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Frequency and Associated Factors of Anemia among Children Age 6 To 59 Months of Age

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ABSTRACT

Objective: To determine the frequency and associated factors of anemia among children aged 6 to 59 months in Quetta, Pakistan

Study Design: Cross-sectional descriptive study

Place and Duration of Study: The study was conducted at the Pediatrics Unit-II, Bolan Medical College Hospital, Quetta, from November 2020 to April 2021.

Material and Methods: A total of 196 children exhibiting palmar pallor and hemoglobin levels below 11 g/dl were enrolled using consecutive non-probability sampling. Data were collected through a pre-designed questionnaire and analyzed using SPSS version 26.0. Quantitative variables were expressed as mean and standard deviation, while qualitative variables were expressed as frequency and percentage. Effect modifiers such as age, gender, and pale skin were controlled through stratification, with a post-stratification chi-square test applied. A p-value of ≤0.05 was considered significant.

Results: Among the 196 children, 44% were male and 56% female, with a mean age of 27.62 ± 14.21 months. The prevalence of anemia was 63%. Children from rural areas (67%), those with pale skin (66%), and those from lower socioeconomic status (47%) had higher anemia rates. Iron deficiency anemia was present in 53% of anemic children. Malnutrition was prevalent, with 31% having mild malnutrition and 42% having moderate to severe malnutrition. No significant association was found between anemia and malarial parasite infection or worm infestations.

Conclusion: The prevalence of childhood anemia in Quetta is alarmingly high. Key contributing factors include iron deficiency, malnutrition, low socioeconomic status, and rural residency. Integrated healthcare strategies, nutritional education, and socioeconomic interventions are crucial to reduce anemia prevalence in resource-limited areas.

Key Words: *Anemia, Children, Prevalence, Iron deficiency, Malnutrition, Socioeconomic status, Rural residency, Quetta, Pakistan.*

INTRODUCTION

Anemia is a significant global concern marked by a shortage or poor quality of red blood cells, hindering oxygen delivery throughout the body, and arises from various factors, including reduced

red blood cell production, increased destruction of red blood cells, and blood loss.[1,2] A reduction in red blood cell production can stem from nutritional deficiencies, including iron, vitamin B12, and folate; bone marrow disorders such as aplastic anemia and myelodysplastic syndromes; chronic illnesses like chronic kidney disease and chronic inflammatory conditions; and endocrine issues like hypothyroidism.[3] Increased destruction can occur in hemolytic anemias, both inherited (e.g., sickle cell anemia, thalassemia) and acquired (e.g., autoimmune hemolytic anemia), as well as through mechanical causes like prosthetic heart valves.[4] According to a 2008 WHO report, more than half of the world's preschool-age children reside in regions where anemia is a significant health concern.[5,6]

Many researchers have been working to show the association of different factors with anemia, but it is still a major unsolved issue in the developing world.

Thus, this research aimed to investigate the prevalence of anemia and the factors contributing to it among children aged 6–59 months in Quetta, Pakistan. The findings of this study will aid in guiding policy formulation and effectively addressing the issue. The objective of the study was to determine the frequency and associated factors of anemia among children aged 6 to 59 months of age.

MATERIAL AND METHODS

Study Design and Setting: This cross-sectional study (descriptive study), was done at the Department of Pediatrics, Balochistan Institute of Child Health Services, Quetta

Duration of the study: The duration of the study was six months (November 2020 to April 2021).

Sample Size: The sample size of 68 patients (34 in each group) was determined using the WHO sample size calculator with the following parameters: a 5% level of significance, 80% study power, pooled standard deviation of 1.55%, test value of the population mean at 1.63%, and an anticipated population mean of 0.57%.[7]

Sampling Technique: A non-probability Consecutive sampling technique was used for the recruitment of patients.

Inclusion Criteria:

- Child of 6 to 59 months of age.
- Patients clinically suspected of anemia.
- Hemoglobin levels less than 11 g/dl.
- Both genders (male and female).

Exclusion Criteria:

- Individuals with pre-existing medical conditions or treatments known to affect hemoglobin levels, such as chronic illnesses or recent blood transfusions.
- Participants with a history of surgery within the past two months
- Participants who have received iron supplementation or blood products within a specified time frame before the study.

MATERIAL AND METHODS

A total of 196 patients having palmar pallor and hemoglobin levels below 11 g/dl were enrolled in this study. Approval was obtained from the CPSP and the hospital's ethical committee. Informed consent was obtained from all the enrolled patients, which was duly signed by the guardian of the patients. A predesign questionnaire was used to collect data. All participants with hemoglobin levels below 11 g/dl, as measured by HemoCue, underwent a complete blood count analysis using automated machines such as MS 9-5H or CELL DYN 3700. Serum ferritin levels (determined by Ferritin Elisa Genwa) were assessed in all anemic children to identify iron deficiency. Furthermore, blood smears underwent examination for malaria parasites utilizing Giemsa stain, with a tally of asexual parasites per 200 white blood cells documented. Stool samples underwent microscopic analysis to identify parasites, ova, or other intestinal helminth forms.

Statistical analysis: All the collected data were analyzed using SPSS version 26.0. Quantitative variables such as age, mean hemoglobin and mean MCV levels were expressed as mean and standard deviation. Qualitative variables like gender, the mother's educational status, socioeconomic status, residential status, pale

skin, anemia, malarial parasite, and nutritional status according to Z scoring (normal/ mild malnutrition / moderate malnutrition / severe malnutrition) were expressed as frequency and percentage. Effect modifiers like age, gender, and pale skin were controlled through stratification, and a post-stratification chi-square test was used. A p-value of ≤0.05 was considered significant.

RESULTS

Out of 196 children, 86 were male and 110 were female, with a mean age of 27.62±14.21 months. The mean weight and height were 12.68 ± 3.47 kg and 86.87 ± 12.73 cm, respectively (table 1). Upon laboratory investigations, the mean hemoglobin levels of children were found to be 9.97 ± 2.20 g/dl (table 1, fig 1).

TABLE 1: Distribution of patients according to gender (n=196)

Variable	Frequency	Percentage
Gender:		
Male	86	44.0
Female	110	56.0
	Mean	**SD**
Age	27.62	14.21
Height (cm)	86.87	12.73
Weight (kg)	12.68	3.47
Hb(g/dl)	9.97	2.20

The table 2 summarizes the demographic and health characteristics of 196 children, focusing on anemia and related factors. Of the children assessed, 124 (63%) were found to be anemic, while 72 (37%) were not. Most participants resided in rural areas, accounting for 132 (67%) of the population. Clinically, 129 children (66%) exhibited pale skin, and 48 children (25%) tested positive for malarial parasites, indicating significant health concerns. In terms of gender, among the anemic children, 58 were male and 66 were female, with no significant association with anemia observed (χ^2 = 1.150, p = 0.28). A strong correlation was identified between anemia and iron deficiency, with 103 children affected (χ^2 = 126.04, p = 0.00). Nutritional status was also assessed, revealing that 49 children were moderately malnourished, but no significant link to anemia was found (χ^2 = 4.072, p = 0.25). Worm infestations were present in 26 children, yet this condition showed no significant impact on anemia status (χ^2 = 0.425, P = 0.51). The educational background of mothers varied, with 33 being illiterate and 63 holding graduate degrees. Additionally, a majority of the children (92, 47%) came from lower socioeconomic backgrounds.

TABLE 2: Demographic, clinical, and socioeconomic correlates of anemia among children (n=196): A focus on anemia, nutritional status, and health factors

Variable	Frequency (Yes)	Percentage (Yes)	Frequency (No)	Percentage (No)	χ^2	p-value
Anemia						
Yes	124	63.0				
No	72	37.0				
Residence						
Urban	64	33.0				
Rural	132	67.0				
Skin Texture						
Pale Skin	129	66.0				
Normal Skin	67	34.0				
Malarial Parasite						
Positive	48	25.0				
Negative	118	75.0				
Gender					1.150	0.28
Male	58		28			
Female	66		44			
Iron Deficiency					126.04	0.00
Anemia						
Yes	103		0			
No	21		72			

|					
Nutritional Status				4.072	0.25
Normal	16		7		
Mild Malnutrition	44		18		
Moderate **Malnutrition**	49		33		
Severe Malnutrition	15		14		
Worm Infestations				0.425	0.51
Yes	26		18		
No	98		54		
Maternal Education Level					
Illiterate	33	17.0			
Primary	43	22.0			
Secondary	26	13.0			
Intermediate	31	16.0			
Graduate	63	32.0			
Socioeconomic Status					
Lower Socioeconomic	92	47.0			
Middle Socioeconomic	52	26.5			
Upper Socioeconomic	52	26.5			
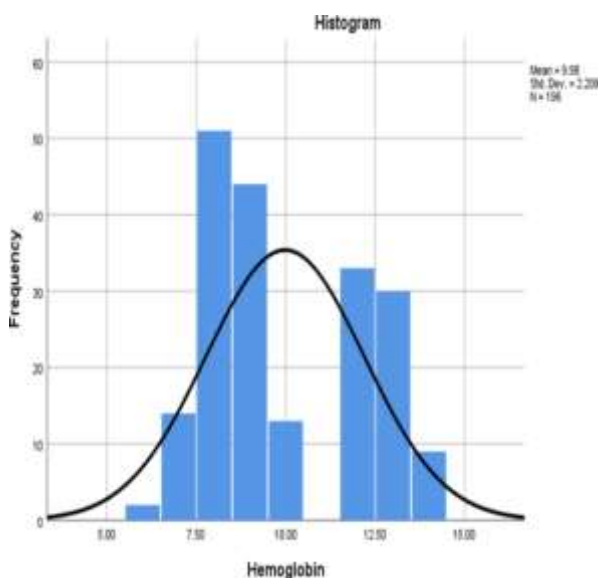
Fig 1: Graphical representation of mean hemoglobin levels of children (n=196)

Out of the total children, 23 (12%) were found to have normal, 62 (31) had mild malnutrition, 82 had moderate malnutrition, and 29 (15%) had severe malnutrition as evaluated by the WHO Z-score system.
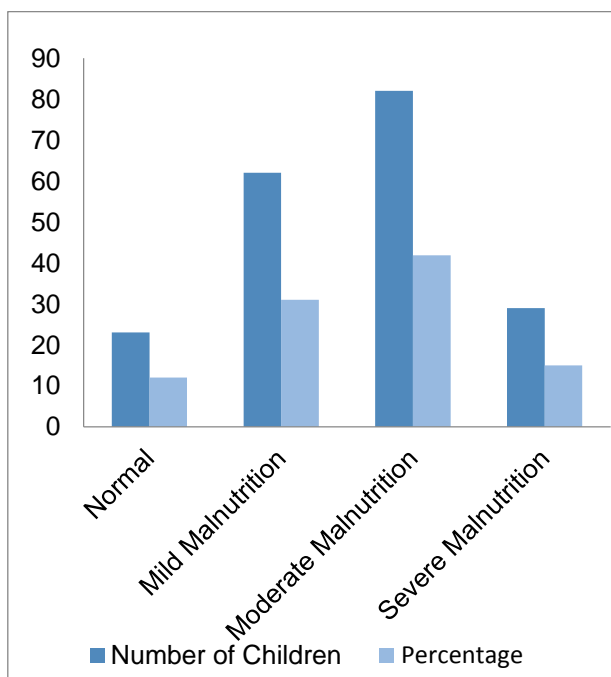

Fig 2: Graphical representation of distribution of children with clinical assessment of malnutrition and their classification by WHO z-scores.

DISCUSSION

The prevalence and factors of anemia among children aged 6–59 months reveal a global health concern. In our study, the prevalence was 63%, surpassing Northern Ethiopia's 37.3%.[8] Different countries have presented different reports regarding the prevalence of anemia.[8] Low socioeconomic status also contributes to the increasing prevalence of anemia. Anemia among children is recognized as a significant public health issue globally. The WHO reported that globally 42.6% of children aged 6–59 months were affected by anemia in 2011, with the highest rates in Africa (62.3%) and Southeast Asia (53.8%).[9]

Another important finding in our study was the place of residence. Children from rural areas tend to be more anemic than those who live in urban areas. Similar results were seen in a study conducted by Aboubakari et al., who highlighted the importance of the place of living.[10] In rural areas, there is a lack of basic provision of health care facilities along with a lack of parental education, which poses a huge threat towards a high prevalence of anemia.

In our study, female children developed more anemia than male children. On the other hand, the study by Dyness et al. demonstrated that the prevalence of anemia is higher in male children than in female children.[11] This discrepancy could be due to our study's sample collection technique, which allows every individual who has met the inclusion criteria equal chances to enroll. Another cause may be the cultural issues in our society that make parents take better care of male children than female children in terms of education and food.

Our study results revealed that about 47% of children who belonged to low socioeconomic class developed anemia compared to children who belonged to middle or upper socioeconomic classes. These results are consistent with the study conducted by Huixia et at China.[12]

Considering other etiological factors that play an important role in the prevalence of anemia, iron deficiency anemia was found to be one of the main factors that is responsible for developing anemia in children. About 53% of children who had anemia developed iron deficiency anemia in our study. The percentage is quite alarming and highlights the deficiency of nutritional components in our society. Unfortunately, food enriched in iron is highly deficient in our population. Due to poor socioeconomic status, fruits, vegetables, and other important sources are highly lacking. A study conducted by Killip et al. revealed that in Pakistan, among children aged six months to five years, 62.3% were found to be anemic, with 33.2% specifically diagnosed with iron deficiency anemia.[13] Conversely, additional studies have indicated that children who experienced persistent iron deficiency during infancy did not demonstrate cognitive score improvement comparable to those with adequate iron levels over time.[14] Our study showed a significant relationship between anemia and iron deficiency anemia, reflecting the important etiological factor that must be addressed promptly and appropriately. Malnutrition was also an essential component evaluated in our study's children with anemia. Most children who developed anemia were found to be mildly or moderately malnourished. Although clinically significant, the relationship between malnutrition and anemia did not show statistical significance. Other important etiological factors causing anemia, like infection with the malarial parasite and worm infestations in stools, were also addressed in our study. However, no significant statistical relationship was found between anemia and these factors.

CONCLUSION

The prevalence of childhood anemia in our study is very alarming. Associated factors causing anemia put a huge burden either in the form of nutritionally imbalanced children or getting infections from other sources. Lack of parental education and poor socioeconomic status, on the other hand, signifies a massive threat that needs to be addressed. Instead, the prevalence is comparatively high in the population residing in rural areas. An integrated approach of provision of primary health care facilities, creating awareness among parents regarding the importance of nutritionally balanced food, avoiding overcrowding, and maintaining good hygiene are the essential steps that need to be taken care of, to reduce the prevalence of childhood anemia and

improve the outcome of children, especially in resource-limited areas of our country.

Conflict of interest: None

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