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FREQUENCY AND DETERMINANTS OF IRON DEFICIENCY ANAEMIA IN CHILDREN AGED 6 MONTHS TO 5 YEARS AND ITS IMPACT ON GROWTH PARAMETERS

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ABSTRACT

Background: One such nutritional disease of early childhood is iron deficiency anaemia (IDA) that has significantly contributed to the health challenge of the developing countries. It may impact adversely physical development, cognitive development, immunity and general wellbeing of children that are below five years of age.

Place and Duration of Study: This study was conducted in Pediatric Medicine Department of Children Hospital and Institute of Child Health, Multan from January 2023 to July 2023.

Objective: To identify the prevalence of iron deficiency anemia among children aged 6 months to 5 years and the predictors of iron deficiency anemia and to evaluate the effects of iron deficiency anemia on the growth parameters.

Methodology: Two hundred and eighty-eight children aged between 6 months, and 5 years were conducted in a tertiary care hospital in a cross-sectional study. The process of informed consent was provided with the help of a structured proforma which included the following demographic data, eating habits, socioeconomic status, maternal education, and history of infections. Diagnosis of iron deficiency anemia (IDA) was done by taking blood samples to determine haemoglobin, serum ferritin and blood indices. The weight and height/length and MUAC growth parameters were measured and compared to WHO standards. The data were subjected to statistical software to identify the prevalence of IDA and the association between it and the risk factors and the growth outcomes.

Results: There were 288 children out of which iron deficiency anemia (IDA) was very prevalent with many of them being diagnosed with the help of low haemoglobin and serum ferritin levels. Children that had low intake of dietary iron and those who had a lengthy milk feeding record were more likely to have IDA. It was also more in low socioeconomic children and those of higher birth order. Maternal illiteracy and frequent infections only added to the danger. The weight, height and MUAC of the children with IDA were significantly less than that of the non-anemic children. These results suggest that low nutritional status is strongly correlated with iron deficiency anemia that exhibits the adverse effect of iron deficiency anemia on growth and development during early childhood.

Conclusion: Anemia associated with iron deficiency is very common in children below the age of five and is connected to unhealthy eating habits, low socioeconomic status, maternal illiteracy and infections. It has adverse effects on development and health in general. There must be screening early, eating better, taking iron supplements, and parent education. Public health should work towards creating awareness and enhancing access to healthcare to reduce its weight.

KEYWORDS: Iron deficiency anemia, children, under five, growth parameters, nutrition, prevalence, risk factors, paediatrics.

INTRODUCTION

The most prevalent nutritional deficiency globally and a key health issue of concern to the populations is iron deficiency anemia (IDA), which affects children under the age of five years the most. The World Health Organization has suggested that a big percentage of young children in the world is affected by anemia and iron deficiency is the most prevalent cause [1]. Children between the ages of 6 months and 5 years are particularly susceptible to this because of the rapid development and the high nutritional need coupled with the poor nutritional intake of iron [2]. Poverty, malnutrition, poor feeding habits, and low access to healthcare services contribute to even higher burden of IDA in developing countries [3].

Iron is crucial in the synthesis of haemoglobin, which is necessary in the transportation of oxygen all over the body. In case of inadequate iron, the production of hemoglobin reduces, hence causing anemia. During early childhood, the effects of iron deficiency anemia are more severe than the decreased oxygen-carrying capacity [4]. It is related to slow cognitive development, learning disability, short attention span, and behavioural issues [5]. Also, anemia suppresses the immune system, exposing children to infections, aggravating their nutritional condition.

The 6 months to 5 years age is a critical period of physical development and brain development. In this phase, children abandon the use of the sole method of feeding, which is breastfeeding, to the use of complementary feeding [6]. When the introduction of complementary foods is not timely or the iron consumption is insufficient, the chances of developing IDA are high [7]. Long durations of exclusive breastfeeding without iron supplement, excessive intake of cow milk, and low-iron content diets are key factors [8]. Additionally, maternal anemia, low birth weight, increased birth order, poor socioeconomic conditions, and parental lack of education are also influential factors in the development of anemia [9].

The important parameters of growth that include the weight, height/length, and mid-upper arm circumference are important indicators of the nutrition and health status of a child [10]. Iron deficiency anemia has been found to have adverse effects on these parameters resulting to underweight, stunting, and delayed physical development [11]. This does not only affect short-term health but also negatively affects productivity and quality of life in the long-term [12].

Although IDA can be prevented and treated, it is not diagnosed and under-managed in most environments. Thus, it is imperative to determine its prevalence, risk factors, and effect on growth to develop effective prevention and intervention measures that can enhance child health outcomes [13].

OBJECTIVE

This paper was undertaken to determine the prevalence of iron deficiency anemia among children aged 6 months to 5 years, the most significant causes of this situation (including dietary and socioeconomic factors), and the effects of the disorder on growth parameters (weight, height and nutritional status) to enable early diagnosis and effective measures to prevent the outcomes.

METHODOLOGY

The study design was a cross-sectional study, which was carried out in the Pediatric Medicine Department of Children Hospital and Institute of Child Health, Multan from January 2023 to July 2023 , to determine the prevalence and the predictors of iron deficiency anemia among young children. The researchers recruited 288 children aged 6 months to 5 years to visit their clinics to have routine check-ups or minor illnesses. To guarantee statistical reliability and validity the sample size of 288 was determined with the formula of the WHO sample size calculator.

A non-probability consecutive sampling method was used to select the participants. The informed consent was given in a structured proforma after which the demographic and clinical information was collected using a structured proforma. The information obtained was age, gender, feeding, dietary intake, socioeconomic status, maternal education and history of recurrent infections.

Laboratory tests to identify iron deficiency anemia were carried out. Blood samples under aseptic conditions were taken to measure the haemoglobin levels, mean corpuscular volume (MCV) and serum ferritin levels. Children who had low haemoglobin and low serum ferritin were referred to as iron deficiency anaemic.

Standardized procedures were used to determine the growth parameters. Measurement of weight was done on a calibrated weighing scale and height, or length was done on a stadiometer or infant meter. To determine nutritional status, mid-upper arm circumference (MUAC) was also used. All metrics were in comparison with WHO growth standards.

INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA: The subjects were the children in the age bracket of 6 months to 5 years, who came to paediatric department. Children were recruited simply, by the informed consent of their parents or guardians. Iron deficiency anemia (IDA) and no anemia children were chosen to allow the comparison of groups to one another. Any participants who visited regularly to check-up or have minor illnesses were eligible. This was done

to have a representative sample of the general paediatric population to properly evaluate the prevalence of anemia and risk factors involved.

EXCLUSION CRITERIA: Children who had known chronic conditions like congenital heart disease, thalassemia, chronic kidney disease or other haematological conditions were also not included in the research. The patients who had blood transfusions or iron supplementation within three months before the study were also excluded so as not to interfere with the laboratory findings. Also, no severely ill children who needed emergency medical care were involved, as it might have added bias and compromised study finding's reliability and validity.

DATA COLLECTION

A structured and pre-tested questionnaire that had been specifically designed to collect data was used to collect data. The 288 children who participated in the study after providing informed consent were interviewed to get information on detailed data regarding demographic characteristics, feeding behaviours, dieting and socioeconomic status. The parents or the caregivers were interviewed. The focus was made on the consumption of the iron-based foods, the duration of the time spent on the breast feeding and the time on complementary feeding.

The children were provided with a comprehensive clinical examination to ascertain the overall health status and anemia (pallor, fatigue and weakness). Anthropometric measurements like weight, height or length and mid-upper arm circumference (MUAC) were measured using standardized procedures and calibrated measuring tools to be accurate and consistent.

Aseptic collection of blood was done by trained health personnel. The amount of haemoglobin was measured using an automated hematology analyser and serum ferritin was measured to make sure that there is iron deficiency. Mean corpuscular volume (MCV) was also measured to aid the diagnosis.

All the data collected were properly documented and verified by examining its completeness and authenticity. We measured the children using anthropometric measurements and compared them with WHO growth charts to classify them as normal, underweight and stunted. The obtained information was then entered into a statistical program to establish patterns, relationship and association between iron deficiency anemia, the risk factors and growth outcomes.

RESULTS

A survey was conducted on 288 children aged 6 months to 5 years, and it was established that there was high level of iron deficiency anemia. A large proportion of children were noted to be anemic with the percentages being higher among the younger age groups and low socioeconomic status. Poor dieting intake of iron rich food, long periods of exclusive milk feeding, illiteracy of the mother, high birth order, and frequent infections were major contributory factors. Children who were iron deficient anaemic had very low mean values, weight and height, compared to the children who were not anaemic. The percentage of children affected with anemia was found to be higher with lower body weight and stunted in relation to WHO growth criteria. The nutritional status was also measured based on the circumference of the mid-upper arm and obtained worse results in children with the disease. In most cases, the findings reveal that the iron deficiency anemia is closely correlated with the impaired growth parameters and, therefore, to diagnose it earlier, improve the nutrition and preventive strategies among young children.

Table 1: Demographic Characteristics of Study Participants (n = 288)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	6–12 months	72	25%
	1–3 years	108	37.5%
	3–5 years	108	37.5%
Gender	Male	150	52.1%
	Female	138	47.9%
Socioeconomic Status	Low	162	56.3%
	Middle	90	31.3%
	High	36	12.5%
Maternal Education	Illiterate	120	41.7%
	Primary	96	33.3%
	Secondary & above	72	25%

Table 1 shows the demographics of the 288 children that were involved in the study. The majority of the sample was aged between 1-5 years old and that there were more males than females. Most of the children were low socioeconomic status which means that they had less access to nutrition and healthcare services. The level of maternal education was also very low with a large number of the mothers being illiterate or having primary education. These demographics are significant because they are highly linked with the incidence of iron deficiency anemia and indicate underlying social determinants to poor child health and nutritional performance.

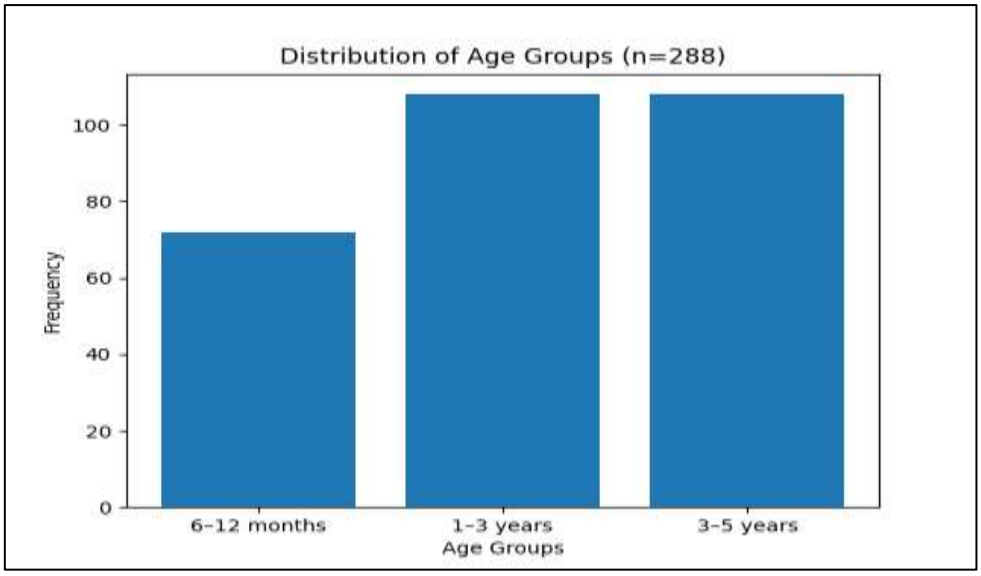


Table 2: Risk Factors Associated with Iron Deficiency Anemia among Children (n = 288)

Variable	Category	Frequency (n)	Percentage (%)
Dietary Iron Intake	Poor iron intake	174	60.4%
	Adequate iron intake	114	39.6%
Milk Feeding Pattern	Prolonged exclusive milk feeding	168	58.3%
	Appropriate complementary feeding	120	41.7%
Socioeconomic Status	Low income	162	56.3%
	Middle/High income	126	43.8%
Maternal Education	Illiterate	120	41.7%
	Literate	168	58.3%
History of Recurrent Infections	Present	132	45.8%
	Absent	156	54.2%
Birth Order	1–2 children	102	35.4%
	3 or more children	186	64.6%

Table 2 shows the high-risk factors of iron deficiency anemia in the 288 children who participated in the study. The most prevalent was poor dietary iron intake, and the subsequent is prolonged exclusive milk feeding and the low socioeconomic status. Many children were also in higher birth order families, which may represent less resources in the household, and less concern about nutrition. Mothers who were illiterate and were often infected were also leading causes. These findings indicate that nutritional causes are not the sole reasons behind iron deficiency anemia, but there are social, maternal and environmental factors also, which predispose young children to iron deficiency anemia.

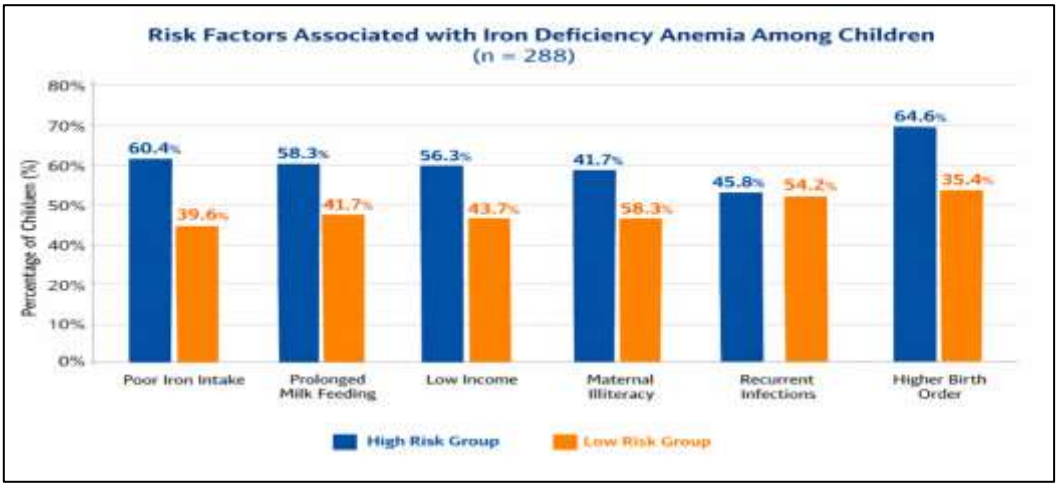


Table 3: Comparison of Growth Parameters between Anemic and Non-Anemic Children (n = 288)

Growth Parameter	Anemic Children (Mean ± SD)	Non-Anemic Children (Mean ± SD)
Weight (kg)	9.8 ± 2.1	12.4 ± 2.6

Height/Length (cm)	78.5 ± 6.3	86.2 ± 7.1
MUAC (cm)	12.1 ± 1.2	13.8 ± 1.4

Table 3 compares the parameters of growth of anemic and non-anemic children that took part in the study. The results are clear, mean weight, height / length and mid upper arm circumference of children with iron deficiency anemia are lower than the mean weight, height / length and circumference of the mid upper arm of non anemic children. These variations indicate the low nutritional condition and physical development in anemic children. The decreased MUAC also indicates under-nutrition and muscle-wasting among children with the condition. Overall, the findings show that growth parameters are strongly correlated with iron deficiency anemia and this is indicative of the importance of diagnosing and treating iron deficiency anemia in children at an early age.

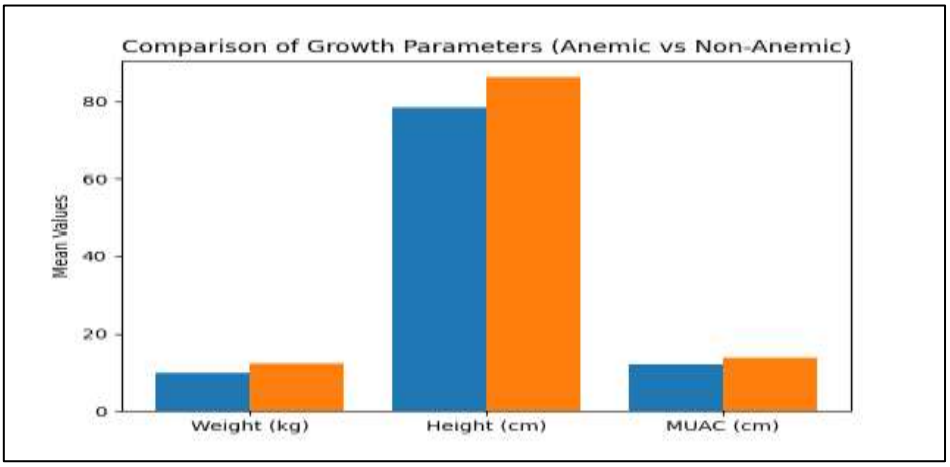


Table 4: Nutritional Status of Anemic and Non-Anemic Children (n = 288)

Nutritional Status	Anemic Children (n)	Non-Anemic Children (n)	Total (n)
Underweight	72	28	100
Stunted	68	24	92
Normal	40	56	96
Total	180	108	288

The data on the prevalence of nutritional status of anemic and non-anemic children is given in Table 4. The percentage of anemic children underweight and stunted was quite high when compared to non- anemic children. In contrast, most non-anemic children were categorized as having normal nutritional status. The results of this study are a clear indication that iron deficiency anemia is closely linked with unhealthy nutrition and maldevelopment. The greater rates of underweight and stunting in anemic children underscores the effect of nutritional deficiencies on physical growth. Overall, the table demonstrates the need to improve nutrition and provide nutritional treatment in time to alleviate anemia and healthy growth in children.

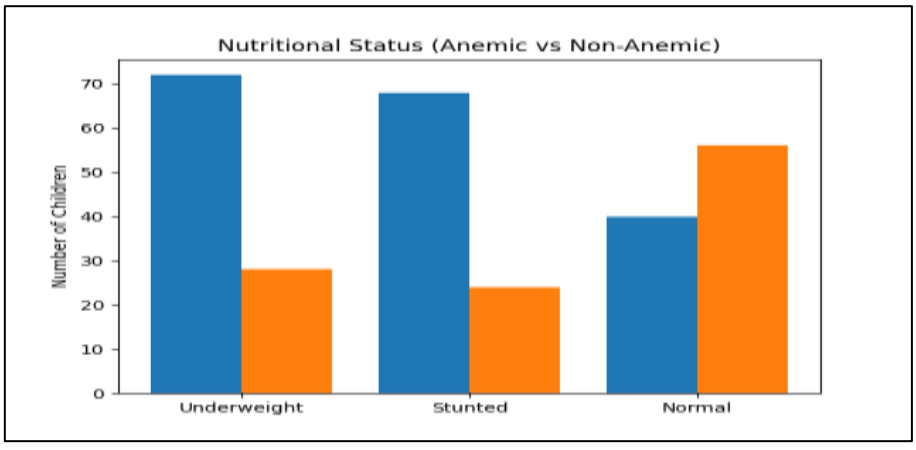
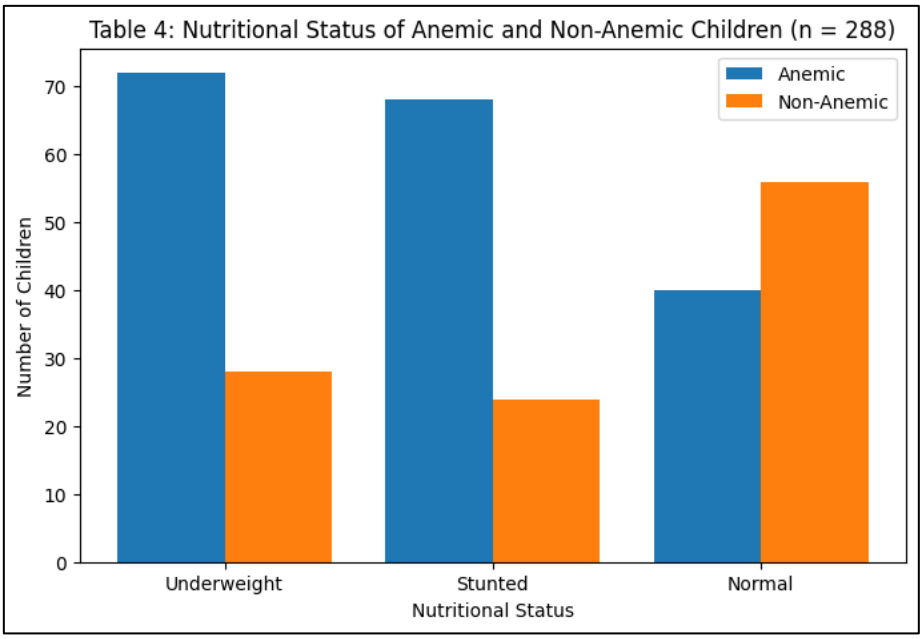


Table 5: Prevalence and Severity of Iron Deficiency Anemia among Children (n = 288)

Category	Frequency (n)	Percentage (%)
Non-Anemic Children	180	62.5%
Mild Anemia	54	18.8%

Moderate Anemia	38	13.2%
Severe Anemia	16	5.5%
Total	288	100%

The general distribution of anemia status of the 288 children who took part in the study is indicated in Table 5. A large proportion of the children were non-anaemic and many of them had iron deficiency anemia of varying severities. The most common was mild anemia followed by moderate and severe anemia. The cases with severe cases were less frequent but of clinical interest because they may lead to health issues. The results show that many children are at a risk and need to be detected and treated early. This underscores the significance of regular screening, better nutrition, and early treatment to alleviate the anemia burden.



DISCUSSION

The present paper demonstrates that iron deficiency anemia (IDA) is highly prevalent in children aged 6 months to 5 years that validates its status as a major health challenge among the populace, predominantly in the developing world [14]. The results are in line with the past national and international research, which indicate that a high percentage of children under five suffers anemia because of several factors in relation. To describe the high burden that was realized in this study, one can refer to the nutritional deficiencies, socioeconomic factors and environmental factors that lead to child health results [15].

Some of the most significant findings are that there is a strong association between iron deficiency anemia and poor diet (Petry et al., 2019). Many anaemic children were identified to have insufficient consumption of iron-rich foods like meat, green leafy vegetables, and fortified cereals. Also, it was observed that the long duration of exclusive milk feeding without the introduction of complementary feeding on time also played a significant role. Milk is low in iron and when milk is consumed at a large quantity, it prevents absorption of iron. These results are consistent with the current research, which has stressed the fact that poor feeding habits of infants and young children are crucial factors in the onset of anemia [16].

Another important determinant of IDA became socioeconomic status. Low-income families were more vulnerable to children mainly due to unhealthy food access, low quality of life, and lack of health care services. Insufficient financial resources would also be a contributing factor to inadequate dietary diversity, which is a risk factor of micronutrient deficiency [17]. In addition, it was established that one of the key determinants that influence the prevalence of anemia is maternal education. The rate of the IDA in children whose mothers were illiterate was higher and this shows the importance of the maternal knowledge regarding the correct nutrition, hygiene and health care practices. The educated mothers will also be in a better position to embrace the correct feeding habits and seek medical attention at the appropriate time and thus improve child health outcomes .

Repeat infections also were also a major cause of the study. Absorption of nutrients, appetite and metabolic rates may be affected due to common diseases such as diarrhea and respiratory diseases which further complicate iron deficiency [19]. This is indicative of the long-standing association between malnutrition and infection wherein malnutrition exacerbates the situation and the vice versa. Therefore, better sanitation, complete immunization and access to healthcare services are important steps to break this cycle.

The other important finding of this study is the consequences of iron deficiency anemia on growth parameters. Anaemic children were very underweight, under height and under mid-upper arm circumference as compared to non-anaemic children. These results indicate that IDA does not affect the haematological status only, as it is also

a cause of growth retardation and poor nutritional status. Loss of haemoglobin level impacts on delivery of oxygen to the tissues which may negatively impact the metabolism and growth processes in cells . The same results have been found by other studies, and they have even associated anemia with stunting, being underweight and having a retarded physical development. There are significant public health implications of findings of this study. Early screening interventions against anemia, promotion of iron-rich diets and iron supplementation interventions are required to alleviate the burden of IDA [16]. The education of parents, particularly mothers can also be very useful in transforming feeding and childcare. Government and healthcare facilities should increase nutrition campaigns and focus on the at-risk populations [20]. Campaigns should also be carried out at the community level to improve the health seeking behaviours and reduce the prevalence of anemia .

CONCLUSION

In conclusion, iron deficiency anemia is a very prevalent health problem among children, those aged 6 months to 5 years aged and is a major health concern that is of concern to the population. Major determinants that have been established, through the research, comprise poor dietary habits, prolonged milk feeding, low socioeconomic status, maternal illiteracy and frequent infections that significantly contribute to the occurrence of anemia in the early childhood stage. The findings also show that iron deficiency anemia and the impaired growth parameters are highly interconnected with each other as the children with the issue were found to have lower weight, height and nutritional status. This shows the dire effects of anemia on physical growth and the health implications in the long-term. The solution to this problem should be found through early diagnosis through regular screening, proper nutritional treatment and iron supplementation and through education of parents. Enhancement of the public health measures and awareness can considerably lower the load of anemia and enhance growth, development and general wellbeing of children within this at-risk age group.

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