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Research Article

A STUDY ON RISK FACTORS AND CLINICAL PROFILE OF ANEMIA AMONG CHILDREN AGED 6 MONTHS–60 MONTHS AT A TERTIARY CARE CENTER IN TAMILNADU

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ABSTRACT

Objectives: Anemia is an alarming health problem worldwide. Although it occurs in all age groups, children are more severely affected. The prevalence of anemia in children under 5 years in Tamil Nadu was 57.4% in 2021. This study aims to identify risk factors and clinical profile of anemia among children aged 6–60 months.

Methods: This cross-sectional and observational study was carried out from January to December 2021. Children with newly diagnosed anemia were included while chronic anemia and secondary anemia were excluded from the study. A detailed history was recorded and relevant investigations were completed in a pre-structured proforma. SPSS software version 23 was used for statistical analysis. Pearson's correlation and ANOVA were used for analysis and $p<0.005$ was considered significant.

Results: Among the 260 children included in the study, 51.9% were between 13 months and 36 months, 61.5% were males, 38.1% belonged to upper lower socioeconomic status, 86.2% were born at term, 70.1% were introduced to cow's milk at 6–12 months, most of the children had anthropometric range in 3rd–50th percentile, 55.3% had PICA, pallor was seen in all children, hematological indices were low ($p<0.005$), and 83.8% had microcytic hypochromic picture in peripheral smear.

Conclusion: Iron deficiency anemia is a preventable cause of cognitive impairment and prompt interventions at the earliest will prevent morbidity and mortality secondary to anemia. Strategy to address poverty and awareness campaign to women on breastfeeding and better nutrition by policy makers can make a difference in preventing anemia in children.

Keywords: Anemia, Cow's milk, PICA, Total Iron binding capacity.

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INTRODUCTION

The word anemia means "without blood" in Greek [1]. The most common hematological disorder with multiple etiologies is anemia. Due to poverty and ignorance, most children in our country are ill fed and under-nourished predisposing them to anemia. Iron deficiency anemia is becoming the most widespread nutritional disorder in the world [2]. Hence, anemia can be considered a public health epidemic. According to National Family Health Survey, India (NFHS V 2019-21), the prevalence of anemia in children of Tamil Nadu is 57.4% [3]. If anemia affects children, who are the future citizens, the wheel and welfare of the community are put to risk. Identification of risk factors for anemia in children will help in prompt interventions and preventing complications of anemia.

Aims and objectives

This study aims to identify factors contributing to anemia in children aged 6–60 months.

METHODS

This was a cross-sectional study conducted in children aged 6 months–60 months at the Department of Pediatrics, Government Villupuram Medical College and Hospital, Mundiyampakkam, Tamilnadu, India, from January to December 2021. Children who were newly diagnosed with anemia according to the WHO guidelines (Hb<11.0 g%) were included in the study [4]. Children who were already diagnosed with anemia and on treatment, those with hematological diseases and anemia, those suffering from chronic kidney disease, and those suffering from malignancies were excluded from the study. Institutional Ethics Committee approval was obtained before initiating the study. Written informed consent was obtained from parents/caregivers before recruiting children. Detailed sociodemographic profile with parent's education, diet consumed, and family structure was recorded in a pre-structured proforma. Revised Kuppuswamy scale was used for assessing socioeconomic status [5]. A general physical examination looking for pallor, icterus, edema, lymphadenopathy, signs of vitamin deficiency, and anthropometric measurements was also performed. After a comprehensive systemic examination, investigations for anemia (complete hemogram, red blood cell indices, peripheral smear, reticulocyte count, red cell distribution width, serum ferritin, and total iron binding capacity) were completed in all children.

Data entry was done in Excel spreadsheet (Microsoft Corporation, Washington, USA) and analyzed with IBM SPSS Statistics for Windows, Version 23.0. (Armonk, NY: IBM Corp). Descriptive data were given in summary statistics while significance of relationship was analyzed with Chi-square test, Pearson's correlation and one-way ANOVA tests. $p<0.05$ was considered significant.

RESULTS

In the present study to identify factors contributing to anemia in children in the age group of 6–60 months, a total of 269 children were recruited after obtaining written informed consent. All investigations could not be completed in nine children (n=9/269) and their data were excluded from analysis. Thus, the final analysis included data from 260 children (n=260).

More than half of the children were in the age group of 13–36 months (51.9%) (n=135/260) followed by 34.6% in the age group of 6–12 months (n=90/260). Most of the children with anemia were

males (61.5%) (n=160/260). Many children belonged to upper lower class (38.1%) (n=99/260) followed by lower middle class (33.5%) (n=87/260). Most of the children were born at term (86.2%) (n=224/260).

Most of the children were exclusively breast fed till 6 months of age (78.5%) (n=204/260). Among the children who were introduced to cow milk (81.2%) (n=211/260), 70.1% (n=148/260) were introduced to cow milk at the age of 6–12 months. Only 12 children in the study group were introduced to formula feeds (4.61%) (n=12/260). Many of the children were already introduced to non-vegetarian diet (72.2%) (n=164/260). Bare foot walking, as an environmental risk factor for worm infestation and anemia, was seen only in 27.3% of the children (n=71/260). In the study of anthropometry among children, weight for age (51.5%), height for age (33.8%), and weight for height (42.1%) were distributed in the 3rd–50th percentile (Fig. 1).

In the present study, PICA was the most common symptom complained by children with anemia (55.3%) (n=136/260), among which geophagia was the most common (49.7%) (n=77/136) followed by pagophagia (37.4%) (n=58/136) and amylophagia. Children also showed symptoms which included lethargy (21.2%) (n=55/260), passage of worms (8.8%) (n=23/260), and easy fatigability (5.8%) (n=15/260). Symptoms which predicted severe anemia such as irritability (3.5%, n=9/260) and breathlessness (0.8%, n=2/260) were less common.

In the general examination of children for features of anemia, pallor was present in all children (100%) (n=260/260) and cheilitis was present in 10% (n=26/260), while features of severe anemia such as glossitis (3.8%) (n=10/260), koilonychia (1.5%) and leukonychia (0.4%) (n=1/260) were rare. Hematological indices showed low mean corpuscular volume in 81.5% (n=212/260), low mean corpuscular hemoglobin concentration in 69.2% (n=180/260), high red cell distribution width in 85% (n=221/260), high total iron binding capacity in 63.1% (n=164/260), low serum iron in 67.3% (n=175/260), low serum ferritin in 59.6% (n=155/260) along with peripheral smear showing microcytic hypochromic picture in 83.8% (n=218), and Mentzer index showing iron deficiency anemia in 89.2% (n=232/260).

Severe anemia was seen more in the age group of 13-36 months 29.63% (n=40/135) followed by age group of 6–12 months 22.22% (n=20/90) (p=0.024). Severe anemia was seen equally in male children 26.25% (n=42/160) and female children 24.0% (n=24/100) (p=1.98). There was no statistical difference in incidence of severe anemia among various socioeconomic states lower (23.91%, n=11/46), upper lower (26.26%. n=26/99), or lower middle (28.73%, n=25/87) (p=0.546). There was no difference in incidence of severe anemia between children taking vegetarian diet (26.98%, n=17/63) and non-vegetarian diet (28.65%, n=47/164) (p=0.904). Severe anemia was seen in children who were born pre-term (41.67%, n=15/36) than children who were born in term (22.76%, n=51/224) (p=0.033). Severity of anemia was not associated with early introduction to cow milk (p=0.226).

Mean corpuscular volume was low in 27.6% of children with severe anemia (n=59/218) (p=0.004), mean corpuscular hemoglobin was low in 29.24% of children with severe anemia (n=62/212) (p=0.002), and mean corpuscular hemoglobin concentration was low in 33.14% of children with severe anemia (n=60/181) (p<0.001). Platelet count was higher in children with severe anemia (90.58%) (n=77/85) (p<0.001). Serum iron was low in children with severe anemia (91.43%) (n=160/175) (p=0.0005). Total iron binding capacity was higher in children with severe anemia 84.76% (n=139/164) (p=0.0005). Serum ferritin was low in children with severe anemia 93.55% (n=145/155). Red cell distribution width CoV was higher in children with severe anemia 85.07% (n=188/221) (p=0.034) (Table 1).

DISCUSSION

This study was primarily designed to determine the risk factors and clinical profile of anemia among children aged 6 months–60 months attending the Department of Pediatrics at a tertiary care hospital. This age group was chosen as these children are more vulnerable to nutritional anemia due to early introduction of cow's milk and improper weaning practices.

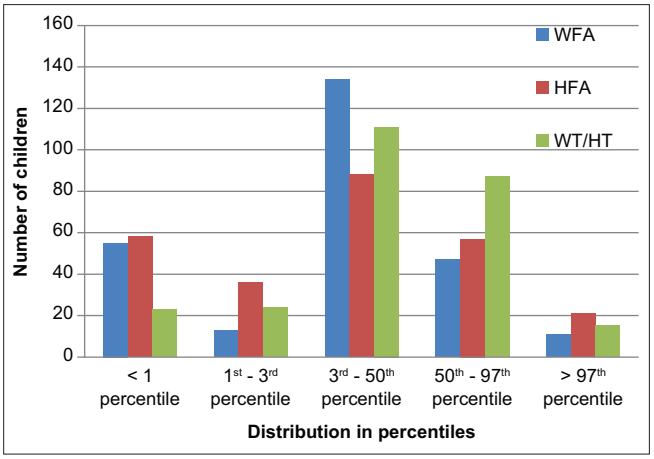

Fig. 1: Distribution of anthropometry (weight for age, height for age and weight for height) among children with anemia

Table 1: Correlation of various parameters with hemoglobin indicating importance in anemia

Parameter correlated with hemoglobin	R	p
PICA	0.06	0.345
Mean corpuscular volume	0.413	0.004
MCH	0.434	0.0005
MCHC	0.408	0.0005
Platelet count	−0.27	0.0005
Serum iron	0.767	0.0005
TIBC	−0.671	0.0005
Serum ferritin	0.601	0.0005
Red cell distribution index – CoV	−0.279	0.0005
Mentzer index	−0.205	0.001

MCH: Mean corpuscular haemoglobin, MCHCL: MCH concentration, TIBC: Total Iron binding capacity

A total of 260 children were recruited based on IMNCI guidelines [6]. After doing targeted history taking and a detailed clinical examination, these children were subjected to complete hemogram, peripheral smear examination, and reticulocyte count besides iron studies. In the present study, percentage of children with mild anemia was 15.8%, moderate was 58.8%, and those with severe anemia was 25.4%. However, in a study by Gebreweld *et al*. among children under 5 years (sample size 404), 67.5% had mild anemia, 31.3% had moderate anemia and only 1.2% were severely anemic [7]. This could be attributed to the difference in ethnicity and food habits of the children.

In the present study, male children outnumbered females at a ratio of 1.5:1 which was similar to results obtained by Dos Santos *et al*. but Saba *et al*. reported a ratio of 1.4:1.3 [8,9].

This implies that selective nutritional deprivation of female children in rural areas is on the decline. This is in contrast to the study conducted by Verma *et al*. in which incidence in females was greater than that of males [10].

In the present study, anemia was more prevalent in upper lower and lower middle socio economic strata which was similar to the study by Chellan *et al*. [11]. This prevalence can be explained by the fact that most of the mothers of children were daily wage workers and hence diet of children remain unsupervised. In the present study, only 27.8% children were vegetarian but there was no statistically significant

difference in anemia between children on non-vegetarian diet and children on vegetarian diet. This was similar to the study by Indhumathi *et al*. (16.7% of vegetarian children among 150) [12].

About 13.8% of children in the present study were born as preterm neonates which was similar as the study by Indhumathi *et al*. (11.3% in 150 children) [12]. Anemia was more severe in children born as pre-term neonates (41.6%) and those introduced early to cow's milk. This was similar to the study by Ferri *et al*. for anemia in children born as small for gestational age (26.5%) (RR – 1.578) and introduction to cow's milk at 6 months (RR – 1.687) [13]. This is explained by the low iron stores at birth in pre-term neonates and the utilization of iron stores due to rapid catch up growth. Introduction of cow's milk in early life precipitates as well as aggravates iron deficiency anemia [14].

Thrombocytosis was associated with severe anemia in 32.7% of children in the present study. This is explained by reactive thrombocytosis to iron deficiency anemia where erythropoietin stimulates thrombopoietin receptors and thus megakaryocytes [15].

In the present study, though ferritin was low in children with severe anemia, 46.1% of children with anemia had normal serum ferritin. This was similar to the observation by Duque *et al*. where there was no correlation between ferritin levels and iron deficiency (low ferritin in 43.6%, n=4955) [16]. This is because ferritin is an acute phase reactant that increases in response to any inflammation. The presence of a subclinical infection or latent inflammation can cause elevation in ferritin, which masks the true iron stores, especially in a hospital based study like ours [17].

In the study of environmental risk factors, PICA was seen in 55.3% of children with anemia and this was in contrast to the observations by Sadeghzadeh *et al*. who did not observe any relation between PICA and anemia (6.7%, n=57/872) but observed prevalence of geophagia more (62.3%, n=35/57) in children with PICA [18]. This is better explained by Young *et al*. who examined the nutrient-deficiency hypothesis in which geophagia would be an attempt to compensate for the lack of iron, zinc, or calcium. Hence, people with the greatest needs would practice geophagia more often [19].

To conclude, this study was undertaken to identify risk factors which help in early diagnosis of anemia and early initiation of therapy. The present study found positive correlation between early weaning with introduction of cow's milk and iron deficiency anemia. PICA was seen more in children with anemia and can be used as a marker for high risk of anemia. Risk factors for anemia like barefoot walking can be addressed by proper health education. Strategy to address poverty and awareness campaign to women on breastfeeding and better nutrition by policy makers can make a difference in preventing anemia in children.

AUTHOR'S CONTRIBUTION

KK conceptualized, designed study, and collected data. AV designed study and compiled data. AN collected data and prepared manuscript. TK critically analyzed data and approved manuscript.

CONFLICTS OF INTEREST

None declared.

AUTHORS' FUNDING

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