Original Research Article

Anaemia in under five children attending a tertiary hospital in central Kerala: a cross sectional study

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ABSTRACT

Background: Anaemia is the most common nutritional problem in the world with significant impact on the neurological and cognitive development of young, growing children. India has a high prevalence of anaemia among its under-five children. The objectives of the study were to estimate the prevalence of anaemia and iron deficiency anaemia in children in the age group 6 months to 5 years.
Methods: A hospital based descriptive study was done on 51 children attending the outpatient department of a tertiary hospital. They were evaluated by obtaining a detailed history, physical examination and haemoglobin and serum ferritin estimation.
Results: The prevalence of anaemia in the present study was 41.2%. 13 (25.5%) had mild anaemia, 8 (15.7%) had moderate anaemia and none had severe anaemia. Iron deficiency anaemia was present in 17 out of 21 children (81%) with anaemia (p<0.00001). There were significant associations between haemoglobin levels and age (p=0.049) and nutritional status (moderate acute malnutrition) (p=0.034) of the children in the study.
Conclusions: The prevalence of anaemia in children under 5 years in Kerala, which has performed well in other health quality indicators, remains high. A multimodal strategy to address this public health problem is required.

Keywords: Child, Anaemia, Iron-deficiency, Prevalence

INTRODUCTION

Anaemia, defined as a low blood haemoglobin concentration, is the most common nutritional problem in the world. It is a global public health problem affecting both developed and developing nations leading to impairment in cognitive and functional ability of the affected individuals, thereby leading to serious consequences in the health, social and economic status of these nations. According to WHO statistics on the global prevalence of anaemia (2011), the worldwide prevalence of anaemia in infants and children in the age group 6months to 59 months with anaemia is 42.6%.[1] This translates to around 273.2 million children affected with anaemia globally in 2011.The prevalence varies from region to region and is estimated to be <20% in the most

developed nations, 20-60% in the developing nations and >60% in parts of Africa and Afghanistan. Among the developing countries, India has a high prevalence of anaemia in children under five at 58.4%, and Kerala has 35.6%, according to the fourth national family health survey (NFHS-4) data (2015-16).[2] Preliminary data from the most recent national family health survey (NFHS-5) (2019-20) has observed an increase in prevalence of anaemia in under five children in Kerala at 39.4%.[3]

Anaemia has a significant impact on the physical and cognitive development of children. Iron deficiency anaemia can lead to delayed motor development, poor neurocognitive development and impaired psychosocial skills in the affected children.[4,5] These effects have been attributed to the dysregulation of normal cellular

functions, impaired myelination of the corticospinal tract, a decrease in the dopamine D2 receptors in the cerebral cortex, altered metabolism of serotonin and noradrenaline, seen in iron deficiency. [4-6] The aim of the study was to estimate the prevalence of anaemia among children 6 months to 5 years of age, attending the outpatient department of a tertiary care hospital in Kerala.

METHODS

A hospital based descriptive study was done on children between 6 months to 5 years of age attending the outpatient department of Amala institute of medical sciences, Thrissur, Kerala from April to June, 2018. The objectives of this study were to estimate the prevalence of anaemia, prevalence of iron deficiency anaemia and demographic, socioeconomic and nutritional factors associated with anaemia in these children. Institutional ethics committee approval was obtained for the study. Parents and caregivers were counselled regarding study and informed consent taken prior to blood sampling.

Inclusion criteria

Children in the age group 6 months to 5 years were included in the study.

Exclusion criteria

Children with chronic systemic illnesses, children with haemolytic anaemia, bleeding disorders and children with recent illnesses, within 7 days prior to clinic visit were excluded from the study.

A detailed history was taken from the parents or caregivers on enrolment to the study at the clinic. A physical examination including height, weight, head circumference, signs of pallor, other nutritional deficiencies and systemic illnesses were looked for and recorded on a proforma. Blood samples were collected for haemoglobin and ferritin estimation after obtaining consent from the parents. A haemoglobin level<11 gm% according to WHO criteria was used to diagnose anaemia in these children. Anaemia was further classified into mild (10-10.9 gm%), moderate (7-9.9 gm%) or severe (<7 gm%) based on the WHO criteria.[7] Ferritin level of <12 ug/l was indicative of iron deficiency anaemia in the absence of infection or inflammation.[8]

Sample size

Taking the prevalence of anaemia to be 48.5% from a previous study and setting the significance level as 5% and relative precision as 15%, a sample size of 43 was calculated for this study.[9]

Statistical analysis

Data was entered into a Microsoft excel spreadsheet and then analysed using SPSS version 23. Data have been summarized using mean, standard deviation, proportion and percentages. Chi square test was used to test the significant difference between two proportions.

RESULTS

The prevalence of anaemia in children in the age group 6months to 5 years in the present study was 41.2% which was statistically significant (p=0.008). Among the 51 children screened, 30 children (58.8%) did not have anaemia, 13 (25.5%) had mild anaemia, 8 (15.7%) had moderate anaemia and none had severe anaemia. The mean haemoglobin level of children in this study was 11.05±1.31 gm% while the mean haemoglobin level of children with anaemia (Hb<11 gm%) was 9.5±2.07 gm%.

Of the 51 children in the study group, majority 39.7% (20 children) belonged to the age group ≤12 months as shown in Table 1. The mean age of children in the study population was 20.147±9.25 months. Male children constituted 56.8% (29 children) of the study population and female children 43.1% (22 children). There was significant difference in Hb level between different age groups (p=0.049) (Table 1) but not between haemoglobin levels and gender of the study participants. (p=0.401).

Among the children with anaemia,17 (81%) had a serum ferritin level <12 ug/l indicating iron deficiency anaemia. (p<0.0001) as shown in Table 2. The prevalence of iron deficiency anaemia among children under five in this study was 33.3%.

The proportion of children with wasting, stunting and underweight were 41.17% (21 children), 19.6% (10 children) and 21.5% (11 children) respectively. All 21 children with wasting had moderate acute malnutrition (MAM) according to WHO child growth standards 2006.[10] Anaemia was present in a significant proportion of children with wasting (p=0.034) (Table 3), but not in children with stunting (p=0.18) or underweight (p=0.714).

Table 1: Age and haemoglobin levels of children in the study population.

Age (months)	Haemoglobin level (g/dl) (anaemia)			Number of children	P value (chi square test)
	7-9.9 (Moderate)	10-10.9 (Mild)	≥11 (Normal)		
≤12	5	6	9	20	
13-24	3	4	7	14	0.049
25-60	0	3	14	17	
Total	8	13	30	51	

Table 2: Distribution of haemoglobin and ferritin levels in children in the study population.

Haemoglobin (g/dl)	Ferritin (ug/l)		Number of children	P value (chi square test)
	<12	>12		
<11	17	4	21	
≥11	8	22	30	0.0001
Total	24	26	51	

Table 3: Anaemia and wasting among children in the study population.

Haemoglobin (g/dl)	Wasting		Number of children	P value (Fisher exact test)
	MAM	Normal		
Mild (10-10.9)	12	1	13	
Moderate (7-9-9)	8	0	8	
Normal (>11)	21	9	30	0.034
Total	41	10	51	

*MAM- Moderate acute malnutrition

In infants (≤12 months) in the study, 11 out of 20 children (55%) had anaemia (Hb<11 g/dl). Among these children, there was no significant difference in anaemia between those who received complementary feeds at 3-6 months of age (18 children,90%) compared to those who received complementary feeds at≥6 months (2 children, 10%) (p=0.884). Majority (98%) of children in the study population had a non-vegetarian diet.

Iron deficiency anaemia (IDA) did not show any statistically significant difference with respect to age (p=0.1), gender (p=0.421) or nutritional status (p=0.21) of the children (Table 4).

Table 4: Characteristics of children with iron deficiency anaemia in the study population.

Variables	Children with IDA	Children without IDA	Total	P value
Gender				
Male	11	18	29	
Female	6	16	22	0.421
Total	17	34	51	
Age (months)				
≤12	10	10	20	
>13-24	4	10	14	0.1
25-60	3	14	17	
Total	17	34	51	
Nutrition				
Normal	15	25	40	
MAM	2	9	11	0.21
Total	17	34	51	

*IDA- iron deficiency anaemia **MAM- moderate acute malnutrition

72.5% of the children belonged to middle class families and 27.4 % to lower class families (modified Kuppuswamy scale for socio-economic status, updated for 2019).[11] All mothers in the study group were literate with an educational level of high school or graduate.

DISCUSSION

Anaemia is a major and long-standing public health problem in India, with its prevalence remaining high in children under five years over the past thirty years despite several measures taken to tackle this problem.[12] There are wide differences in the prevalence rates within the country, as evidenced from the data from the NFHS surveys over the years.

The prevalence of anaemia was found to be 41.2% in children 6 months to 5 years of age in our study, which is high compared to the state's average of 35.6% and low compared to the national prevalence of 58.4%, from the NFHS-4 data.[2] Studies from different parts of India since 2010 have reported varying prevalence of anaemia ranging from 48.5% to 95.7%.[9,13-15] Hospital based studies from Kerala by John et al, Manoj et al have shown a prevalence of anaemia of 30% and 25.8% respectively in preschool children.[16,17] The prevalence of anaemia has shown an increase over the past few years. The most recent NFHS survey (NFHS-5) (2019-20) phase 1 data has reported an increased prevalence of anaemia in children in 16 states and 2 union territories compared to the previous NFHS-4 statistics, with Ladakh (92.5%) and Gujarat (79.7%) showing high prevalence and Kerala showing a prevalence of 39.4% (a percentage increase of 3.8%).[3]

In our study, 25.5% children (13 children) had mild anaemia, 15.7% (8 children) had moderate anaemia and none had severe anaemia. This is in concordance with data for Kerala from the NFHS -4 (2015-16) which showed that 23 % children under five years were mildly anaemic, 13% were moderately anaemic, and 0.4 percent had severe anaemia. Kanchana et al and John et al has reported a prevalence of 26.6%, 46.8% and 3.6% and 51.2%, 43.9% and 4.9% respectively for mild, moderate and severe anaemia in their studies.[13,16] The wide inter regional differences in prevalence of anaemia and its severity can be attributed to the multifactorial aetiology of anaemia and other factors potentiating it including

genetic, nutritional, environmental, socioeconomic and cultural factors which differ between region to region and between communities.

17 (81%) children with anaemia had low levels of ferritin (<12 ug/l) which was statistically significant (p<0.0001). The prevalence of iron deficiency anaemia among children 6 months to 5 years of age in this study was 33.3%. Other studies by John et al, Ray et al, Pasricha et al, Santokh et al have reported prevalence of IDA of 25.6%, 56%, 61.9% and 69.5% respectively.[16,18-20] The single most common nutritional cause of anaemia in children is iron deficiency anaemia. 4 children (19%) with anaemia in the present study had normal ferritin levels. Apart from iron deficiency anaemia, various other nutritional deficiencies like folic acid, riboflavin, vit B12, vit A, C, E, acute and chronic infections, haemoglobinopathies etc may cause anaemia in individuals.[7] 15.6% of children (8 children) had low ferritin levels (<12 ug/l) with normal haemoglobin levels (Hb≥11 gm%) indicating iron deficiency without anaemia. In the sequence of progressive iron deficiency, the earliest biochemical manifestation is a decrease in serum ferritin due to depletion of tissue iron stores. Anaemia is a late manifestation in the process. Hence estimating serum ferritin may be a better tool to diagnose iron deficiency early in children, in the absence of infection or inflammation.

The majority of cases of anaemia were found in children less than 24 months of age (85.7%). There was a significant association between age and anaemia (p=0.049). This is similar to findings from other studies which have also reported higher prevalence of anaemia in less than 24 months of age.[16-18,21,22] The high risk of anaemia in this age group is influenced mainly by the rapid growth during this period. IDA was seen more in younger children ≤24 months; there was significant difference between the mean ages of children with iron deficiency anaemia (15.706±7.3124 months) and children without iron deficiency anaemia (22.368±9.4174 months) (p=0.014).

There was no association between anaemia and gender in this study (p=0.401). This is unlike findings from other studies which have shown a significant association between male sex and anaemia.[18,19,23] The higher prevalence of anaemia in male children has been attributed to the greater growth velocity in them compared to female children. Iron deficiency anaemia also did not show any significant association with gender in our study (p=0.421).

Rice (29.4%) and banana powder (55%) which are poor sources of iron were the chief complementary feeds in children <1 year of age, a practice based on local customs; ragi, rich in iron was given only in 15.6%. This may be a contributory factor in the occurrence of iron deficiency anaemia in this age group, but was not statistically significant (p=0.964).

Our study showed significant association between moderate acute malnutrition (MAM) and anaemia (p=0.034) but not between MAM and iron deficiency (p=0.21) among children in the study population. This may be explained by the fact that anaemia in moderately malnourished children is usually due to multiple micronutrient deficiencies and not exclusively due to iron deficiency alone.[24]

Analysis of the socio-economic profile of the children in the study showed no statistically significant association between haemoglobin levels of children and maternal age (p=0.084), birth order (p=0.179), socio economic status of the family (p=0.176) or educational status of the mother (p=0.856). Several studies have found a significant association between low socio-economic status and anaemia in children which was not found in this study.[13,15,19] Improved education status of mothers has not had an impact on the occurrence of anaemia, according to the present study, a finding which has also been reported in studies by Manoj et al and Pasricha et al.[17,19] This may be partly due to inadequate knowledge regarding infant and child nutrition among the mothers which need to be addressed for effective prevention of anaemia among infants and young children.

The alarming trend in increase in prevalence of anaemia poses a significant public health problem for India. Kerala, a state which has shown good performance in several health quality indicators, also has demonstrated a rising trend in prevalence of anaemia in under-five children. Anaemia preventive measures in the last decade have focused mainly on preventing iron deficiency anaemia in children and other vulnerable groups chiefly through strategies like iron folic acid supplementation (IFA) under the national iron plus initiative program.[12] Effective strategies to prevent deficiencies of other nutrients like zinc, copper, vitamin B12 and vitamin A also are needed.[24] Additional measures to control anaemia in preschool children include earlier IFA supplementation in low birthweight infants, delayed cord clamping at birth, development of local innovative iron and nutrient rich complementary feeds in infants, education to mothers regarding infant and child nutrition, periodic de worming, enhancers of iron absorption in diet, treatment of common infections etc.[25,26] Region specific interventions must be undertaken in areas which have high burden of haemoglobinopathies and malaria. Further research is required to evaluate aetiology, test feasibility of additional interventions and implementation issues of existing programs.

Limitations

Apart from iron deficiency anaemia, a work up for other aetiologies of anaemia was not done because of financial constraints. A detailed dietetic evaluation of the children with calculation of specific nutrient intake could not be undertaken.

CONCLUSION

The prevalence of anaemia and iron deficiency anaemia were high in under five children. There were significant associations between haemoglobin levels and age and nutritional status (MAM) of the children in the study but not with gender, maternal age, socio-economic status of the family or maternal education. A multimodal strategy to address this public health problem is urgently needed.

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