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Iron Deficiency Anemia in Infancy and Early Childhood

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Abstract

Introduction: iron deficiency anemia is a prevalent health issues affecting psychological and physical well-being of children in infancy and early childhood in Pakistan.

Objectives: The objective of the study is to find the prevalence of iron deficiency anemia in infancy and early childhood along with its gender and age based variation.

Methodology: This is a cross sectional study conducted at the department of pediatrics in government hospital, Karachi from November 2022 to November 2023 on 300 patients with age less than 11 years of age. Demographic characteristics were noted and sample was collected to perform complete blood count. In patients with hemoglobin level less than predefined criteria serum ferritin levels were performed and level of less than15 µg/L were taken as a standard.

Result: the mean age of the sample was 5.1 ± 4.7 with 54.3% males and 45.67% females. From male patients 60.12 % suffering from iron deficiency anemia, 19.02 had anemia due to other cause and 20.86% were not anemic. In female patients, 73.72% had iron deficiency anemia, and 10.95% had non-iron deficiency anemia. On the other hand, in the age group under a year, 49.21% (P = 0.05) were anemic and the age range of 1-3 years 60.27% (0.04) had iron deficiency anemia. A startling 82.02% (P=0.03) anemia prevalence was reported in the 4–7 years age range. Comparably, 68% (P=0.04)of patients in the 8–11 age range were anemic

Conclusion: The study's thorough examination of the demographics of gender and age group highlighted important correlations between these factors and the frequency of iron deficiency anemia in infancy and early childhood.

Keywords: Iron deficiency anemia, infancy, childhood, gender.

Introduction

Iron insufficiency (ID) is the most prevalent micronutrient deficit globally. ID, which affects around 2 billion people globally—roughly 25% of the world's population—is the most prevalent kind of malnutrition, according to the WHO[1]. Global estimates indicate that iron deficiency accounts for 50% of anemia cases [2]. The body's immune system needs iron to grow. Deficits in motor and psychomotor development as well as poor cognitive functions have been associated with ID vary in preterm infants from 25 to 80% during infancy [3]. Worldwide, the prevalence of ID is 4.6% in babies under 6 months, 12% in babies between 6 and 12 months, and 6.6-25.2% in toddlers [4]. Since between 30 and 69% of Pakistanis have ID, it is a serious health issue in their country. Particularly in underdeveloped nations like Pakistan, iron deficiency anemia (IDA) continues to be a serious public health problem in infancy and early childhood. In Pakistan, ID affects 65-78% of children under the age of five [5]. Because it can cause irreparable loss of productivity in adult health due to its lasting influence on mental development and higher mortality, childhood IT is particularly harmful.

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Iron deficiency anemia is a very concerning condition that poses a significant risk to the health and development of newborns and young children in Pakistan [6]. Rural locations with little access to proper nutrition and treatment tend to have higher incidence rates. In Pakistan, iron deficiency anemia affects a large number of infants and young children, for a variety of reasons [7]. The main cause is inadequate dietary iron intake, which is typified by a deficiency of foods high in iron and a low nutritional variety. Iron loss is further aggravated because absorption is compromised by recurring illnesses and parasite infestations [8]. Infants and young children that experience anemia early in life are largely caused by low maternal iron status during pregnancy, poor nursing, and a delayed introduction of iron-rich complementary meals[9].

Early childhood iron deficiency anemia has a profound impact on a child's physical and mental development. According to research, Pakistani anemic children are more likely to experience delayed motor skills development, limited growth, and cognitive impairment [10]. The effects are not limited to the early years; they also have an impact on productivity and educational success in later life. Numerous treatments and initiatives have been put in place to address the problems that iron deficiency anemia poses for Pakistani children [11]. Policy development has benefited from the important insights into the prevalence and determinants of anemia offered by the National Nutrition Survey and the National Micronutrient Survey [12]. With frequent supplementation, the National Iron and Folic Acid supplementation Program aim to increase iron status in children and pregnant women. However, issues including inadequate healthcare infrastructure, low knowledge, and cultural influences on eating behaviors impede the efficacy of these initiatives [13].

In Pakistan, there are still a number of obstacles to overcome in the fight against iron deficiency anemia in infancy and early childhood. Intervention program success is still being hampered by sociocultural obstacles, inadequate finance, and inadequate healthcare systems. Sustainable transformation requires an all-encompassing, multi-sectoral strategy that involves public awareness campaigns, education, and better access to healthcare [14]. In conclusion, iron deficiency anemia throughout the early stages of life is still a serious public health concern in Pakistan. Its great frequency and detrimental consequences on cognitive and physical development highlight the urgent need for efficient therapies. To lessen the impact of iron deficiency anemia in this susceptible group, it is imperative to address the underlying causes, improve nutritional education, and upgrade the healthcare system. Policymakers, medical experts, and community members must work together to adopt long-term initiatives that guarantee Pakistani children's future opportunities and well-being.

Methodology

This is a cross sectional study conducted at the department of pediatrics in government hospital, Karachi from November 2022 to November 2023 after taking approval from the ethical review committee. A total of 300 patients with age less than 11 years of age were selected for the study after taking informed consent from their parents and guardians. All the steps involved in this study were explained to the parents and patient. The patients who were admitted in pediatrics ward or presented in outdoor patients department were studied. A predefined criterion of inclusion and exclusion was used for selection of study sample. All children with history of pallor, easy fatigability, breathlessness and pica were included in the study. Similarly, children with learning and behavioral disorders, poor school performance and cow milk intake were also included in the study. On the other hand patients with history of any co-morbidity like malnutrition, infection, inflammation, and congenital heart disease, history of frequent blood transfusions or thalassemia were excluded from this study. Moreover, any patients who have complaint of renal failure, liver failure, congenital syndromes/anomalies and inborn errors of metabolism were also excluded from the study sample.

After selection of the sample each patient was given a unique number and detailed history about demography like age, height, weight, dietary habits, worm infestation and PICA was taken by a trained resident. Similarly, clinical data was also collected and examination of the patients was also done for pallor. A 5ml sample of blood was collected from each patient and complete blood count was done for each patient. All those patients who have serum hemoglobin level less than the pre-defined criterion their serum ferritin levels were assessed. Anemia was defined as the level of hemoglobin level with two standard deviations below the mean for age [15]. Hence, reference ranges for different age groups were defined as per the guidelines. The lowest limit of the normal range for hemoglobin in newborns younger than two months of age is 9.0 mg/L. As children go up through the age groups, the lower limit rises to 9.5 mg/L for 2 to 6 months old and then to 10.5 mg/L for 6 to 24 months old . The lower limit of normal hemoglobin levels for children is set at 11.5 mg/L for those between the ages of 2 and 11 [16]. The standard of low serum ferritin levels were set at levels less than 15 µg/L [17].

The ferritin levels and CBC were performed for free in the hospital. The data was put into SPSS version 23 for statistical analysis. The mean and standard deviation of numerical data, such as age, were measured using

descriptive analysis. Frequency and percentage were used to measure iron insufficiency. Stratification was utilized to account for age and gender as impact modifiers. For post-stratification, the chi square test was employed. It was deemed significant when the result was $p < 0.05$.

Result

The results of the study has shown that that the mean age of 5.5 years and a standard deviation of 4.7 years were observed in the 300-person study sample, which represented a varied range of ages. Given the vast age span within the cohort, the distribution across age groups showed a variable representation. Intriguingly, the age groups were divided into four categories: under one year (21%), one to three years (24.3%), four to seven years (29.6%), and eight to eleven years (25%). The demographic makeup of the research participants may be thoroughly analyzed thanks to this segmentation. With 54.3% of individuals identifying as male and 45.67% as female, the cohort's gender distribution showed a well-balanced representation. In addition, the study examined the participants' socioeconomic level and found that they were distributed differently throughout socioeconomic strata. 48.67% of participants, or most of the group, were classified as having a low socioeconomic position. In the meantime, 23.67% and 27.67%, respectively, were assigned to the medium and upper socioeconomic classes as shown in table 1 and figure 1 .

The study examined the associations between anemia prevalence, age groups, iron deficiency, and gender in 300 patients. An examination of the 163 male patients showed that 60.12% of them were anemic, with 19.02% of those cases being related to non-iron deficiency anemia with normal serum ferritin levels. Meanwhile, 20.86% were non-anemic. On the other hand, 73.72% of the 137 female participants in the study had iron deficiency anemia, and 10.95% had non-iron deficiency anemia. Gender-based disparities in anemia rates may exist, as evidenced by the statistically significant variations in anemia prevalence identified across genders ($P = 0.04$) as shown in table 2 and figure 2.

Age group analysis further unveiled intriguing patterns. Of the 63 patients in the age group under a year, 49.21% were anemic, of which 17.46% were not iron deficient and 33.33% were non-anemic. The age range of 1-3 years, including 73 patients, had a 60.27% prevalence of anemia. Of them, 21.92% were non-iron deficient anemics and 17.81% were not anemic. A startling 82.02% anemia prevalence was reported in the 4–7 age range (89 patients), with 7.87% of anemic individuals were not deficient in iron and 10.11% were not anemic. Comparably, 68% of the 75 patients in the 8–11 age range were anemic, with 18.67% were suffering from non-iron deficiency anemia. On the other hand 16% were non anemic. The statistical study, which took into account age-specific factors influencing changes in anemia rates, showed substantial differences in the prevalence of anemia across different age groups ($P = 0.05$, 0.04, 0.03, and 0.04, respectively).

Table 1: demographic characteristics of the study sample

1.	**Variable**	**Frequency (n=300)**
	Age in years (mean ± SD)	5.5 ± 4.7
2.	**Age groups (%)**	
	Less than 1 year	63(21%)
	1-3 years	73 (24.3%)
	4-7 years	89 (29.6%)
	8-11 years	75 (25%)
3.	**Gender**	
	Male (frequency and percentage)	163(54.3%)
	Female (frequency and percentage)	137 (45.67%)
4.	**Socioeconomic status**	
	Low	146 (48.67%)
	Middle	83 (27.67%)
	High	71 (23.67%)

Table 2: Age and gender base distribution of anemia

	Variable	**Number of patients**	**Anemia**		**Non anemic**	**P value**
			Iron deficient	**Non- iron deficient**		
	Gender **Male**	163	98(60.12%)	31(19.02%)	34(20.86%)	0.04

	Female	137	101(73.72%)	15(10.95%)	21(15.33%)	0.03
	Age groups					
	Less than 1 year	63	31(49.21%)	11(17.46%)	21(33.33%)	0.05
	1-3 years	73	44(60.27%)	16(21.92%)	13(17.81%)	0.04
	4-7 years	89	73(82.02%)	7(7.87%)	09(10.11%)	0.03
	8-11 years	75	51(68%)	12(18.67%)	12(16%)	0.04

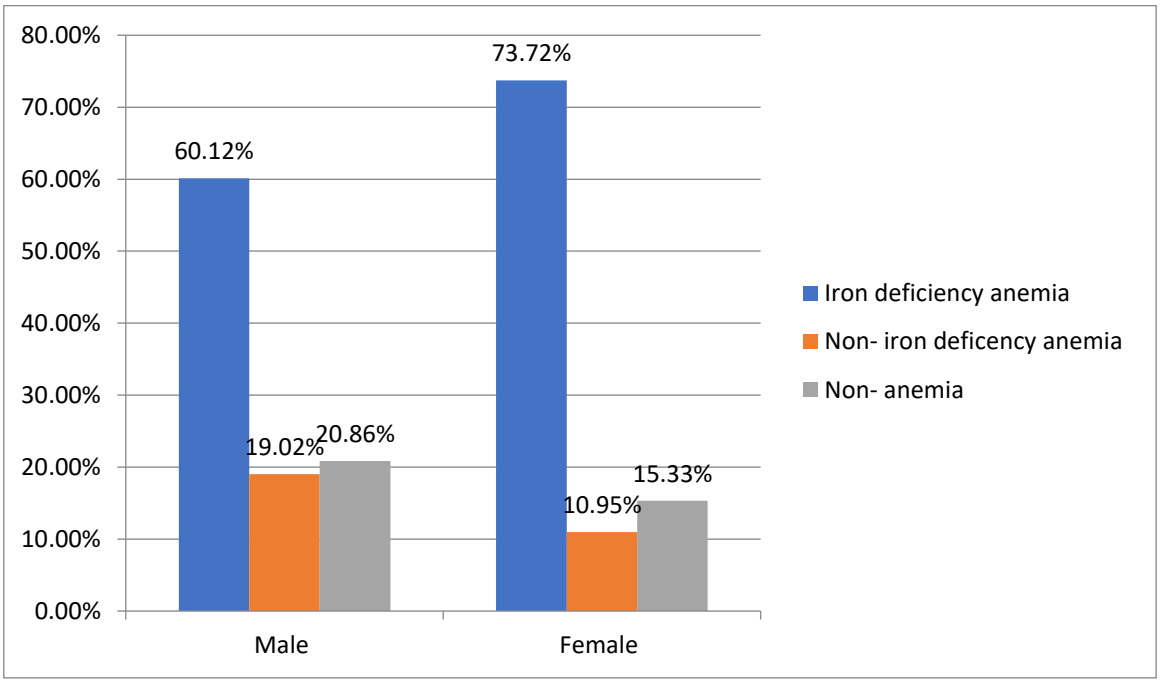

Figure 1: Gender based variation in anemia

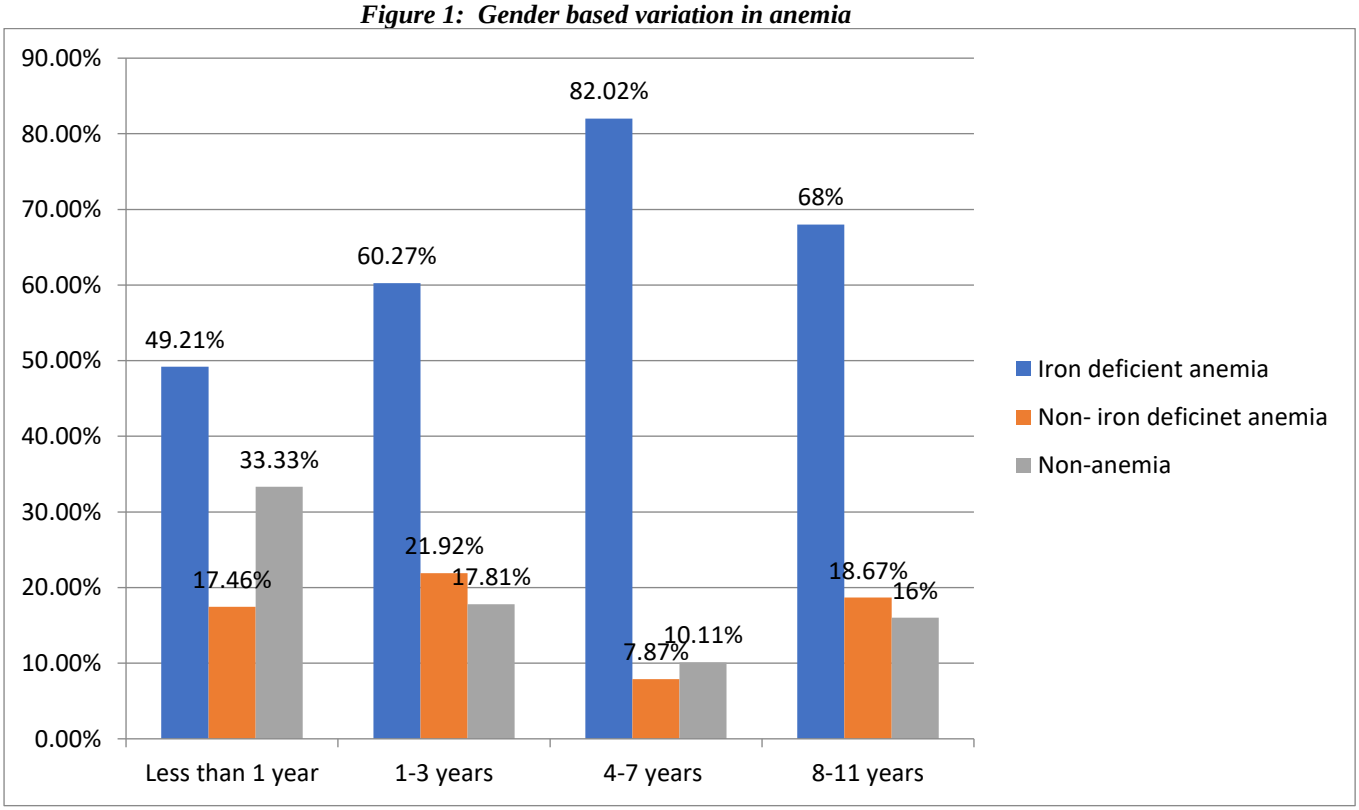

Figure 2: Age based variation in prevalence of anemia

Discussion

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Hemoglobin (Hb) levels are a vital sign of general health and iron status, and they vary within acceptable ranges for different age groups. These age-appropriate benchmarks give medical practitioners a framework for measuring and tracking hemoglobin levels, which helps with the early diagnosis and treatment of diseases like iron deficiency anemia, which is especially important during the formative years of infancy and childhood [18]. Because socioeconomic position has been demonstrated to affect access to resources, healthcare, and general well-being, it is also essential for comprehending the contextual elements that may affect health outcomes. A thorough description of the research population, including age, gender, and socioeconomic position, is provided by the dataset that was used [19]. The observed variation in age and socioeconomic position highlights the significance of taking these elements into account in any further analysis, guaranteeing a thorough comprehension of the connections between demographic variables and the outcomes being studied. Furthermore, the gender distribution presents a possible way to investigate gender-specific differences or patterns in the research group.

The provided data illustrates the prevalence of iron deficiency anemia, non-iron deficiency anemia, and non-anemia across gender categories. These percentages illustrate notable trends and public health consequences regarding the distribution of anemia types among males and females. Females are more likely than males to suffer from iron deficiency anemia [20]. This disparity in gender is consistent with the body of research, which highlights how societal taboos and other factors make women more susceptible to iron deficiency. The results also indicate that although iron deficiency anemia is more common in women, men may also develop other types of anemia, which might be caused by long-term illnesses, genetic disorders, or malnutrition other than iron deficiency [21]. To fully comprehend the anemia trends in various demographic groups, more research into the individual etiologies of male non-iron deficiency anemia is important. Furthermore, the data raises questions about sociocultural variables that could be involved in these gender-specific trends. The frequency of anemia in both males and females can be influenced by gender roles, food choices, and healthcare-seeking behaviors. Using qualitative research techniques to investigate these contextual elements would provide a deeper comprehension of the patterns found and guide the creation of solutions that are sensitive to cultural differences [22].

Even while there are clear gender differences, it's important to understand that anemia is a complex illness impacted by a range of factors other than gender, such as socioeconomic position, dietary habits, and access to treatment. To successfully manage anemia, a thorough investigation of these variables is essential for the development of comprehensive and context-specific therapies. The age-specific trends in the prevalence of non-iron deficient anemia, anemia, and iron deficiency anemia show how anemia-related variables change with the stages of childhood [23]. During the initial years, when iron deficiency anemia is more common, early treatments and focused techniques seem to be essential. The fact that the prevalence of non-iron deficient anemia decreases with age emphasizes how crucial it is to comprehend how anemia develops with time and its changing causes. The basis for creating age-appropriate treatments is provided by this analysis, which highlights the importance of continued surveillance and early childhood interventions in addressing the evolving anemia landscape in the pediatric population.

Conclusion

In conclusion, the study's thorough examination of the demographics of gender and age group highlighted important correlations between these factors and the frequency of anemia. In order to manage and alleviate anemia in this patient group, the observed discrepancies highlight the necessity for focused interventions and age- and gender-specific healthcare measures. These results provide important new information for academics, politicians, and healthcare professionals who work to improve our knowledge of and ability to treat anemia in a variety of demographic settings.

Conflict of interest

There is no conflict of interest involved in this study

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