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Anemia prevalence in children's admitted to Patna medical college & hospital, Patna, Bihar

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Abstract
Anemia prevalence in young children continues to remain over 70% in the most parts of India and Asia despite a policy being in place and a programme that has been initiated for a long time. The irreparable damage that anemia in childhood can cause particularly to the development of a young child on one hand and the knowledge and mechanism available for its control on the other, makes this silent morbidity completely unacceptable in modern times where we strive for Millennium Development Goal 4. Hence based on above findings the present study was planned for study of Anemia Prevalence in Children's admitted to Patna Medical College & Hospital.
The present study was planned in Upgraded Department of Paediatrics, Patna Medical College & Hospital, Patna, Bihar, India. Total 550 children of age below 12 years were evaluated in the present study. Twenty micro litre of anti-coagulated blood was added to 5 ml of freshly made standarized Drabkin's solution in a vial. This was inverted several times to mix the solution. It was allowed to stand for 10 minutes. The solution was read in spectro-photometer at 540 nm and values were compared with a standard table. All observations were made by a single person to prevent inter-observer bias.
The study aimed at determining the prevalence of Anemia with special reference to Iron status. The important associated risk factors and existence of morbid illness, in the school going age of both sexes. Overall frequency of consumption of iron-rich food is lower in males and females. Awareness of anemia is very poor in school-going children. Nutrition and Health Education session should be conducted in school with teachers and parents' involvement to raise awareness regarding anemia.

Keywords: prevalence, Anemia, children, Patna

Introduction
Pediatric anemia refers to a hemo globin or Hemato crit level lower than the age-adjusted reference range for healthy children. Physiologically, anemia is a condition in which reduced Hemato crit or hemo globin levels lead to diminished oxygen-carrying capacity that does not optimally meet the metabolic demands of the body.
Anemia is not a specific disease entity but is a condition caused by various underlying pathologic processes. It may be acute or chronic [1]. This article provides a general overview of anemia, with an emphasis on the acute form. In addition, conditions are emphasized in which anemia is the only hematologic abnormality. The combination of anemia with leukopenia, neutropenia or thrombocytopenia may suggest a more global failure of Hemato poiesis, caused by conditions such as aplastic anemia, Fan coni anemia, myelo fibrosis, or leukemia or may suggest a rapid destruction or trapping of all blood elements, such as hyper splenism, localized coagulopathy in a large hemangioma, or hemo phagocytic lymphohistiocytosis (HLH) or macrophage activation syndrome (MAS). The main physiologic role of red blood cells (RBCs) is to deliver oxygen to the tissues. Certain physiologic adjustments can occur in an individual with anemia to compensate for the lack of oxygen delivery. These include (1) increased cardiac output (2) shunting of blood to vital organs (3) increased 2,3-diphosphoglycerate (DPG) in the RBCs, which causes reduced oxygen affinity, shifting the oxygen dissociation curve to the right and thereby enhancing oxygen release to the tissues and (4) increased erythropoietin to stimulate RBC production.
The clinical effects of anemia depend on its duration and severity. When anemia is acute, the body does not have enough time to make the necessary physiologic adjustments and the symptoms are more likely to be pronounced and dramatic. In contrast, when anemia develops gradually, the body is able to adjust, using all four mechanisms mentioned above (1, 3 and 4 in most cases), ameliorating the symptoms relative to the degree of the anemia.
Acute and severe anemia can result in cardiovascular compromise. Moreover, if individuals with acute anemia are not treated immediately and appropriately, the resulting hypoxemia and hypovolemia can lead to brain damage, multi organ failure, and death. Long-standing anemia can result in failure to thrive.
Many studies have shown the deleterious effects of iron deficiency anemia or iron deficiency without anemia on the neurocognitive and behavioural development in children. Other complications can include congestive heart failure, hypoxia, hypovolemia, shock, seizure, and acute silent cerebral ischemic events.
To evaluate anemia, obtain initial laboratory tests, including the complete blood count (CBC), reticulocyte count, and review of the peripheral smear. Chest radiography is performed in patients who may have congestive heart failure (CHF) and to rule out media stinal mass (associated with acute leukemia and lymphoma).
Abdominal ultrasonography is used to assess for gallstones or splenomegaly in hemolytic anemia, while computed

tomography (CT) scanning is used to evaluate occult bleeding in blunt trauma (eg, splenic rupture, subcapsular hemorrhage of the liver) or a bleeding disorder. Abdominal Doppler study is used to detect portal vein thrombosis.

Transfusion with packed red blood cells (PRBCs) is the universal treatment for most individuals with severe acute anemia. The indication to transfuse should not be based solely on the hemoglobin or hematocrit levels, more importantly, one must consider the clinical effects or the signs and symptoms of the individual with anemia [3].

Girls with heavy and/or prolonged menstrual periods should seek medical attention (should tell parents to obtain CBC count). One of the most common reasons for fainting spell or syncope in adolescent girls is rapidly developing anemia due to menstrual blood loss. Toddlers who drink more than 24 oz. of milk a day most likely have iron deficiency. Primary care physicians should inquire about the amount of milk intake [4].

Children diagnosed with anemia should be taught to look at their stool color and to report to their parents if it is tarry or bloody. Educate the patient and/or the family about the specific disease that causes the anemia. For example, provide a list of drugs, food, and other agents to avoid because of their effect of triggering acute hemolysis in glucose-6-phosphate dehydrogenase (G-6-PD) deficiency.

In pediatrics beyond the immediate neonatal period, acute anemia is rare in otherwise healthy children. In most instances, it is due to blood loss, usually through the GI tract or via a heavy menstrual period or in some instances, as a result of an acute hemolytic episode in a child with undiagnosed G-6-PD deficiency. The most common reason for hospitalization because of acute anemia is so-called aplastic crisis in children with chronic hemolytic anemia who otherwise had been stable. The most common varieties are hereditary spherocytosis and sickle cell disease. Therefore, it would be prudent to educate parents regarding this complication, at the time when the diagnosis is established.

Causes of anemia are either inherent in the RBCs or related to an external factor. The underlying pathologic processes that cause anemia can be broadly categorized as (1) decreased or ineffective red cell production, (2) increased red cell destruction (hemolysis) and (3) blood loss, although more than 1 mechanism may be involved in some anemia.

Obvious or occult sites of blood loss may include the GI tract or intra-abdominal, pulmonary, or intracranial (in neonates) sites. Patients with bleeding disorders are at particular risk for massive hemorrhage (internal or external).

Anemia associated with acute infection is common. This may be mediated by increased destruction by erythro phagocytosis [7] and suppression of erythropoiesis by the infection.

In adolescents and adults, normal values for the hemo globin and hem atocrit levels vary according to sex. Racial differences are also apparent, with black children having lower normal values than white and Asian children of the same age and socioeconomic background.

Among all races, ages, and socioeconomic groups studied, an overall steady decline (from 7.8% in 1975 to 2.9% in 1985) in prevalence of anemia in the US pediatric population (aged 6 months to 6 yrs.) has been observed. Data showed continued decline in the prevalence of anemia from the mid-1980s to the mid-1990s [8]. Iron deficiency was the most common etiology.

A prevalence study of anemia on selected groups using the National Health and Nutrition Examination Surveys covering 1988-1994 and 1999-2002 showed a decrease in the prevalence of anemia from 8% to 3.6% in children aged 12-59 months and from 10.8% to 6.9% in women aged 20-49 years. However, no significant change in the prevalence of iron deficiency anemia was seen in either group [9].

In developing nations, the prevalence of anemia is extremely high. This is particularly true in preschool-aged children, in whom the prevalence reached as high as 90% of the sample population studied. Although iron deficiency is identified as the major factor, the etiology is often multifactorial, including recurrent or chronic infections (bacteria, parasites), malnutrition and reduced immunity.

In addition, the prevalence of certain hereditary forms of anemia (eg, thalassemia, sickle cell disease) varies with ethnicity and thus with geography. For instance, α thalassemia, which may be the most common single gene disorder in the world, has a frequency of as much as 68% in the southwest Pacific, 20-30% in western Africa and 5-10% in the Mediterranean region. Beta thalassemia mutations have high frequencies in the Mediterranean, northern Africa, Southeast Asia and India, but they have low frequencies in Great Britain, Iceland and Japan.

A study by Mujica-Coopman *et al* of anemia rates in children under age 6 years in Latin America and the Caribbean found the lowest rates in Chile (4.0%), Costa Rica (4.0%), Argentina (7.6%) and Mexico (19.9%). Anemia was found to pose a severe public health threat in Guatemala, Haiti and Bolivia [10]. A study by Aladjidi *et al* estimated that in the Aquitaine region of France, the incidence of the rare disease autoimmune hemolytic anemia in persons under age 18 years is 0.81 per 100,000 per year [11]. Acute anemia is universal, but the likely underlying etiologies are influenced by race. Inherited red cell disorders are predominant in certain racial populations, such as sickle cell disease in black persons, β thalassemia in persons of Mediterranean ethnicity and α thalassemia in Asians, African Americans and others [12].

Sex predisposition to anemia varies according to the underlying etio logy. For instance, certain hereditary X-linked red cell disorders (eg, G-6-PD deficiency) are observed in males. Anemia caused by blood loss can be observed in males with an X-linked bleeding disorder (eg, hem ophilia).

Females with the auto somally inherited Von Wille brand disease may be anemic because of heavy blood loss during menstruation. Even without this disorder, they have a high risk of developing iron deficiency and iron deficiency anemia, quite often worsened by acute blood loss. Acquired hemo lytic anemia related to autoimmune disorders such as systemic lupus erythema tosus is more common in females because of their relative predisposition to autoimmune disease.

Acute anemia most commonly occurs among new borns. Significant blood loss can occur from birth trauma or blood exchange from the baby's mother (feto maternal transfusion) or the placenta. Iso immune anemia can result from maternal antibodies crossing the placenta. Neonates have a shorter red cell life span and limited erythropoiesis that can aggravate any hemo lytic process. Abnormalities of fetal hemo globin may cause anemia that resolves with the normal shift to adult-type hemo globins. Deletion of α globin gene, unlike β globin gene mutation, causes anemia

in neonates. Hemoglobin H disease is a good example (in neonates Hb Barts is the abnormal hemoglobin rather than HbH).

Nutritional anemia is common in infancy because of the associated rapid growth (necessitating an increase in red blood cell mass) and dietary adjustments. With exposure to new infections in early childhood, the anemia of acute infection is common. Rarely, severe autoimmune hemolytic anemia can be triggered by certain infections. Adolescence is characterized by rapid growth and vulnerability to nutritional anemia. In addition, blood loss with heavy menstruation can be observed in adolescent girls. The prognosis depends on the severity and acuteness with which the anemia develops and the underlying cause of the anemia.

Mortality and morbidity rates vary according to the underlying pathologic process causing the anemia, the degree of severity and the acuteness of the process. When a precipitous drop in the hemoglobin or hematocrit level occurs (eg, due to massive bleeding or acute hemolysis), the clinical presentation is typically dramatic and can be fatal if the person is not immediately treated. A good example is so-called splenic sequestration crisis in infants and young children with sickle cell anemia (equivalent to massive blood loss). In this instance, the patients may develop a state of shock due to pooling of the blood in the spleen. In addition to the signs and symptoms of anemia, patients can present with congestive heart failure (CHF) or hypovolemia. Cerebral injury has been reported in perioperative patients with anemia [13].

Malnutrition affects the mental and physical development of a child from the time it begins to grow in its mother's womb. If the mother is malnourished the child is very likely to be unhealthy at the time of birth. From conception to 24 months of age is the critical period. Primarily poor access to nutritional diets is the cause of malnutrition in both mother and child. In nutritional anemia the blood hemoglobin level drops to an abnormally low level due to deficiency in food nutrients (iron, folic acid and vitamin B12). The level of iron in a child's blood at the time of birth depends upon the store of iron in the mother during pregnancy. Iron deficiency hampers both mental and physical growth in children as iron plays an important role during rapid growth of a child. The brain is the fastest developing organ during infancy and childhood. The damage is irreversible. But iron deficiency is preventable with timely intervention.

Anemia, Iron deficiency and Iron-deficiency anemia are three conditions with minor differences. Abnormally low hemo globin level due to pathological conditions is defined as anemia. Iron deficiency is one of the most common causes of anemia. Inadequate dietary iron causes iron deficiency. In the case of a girl, increased blood loss can be a cause of anemia. Anemia, when caused by severe deficiency of iron is termed as iron-deficiency anemia. Other causes of anemia are deficiency of folic acid (folate), chronic infections (especially from malaria) and hereditary hemo globin opathies.

Iron is needed by the body to make red blood cells. Improper nutrition significantly decreases the child's ability to learn and remember and the child is unable to perform outdoor physical activities like sports. It also blunts intellectual capacity. This can be solved by changing nutritional attitudes and behaviour of adolescent girls (who would become mothers within few years).

Hence based on above findings the present study was planned for study of Anemia Prevalence in Children's admitted to Patna Medical College & Hospital.

Methodology

The present study was planned in Upgraded Department of Paediatrics, Patna Medical College & Hospital, Patna, Bihar, India. Total 550 children of age below 12 years were evaluated in the present study. Twenty micro litre of anticoagulated blood was added to 5 ml of freshly made standarized Drabkin's solution in a vial. This was inverted several times to mix the solution. It was allowed to stand for 10 minutes. The solution was read in spectro-photometer at 540 nm and values were compared with a standard table. All observations were made by a single person to prevent inter-observer bias.

Informed consents were taken from the parents of the patients. The aims and the objectives of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to the conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion criteria

All children belonging to the age group of 6 months – 12 years.

Exclusion criteria

Children belonging to the age outside inclusion age limit. Children suffering from chronic illness.

Results and Discussion

Worldwide, at any given moment, more individuals have iron-deficiency anemia than any other health problem [14]. Anemia is the most common morbidity among micronutrients and affects health, education, economy, and productivity of the entire nation. Anemia, like fever, is a manifestation and not a disease per se. The most common group among the causes for anemia is malnutrition and among that group, iron deficiency makes up the bulk of it. A large portion of iron deficiency is preventable with appropriate and timely intervention. Iron deficiency is the most common nutritional disorder in the world. The numbers are staggering: two billion people - over 30% of the world's population are anemic, mainly due to iron deficiency, and in developing countries this figure is frequently exacerbated by malaria and worm infections [15]. Iron deficiency affects more people than any other condition, constituting a public health epidemic. It exerts the heaviest overall toll in terms of ill-health, premature death and lost earnings. The effects of anemia on children are the most dire because their bodies are still developing, including the brain, which is the fastest developing organ in infancy and early childhood.

Iron deficiency, and the anemia that results from it, is a major health problem affecting more than 3.5 billion people in developing countries, reducing vitality for the young and old alike and impairing the cognitive development of children. Anemia is most often a hidden deficiency, with a few overt symptoms [16]. Policy makers often fail to recognize the massive economic costs, service providers often fail to recognize the significant health consequences and societies are too often ignorant of anemia's capability to cause permanent cognitive defects, denying children their

right to full mental and emotional development, before they ever reach a classroom.

The prevalence of anemia in the developing countries tends to be three to four times higher than in the developed countries [17]. Anemia affects the physical and mental development of an individual leading to decreased working capacity, which in turn affects the development of the country [18].

Table 1: Demographic Details

Variables	No. of Cases
No. of Cases Evaluated	550
Anemic Cases	22
Sex	
Males	12
Females	10
Age	
6 month to 2 year	3
2 to 4 years	5
4 to 6 years	6
6 to 8 years	3
8 to 10 years	3
10 to 12 years	2

Table 2: Different Variables responsible for Hemo globin

Variables	No. of Cases
Diet	
Non vegetarian	5
Only milk diet	7
Vegetarian	10
PICA	
No	9
Yes	13
Class of Family	
Upper	3
Middle	5
Lower	14
Parent Literacy	
Illiterate	10
Literate	12

Table 3: Distribution of Anemia based in Hemo globin Levels

Age	Number of Anemic Cases
Below 6 years	
10.0 – 10.9 g/dl (mild)	2
9.0 – 9.9 g/dl (moderate)	3
< 9.0 g/dl (severe)	9
Above 6 years	
11.0 – 11.9 g/dl (mild)	4
10.0 – 10.9 g/dl (moderate)	2
< 10.0 g/dl (severe)	2
Total Cases	22

An abnormally low hemo globin level due to pathological condition(s) is defined as anemia. Iron deficiency is one of the most common, but not the only cause of anemia. Other causes of anemia include chronic infections, particularly malaria, hereditary hemo globinopathies and folic acid deficiency. It is worth noting that multiple causes of anemia can coexist in an individual or in a population and contribute to the severity of the anemia. Thav raj and Reddy had also noted iron deficiency among 20% of healthy, non-anemic, high income group children [19]. In view of these findings it is evident that a significant proportion of the apparently healthy children belonging to the higher socio-economic classes suffer from overt anemia and may have latent iron deficiency even if not anemic. The possible reason for this could be the poor bio- availability of iron in the Indian diets [20]. The rising trend of consuming snacks and junk foods which supply empty calories is also responsible for so called 'healthy' but anemic children. This fad is fast spreading to the lower socio-economic status as well. The higher prevalence of anemia among vegetarian children in the present study further adds to the already existing evidence indicating that vegetarian diets are a poor source of iron [21-22].

Anemia, when caused by severe iron deficiency is termed as iron-deficiency anemia (IDA). Although, some functional consequences may be observed in individuals who have iron deficiency without anemia. Cognitive impairment, decreased physical capacity and reduced immunity are commonly associated with iron-deficiency anemia. In severe iron-deficiency anemia, the capacity to maintain body temperature may also be reduced. Severe anemia is also life-threatening. As the most common cause of anemia is iron deficiency, these terms are often used interchangeably. However, it is important to realize that anemia resulting from iron deficiency characterizes a very late stage of iron deficiency.

Anemia is a nutrition problem worldwide and its prevalence is higher in developing countries when compared to the developed countries [20-21]. Young children and pregnant women are the most affected, with an estimated global prevalence of 43% and 5l% respectively [22]. Anemia is not a specific disease, but an indication of underlying pathological process or disease of various etiologies. Among all different etiologies, nutritional anemia is the most common in all age groups, Iron deficiency is responsible for most of the nutritional deficiency anemias. Numerous studies amongst children have shown that, prevalence of anemia ranges from 52.2 to 96.5% in India. There are relatively few studies on the prevalence of anemia in the adolescent age group. The prevalence in developing countries is very significant in adolescence and in girls. It worsens further during pregnancy, leading to problem both to mother and foetus [23]. Iron and Folate supplementation in pregnant mother is well established in our country by National Anemia Control Program, but no concerted effort has been directed so far towards the care of adolescents. The most important way to prevent anemia is to take good diet rich in Iron. Adding vitamin c should also be provided for children which can improve the absorption of Iron [24]. Finally, by establishing more studies in developing countries and proposing strategies towards prevention of anemia may reduce the burden of anemia and its associated morbidity in this age group. Nutrition and Health Education sessions should be conducted in schools and in community to inculcate healthy eating habits. Adolescents should be informed about correct dietary practices for increasing iron intake. They should be informed about the causes, symptoms and ill effects of the anemia and importance of prophylactic/curative treatment for anemia. Also training should be given to them to understand the importance of each body part so that they don't feel shy. Apart from these, the health messages should include prevention of worm infestation, passing of blood in stools and personal hygiene.

Conclusion

The study aimed at determining the prevalence of anemia

with special reference to Iron status. The important associated risk factors and existence of morbid illness, in the school going age of both sexes. Overall frequency of consumption of iron-rich food is lower in males and females. Awareness of anemia is very poor in school-going children. Nutrition and Health Education session should be conducted in school with teachers and parents' involvement to raise awareness regarding anemia.

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