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Original Research Article

Study of Anemia and Its Association with Nutritional Status Among School-Going Children: A Cross-Sectional Observational Study

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Abstract:

Background: Anemia is the most common form of nutritional disorder in school-going children around the world, especially in developing countries such as India. Malnutrition, lack of proper diet containing iron, infections, and socioeconomic issues play a crucial role in the prevalence of anemia and poor physical growth among children. The nutritional status of an individual is essential for his/her mental and physical development.

Aim: To evaluate the prevalence of anemia and its correlation with nutritional status among school-going children.

Methodology: The researchers at the Department of Pediatrics, Hind Institute of Medical Sciences, Sitapur, Uttar Pradesh, India. undertook a cross-sectional observational study. Participants in the study ranged in age from six years old to fifteen years old. We measured height, weight, blood pressure, and hemoglobin levels, as well as looked at the patient's nutrition and health history. We used growth metrics and BMI based on World Health Organization (WHO) criteria to evaluate nutritional status.

Results: Among 120 children, 52 (43.3%) were found to be anemic. Mild anemia was observed in 28 (23.3%) children, moderate anemia in 20 (16.7%), and severe anemia in 4 (3.3%). Underweight children showed significantly higher prevalence of anemia compared to children with normal nutritional status. Poor dietary habits, low socioeconomic status, and inadequate iron intake were strongly associated with anemia.

Conclusion: Anemia is still common in school-age children, and there is a high correlation between anemia and malnutrition. Nutritional interventions early in life, screening, health education, and good nutrition are key to minimizing anemia and ensuring proper child development.

Keywords: Anemia, Nutritional Status, School-Going Children, Hemoglobin, Malnutrition, Pediatric Health.

Introduction

Worldwide, children suffer from anemia, a serious condition linked to poor nutrition that poses a public health risk, particularly in developing nations like India [1]. A low hemoglobin level in the blood, which means that red blood cells can't carry as much oxygen, is what the World Health Organization calls anemia [2]. Anaemia in children is most commonly caused by an iron deficit, although other micronutrient deficiencies, such as those in folic acid and vitamin B12, may also play a role [3]. Anemia in children is a major health concern since it hinders a child's ability to grow physically, mentally, immune system-wise, and academically.

School going children are also at high risk of developing anaemia because of the high demand for nutrients during rapid growth and development [4]. The dietary intake of infants and young children, their socioeconomic status, repeated infections, intestinal parasitic infestations and knowledge and awareness of balanced nutrition are important factors that contribute to anemia in this age group. Anemic children are likely to be weaker, more lethargic, less active, less interested in learning, more susceptible to infection, and less able to enjoy their lives, which all have repercussions for education [5].

Children's nutrition status is a key measure of their health and well-being. Malnutrition, undernutrition and micronutrient deficiencies are very common amongst school-age children particularly in rural and semi-urban regions [6]. Anthropometric indicators including BMI, height-for-age, and weight-for-age are widely used for the evaluation of the nutritional status of children and detection of growth abnormalities [7]. Inferior nutritional status has significantly been correlated with anemia in a number of epidemiological studies, demonstrating

that poor nutrition status has a strong impact on hemoglobin synthesis and health [8].

Different studies carried out across India have shown that anemia is a very high prevalence disease among the school going children and have shown a strong association between nutritional status and anemia [9]. Parental education, socioeconomic status, dietary habits, personal hygiene and environmental conditions also play a role in anemia in children besides nutritional deficiency [10]. Hence, it is necessary to know the link between anemia and nutrition to design appropriate and effective preventive and therapeutic strategies [11].

It is essential to diagnose and treat anemia early, to avoid long term physical, mental and developmental complications in children [12]. Nutritional education, iron supplementation, deworming programs and periodic school health checks can be powerful tools in the fight against anemia and the health status of children [13,14].

The purpose of this research was to determine how common anemia is among school-aged children who use the pediatric services at the Hind Institute of Medical Sciences and how it relates to their nutritional status [15].

Methodology

Study Design: Examining the correlation between nutritional status and the incidence of anemia in school-aged children was the purpose of the current cross-sectional observational study. We chose a cross-sectional design because it allowed us to measure the research population's dietary characteristics and hemoglobin content at a certain point in time. The goals of the study were to find out how common anemia is and how it relates to anthropometric measurements and food in children who go to pediatric clinics.

For the purpose of assessing unaffected, naturally occurring variation in nutritional status and hemoglobin levels, an observational design was selected. Extensive clinical examinations, laboratory investigations, and nutritional assessments were conducted to gather extensive information regarding the individuals' health status.

Study Area: The research took place at the Department of Pediatrics, Hind Institute of Medical Sciences, Sitapur, Uttar Pradesh, India. children receive outpatient and inpatient care and regularly undergo nutritional/development evaluation. Children of different socio-economic status are admitted to the hospital so that it is an appropriate place to assess anemia and nutritional disorders in school going children. Laboratory facilities and services of children's health care centers allowed the proper clinical evaluation and hematological investigations necessary for the study.

Study Duration: The study was conducted for one year.

The 1-year study period provided sufficient time for recruitment and enabled seasonal variation in dietary intakes, infections, and nutritional status that could affect haemoglobin levels in children to be reduced.

Study Participants: Patients visited in the pediatric outpatient clinic were a convenience sample of school-aged children (ranging in age from 6 to 15 years old). department during the study period. After taking detailed clinical history, informed consent from the parents/guardians, children were selected.

Inclusion Criteria

The following children were included in the study:

- School-going children aged between 6 and 15 years
- Minors whose legal guardians gave their signed, informed agreement to participate Children attending pediatric outpatient services during the study period
- Children who were cooperative for clinical examination and laboratory investigations

Exclusion Criteria

- Children with long-term systemic diseases such kidney or liver disease, cancer, or TB
- Children receiving hematinic therapy, iron supplementation, or blood transfusion within the previous three months
- Children diagnosed with congenital hematological disorders such as thalassemia or sickle cell anemia
- Seriously ill children requiring emergency medical management or hospitalization
- Children whose parents did not provide consent for participation in the study

Sample Size: The number of children in the study was 120 school going children who met the eligibility criteria. Sample size was aimed to have a good representation of age groups and categories of nutrition in school-age children in the pediatric department.

Data Collection Procedure: A predesigned structured proforma was used to collect thorough demographic and clinical data after informing the parents or guardians. The following demographic information was gathered: age, sex, socioeconomic situation, eating habits, parents' educational background, and personal hygiene routines.

We measured the subjects using standard anthropometric tools, including height and weight. For the purpose of measuring height in centimeters and body weight in kilograms, a calibrated

weighing scale was employed. The formula was used to compute BMI:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

The nutritional status was classified using the WHO growth standards into underweight, normal weight, overweight and obese.

Venous blood samples were taken under aseptic conditions for estimation of haemoglobin level. Standard laboratory procedure was used for measuring hemoglobin concentration in the institutional laboratory. WHO criteria for anemia were applied and anemia was considered as mild, moderate and severe anemia based on age specific hemoglobin concentration.

A clinical examination was also carried out, in order to detect pallor, nutritional deficiencies, and related diseases.

Statistical Analysis: The data that was collected was input into Excel and then analyzed using SPSS version 20.0. Using descriptive statistics such as percentage, frequency, standard deviation, and mean, the data was summarized.

Anemia was found to be associated with nutritional status, a categorical variable, according to a chi-square test. The data for continuous variables were shown as the average plus or minus the standard deviation. A statistically significant result was defined as a P value less than 0.05 for all analyses.

At all times, participants' identities were protected, and the study adhered to all applicable ethical standards in data collection and processing.

Results

A total of 120 school going children aged 6-15 years were included in the present study and they were assessed for anemia and nutritional status. Collected data was analyzed to determine the demographic characteristic, prevalence and severity of anemia, nutritional status and associated factors of anemia to the subjects in the study. The results are summarized in the tables below along with frequencies and percentages for categorical variables. The results also show the link between nutrition status and anemia, and the key dietary and socio-economic factors associated with anemia among children.

Table 1: Demographic Characteristics of Study Participants (n = 120)

Parameter	Frequency (n)	Percentage (%)
Age Group (Years)		
6–10 years	68	56.7
11–15 years	52	43.3
Gender		
Male	64	53.3
Female	56	46.7
Residence		
Rural	72	60.0
Urban	48	40.0

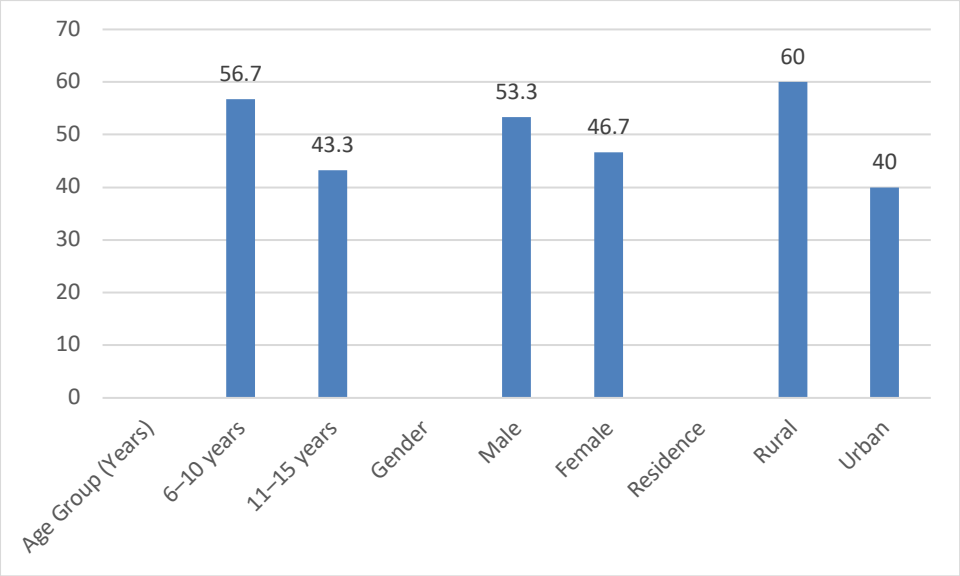

Figure 1: Graphical presentation of Demographic Characteristics of Study Participants

Table 1 Describes the characteristics of the subjects of the study. A total of 120 school going children were included in the study out of which 68 (56.7%) and 52 (43.3%) were in 6-10 years and 11-15 years age group respectively. Gender distribution revealed that males were slightly higher 64 (53.3%) and females were 56 (46.7%). In terms of background, most of the children were from rural background (72 children or 60.0%) and 48 children (40.0%) were from urban background. The results show that the population in the study was mostly rural younger school aged children.

Table 2: Prevalence and Severity of Anemia Among Study Participants (n = 120)		
Severity of Anemia	**Frequency (n)**	**Percentage (%)**
Mild Anemia	28	23.3
Moderate Anemia	20	16.7
Severe Anemia	4	3.3
Normal Hemoglobin	68	56.7

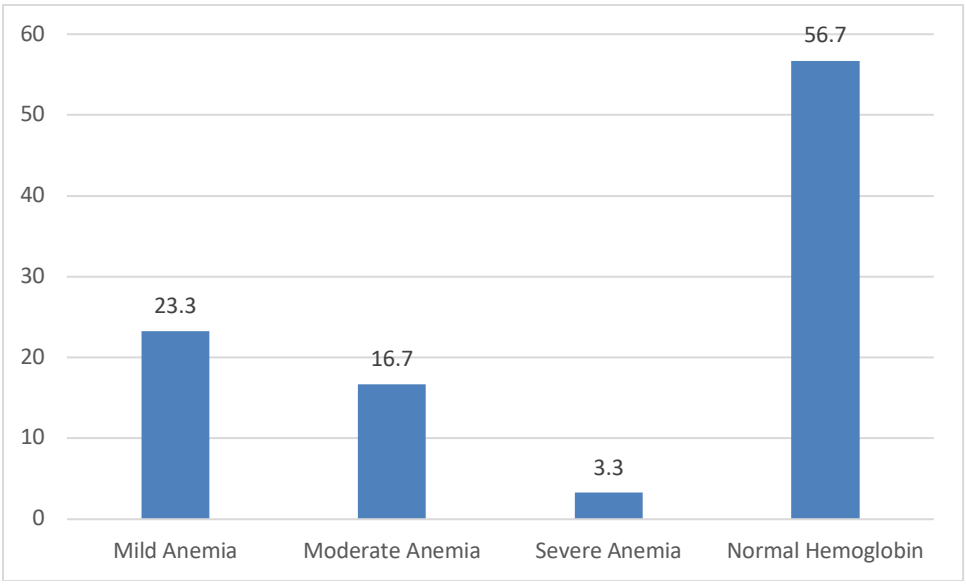

Figure 2: Graphical presentation of Prevalence and Severity of Anemia Among Study Participants

Table 2 shows how many and how bad the anemic participants in the study are. 28 children (23.3%) had mild anemia, 20 children (16.7%) had moderate anemia and 4 children (3.3%) had severe anemia out of 120 children. In the meantime, 68 kids (56.7%) were normal in hemoglobin. The findings show that a significant number of school-going children were anaemic and the most common was mild anaemia among the school children in the study area.

Table 3: Nutritional Status of Study Participants (n = 120)		
Nutritional Status	**Frequency (n)**	**Percentage (%)**
Underweight	40	33.3
Normal Weight	62	51.7
Overweight	12	10.0
Obese	6	5.0

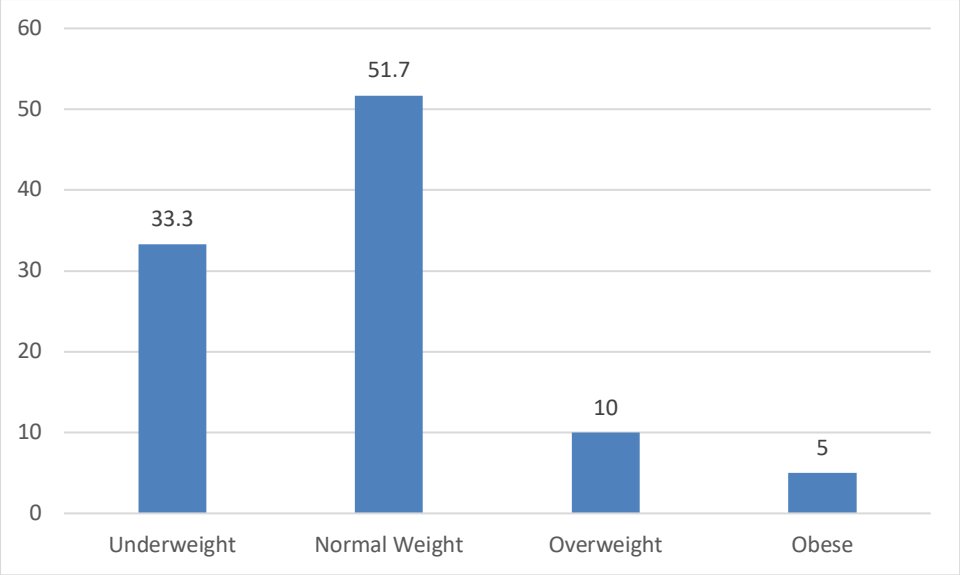

Figure 3: Graphical presentation of Nutritional Status of Study Participants

Table 3 shows the nutritional status of the study participants using anthropometric assessment. Of all the children observed, 40 (33.3%) were underweight, suggesting a high level of undernutrition. Most children (62; 51.7%) were of normal weight. Also, 12 children (10.0%) were classified as overweight and 6 children (5.0%) were classified as obese. Results indicated that while majority of children did not suffer from undernutrition, there were issues of undernutrition among the children in the study population.

Table 4: Correlation Between Nutritional Status and Anemia Among Study Participants (n = 120)

Nutritional Status	Anemic n (%)	Non-Anemic n (%)
Underweight	28 (70.0)	12 (30.0)
Normal Weight	20 (32.3)	42 (67.7)
Overweight/Obese	4 (22.2)	14 (77.8)

Table 4 shows the nutritional status and anemia status of the subjects. Underweight children had a high prevalence of anaemia (28 (70.0%) were anaemic and 12 (30.0%) had normal levels of Haemoglobin). On the other hand, in the normal weight children group, 20 (32.3%) were anemic and 42 (67.7%) were non-anemic. Likewise, only 4 of the overweight and obese children (22.2%) were found to be anaemic and 14 (77.8%) had normal haemoglobin levels. Results clearly showed that the prevalence of anemia was higher in underweight children which mean that there was a strong association of poor nutritional status and anemia.

Table 5: Dietary and Socioeconomic Factors Associated with Anemia (n = 120)

Variable	Frequency (n)	Percentage (%)
Poor Iron Intake	46	38.3
Low Socioeconomic Status	54	45.0
Poor Dietary Habits	50	41.7
History of Worm Infestation	24	20.0

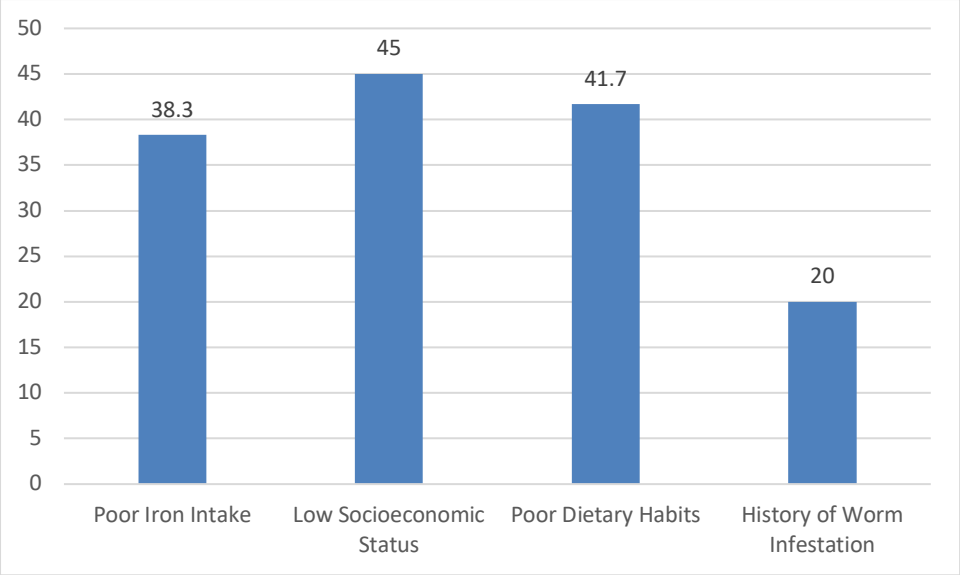

Figure 4: Graphical presentation of Dietary and Socioeconomic Factors Associated with Anemia

Table 5 shows the dietary and socio-economic factors of anemia among the participants. Thirty-eight percent (46 children) were found to have poor iron intake, and 41.7 % (50 children) had poor dietary habits. One of the most common associated factors was low socioeconomic status (45.0%, 54 children). Also, 24 participants (20.0%) had history of worm infestation. These results indicate that malnutrition, poor socio-economic status and parasitic infection are important factors in the pathogenesis of anaemia in school going children.

Discussion

The present study was done for the purpose of assessing prevalence of anemia and its nutritional status association in school going children Chauhan et al. (2011) [16]. Study results showed that anemia is still a major public health issue among children, especially in the developing areas where nutritional deficiencies and socioeconomic problems are prevalent. According to the current research, the total prevalence of anemia was 43.3% which means that the majority of school going children were affected by low hemoglobin concentration. Childhood anemia is known to be an important factor in poor health and developmental outcomes and has been reported in several studies conducted in different parts of India to be similar Swami and Kumar (2011) [17].

The study showed that the prevalence of anemia was significantly higher among underweight children than among the children with normal nutritional status. The result in this study indicates that there is a high association between malnutrition and low hemoglobin concentration Intiful et al. (2013) [18]. Low levels of nutrition have a negative impact on iron stores and on hemoglobin production, thus increasing the likelihood of anemia. Lack of iron-rich food, proteins, vitamins and other micronutrients can impact growth, compromise immunity and affect physical and intellectual growth in children. Previous epidemiological studies in school-age children have reported similar relationships between undernutrition and anaemia Dubey (2013) [19].

The current study also found that anaemic status was more prevalent for children in rural and low socio-economic status. High prevalence of anemia in these populations is due to limited access to nutritious food, poor living condition, inadequate awareness on balanced diets and insufficient health care facilities. Children are also at risk from low intakes of green leafy vegetables, pulses, fruits and iron-rich foods. Also, recurrent infections and parasitic infections in the gut can lead to poor absorption of nutrients and frequent bleeding which can worsen anaemia.

The various grades of anemia seen in this study were mostly mild and moderate anemia. This discovery suggests a large number of children are not diagnosed and treated until health screening is done routinely. While severe anemia was less common, moderate anemia (and even mild anemia) can have a profound impact on learning capacity, concentration, school performance, physical activity, and quality of life Agarwal (2011) [20]. Hence, the early diagnosis and prompt intervention is critical to avoid the long-term complications related to childhood anemia.

The results of the present study emphasize the need for the regular school health programme for early detection and management of anemia in children. Parental and teacher nutritional education, supplementation with iron and folic acid, deworming programs, promotion of good nutrition and regular health checks can all have a large

impact on reducing the burden of anemia. Government nutrition and child health programmes need to be strengthened to provide a better understanding and adequate nutrition support for vulnerable groups.

Conclusion

The study concluded that anaemia incidence is very high in the school going children and is significantly associated with poor nutritional status. There was significant association between malnutrition and low Haemoglobin levels as underweight children were observed more frequently than normal weight children. Dietary intake (poor dietary habits), low iron intake, low socioeconomic status, and recurrent infections were recognized as the main factors in the etiology. Anemia in childhood can have a detrimental impact on growth, immunity, cognitive function and school performance. Thus, it is important that the prevalence of anaemia is reduced through early diagnosis, nutrition counselling, iron supplementation, deworming programme and periodic school health check-ups, and it will have a positive effect on the health and development of children.

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