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**Original Article** 

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# TYPES OF ANEMIA IN RELATION TO FEEDING PATTERN IN MALNOURISHED CHILDREN

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## ABSTRACT

Background: Anemia is defined as having a reduced red blood cell volume or hemoglobin concentration below the normal level. Anemia and micronutrient deficiencies can be made worse by intestinal helminth and hookworm infections, which can cause gastrointestinal blood loss, depletion of iron stores and inhibition of erythropoietin. Consequently, anemia and micronutrient deficiencies are made worse by the malabsorption and appetite suppression. **Objectives:** Is to identify the most common type of anemia among malnourished children, moreover; to assess the degree of anemia in relation to severity of malnutrition. And to illustrate the causes of anemia in malnourished children. Methods: A cross section study was conducted, from January 2023 to the end of December 2023. The study involved one hundred sixteen babies (seventy-four males and forty-two females) from different residence, they were interviewed at Ibn-Sena Teaching Hospital. The questionnaire includes four parts; part one for socio-demographic data. Part two for feeding pattern. Part three for severity of anemia. And part four for complications faced patients with nutritional anemia. Results: Among 116 children enrolled in this study, the total number of breastfed malnourished babies were 49 (42.3%) subjects, bottle feeding malnourished babies were 43 (37%) subjects and mixed feeding malnourished babies were 24 (20.7%). It had been found that normochromic normocytic anemia was found to have the highest percentage among the type of anemia in all malnourished babies. Regardless of feeding pattern the difference was statistically not significant, (p Value =0.254). The study found that mild anemia was the commonest type of anemia found within the study participants (66.3%). Among breast fed malnourished anemic babies, the study showed that malnourished anemic breast-fed babies in whom the time of added food at less than 6 months was attributed to only (12.2%), and at 7-9 months account for (26.5%), and after 9 months (61.3%) of patients. While in bottle fed malnourished anemic babies in whom the time of added food at less than 6 months account for (41.8%), and at 7-9 months account for (37.3%), and after 9 months (20.9%). Anemic malnourished children found in this study, (47.4%) were aged less than 1 year and (52.6%) were aged more than 1 year. Moreover; hypochromic microcytic anemia was found more commonly among children aged less than 1 year versus among those aged more than 1 year it was hypochromic microcytic with statistically significant difference (P value = 0.007). Conclusion: Anemia and malnutrition can occur with all patterns of feeding and this can be attributed to a number of factors like delayed added food, little or unsatisfactory food intake, severe and repeated infections, or combination of all above factors. Improved house hold food security, protecting children through improved food quality and safety, preventing specific micronutrient deficiencies, promoting breast feeding in the first 6 months of life and enhance fruit, vegetables and high iron containing diet at 6 months of age. Can be beneficial for preventing nutritional anemia in children.

KEYWORDS: Pediatrics, Normocytic anemia, Nutrition, Mosul, Iraq.

#### 1- INTRODUCTION

Anemia is defined as having a reduced red blood cell volume or hemoglobin concentration below the normal level.<sup>[1-2]</sup> Anemia is a major concern worldwide, particularly in developing countries, although it is far from nonexistent in wealthy countries.<sup>[3-4]</sup> Anemia is a

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disorder, similar to fever, with several probable causes and clinical manifestations.<sup>[5]</sup> Anemia can be caused by dietary deficiencies, inherited genetic defects, drug adverse effects, or chronic disease. It can occur due to blood loss, internal bleeding, hemolysis of red blood cells, or inadequate production of red blood cell.<sup>[6-8]</sup> The disease, whether mild or severe, may be transitory or long-term, and it can appear in various ways.<sup>[9]</sup> The three most common kinds of anemia are iron deficiency anemia, chronic illness anemia, and megaloblastic anemia caused by a lack of vitamin B12, folate, or both.<sup>[10]</sup>

Anemia affects around 1.62 billion people worldwide.<sup>[11]</sup> In 2025, the global prevalence of anemia in children aged 6-59 months is estimated to be around 40%.<sup>[12]</sup> This means that this age group are under significant health challenges. Anemia in children is usually linked to factors such as low socioeconomic status, big family size, illiterate families, and ignorance.<sup>[13]</sup> Anemia and micronutrient deficiencies can be made worse by intestinal helminth and hookworm infections, which can cause gastrointestinal blood loss, depletion of iron stores and inhibition of erythropoietin.<sup>[14]</sup> Consequently, anemia and micronutrient deficiencies are made worse by the malabsorption and appetite suppression.<sup>[15]</sup> Children with anemia mostly have poor mental performance, decreased immunity, and having the potential death from anemic heart failure.<sup>[16]</sup>

This study aimed to identify the most common type of anemia among malnourished children, moreover; to assess the degree of anemia in relation to severity of malnutrition. And to illustrate the causes of anemia in malnourished children.

#### 2-PATIENTS AND METHODS

After obtaining ethical approval from the ethical committee of Nineveh Health directorate. A cross section study was conducted, from January 2023 to the end of December 2023.

The study involved one hundred sixteen babies (seventyfour males and forty-two females) from different residence, they were interviewed at Ibn-Sena Teaching Hospital.

A questionnaire form was designed to collect a specific information about all the infants included in this study. The following information were obtained from their mothers as age, sex, feeding pattern (breast, bottle or mixed), the type and age of child at time of added food  $(\leq 6 \text{ months}, 7-9 \text{ months}, and >9 \text{ months})$ , the accompanying symptoms as vomiting, diarrhea, cough, shortness of breath, past medical history, past surgical history, the job of the mothers, educational status of the mothers, and socio economic status of the family. All children were examined properly including weight-age and designed as mildly, moderately or severely malnourished according to -2SD, -3SD and -4SD respectively and all of them were anemic with variable degree of anemia (mild-moderate or severe). The symptoms and signs of anemia like irritability, apathy, tiredness. fatigue, muscle weakness lack of concentration, palpitation, pallor, jaundice, glossitis, angular stomatitis, spoon nail, pigmentation, hepatosplenomegaly, and systolic flow murmur were documented. The investigations done for them included; complete blood count and blood film, and anemia was diagnosed when the hemoglobin level is less than 10 gm/dl. Additionally; general stool examination and general urine were done for all of the patients. Furthermore; bone marrow examination was done for suspected case of malignancy to exclude malignancy as lymphoma and leukemia. Hemoglobin electrophoresis was done for all patients with hypochromic microcytic anemia to exclude thalassemia. The results were analyzed by using T-test to find P-value where it is significant if it was less than 0.05.

#### 3. RESULTS

Among 116 children enrolled in this study, the total number of breastfed malnourished babies were 49 (42.3%) subjects, bottle feeding malnourished babies were 43 (37%) subjects and mixed feeding malnourished babies were 24 (20.7%). It had been found that normochromic normocytic anemia was found to have the highest percentage among the type of anemia in all malnourished babies. Regardless of feeding pattern the difference was statistically not significant, (p Value =0.254). As shown in table 3.1.

Table 3.1: Distribution of children with anemia according to their feeding pattern.

Feeding pattern			Types of anemia						
Туре	Number	Percent	Normochromic normocytic, No. (%)		Hypochromic microcytic, No. (%)		Dimorphic, No. (%)		P-Value
Breast feeding	49	42.3%	38	77.5%	6	12.3%	5	10.2%	
Bottle feeding	43	37%	36	83.7%	7	16.7%			0.254
Mixed feeding	24	20.7%	17	70.8%	5	20.8%	2	8.3%	0.234
Total number	116		91	78.5%	18	15.5%	7	6%	

Figure 3.1 shows distribution of anemia among patients with malnutrition according to their severity. It's evident

that mild anemia was the commonest type of anemia found within the study participants.



Figure 3.1: Distribution of anemia according to their severity

Table 3.3 shows that there is a relation between prolonged breast feeding and malnutrition in comparison

to bottle fed malnourished babies who get malnutrition at earlier time.

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	Time of added food					
Types of feeding	Less than 6 months,	Seven-night months,	More than 9 months,			
	number (%)	number (%)	number (%)			
Breast feeding	6 (12.2%)	13 (26.5%)	30 (61.3 %)			
Bottle feeding	18 (41.8%)	16 (37.3%)	9 (20.9)			
Mixed feeding	24 (100%)					

Table 3.3 illustrates that bottle-fed children were more frequently prone to diarrhea. Other complications were less frequently seen within the study participants.

Table 3.3:	Distribution	of children	with anemia	according	to their	complications.
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Dianaga		Total		
Disease	Breast feeding	Bottle feeding	Mixed feeding	number
Diarrhea	39 (79.6%)	40 (93.01%)	22 (91.68%)	101 (87.2%)
Urinary tract infection	4 (8.16%)	3 (6.99%)	1 (4.16%)	8 (6.8%)
Heart failure	3 (6.12%)			3 (2.6%)
Meningitis	2 (4.08%)		1 (4.16%)	3 (2.6%)
Malignancy	1 (2.04%)			1 (0.8%)
Total number	49	43	24	116

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Table 3.4 shows comparison between children aged less than 1 year and those of more than 1 year according to their types of anemia. Most of malnourished babies with normochromic normocytic anemia were found to be under 1 years of age and this was statistically significant (P-Value =0.007).

Age	Total number	Normochromic normocytic, No. (%)	Hypochromic microcytic, No. (%)	Dimorphic, No. (%)	P-Value
Less than 1 year	55 (47.4%)	50 (91%)	3 (5.4%)	2 (3.6%)	0.007
More than 1 year	61 (52.6%)	41 (67.2%)	15 (24.5%)	5 (8.3%)	0.007

Table 3.4: Comparison between children with anemia according to their age.

#### 4. DISCUSSION

In this study, normochromic normocytic anemia was found to be the commonest type of anemia within all of feeding types. While normochromic normocytic anemia can occur in children, it is not often the most frequent type of anemia across all feeding patterns. Globally; iron which can be microcytic deficiency anemia, hypochromic anemia, is the more prevalent diagnosis. While iron deficiency can initially present as normocytic, it can progress to microcytic hypochromic anemia if left untreated.<sup>[17]</sup> Anyhow, these findings might attribute to causes as, mixed deficiencies including manv and multivitamin mineral, infections, erythroid hypoplasia and adaptation to lower metabolic oxygen requirement.[18]

Furthermore, the majority of nutritional anemia found in this study, was mild-moderate (6-10 g/dl). This range generally defines mild anemia as 10 g/dL to the lower limit of normal, and moderate anemia as 8 g/dL to 10 g/dL. Comparable results were obtained from Getayeneh Antehunegn Tesema et al.<sup>[19]</sup> and Abdu Hailu Shibesh et al.<sup>[20]</sup>

Malnutrition could be seen among breast fed babies and this might be attributed to various factors, like delay added food, little or unsatisfactory food intake, the former was the most important factor in the causation of protein energy malnutrition. Among breast fed malnourished anemic babies, the study showed that malnourished anemic breast-fed babies in whom the time of added food at less than 6 months was attributed to only (12.2%), and at 7-9 months account for (26.5%), and after 9 months (61.3%) of patients and this also was found by Hikmah Maulidya et al.<sup>[21]</sup> While in bottle fed malnourished anemic babies in whom the time of added food at less than 6 months account for (41.8%), and at 7-9 months account for (37.3%), and after 9 months (20.9%), this might be attributed to various factors as unhygienic food, unsafe water, inappropriate care and feeding practice, diseases especially diarrhea which was more frequent in bottle fed malnourished anemic babies. Consistent results found in Malakeh Z. Malak et al study findings.<sup>[22]</sup>

Regarding the complications faced malnourished anemic patients. The study found diarrhea and urinary tract infection are the commonest infection occurred among such patients. As malnutrition weakens the immune system, making individuals more susceptible to various infections, including those affecting the digestive and urinary tracts. Moreover; diarrhea and urinary tract infection can further exacerbate malnutrition by interfering with nutrient absorption and potentially leading to dehydration, Ushani Jayamanna et al found similar findings.<sup>[23]</sup>

Anemic malnourished children found in this study, (47.4%) were aged less than 1 year and (52.6%) were aged more than 1 year. Moreover; hypochromic microcytic anemia was found more commonly among children aged less than 1 year as the nutritional (iron deficiency) anemia was at early stage and then after 1 year it was hypochromic microcytic when the anemia (iron deficiency) become more advanced, this is nearly similar to what found by Abebe Sorsa.<sup>[24]</sup>

#### **5. CONCLUSION**

According to the study findings; anemia is common in protein energy malnutrition and it was of mild to moderate degree. Anemia and malnutrition can occur with all patterns of feeding and this can be attributed to a number of factors like delayed added food, little or unsatisfactory food intake, severe and repeated infections, or combination of all above factors. Diarrhea is the main cause of malnutrition and anemia especially in bottle fed babies. Improved house hold food security, protecting children through improved food quality and safety, preventing specific micronutrient deficiencies, promoting breast feeding in the first 6 months of life and enhance fruit, vegetables and high iron containing diet at 6 months of age. Can be beneficial for preventing nutritional anemia in children.

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#### Conflict of intertest

About this study, the authors disclose no conflicts of interest.

## REFERENCES

- 1. Freeman A, Zubair M. Anemia screening. StatPearls, 2025 Feb 17.
- Hoenemann C, Ostendorf N, Zarbock A, Doll D, Hagemann O, Zimmermann M, Luedi M. Reticulocyte and erythrocyte hemoglobin parameters for iron deficiency and anemia diagnostics in patient blood management. A narrative review. Journal of clinical medicine, 2021 Sep 19; 10(18): 4250.

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- Kaur R, Mishra S, Nevolin IV, Choudhury DR, Singh M. Nutritional anemia: Patent landscape. World Patent Information, 2022 Sep 1; 70: 102123.
- Lee S, Son Y, Hwang J, Kim MS, Il Shin J, Yon DK, Kassebaum NJ. Global, regional and national burden of dietary iron deficiency from 1990 to 2021: a Global Burden of Disease study. Nature Medicine, 2025 Apr 22: 1-21.
- 5. Lasky J. Anemia. Berkowitz's Pediatrics-A primary care approach.(S 545).
- Wagh D, Kanase S, Balid A, Fulari S, Bhosale A, Wadkar S, Gurud T, Narawade T, Walekar S. A Brief Review on Anemia. Int. J. Sci. R. Tech. 2024; 1(12).
- Gallagher PG. Anemia in the pediatric patient. Blood, The Journal of the American Society of Hematology, 2022 Aug 11; 140(6): 571-93.
- Chinelo OV, Chukwuka E, Ifeoma AC, Umeh I, Okoro C, Peterson JC. Causes of anemia due to diminished red blood cell production in pediatrics. Int J Sci Adv, 2022; 3(5): 711-8.
- 9. Chaudhary N, Jassar R, Singh R. Neonatal anemia. Newborn, 2022; 1(3): 263-70.
- Hussien RS, Jabuk SI, Altaee ZM, Al-Maamori AM. Review of anemia: types and causes. European Journal of Research Development and Sustainability, 2023; 4(7): 3.
- 11. Baldi A, Pasricha SR. Anaemia: worldwide prevalence and progress in reduction. InNutritional Anemia 2022 Dec 16 (pp. 3-17). Cham: Springer International Publishing.
- Eltayeb R, Binsaleh N, Barnawi H, Ali RM, Kanwal R, Alyahyawi AR. A persistent burden: global prevalence of and changes in anaemia by country income in children aged 6–59 months (2000–2019). Arch Med Sci DOI: https: //doi. org/10.5114/aoms/197062. 2025.
- Gore MN, Drozd ME, Patil RS. Anemia Prevalence and Socioeconomic Status among Adolescent Girls in Rural Western India: A Cross-Sectional Study. Ethiopian journal of health sciences, 2024 Mar 9; 34(1).
- Caldrer S, Ursini T, Santucci B, Motta L, Angheben A. Soil-transmitted helminths and anaemia: a neglected association outside the tropics. Microorganisms, 2022 May 13; 10(5): 1027.
- Montoro-Huguet MA, Belloc B, Domínguez-Cajal M. Small and large intestine (I): malabsorption of nutrients. Nutrients, 2021 Apr 11; 13(4): 1254.
- Mitterstiller AM, von Raffay L, Nairz M. Iron deficiency, anemia, and the immune system. InNutritional Anemia 2022 Dec 16 (pp. 235-248). Cham: Springer International Publishing.
- 17. Faisal M, Mustafa S, Yasin M, Saeed J. Frequency of Iron Deficiency in Children With Hypochromia and Microcytosis on Blood Smears. Pakistan Postgraduate Medical Journal, 2023 Sep 30; 34(03): 162-5.

- 18. Equitz E, Powers JM, Kirk S. Etiologies and Outcomes of Normocytic Anemia in Children. The Journal of Pediatrics, 2024 Aug 1; 271: 114041.
- 19. Tesema GA, Worku MG, Tessema ZT, Teshale AB, Alem AZ, Yeshaw Y, Alamneh TS, Liyew AM. Prevalence and determinants of severity levels of anemia among children aged 6–59 months in sub-Saharan Africa: A multilevel ordinal logistic regression analysis. PloS one, 2021 Apr 23; 16(4): e0249978.
- 20. Shibeshi AH, Mare KU, Kase BF, Wubshet BZ, Tebeje TM, Asgedom YS, Asmare ZA, Asebe HA, Lombebo AA, Sabo KG, Fente BM. The effect of dietary diversity on anemia levels among children 6–23 months in sub-Saharan Africa: A multilevel ordinal logistic regression model. Plos one, 2024 May 21; 19(5): e0298647.
- 21. Hubungan Perilaku Ibu dalam Pemberian MP-ASI Dengan Kejadian Gerakan Tutup Mulut dan Status Gizi pada Baduta The Relationship of Mother Behavior in Providing Complementary Feeding with the Case of Mouth Movement and Nutritional Status in Child Under TwoYears Old. Media Gizi Kesymasy, 9(1): 24-28.
- 22. Malak MZ, Shehadeh A, Ayed A, Alshawish E. Predictors of anemia among infants at the age of one year attending health centers in the West Bank/Palestine: a retrospective study. BMC Public Health, 2025 Jan 16; 25(1): 179.
- 23. Jayamanna U, Jayaweera JS. Childhood anemia and risk for acute respiratory infection, gastroenteritis, and urinary tract infection: a systematic review. Journal of Pediatric Infectious Diseases, 2023 Mar; 18(02): 061-70.
- 24. Sorsa A, Habtamu A, Kaso M. Prevalence and predictors of anemia among children aged 6–23 months in Dodota District, southeast Ethiopia: a community-based cross-sectional study. Pediatric Health, Medicine and Therapeutics, 2021 Apr 6: 177-87.