Original Research Paper

STUDY OF PREVALENCE, ETIOLOGY, MORPHOLOGICAL TYPES OF ANEMIA INNCHILDREN IN DIFFERENT AGE GROUPS

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ABSTRACT:

Background: Anemia is a global health problem affecting persons of all ages and economic groups. According to the National Family Health Survey (NFHS-4) data, the incidence of anemia in urban children is 55.9%, rural is 59.4%, and overall is 58.4%[10] .In the developing world, in less than five years of age, 42% of children and 53% of children 5–14 years of age are anemic [15] . **Objective:** The aim of the present study is to study the prevalence, etiology, morphological types of anemia in children in different age groups with regard to genders, their feeding practices and socioeconomic status. **Results:** The prevalence of anemia in this present study was 66.7% more in females compared to males. Microcytic hypochromic anemia was the most common type.Iron deficiency anemia was the most common etiology. Severe anemia cases were more in class 4 and class 5 socioeconomic status. **Conclusion:** Nutritional anemia due to iron deficiency is the leading trace element deficiency seen in children.Creating awareness, providing health education to mothers and caregivers helps to prevent iron deficiency anemia in infants and young children.

KEYWORDS: Anemia , Etiology, Morphology, Prevalence

INTRODUCTION:

Anemia is a manifestation of various underlying deficiency and disease conditions . Anemia effects overall development of children. A reduction in the blood hemoglobin concentration two standard deviations below the mean for the normal population with respect to age, gender, and altitude of residence is known as anemia.In any country prevalence of anemia, more than 40 percent is considered as a public health problem as per WHO criteria [15]. According to the World Health Organization (WHO) data, the prevalence of iron deficiency anemia (IDA) in industrialized countries and in non-industrialized countries is 10-20% and 50- 60% [11], respectively.According to World Health Organization (WHO), data globally 1.62 billion people are anemic, with the highest prevalence of anemia (47.4%) among preschool-aged children; of these 293 million children, 89 million live in India. There were many studies about the prevalence of anemia at the community level. The present study is done for early diagnosis and better management of children with anemia. The aim of the present study is to study the prevalence, etiology and morphological types of anemia in children in different age groups with regard to genders, their feeding practices and socioeconomic status.

MATERIAL AND METHODS:

The present study was a hospital based observational study for period of 18 months from January 2019 to June 2020 .This study includes children admitted to tertiary care hospital ,department of pediatrics ,GGH , Kakinada during the study period.

INCLUSION CRITERIA:

After obtaining consent from guardians children in the age group of 6 months to 12 years were admitted to Pediatric wards.

EXCLUSION CRITERIA:

1) Cases that are referred to higher centers.

2) Children whose parents are not willing to give consent.

3) Moribundly ill patients.

STATISTICAL ANALYSIS:

Data entry was done in MS -EXCEL. 2019. Statistical package for social sciences (SPSS) version 23was used for data analysis. Descriptive data were represented in frequencies, percentages. Chi-square test was applied, and p- values were calculated to find a statistical difference between categorical values. Statistical analysis was carried out at a 5% level of significance,

and p-value <0.05 was considered significant.

OBSERVATION AND RESULTS:

1040 children who were admitted in pediatric ICU and wards during the study period (JANUARY 2019-JUNE 2020) were screened for anemia. Out of them 1023 children were enrolled in the study.

TABLE 1: PREVALENCE OF ANEMIA

The total number of children enrolled	1023
Number of anemia cases	683
Percentage of anemia	66.7%

Out of 1023 children screened, 683 had anemia based on the WHO cut off values. The prevalence of anemia in our study was 66.7%.

TABLE 2: Age-wise distribution of anemia cases

| Age group	Number of children studied	Number of Anemia cases	Percentage
6 mon-23 months	334	237	70.9%
2 years-5 years	368	252	68.4%
6 years – 9 years	218	126	57.7%
10-12 years	120	68	56%

The prevalence of anemia was 70.9%,68.4%,57.7% and 56% in the age group of 6 months – 23 months, 2-5 years,6 -9 years and 10-12 years, respectively.

TABLE 3: Morphological types of anemia

Peripheral smear	Mild	Moderate	Severe	Total number	Percentage
Microcytic hypochromic	64	303	196	563	82.4%
Normocytic normochromic	14	36	46	96	14.05%
Macrocytic normochromic	-	-	14	14	2.04%
Dimorphic	-	-	10	10	1.5%

Out of 683 children with anemia, 563 (82.4%) had microcytic hypochromic anemia,10 (1.5%) had dimorphic anemia, and 96 (14.05%) had normochromic normocytic anemia, and 14 (2.04%) had macrocytic anemia.

Figure 1 : Etiology of anemia
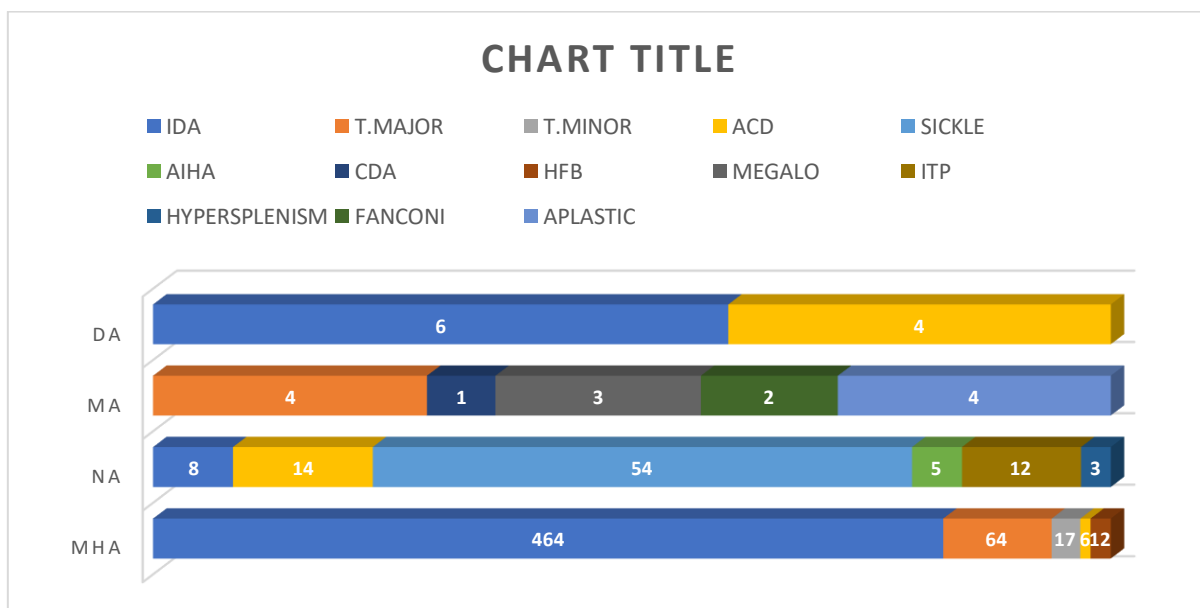
DA-dimorphic anemia, MA-macrocytic anemia, NA-normocytic anemia, MHA-microcytic hypochromic anemia Among children with microcytic hypochromic anemia, iron deficiency anemia was seen in 464 cases (82.4%), thalassemia major in 64 cases (11.3%); thalassemia trait in 17 cases (3%); persistent hereditary fetal hb seen in 12 cases (2.13%) and anemia of chronic disease was seen in 6 cases (1%). Out of 14 children with macrocytic anemia, 3 had (21.4%) B12 deficiency,2 had (14.3%) Fanconi anemia, 1 had (7.14%) congenital dyserythropoietic,4 had (28.6%) aplastic anemia and, 4 had (28.6%) folic acid deficiency. In normocytic anemia, sickle cell disease (hbss and hbsc) was seen in 54 cases (56.25%), immune hemolytic anemia was seen in 5 cases (5.2 %), anemia of chronic disease was seen in 14 cases (14.6%), immune thrombocytopenic purpura was seen in 12 cases (12.5%) , anemia secondary to hypersplenism was seen in 3 cases (3.1%), acute blood loss due to GI bleed was seen in 8 cases (8.3%),and Dimorphic anemia was seen in 10 cases.

TABLE 4 : Relationship between age and etiology

ETIOLOGY	6 months -23months	2 – 5 years	6- 9 Years	10-12 Years
IDA	187	188	69	26
THALASSEMIA	26	27	19	16
SICKLE	18	16	16	4
ITP	-	5	3	4
ACD	-	8	10	6
MA	-	2	1	-
FANCONI	-	-	-	2
APLASTIC	-	-	2	2
IHA	-	-	2	3
CDA	-	-	1	-
BLOOD LOSS	-	-	3	5

In 6 months to 23 months, the age group prevalence of iron deficiency anemia was 78.9%; thalassemia was 10.9%; sickle cell anemia was 7.5%, and hereditary persistent fetal hemoglobin was 2.53%. In 2-5 years, the age group prevalence of iron deficiency anemia was 74.6%; thalassemia was 10.7%; sickle cell anemia was 6.3 %. The remaining cases of anemia were contributed by ITP 5(1.9%), anemia of chronic disease 3.2%; megaloblastic anemia 2 cases (0.8%); persistent fetal hemoglobin 6 cases (2.4%), blood loss due to GI bleed in 3 cases (1.19%). In 6-9 years, age group iron deficiency anemia was seen in 72 (57.1%), thalassemia in 19 cases (15.07%); sickle cell anemia in 16 cases (12.7%); anemia of chronic disease in 10 cases (7.9%), one case of congenital dyserythropoietic anemia (0.8%), aplastic anemia in 2 cases (1.58%), immune hemolytic anemia in 2 cases (1.58%) and one case of megaloblastic anemia (0.8%), blood loss due to GI bleed in 5 cases (3.9%). In 10-12 years, age group iron deficiency anemia was seen in 31 cases (45.5%); thalassemia in 16 cases (23.5%), sickle cell anemia in 4 cases (5.8%), ITP in 4 cases (5.8%), anemia of chronic disease in 6 cases (8.8%), autoimmune hemolytic anemia in 3 cases (4.4%), 2 cases of Fanconi anemia (2.9%) and 2 cases of aplastic anemia (2.9%).

TABLE 5: The severity of anemia among different socioeconomic classes

Socioeconomic status	Mild	Moderate	Severe	Chi-square	p-value
Class 1	1 (33%)	2(66%)	-	306.7688	<0.00001
Class 2	43(57.3%)	20(26.6%)	12(16%)		
Class3	22 (5.75)	264(69%)	97(25.3%)		
Class 4	9 (4.5%)	50(25.2%)	139(70%)		
Class5	4 (14.8%)	5 (18.5%)	18 (66%)		

The majority of anemic children in class 4 and class 5 socioeconomic group had severe anemia (70% and 66%, respectively). The difference is statistically significant as the p-value is < 0.05.

TABLE 6: Time of introduction of complementary feeding in children <2yrs

Time of introduction	Total number of children	Number of anemic children	Percentage
4-6 months	64	35	54.6 %
6-9 months	124	82	66.1%
9-12 months	146	120	82.1%

In our study prevalence of anemia was low in those children who started complementary feeding at 4-6 months of age (54.6%). The prevalence of anemia in those groups who started complementary feeding at 6-9 months and 9-12 months was 66.1% and 82.1%, respectively.

DISCUSSION:

This study was designed to determine the prevalence, etiology, and morphological types of anemia among children aged 6 months -12 years admitted in the department of pediatrics of a tertiary care hospital in Kakinada. A total of 1023 children who satisfied the inclusion criteria were enrolled in the study. They were subjected to complete hemogram with peripheral smear examination. Bone marrow study and hemoglobin electrophoresis were also done as and when required.

1) Prevalence of anemia:

A total of 1023 children were screened, out of whom 683 children were found to be anemic based on the WHO anemia specific cut-offs. The prevalence of anemia in the present study was 66.7%. A prevalence rate of over 65% in preschool children has been reported in various studies undertaken in rural and urban India. Trends between 2005-06 (NFHS-3)[9] and 2015-16(NFHS-4)[10] showed that the prevalence of anemia among children aged 6-59 months declined from 70 % to 59% but continued to be higher among rural children. The prevalence of anemia in the age group of 6 months -59 months (69.6%) in our study was still higher compared to NFHS 4 data (59%) and the overall prevalence of anemia in 6 months -12 years in our study was 66.7%. Our study was conducted in a tertiary care hospital where sick children get admitted, and that may be the contributing factor for the higher prevalence of anemia in the study group. The prevalence of anemia in our study is similar to the studies done by Saba et al.[4] kanchana et al.[1] and simbauranga et al.[6] which showed a higher prevalence of anemia (72.7%,77.8% and 77.2%, respectively). The studies done by Sharma et al.[14] and ocan et al.[7] showed a much lower prevalence of anemia (42.4% and 46.7%) compared to the present study.

2) SEVERITY OF ANEMIA:

In the present study, anemia was graded into mild (10-10.9g/dl), moderate (7-9.9g/dl), and severe (<7g/d/) according to WHO cut-offs. The prevalence of mild, moderate and severe anemia was 11.4%, 49.6% and 38.9%, respectively. According to NFHS 4 in 2015-2016,[10] overall, 59% of children had some degree of anemia, .29 % of children had mild anemia, 29 % had moderate anemia, and 2 % had severe anemia. The percentage of severe and moderate anemia in our study was higher compared to NFHS 4 data since our study was a hospital-based study. Being a tertiary care Centre number of cases with moderate and severe anemia cases were referred to our hospital for a complete evaluation and blood transfusions. Mild anemia was actually picked up during routine investigations of cases who were admitted for other complaints. In the present study, hemolytic anemias contributed to 22.7% (155 cases) who were referred for blood transfusions, which might be the reason for a greater number of cases with moderate and severe anemia in the present study.

3) Morphological types of anemia:

Microcytic hypochromic anemia was the most common type of anemia seen in our study accounting for 82.4%. This is the most common morphological type in all age groups in our study. Even though microcytic hypochromic anemia was the most common type of anemia in several studies, the prevalence was less compared to our study. The prevalence of microcytic hypochromic anemia in studies done by Dr.M. muthuraman, Ocan et al. ;[7]

Tejeswini. V et al,[8] Sab etal [4] and Dr.A. Indumathi was 59.25%, 65.4%, 60%,49% and 36.7% respectively. The prevalence of normocytic normochromic anemia in our study was (14.05%). This was similar to studies done by Tejeswini. V et al. and N.D. Vaswani ˙ where the prevalence was 14% and 17%, respectively. In contrast to the present study, the prevalence of normocytic normochromic anemia in studies done by Dr.A.T. INDHUMATHI et al. and Dr.M. Muthuraman et al. [9] was 53.3% and 28.25%, respectively. The prevalence of Macrocytic anemia in the present study was 2.04%. This finding was similar to a study done by Dr.M. Muthuraman et al. [9] (2.8%.) The prevalence of macrocytic anemia in other studies done by Tejeswini. V et al.[8] and Saba et al.[4] was 4 %. The prevalence of macrocytic anemia in Ocan et al.[7] study and M. Muthuraman [9] ˙N.D. Vaswani [16] was 15.4% and 23 %, respectively. Dimorphic anemia was accounting for a smaller number of cases (10) compared to other morphological types (1.5%). The finding was comparable to a study done by tejeswini. v.et al [8] (5%). but the incidence of dimorphic anemia was very high in other studies done by Saba [4] and N.D. Vaswani [16] 24% and 18% respectively.

4) Etiology of anemia

➢ IRON DEFICIENCY ANEMIA:
IDA was the most common type of anemia in our study, accounting for (68.8 %). A presumptive diagnosis of IDA was made by hemogram with smear demonstrating microcytic hypochromic anemia with a high red cell distribution width, reduced red blood cell count, normal white blood cell count, and normal or elevated platelet count. Iron studies were not done routinely because of economic constraints. The prevalence of IDA in other studies done by Dr.M. Muthuraman et al.[9] , kanchana et al.[1] and Dr. Sunitha kulhari [2] was 71.37%,72% and 75.9%, respectively, which was similar to our study. In contrast, the prevalence of IDA was (55.6%) in a study done by Muhammad Atif Habib, which was low compared to the present study. IDA was the most common type of anemia in many other studies. The prevalence of parasitic infestation in the present study was 20.2%, which is one of the important risk factors for IDA. In a study done by Kanchana et al. [1], the prevalence was (26%), and in another study done by ocan et al.,[7]

prevalence of parasitic infestations was 4.9%, which was lower than our study. A study was done in Bangalore, India, reported a much lower prevalence (13.6%) of anemia in school-aged children after initiation of deworming and vit A supplementation as a school-based intervention program.[15] In view of high prevalence of IDA, many programs were launched by GOI. The national iron plus initiative was one of the important programs. Recently this program was replaced by Anemia Mukt Bharat. The important target in this program is to reduce the prevalence of anemia in 6 months – 59 months age group from 58% to 40% by 2022 .

➢ THALASSEMIA:
Thalassemia was the next common type of anemia in our study, accounting for 12.8%, which includes both thalassemia major and minor. Our hospital is a tertiary care centre attached to DIEC and thalassemia centre where 280 cases of transfusion-dependent thalassemia were enrolled, but most of them were attending red cross bank for regular blood transfusions. Only complicated cases were being referred to our hospital for blood transfusions; hence the number was low. In a study done by N.D. Vaswani [16] , the prevalence of thalassemia was 9%, which was comparable to the present study. In a study done by A. Munshi et al., the prevalence of thalassemia major and trait was 66%, which was very high compared to the present study (12.8%). This study was conducted in an institute of genetics and genetic diseases, and this could be the reason for its high prevalence, as most of the doubtful inherited hemoglobinopathies attend their hospital. In the same study prevalence of sickle cell anemia was 13%, which was slightly high compared to the present study (7.9%).

➢ SICKLE CELL ANEMIA:
It was the 3rd common type of anemia in our study, accounting for 7.9%. Patients with sickle cell anemia were presented with vaso occlusive crisis. In a study done by Ramya P, the prevalence of sickle cell anemia was 1 %, which was very low compared to our study. In another study done by A.M. Elizabeth et al. [12] sickle cell anemia was 25.8%, which was very high compared to the present study (7.9%). This study was done In thotis, a tribe in Adilabad, Andhra Pradesh, which could be the reason for its very high prevalence.

TYPE OF STUDY	IDA	THALASSEMIA	SICKLE CELL ANEMIA
Present study	68.8%	12.8%	7.9%
N.D. Vaswani et al.[14] (2020)	51%	9%	-
Dr.Sunitha kulhari[4](2020)	75.9%	0.8%	0.8%
Kanchana et al.[2] (2018)	72%	-	-
Swapnatai A Meshram et al.[11](2013)	57.3%	18.7%	29.6%

➢ **MEGALOBLASTIC ANEMIA :**
Megaloblastic anemia was seen in 3 cases, out of which 2 cases were seen in 2-5 years age group and one in 6 – 9 years age group.20-month-old female child born out of consanguineous marriage presented with pallor, repeated infections, recurrent aphthous stomatitis and growth retardation. On examination, the child had cheilitis, glossitis and hyperpigmented knuckles. Peripheral smear showed macrocytes ,tear drop cells and pancytopenia. Bone marrow aspiration showed megaloblastic hematopoiesis. Serum Vit B12 levels were 34.96 pg/ml (normal 191-663), suggestive of deficiency. 24 hr urine protein was 200 mg/dl. Investigations of her sibling also revealed anemia, low serum B12 with proteinuria. Investigations of parents were normal. A diagnosis of IMERSLUND GRASBECK syndrome (which is an autosomal recessively inherited disease) was made in both siblings and confirmed in one child by genetic mutation analysis (AMN gene mutation). Both siblings were treated with parenteral vitamin B12, and there was an increase in hemoglobin, total WBC count and platelets, but proteinuria persisted. Fanconi anemia was seen in 2 cases. Fanconi anemia was diagnosed by chromosomal analysis by mitomycin c.

5) Effect of Socioeconomic status:
In the present study prevalence of anemia was highest in class 4 (78%), followed by class 3 (69%) and least in class 1 (7.5%). Our study was done at a tertiary government centre in which the number of admissions from the upper socioeconomic class were very less compared to other groups which could be one of the important factors for less prevalence of anemia in this group. The severity of anemia increases with decreasing SES. The majority of children with anemia in class 4 and class 5 had severe anemia, and the difference is statistically significant. Lack of awareness of symptoms of anemia, late healthcare-seeking behavior and lack of knowledge about the availability of different national programs for infants and young children may be the contributing factors for this difference.

6) COMPLEMENTARY FEEDING PRACTISES:
In our study prevalence of anemia was low in those children who started complementary feeding at 4-6 months of age (54.6%). The prevalence of anemia in those groups who started complementary feeding at 6-9 months and 9-12 months was 66.1% and 82.1%, respectively. The time of introduction of complementary feeding is an important contributing factor in anemia. In young children, iron deficiency is most common because of decreased milk production after six months, prolonged breastfeeding or delayed introduction of complementary feeding. Because of lack of knowledge of the mother or caregiver, home-based preparations were mainly mono cereal-based rather than cereal -pulses combination. They used to offer less frequent feeds and a lesser number of complementary foods during each feed. Public health officials must be aware of the problem and must take serious actions to improve adequate iron intake in infancy. Mothers should be   and   counseled for appropriate initiation of complimentary feeding to prevent iron deficiency anemia in early childhood. Nutritional education aimed at the Toddlers (NEAT) program was developed to improve the knowledge, attitudes, mealtime practices of caregivers and to increases the dietary intake of toddlers.

CONCLUSION:

- The prevalence of anemia in the present study was 66.7%
- The prevalence of anemia was highest in 6 months – 23 months age group (70.9%).
- Moderate anemia was the most common type of anemia.

- Microcytic hypochromic anemia was the most common type of anemia.
- Iron deficiency anemia was the most common etiology
- Pallor was the most common and consistent physical finding.
- Severe anemia cases were more in class 4 and class 5 socioeconomic class.
- Prevalence of anemia was less in those children who were on exclusive breastfeeding for 4-6 months of age.
- Prevalence of anemia was less in those children whose complementary feeding started at 4-6 months of age.

To become a developed and healthy nation, we need to have healthy children. Nutritional anemia due to iron deficiency is the leading trace element deficiency seen in children. We need to ensure antenatal iron supplementation. Screening for anemia should be done periodically. We should create awareness among parents about iron rich foods. In malaria-endemic areas, periodic screening for parasitic infestation will help to reduce the burden. Biannual deworming should be done in all children. In hemolytic anemia, parents should be educated about the importance of regular blood transfusions and chelation therapy and trained them to identify the symptoms of anemia before the child land into congestive cardiac failure. Health education to mothers and caregivers about the benefits of breastfeeding and timely initiation of complementary feeding to prevent iron deficiency anemia in infants and young children.

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