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Prevalence of anemia in under five-year-old children: a hospital-based study

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ABSTRACT

Background: Anemia affects individuals of both gender and all ages, there is a need for localized and age- and context-specific studies to improve our knowledge of prevalence patterns and associated risk factors of Indian population. The present study was done to determine the prevalence of and associated risk factors for anemia in under five-year-old children in a tertiary care teaching hospital.

Methods: A prospective observational study was carried out among under five-year-old children suffering from anemia. For the diagnosis of anemia, WHO criteria for haemoglobin (Hb) threshold in different age group were used. The growth and development statuses of children were evaluated by WHO's Child Growth Standards 2006.

Results: Total 240 anaemic children were enrolled into the study. Children of age group of between 2-5 years was more affected. A majority of the mother of anaemic children had primary level of school education. More than half of the children belong to lower socioeconomic classes (Class IV + Class V). Nutritional deficiency was the single most important causative factor in the development of anemia. Infectious diseases found to be more prevalent.

Conclusions: Nutritional deficiency, particularly, iron deficiency is the leading cause of anemia in the present study. In addition to nutritional deficiency, socioeconomic factors like, gender, maternal education and SE class also play an important role in development of anemia.

Keywords: Anemia, Pre-school children, Prevalence, Under five-year-old children

INTRODUCTION

Anaemia is the commonest nutritional problem in the world.¹ Anaemia is a condition characterized by reduction in number of red blood cells or their oxygen-carrying capacity to meet physiologic needs, which vary by age, sex, altitude, smoking, and pregnancy status.² It is estimated that 24.8% (~1.62 billion people) of global population is suffering from anemia. Estimated anaemia prevalence is 47.4% (~293 million) in preschool-aged children, which is highest in particular age-group. 41.8% (~56 million) of pregnant women and 30.2% (~468

million) of non-pregnant women are suffering from anemia.³ India has the highest prevalence (39.86%) of anemia among the 16MM (16 major pharmaceutical markets: United States of America, France, Germany, Italy, Spain, United Kingdom, Japan, Australia, Brazil, Canada, China, India, Mexico, Russia, South Africa, and South Korea).⁴ In India, as of 2016, prevalence of anemia among women of reproductive age was 51.40%; among under five-year-old children was 57.30%; and among non-pregnant women was 51.50%.⁵ There are several potential causes of anemia in the context of Indian population has been identified which include, nutritional-

low iron intake and low vitamin C intake; lower gastric acidity; parasitic infections, such as hookworm and malaria; and repeated pregnancies in case of women with reproductive age-group. 6-11 Development of anemia among under five-year-old children is multi-factorial. Many factors contribute to the occurrence of anemia, including biological, socioeconomic, environmental, health and nutrition. Now, it is well established fact that the high prevalence of anemia among under five-year-old children arises from the combination of increased iron needs due to accelerated growth and development, and is mainly associated with diets poor in heme iron. 12 In under five-year-old children, anemia causes depression of the immune system with increased propensity for infection; and reduction of cognitive function, growth and psychomotor development, which leads to difficulties in learning and reduced physical capacity. 13 These changes may persist even after appropriate drug treatment.¹⁴

Anemia affects individuals of both gender and all ages, there is a need for localized and age- and context-specific studies to improve our knowledge of prevalence patterns and associated risk factors of Indian population. The present study was done to determine the prevalence of and associated risk factors for anemia in under five-year-old children in a tertiary care teaching hospital.

METHODS

This was a prospective observational study, carried out to analyse prevalence of and associated risk factors for anemia in under five-year-old children in a tertiary care teaching hospital. The study was conducted in Department of Paediatrics, Govt. Medical College, Srinagar, Jammu and Kashmir between July 2010 to June 2012. The study was approved by Institutional Ethics Committee. Written informed consent was obtained from patient before enrolling them into the study.

Inclusion criteria

Children with the both gender and age group of 6
months to 5 years admitted in Paediatric ward of
Government Medical College, Srinagar and
diagnosed having anemia were included in this study.

Exclusion criteria

 The children who were not investigated with complete hemogram; and/or having final diagnosis as haemoglobinopathies; and/or currently consuming multivitamin and/or mineral supplements on a regular basis were excluded from the study.

For the diagnosis of anemia, WHO criteria for haemoglobin (Hb) threshold in different age group were used and according to this haemoglobin threshold is 11.0gm/dl for age group of 6 months to 5 years. ¹⁵ According to WHO criteria, severity of anemia is classified as: (i) severe anemia: Hb <7.0gm/dl; (ii)

moderate anemia: Hb 7.0-8.9gm/dl; and (iii) mild anemia: Hb 9.0-10.9gm/dl.¹⁵

Mid-upper arm circumference (MUAC) at the left arm and head circumference (HC) were measured using single-slotted insertion tapes. The growth and development statuses of children were evaluated by (i) weight-for-age ratio Z score (WAZ); (ii) height-for-age ratio Z score (HAZ); (iii) weight-for-height ratio Z score (WHZ); and (iv) HC Z score according to WHO's Child Growth Standards 2006. WAZ <-2 SD, HAZ <-2 SD, and WHZ <-2 SD were defined as underweight, stunting, and wasting, respectively. HC Z score <-2 SD was defined as small HC. 16

A detailed history of the patient was evaluated; a thorough physical examination was carried out and laboratory investigations including complete haemogram and peripheral smear study were done. Various Data on a range of socioeconomic, demographic, and childhoodrelated illnesses were captured. Important information: (i) child-information: gender, age, height, weight, feeding practices, and illness 2 weeks prior to survey; and (ii) family-specific-socioeconomic and demographic characteristics of parents, including education level, and marital status. Socioeconomic status of family of children was determined with the help of updated BG Prasad socioeconomic classification scale, which is based on per capita monthly income of the family.¹⁷

Statistical analysis

The data was entered in the excel sheet. The data was analysed using descriptive statistics. The test variables were compared using Chi-square test for qualitative variables and Student's test for quantitative variables. The p-value <0.05 was considered statistically significant for difference and association between variables.

RESULTS

As per the diagnostic criteria defined for anemia according to haemoglobin level and after fulfilling the inclusion and exclusion criteria, total 240 children were enrolled into the study.

Table 1 shows the characteristics of children suffering from anemia. Boys (n=128, 53.33%) were more affected as compared to girls (n=112, 46.67%). As per the division according to age groups, children of age group of between 2-5 years (n=134, 55.83%) was more suffered from anemia as compared age group of between 6 months-2 years (n=106, 44.17%). A majority of the mother of anaemic children had primary level of school education (n=136, 56.67%), followed by secondary or above level of education (n=86, 35.83%). 28 (11.67%) mothers of anaemic children found to be illiterate. More than half of the children (56.67%) belong to lower socioeconomic (SE) classes [Class IV: 63 (26.25%) + Class V: 73 (30.42%)].

Table 1: Characteristics of anaemic children (N=240).

| Characteristics | | Frequency | Percentage | |
|----------------------|-----------------------|-----------|------------|--|
| Gender | Girls | 112 | 46.67 | |
| Gender | Boys | 128 | 53.33 | |
| Age | >6 months- 2 years | 106 | 44.17 | |
| | >2 years- <5 years | 134 | 55.83 | |
| Education of mother | Illiterate | 28 | 11.67 | |
| | Primary | 136 | 56.67 | |
| | Secondary or above | 86 | 35.83 | |
| Socioeconomic status | Class I | 23 | 9.58 | |
| | Class II | 40 | 16.67 | |
| | Class III | 41 | 17.08 | |
| | Class IV | 63 | 26.25 | |
| | Class V | 73 | 30.42 | |

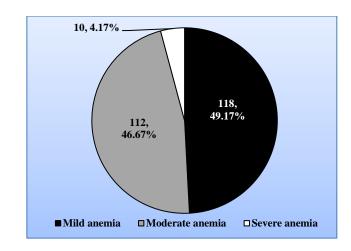


Figure 1: Distribution of the children according to severity of anemia.

Table 2: Age-distribution of the children according to types and severity of anemia.

| Types and severity of anemia | | 6 months | - 2 years | 2 years - 5 | years | Total | |
|------------------------------|------------|----------|-----------|-------------|-------|-------|-------|
| | | N | % | N | % | N | % |
| Severity of anemia | Mild | 56 | 23.33 | 62 | 25.83 | 118 | 49.17 |
| | Moderate | 66 | 27.50 | 46 | 19.17 | 112 | 46.67 |
| | Severe | 6 | 2.50 | 4 | 1.67 | 10 | 4.17 |
| Types of anemia | Microcytic | 44 | 18.33 | 54 | 22.50 | 98 | 40.83 |
| | Normocytic | 48 | 20.00 | 54 | 22.50 | 102 | 42.50 |
| | Dimorphic | 26 | 10.83 | 14 | 5.83 | 40 | 16.67 |

According to severity of anemia, 118 (49.17%) children have mild anemia, 112 (46.67%) children have mild anemia, and 10 (4.17%) children have severe anemia (Figure 1).

Out of total 240 children, 200 cases (83.33%) were due to iron deficiency. 40 cases (16.67%) showed dimorphic blood picture indicating deficiency of iron and other essential hematopoietic factors, mainly folic acid. Nutritional deficiency was the single most important causative factor in the development of anemia in children under present study.

Table 3: Distribution of the children according to concomitant diseases.

| Concomitant diseases | Frequency | Percentage |
|------------------------|-----------|------------|
| Infectious diseases | 92 | 38.33 |
| Respiratory | 80 | 33.33 |
| Gastrointestinal | 51 | 21.25 |
| Cardiovascular system | 28 | 11.67 |
| Central nervous system | 22 | 9.17 |
| Renal | 20 | 8.33 |
| Other | 32 | 13.33 |

According to age-distribution of the children according to types and severity of anemia, both age groups shown similar type of distribution (Table 2).

As per analysis of the anaemic children according to concomitant diseases (Table 3), infectious diseases (n=92, 38.33%) found to be more prevalent, followed by respiratory tract diseases (n=80, 33.33%) and gastrointestinal tract diseases (n=51, 21.25%).

According to nutritional status of anaemic children (Table 4), wasting (WHZ score <-2 SD) in 124 (51.67%) cases; stunting (HAZ score <-2 SD) in 118 (49.17%) cases and underweight (WAZ score <-2 SD) in 140 (58.33%) cases.

Table 4: Distribution of the children according to nutritional status.

| Nutritional status | Frequency | Percentage |
|--------------------|-----------|------------|
| Wasting | 124 | 51.67 |
| Stunting | 118 | 49.17 |
| Underweight | 140 | 58.33 |

DISCUSSION

Total 240 under five-year-old children with anemia were enrolled in present the study. Boys (53.33%) were more affected as compared to girls (46.67%). There are several studies available which have reported a gender-related difference in prevalence of anemia. Studies involving preschool children of Kenya and Zanzibar found that the prevalence of anemia was higher in boys while in a Philippines study, females have higher prevalence of anemia. 18-20 The higher prevalence of anemia in male children in the present may be due to the prevailing custom in India of caring more for the male child who were being brought more frequently to hospital for treatment. As per the division according to age groups, children of age group of between 2-5 years (55.83%) was more suffered from anemia as compared age group of between 6 months-2 years (44.17%). Similar type of anemia distribution for age group have been found in the study done by Kanchana et al.²¹ Physiological anemia can be seen during early infancy due to progressive decline in Hb level in first few weeks. If in infants with low reserve of iron and/or the subsequent supply of iron through dietary source is inadequate, they manifest as iron deficiency anemia. This is commonly seen in the age group of 9-24 months.¹⁵ A majority of the mother of anaemic children had primary level of school education (56.67%), followed by secondary or above level of education (35.83%). 28 (11.67%) mothers of anaemic children found to be illiterate. Many studies have reported that maternal educational level plays an important role in the anemia status of pre-school children. 18-19 In the present study most of the mothers in the study area had a low literacy rate (67.33%), similar to that seen in Malaysia.²²

In the present study, more than half of the children (56.67%) belong to lower socioeconomic (SE) classes (Class IV + Class V). There is a number of studies, which have shown an association between the socioeconomic status (SES) and the prevalence of anemia.²³ Several studies also have shown that low parental education levels, low household incomes, and demographic factors including age, sex, and family size have been associated with development of anemia.²⁴⁻²⁸ Among the different socioeconomic factors, maternal education and exposure to mass media are found to play a key role in determining their own and their children's health status. Preventive health care is supposed to be more effective those areas where accessibility of and affordability for health care services are much less.²⁹ Hence, it is always important to understand the background characteristics of women and their children to increase the awareness on preventive health care practices.

According to severity of anemia, 49.17% of children have mild anemia, 46.67% of children have mild anemia, and a very few (4.17%) children have severe anemia. Nutritional deficiency was the single most important causative factor in the development of anemia in children

under present study. At any point of time, higher number of individuals have iron-deficiency anemia than any other health problem-public health epidemic-worldwide.³⁰ Iron deficiency anemia (IDA) is the commonest nutritional disorder in the world. Around 30% of the world's population are anemic, mainly due to iron deficiency. In developing countries like India, this figure is frequently exacerbated by malaria and worm infections.³¹ The effects of IDA on children are the most dangerous one because their bodies are still developing, including the brain, which is the fastest developing organ in infancy and early childhood. IDA impair impairing the cognitive development of children.¹³ A large portion of iron deficiency is preventable with appropriate and timely intervention.

As per analysis of the anaemic children according to concomitant diseases in the present study, infectious diseases found to be more prevalent, followed by respiratory tract diseases and gastrointestinal tract diseases. Other studies have identified parasitic infections, especially hookworm infestation, as an important predictor of anemia among children. 19,20 Because of routine deworming of children aged two years and older under National Deworming Programme in India, stool examinations were not included in the present study. Anemia and infectious diseases, are often co-exist, are the major health burden in developing countries in young children. In infectious diseases, there are chances of lower bioavailability of iron due to less synthesis and release of the Hepcidin. 32

According to nutritional status of anaemic children (Table 4), wasting (WHZ score <-2 SD) in 124 (51.67%) cases; stunting (HAZ score <-2 SD) in 118 (49.17%) cases and underweight (WAZ score <-2 SD) in 140 (58.33%) cases. Present results are similar with higher prevalence of wasting, stunting, and underweight in the study conducted by Rocha et al. 33

CONCLUSION

Anemia in children is a common preventable health issue in in under five-year-old children in India. Nutritional deficiency, particularly, iron deficiency is the leading cause of anemia in the present study. In addition to nutritional deficiency, socioeconomic factors like, gender, maternal education and SE class also play an important role in development of anemia. Being more frequent in children below 2 years of age, it may lead to this vulnerable population to future hematologic, infectious, psychomotor and developmental disorders. These disorders can be primarily prevented by proper nutritional habits and adequate treatment.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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