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Original Research Article

PREVALENCE AND DETERMINANTS OF MICROCYTIC HYPOCHROMIC ANEMIA IN CHILDREN UNDER FIVE IN CHIKKAMAGALURU: A TWO YEAR STUDY.

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ABSTRACT

Background: Microcytic Hypochromic anemia is a common nutritional and hematological disorder among children under five years, especially in rural and semi-urban areas. Chikkamagaluru, Karnataka, being a region with diverse socio-economic and dietary practices, presents an unique opportunity to study the prevalence and determinants of this condition. **Objective:** To evaluate the prevalence, etiological factors and severity of Microcytic Hypochromic anemia among children under five years in Chikkamagaluru district over a two-year period (December 2022- December 2024).

Methods: A cross- sectional study was conducted involving 373 childrens aged 6 months till 5 years. Participants were selected using stratified random sampling from Urban and rural areas of Chikkamagaluru. Hematological parameters, including Hemoglobin levels, Mean Corpuscular Volume (MCV), and Mean Corpuscular Hemoglobin Concentration(MCHC) were assessed. Nutritional history, socio-economic status and dietary habits were collected using structured questionnaires. Peripheral Smear examination was performed for morphological confirmation.

Results: Preliminary analysis indicates a significant prevalence among the study population, with higher rates observed in rural areas compared to urban settings. Iron deficiency emerged as a leading cause, followed by other nutritional deficiencies and parasitic infections. Severity was categorized as mild, moderate or severe based on hemoglobin levels with majority falling under mild category (47.7%)

Conclusion: Microcytic Hypochromic anemia remains a significant public health challenge among children under the age of five in Chikkamagaluru. Addressing nutritional deficiencies and improving public health public health interventions are essential to reduce its burden. This study underscores the need for region-specific strategies to combat anemia in young children.

Keywords: Microcytic hypochromic anemia, children under five, iron deficiency, nutritional anemia.

INTRODUCTION

Anemia is a significant global public health concern particularly among children under five years of age. It is characterized by reduced hemoglobin levels, leading to impaired oxygen transport and a range of adverse health outcomes. According to World Health Organisation (WHO), anemia affects approximately 39.8% of children aged 6 months -5 years globally, equating to about 269 million children with the highest proportion of anemia (47.4%) among preschool-aged children. According to the National Family Health Survey (NFHS-4) conducted in 2015-16, approximately 58.6% of children aged 6 months -5 years in India were anemic. In Karnataka, the prevalence was slightly higher at 60.9%.[1]

There are potentially multiple causes of anemia in developing countries like India which include poor dietary practices, iron deficiency, parasitic infections, low socio-economic status and inadequate healthcare access. The demand for iron increases during rapid

growth periods, making children under five especially vulnerable. It is now a known fact that a high prevalence of anemia among under 5-year-old children arises from the combination of increased iron needs due to accelerated growth and development and is mainly associated with diet which is poor in heme iron.[1]

The World Health Organization (WHO) and United Nations International Children Emergency Fund (UNICEF) have recommended that breastfeeding should be initiated within the 1st hour of birth and exclusive breastfeeding should be continue for the first 6 months of life. From the age of 6 months, children should begin eating complementary foods while continuing to breastfeed for up to 2 years and beyond,[2] as the child has maximum brain growth and myelination in this period. Even though human milk has low iron content, it is better suited for need of a growing infant, having much better bioavailability for iron than cow's milk.[3] If the complementary feeds are mostly vegetarian items and cow's milk, then there is risk of developing deficiency of calcium, iron, zinc, vitamin A, folic acid, vitamin C, and vitamin B12.[3] Early weaning practices lead to contamination and infections because of unhygienic preparations and late weaning can lead to growth faltering and malnutrition. Hence, most children fall into the pit of malnutrition during the weaning and post-weaning phase.[3]

Anemia also causes suppression of the immune system with increased tendency for infection, depression of cognitive function, growth, and psychomotor development, leading to difficulties in learning and reduced physical capacity.[4] Since it is a multifactorial condition, even the history of the patient is as important as the physical examination and laboratory tests. Looking at the condition from all its aspects will help reduce the disease burden in our state and country. The most common cause is said to be nutritional anemia, commonly iron deficiency. Therefore, the term iron deficiency anemia is being used synonymously with the term anemia in children. In Karnataka, NFHS-5 fieldwork was conducted from July 10, 2019, to December 11, 2019, by Nielsen India Pvt. Ltd and an increase in anemia of children from 60.9% to 65.5% in the age group of 6 months–5 years was observed.[1]

Although anemia remains a widespread public health problem, it contributes to significant proportion of children death in developing countries. As such, various factors like parasite have impact on cognitive development and physical growth, studies on the magnitude of anemia among under five age children have paramount importance. Meanwhile, there is a very limited study on the prevalence and associated factor of anemia under five years of age in our study area. Therefore, this study aimed to determine the prevalence of anemia and its associated factors under five children in Chikkamagaluru, Karnataka.

MATERIALS AND METHODS

This is a prospective observational study conducted with 200 children aged 6 months–5 years over a time span of 2 years (December 2022-December 2024) in a tertiary hospital, Chikkamagaluru. The included children were evaluated and screened for anemia by hemoglobin estimation and other relevant investigations. Informed consent was obtained from the parents or the legal guardians of the children. The inclusion criteria were children aged between 6 months and 5 years with clinical features of anemia or with Hb <11 g/dl. Children on treatment were excluded from the study.

The sample size of 373 was calculated using the standard statistical formula for proportions: $N=Z^2*P*Q/d2$ where P is the estimated prevalence – 41%, Q = 100–P = 59%, and d= acceptable margin of error for proportion being estimated (0.05%) Hence, the sample size N= 0.93174/0.0025=372.7 ~373.

On admission, a detailed history with emphasis on current and past symptoms was taken, with importance to the nutritional status of the child, their socioeconomic status, and history of breastfeeding and weaning. Children selected for the study underwent hematological work-up including complete hemogram, peripheral blood smear, and red blood cell indices. Further workup, such as an iron profile, reticulocyte count, red cell distribution width, folic acid, and vitamin B12 levels, was tested if required.

The data were analyzed using the Chi-square test, a statistical test which is applied to sets of categorical data to evaluate any observed difference. $p < 0.05$ is considered as statistically significant.

RESULTS

According to Indian Academy of Pediatrics (IAP) classification of malnutrition and Waterlow's classification, it was also seen that 43.9% of the anemic children had normal nutritional status whereas 54.9% were underweight and a minor percentage (1.1%) suffered from wasting and stunting. In this study also, the nutritional status of a child is being found highly correlated with the incidence of anemia ($p<0.001$, Table 1). Mother's education status was also taken as a factor to compare the proportion of anemia. [Table 1]

Table 1: The sociodemographic profile of the Study population

DEMOGRAPHICS	FREQUENCY(N=373)	PERCENTAGE
AGE		
6months-2 years	292	78.3
2-5 years	81	21.7

GENDER		
Male	189	50.6
Female	184	49.3
SEVERITY OF ANEMIA		
Mild	178	47.7
Moderate	139	37.2
Severe	56	15
PERIPHERAL SMEAR		
Normocytic	74	19.8
Microcytic	294	78.8
Dimorphic	5	1.34
NUTRITIONAL STATUS		
Normal	164	43.9
Grade-I	105	28.2
Grade-II	90	24.1
Grade-III	8	2.1
Grade-IV	2	0.5
Wasting and Stunting	4	1.1
MOTHER'S EDUCATION		
Post graduate	2	0.5
Graduate	70	18.7
Secondary	199	53.3
Primary	47	12.6
Illiterate	55	14.7
SOCIO-ECONOMIC STATUS		
Lower	27	7.23
Upper-lower	92	24.6
Low-middle	142	38
Upper-middle	104	27.8
Upper	8	2.1
CONCURRENT ILLNESS		
CNS symptoms	7	1.8
Gastrointestinal symptoms	76	20.3
Chronic Infections	254	68
Respiratory Symptoms	36	9.6
EXCLUSIVE BREAST FEEDING		
Till 6 months	103	27.6
< 6 months	158	42.4
Not Breast fed	112	30

It is also noted that, 4 children who suffered from wasting and stunting, socio-economic status was poor and mother was illiterate but breast feeding was more than a year.

DISCUSSION

Table 2: The WHO Criteria for the diagnosis of anemia and further division of the degree of anemia

Population	Non-anemia (Hb in gm/dL)	Anemia as per severity(Hb in gm/dL)		
		Mild	Moderate	Severe
Children(age 6-39 months)	≥11	10–10.9	7–9.9	<7
Children(age 5-11 years)	≥11.5	11–11.4	8–10.9	<8
Children(age 12-14 years)	≥12	11–11.9	8–10.9	<8

Anemia remains a significant public health concern, particularly in pediatric population. This study highlights that anemia was more prevalent in 2-5 years of age (21.7%) as compared to 6months-2 years (78.3%). This aligns with findings from Singh and Parihar,[5] and Gebrewald et al,[6] who also reported higher anemia prevalence in children under 2 years, attributing it to insufficient iron intake during the weaning period and improper dietary practices, such as early cow's milk introduction.

The gender based distribution show almost equal prevalence. In males, 50.6% showed anemia whereas females showed 49.3% anemia. This prevalence is inconsistent with study done by Parkin and Maguire,[7] and Gebrewald et al.[6] However, it is essential to note that gender predominance in anemia may vary across studies and the underlying reasons could be linked to sociocultural and biological factors.

The severity of anemia was categorized into mild (47.7%), moderate (37.2%) and severe (15%). with

mild anemia being more prevalent. This prevalence could show variation depending upon various factors like low resource settings. According to World Health Organization, moderate anemia is frequently reported in low resource settings.[8]

The study also observed variation in peripheral smear findings, with microcytic hypochromic blood picture being the most common pattern (78.8%), consistent with etiology of Iron deficiency anemia.

Nutritional status plays a pivotal role in the development of anemia, as evidence by the fact that 56.1% of children and varying degrees of malnutrition. Malnutrition exacerbates anemia by impairing iron absorption and limiting access to nutrient rich foods. Similar correlations were observed in studies by Santos et al,[9] and Kanchana et al,[8] emphasizing the bidirectional relationship between anemia and malnutrition.

Exclusive breastfeeding practices and socioeconomic status were additional factors influencing anemia prevalence. Notably, children who were exclusively breastfed for less than six months exhibited higher prevalence of anemia (42.4%), as early cessation of breastfeeding often results in inadequate dietary iron intake. Lower socioeconomic status was also associated with higher anemia rates, reflecting limited access to iron-rich foods and healthcare services.

Biochemical evaluation was also done for all children participated in the study, which revealed 62% of children has low ferritin levels, reinforcing the role of iron deficiency as the leading cause of anemia. This finding underscores the need for routine ferritin assessment, as it serves as a sensitive and specific marker for Iron deficiency anemia, even in the presence of inflammation.

CONCLUSION

Overall, this study underscores the multifactorial etiology of anemia in young children, with dietary deficiencies, malnutrition and socioeconomic factors playing key roles. Targeted interventions, including nutritional education, iron supplementation and breastfeeding promotion are crucial for mitigating the burden of anemia in this vulnerable population. Since most of the younger children with mild or moderate anemia might be asymptomatic, a laboratory screening should be done at 12 months of age with appropriate long-term follow-up. It is also important to counsel and educate the parents, especially the mother on nutritional practices and hygiene measures to prevent the occurrence of anemia in the child.

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