FREQUENCY OF ANEMIA AMONG BREASTFED AND BOTTLE FEED CHILDREN (AGED UNDER 59 MONTHS) COMING TO THE KHYBER TEACHING HOSPITAL

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ABSTRACT

Objective:
To determine the frequency of anemia in children under five years of age and to compare anemia status between breastfed and bottle-fed children.

Methods:
This cross-sectional study was conducted at the Pediatric Outpatient Department of Khyber Teaching Hospital, Peshawar, from August 19, 2024 to February 19, 2025. A total of 384 children aged under 59 months were enrolled through consecutive sampling. Children with chronic disease, blood transfusions, or iron supplementation were excluded. Demographic data, feeding practices and hemoglobin levels were recorded. Anemia was classified using WHO criteria into severe, moderate, mild and no anemia. Data were analyzed using SPSS version 20. Chi-square test was applied and $p \leq 0.05$ was considered statistically significant.

Results:
Anemia was present in 241 children (62.8%). Moderate anemia was most frequent 143 (37.2%), followed by mild anemia 95 (24.7%) and severe anemia 3 (0.8%). Bottle-feeding was practiced by 269 (70.1%) children. No statistically significant association was found between anemia and feeding pattern ($p = 0.97$) or type of bottle feed ($p = 0.83$).

Conclusion:
Anemia was highly prevalent among children under five years, predominantly moderate and mild in severity, and was not significantly associated with feeding pattern. Broader nutritional, socioeconomic and behavioural determinants are likely responsible. Strengthening maternal and child nutrition practices, improving complementary feeding quality, and increasing access to iron-rich and fortified foods are essential strategies for reducing childhood anemia in this population.

Keywords:
Anemia, Bottle Feeding, Breastfeeding, Child Health, Hemoglobin

INTRODUCTION

Anemia is a major global public health concern disproportionately affecting young children and women of reproductive age. It is associated with impaired cognitive development, reduced motor performance, and lower future productivity.[1] According to the World Health Organization, 42% of children aged 6–59 months are anemic worldwide, and in Pakistan the reported prevalence ranges between 37.6% and 68.4%, with an average of approximately 53%.[2]

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This burden is more pronounced in low- and middle-income settings where poverty, food insecurity, and limited access to healthcare remain persistent determinants.[3]

While developed nations have achieved a decline in anemia prevalence through improved nutrition, food fortification policies and better healthcare systems, the condition continues to contribute substantially to morbidity among children under five in South Asia. Nearly 45% of global under-five mortality is linked to malnutrition, with the majority of these deaths occurring in low-income regions.[4] In Pakistan, more than 60% of the rural population is reported to live below the poverty line, restricting access to nutrient-dense foods such as meat, poultry and fruit.[5]

Iron-deficiency anemia remains the commonest etiology in children due to inadequate dietary intake, poor absorption, increased physiological demand and chronic gastrointestinal blood loss.[6] In addition, maternal undernutrition, low maternal education status, and difficulty sustaining

exclusive breastfeeding practices further aggravate the problem.[7] Inadequate awareness regarding optimal feeding behaviours and cultural norms that promote mixed or early complementary feeding add to this burden.[8]

Despite the high magnitude of anemia in Pakistani children under five, there is limited local evidence evaluating the association between feeding practices and anemia status.[9] Global literature suggests that exclusive breastfeeding may provide protective benefit because of superior iron bioavailability.[10] However, many regional studies have not adequately compared anemia status between breastfed and bottle-fed children.[11]

This study was therefore conducted to determine the frequency of anemia in children under five years of age and to compare its frequency between breastfed and bottle-fed children. The findings are expected to support more informed nutritional counselling, improve feeding-related recommendations and assist in designing targeted public health interventions tailored to the Pakistani population.

MATERIAL AND METHODS

This cross-sectional observational study was conducted in the Pediatric Outpatient Department (OPD) of Khyber Teaching Hospital, Peshawar. The study duration was from 19 Aug 2024 to 19 February 2025 after approval from Institutional Review Board (IRB) vide reference number 418/DME/KMC and CPSP Karachi. Written informed consent was taken from the parents or guardians of all participants. The purpose, potential risks, and benefits of the study were explained to the parents or guardians, ensuring voluntary participation and confidentiality of personal data. The sample size was calculated using OpenEpi software, assuming a population size of one million, a prevalence of anemia in children at 53%[2], 95% confidence level, a precision of 5%. The calculated sample size was 384 children. A non-probability consecutive sampling technique was employed to recruit participants.

Children under five years of age presenting to the Pediatric OPD with any health concerns were included in the study. Participants had to be clinically stable and not undergoing any acute medical interventions.

Children who had received blood transfusions, used iron supplementation (in any form of medication), or were diagnosed with chronic illnesses such as leukemia, thalassemia, hemolytic anemia, or conditions involving chronic blood loss were excluded. Additionally, children with a history of congenital or systemic diseases affecting hemoglobin levels were not included in the study.

Data were collected using a structured proforma. After obtaining informed consent, demographic and clinical details, including age, gender, feeding patterns, and duration of feeding, were recorded. Blood samples were collected from each participant to measure hemoglobin levels. Hemoglobin levels were classified according to the World Health Organization (WHO) criteria: mild anemia (10.9–10 g/dL), moderate anemia (7–9.99 g/dL), and severe anemia (<7 g/dL). Feeding practices were categorized into exclusively breastfed, bottle-fed, or mixed-fed, and the type of feed in bottle-fed children (formula or cow's milk) was documented. The study protocol ensured standardization of data collection and laboratory procedures. All blood samples were analyzed in the hospital's pathology laboratory under strict quality control measures.

Data were analyzed using SPSS version 20. Descriptive statistics were used to summarize categorical variables, including gender, feeding patterns, and presence of anemia, which were presented as frequencies and percentages. Continuous variables, such as age, were expressed as mean ± standard deviation. The chi-square test was used to assess associations between categorical variables, with p value less than 0.05 considered significant.

RESULTS

A total of 384 children were included in the study. The mean age of participants was 29.23 ± 17.19 months, mean hemoglobin level was 10.71 ± 1.48 g/dL, and mean weaning age was 6.05 ± 1.60 months. Among the enrolled children, 52.1% were females and 47.9% males. Bottle-feeding was more prevalent (70.1%) than breastfeeding (29.9%). Among bottle-fed children, 53.9% received formula milk and 16.1% cow's milk. Most participants had moderate anemia, while severe anemia was uncommon (Table 1).

Anemia was found in 62.8% of all children. No statistically significant association was observed between anemia status and age (p = 0.53), gender (p = 0.34), or weaning age (p = 0.20). Similarly, feeding pattern showed no significant relationship with anemia prevalence (p = 0.97). Within the bottle-fed subgroup, the difference in anemia occurrence between formula-fed and cow's-milk-fed children was

also not statistically significant (p = 0.83) (Table 2).

Table 1: Baseline Characteristics of Study Participants (n = 384)

Continuous Variables	**Mean ± SD**
Age (months)	29.23 ± 17.19
Hemoglobin (g/dL)	10.71 ± 1.48
Weaning age (months)	6.05 ± 1.60
Categorical Variables	**N (%)**
Gender	
Male	184 (47.9%)
Female	200 (52.1%)
Feeding pattern	
Bottle-fed	269 (70.1%)
Breastfed	115 (29.9%)
Type of bottle feed	
Formula milk	207 (53.9%)
Cow's milk	62 (16.1%)
Anemia severity	
Severe	3 (0.8%)
Moderate	143 (37.2%)
Mild	95 (24.7%)
None	143 (37.2%)

Table 2: Association between participant characteristics and anemia status (n = 384)

Variable	**Category**	**Anemia**		**p-value**
		Yes n (%)	**No n (%)**	
Age (months)	< 12	49 (59.8%)	33 (40.2%)	0.53
	≥ 12	192 (63.6%)	110 (36.4%)	
Gender	Male	111 (60.3%)	73 (39.7%)	0.34
	Female	130 (65.0%)	70 (35.0%)	
Weaning age (months)	< 6	155 (60.5%)	101 (39.5%)	0.20
	≥ 6	86 (67.2%)	42 (32.8%)	
Feeding pattern	Bottle-fed	169 (62.8%)	100 (37.2%)	0.97
	Breastfed	72 (62.6%)	43 (37.4%)	
Type of bottle feed	Formula milk	128 (61.8%)	79 (38.2%)	0.83
	Cow's milk	41 (66.1%)	21 (33.9%)	

DISCUSSION

In this study, anemia was present in 241 children (62.8%), with moderate anemia being the most frequent category 143 (37.2%), followed by mild anemia 95 (24.7%), while severe anemia was infrequent 3 (0.8%). This high burden is comparable to national Pakistani estimates ranging from 37.6% to 68.4% and confirms that anemia remains a major childhood morbidity requiring targeted policy attention.[12] The pattern of predominance of moderate anemia observed here is similar to other low and middle income settings, where diets are cereal-based, low in haem iron density, and frequently lack bioavailable micronutrients essential for hematopoiesis.[13]

No significant association was noted between feeding pattern and anemia status, as similar proportions of bottle-fed 169 (62.8%) and breastfed 72 (62.6%) children were anemic (p

= 0.97). While breastmilk offers superior iron bioavailability and immunologic benefits,[14] the expected protective effect may not have manifested fully in this cohort. Early initiation of complementary feeding, low maternal iron reserves, inappropriate feeding transitions, and cultural pressure for early follow-up foods may weaken breastfeeding's inherent advantage.[15] Furthermore, in Pakistan, exclusive breastfeeding rates remain suboptimal and many households rely on mixed feeding or diluted feeds due to economic limitations.[16] This context underscores that promotion of breastfeeding alone is insufficient unless paired with maternal micronutrient improvement and culturally sensitive nutrition education.

Similarly, no significant difference in anemia prevalence was observed between formula-fed 128 (61.8%) and cow's-milk-fed children 41 (66.1%) (p = 0.83). Although cow's milk is known to have poor iron bioavailability and may predispose to occult gastrointestinal losses,[17] the smaller proportion of children receiving cow's milk 62 (16.1%) and the increasing use of iron-fortified commercial formula may have mitigated this risk. The findings suggest that anemia in this age-group is likely influenced by broader determinants beyond type of milk alone. These likely include meal quality, delayed introduction of animal-source foods, household-level food insecurity, recurrent infections and limited dietary diversification — all well-recognised contributors in South Asian nutritional epidemiology.

A major strength of this study is that it used WHO defined anemia thresholds and included a sizeable sample 384 (100.0%) from a major tertiary referral centre, which improves internal reliability. However, it was a single-centre cross-sectional design and therefore findings cannot be generalized to the entire region and cannot establish cause–effect relationships. Dietary quantity and quality, complementary feeding diversity, maternal anemia status, micronutrient supplementation history and socioeconomic index were not objectively evaluated, all of which influence iron status. Future multicentre longitudinal studies with dietary recall validation, maternal micronutrient profiling, iron status biomarkers and household economic stratification are therefore recommended to better characterise feeding-specific risk patterns and generate actionable prevention strategies for childhood anemia in this population.

CONCLUSION

This study demonstrated a high burden of anemia among children under five years, with moderate anemia being most frequently observed, and no significant association noted with feeding pattern or type of bottle feed. These findings indicate that anemia in this age group is not driven by feeding modality alone but is influenced by broader nutritional, socioeconomic and behavioural determinants. Strengthening maternal and child nutrition, improving complementary feeding practices, and enhancing access to iron-rich and iron-fortified foods are essential components of preventive strategy. Broader community-based interventions, nutrition counselling, and targeted public health policies are therefore needed to mitigate childhood anemia in low-resource settings

Authors' contributions:

Aamir Karim Afridi was involved in the conception and design of the study.

Lema Shinwari contributed to the analysis and interpretation of data.

Aizaz Raheem was involved in the design of the study and the collection of data.

Each author has participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed that others named as co-authors have met the authorship criteria.

Conflicts of Interests:

The authors declare no conflict of interest.

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