjects who provided venous blood samples and excluded all subjects with pregnancy, hemoglobinopathies, or an abnormality in iron/total iron-binding capacity (Fe/TIBC), mean corpuscular Hb (MCV), or erythrocyte protoporphyrin (EP). These reference ranges were then used as a basis for estimates of the prevalence of Anaemia i.e. the percentage of individuals with Hb values below the 95% reference range for age and sex.

Anaemia can also be considered in terms of the depression of Hb concentration by the presence of common abnormalities such as iron deficiency or

inflammatory disease (in which laboratory abnormalities are similar), even if that depression occurs within the “normal” reference range. The relative prevalence of Anaemia defined in this manner was estimated from the degree to which the frequency distribution for Hb concentration shifted toward higher values after exclusion of subjects who had one or more laboratory values indicative of iron deficiency and/or inflammatory disease.

### Signs and symptoms of Anaemia

When Anaemia is present insidiously, such as with iron deficiency, the diagnosis is often delayed. Cutaneous pallor is not helpful because of the wide variability in skin pigmentation depending on ethnic origin. Conversely, conjunctival pallor, tongue pallor, and pallor of palms and soles seem to be more reliable (Kalantri et al., 2010). Reduced food intake and fatigue may be frequent (Panepinto et al., 2014). The degree of tachycardia is correlated with the Hb level and reflects the tolerance of Anaemia (Gv et al., 2014). Signs of hemolysis may be present, such as jaundice or dark urine. Dysmorphic features may help to diagnose a thalassemic syndrome (frontal bossing, prominent malar eminence, and depressed bridge of the nose).

Vitamin B12 deficiency Anaemia was diagnosed if the serum vitamin B12 level was low (less than 211 ng/l), associated with macrocytosis (mean corpuscular hemoglobin > 98 fl). Folate deficiency Anaemia was diagnosed if the erythrocyte folate level was low (less than 186 µg/l) combined with macrocytosis. The diagnosis of hematological malignant conditions was based on examinations of the bone marrow aspirate and biopsy. Renal disease was accepted as the cause of Anaemia if the patient was known to have chronic renal failure, or had small kidneys on ultrasound examination and the results of the iron studies, serum vitamin B12 levels and erythrocyte folate levels were normal (Wonke et al., 1998). Dietary iron intake Overall, women do not make major changes in their dietary habits during pregnancy (Pedersen et al., 2003), which means that the results of nutrition surveys in non-pregnant

women can be transferred to pregnant and postpartum women. Danish women of reproductive age have a mean dietary iron intake of ~9 mg/day (Pedersen et al., 2003), which means that more than 90% of the women have an intake below the recommended daily allowance of ~18 mg/day (NCM, 2004). 96% of the women had a dietary iron intake below the recommended 18 mg/day (Trygg et al., 1995; NCM, 2004). In the third trimester, there is too short time for oral iron treatment to be effective in the correction of Anaemia due to the limited iron absorption capacity. Gastrointestinal iron absorption is regulated according to body iron reserves and the intensity of erythropoiesis. Exhausted body iron reserves in otherwise healthy women will increase the intestinal iron absorption (Krafft and Breyman 2011). In women who do not respond to oral iron, i.v. iron therapy should be considered. The recently introduced third-generation i.v. iron compounds are ferric iron carboxymaltose (Ferinject; Vifor Pharma Ltd.) (Lyseng-Williamson and Keating, 2009) and ferric iron isomaltoside 1000 (Monofer Pharmacosmos Ltd., 2011).

### Discussion

The majority of our patients had a mild normocytic Anaemia, the most likely cause in these cases being Anaemia of chronic disease, which was confirmed with special investigations in patients. The data for adult males are of interest in showing a definite peak in Hb concentration in the early twenties with a gradual decline thereafter to median values that were 1.0 g/dl lower in the oldest age group. One distinct possibility is a decrease in an androgen stimulation of erythropoiesis that began during puberty. Another hypothesis proposed by (Lipschitz et al., 1981) is that Anaemia in otherwise healthy, aged subjects may indicate an overall reduction in hematopoietic reserve. The application of Hb reference values to elderly men will strongly influence the percentage that are considered anemic. Application of the same criteria for Anaemia to adult men of all ages might result in classifying a very large percentage of elderly men as anemic. Until there is strong evidence to the

contrary, it seems reasonable to apply age-specific reference standards to elderly men. In contrast, the lower limit of the reference range remains almost constant in women, making it practical to use the same criterion for Anaemia at all adult ages. The apparent predominance of iron-deficiency Anaemia among children, adolescents, and women during the child-bearing years is in accord with previous data (Bothwell et al., 1979; Dallman et al., 1980).

## Conclusion

Overall prevalence of Anaemia was high in the study population. The most common cause of Anaemia was nutritional deficiency followed by chronic kidney disease and blood loss due to antiplatelet agents. The presence of Anaemia is a risk factor for increased morbidity and in-hospital mortality in these patients. As Anaemia is a relatively frequent condition which remains often under-diagnosed and untreated, its prevention and earlier detection may lead to improved outcomes. Mothers are fostering the future citizens of our societies. The most reliable way to obtain this goal is to give oral ferrous iron supplements from early pregnancy in doses ranging from 40 to 50 mg daily and perform obstetric prophylactic measures in pregnancies at risk for complications.

## Conflict of Interest

The authors declare that they have no conflict of interest.

## References

Aapro M, Osterborg A, Gascon P, et al. Prevalence and management of cancer-related anaemia, iron deficiency and the specific role of i.v. iron. *Ann Oncol.* 2012;23(8):1954–1962.

Bothwell TH, Charlton RW, Cook JD, Finch CA. *Iron metabolism in man.* Oxford: Blackwell Scientific Publications, 1979.

Chalco JP, Huicho L, Alamo C, Carreazo NY, Bada CA. Accuracy of clinical pallor in the diagnosis of anaemia in children: a meta-analysis. *BMC Pediatr.* 2005; 5:46.

Dallman PR, Siimes MA, Stekel A. Iron deficiency in infancy and childhood. *Am J Clin Nutr* 1980;33:86-118.

Dallman PR. Manifestations of iron deficiency. *Semin Hematol* 1982;19:19-30.

FAO, WHO. World declaration and plan of action for nutrition: Food and Agriculture Organization of the United Nations; 1992.

Ferinject. Summary of Product Characteristics [www.medicines.org.uk](http://www.medicines.org.uk) Accessed February 6th 011.

Garby L, Irnell L, Werner I. Iron deficiency in women of fertile age in a Swedish community. III. Estimation of the iron status of a population. *Acta MedScand* 1969; 185:113-17.

Joosten E, Pelemans W, Hiele M, Noyen J, Verhaeghe R, Boogaerts MA. Prevalence and causes of anaemia in a geriatric hospitalized population. *Gerontology.* 1992; 38:111–7.

Kalantri A, Karambelkar M, Joshi R, Kalantri S, Jajoo U. Accuracy and reliability of pallor for detecting anaemia: a hospital-based diagnostic accuracy study. *PLoS One.* 2010;5(1):8545.

Ludwig H, Müldür E, Endler G, Hübl W. Prevalence of iron deficiency across different tumors and its association with poor performance status, disease status and Anaemia. *Ann Oncol.* 2013; 24(7):1886–1892.

Lyseng-Williamson KA, Keating GM. Ferric carboxymaltose: a review of its use in iron-deficiency Anaemia. *Drugs.* 2009;69:739–756.

Meyers LD, Habicht J-P, Johnson CL. Components of the difference in hemoglobin concentrations in blood between black and white women in the United States. *Am J Epidemiol* 1979;109:539-49.

## How to Cite This Article:

Shukla SK, Shukla S, Verma RK, Singh VR, Khan BJ, Gupta V, Saxena DP, Ahmed SU, Dhasmana A, Sharma N. Study of Anaemia in children and current update. *Ind. J. Biotechnol. Pharma. Res.* 2018; 6(3): 1-03.