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Research Article

MAGNITUDE OF IRON DEFICIENCY ANEMIA AMONG CHILDREN IN DODA (JAMMU AND KASHMIR), INDIA: A CROSS-SECTIONAL STUDY

ZAHOOR HUSSAIN DARAZ[1], BERKHEEZ SHABIR[2], MAHVISH QAZI[3], NAJMUS SAQIB[1]*

[1]Department of Pediatrics, Government Medical College, Doda, Jammu and Kashmir, India. [2]Department of Obstetrics and Gynecology, Government Medical College, Doda, Jammu and Kashmir, India. [3]Department of Obstetrics and Gynecology, Government Medical College, Jammu, Jammu and Kashmir, India. Email: shstar321@gmail.com

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ABSTRACT

Objective: The goal of our study was to determine the magnitude, prevalence and severity of iron deficiency anemia among children in Doda (J&K) India.

Methods: It was a prospective, cross-sectional, multistage hospital-based and outpatient department (OPD) study of apparently healthy children who visited our Hospital/OPD clinic for follow-up from different regions of district Doda from February 1, 2021, to February 28, 2022. Five hundred children aged 6 months–12 years were included in our study. The sociodemographic data of subjects were collected using a structured questionnaire. 5 mL of venous blood sample was collected for complete blood count. Hemoglobin level was estimated, along with indices. Anemia was classified into mild (≤12 g/dl – >10 g/dl), moderate (≤10 g/dl – >7 g/dl), and severe (≤7 g/dl), respectively. Microcytic hypochromic picture using indices was considered for labeling iron deficiency. The dietary pattern of children was assessed using questionnaire and anthropometric measurements were done. Data were analyzed using SPSS software version 20.

Results: Overall, the prevalence of anemia was 77.6%. Out of the total vegetarians, 60.1% were anemic. Poor family status particularly families with low income <5000 Rs. per month and less education were more prone to develop anemia. Another important predictor of IDA was no anti-parasitic medications in 60.4%.

Conclusion: Iron deficiency anemia in children seems less severe public health problem; however, its consequences are disastrous and a huge burden on health, wealth and workforce. Parents need special counseling sessions for understanding its magnitude. Recommendations to put preventive strategies in place and mass awareness of people about the consequences of iron deficiency anemia should be made.

Keywords: Prevalence, Iron deficiency anemia, Children.

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INTRODUCTION

Anemia is a qualitative and quantitative deficiency of hemoglobin (Hb) below a set average based on standard texts and literature [1]. The condition demonstrates a reduction in red blood cell volume or a decrease in the concentration of Hb in the blood [2]. The overall prevalence of anemia is quite high and in the developing world, it is even higher. There are various factors attributed to the cause of anemia ranging from micronutrient deficiencies such as iron, folic acid and vitamin B12 to certain parasitic infestations (Worms) and infectious diseases (Malaria) [3,4]. Center for disease control and prevention and World Health Organization 2008 gave a joint report showing the global prevalence of anemia in school-going children to be 25.4% [5]. However, the scenario has further deteriorated. The data, in NFHS 2019–2021, showed that among all the age groups, the highest spike in anemia was reported among children aged 6–59 months; (67.1% (NFHS-5) from 58.6% (NFHS-4, 2015-2016). As per data, the number of cases were higher in rural India (68.3%) compared to urban India (64.2%). As far as J&K is concerned, approximately 73% of children between the 6 and 59 months age group have anemia as compared to 53.8% in the last survey (NFHS-4) conducted in 2015–2016.

Iron, folic acid and vitamin B12 are essential nutrients required for the proliferation and differentiation of hematopoietic stem cells in the bone marrow [6]. Cell growth and differentiation in many ways are dependent on iron intake [7]. Iron deficiency occurs when iron stores in the body exhaust and the transport protein "transferrin" are no longer able to deliver the iron. The important cause is less intake and decreased absorption; hence, transferrin saturation decreases [8]. Moreover, iron deficiency sets in; resulting in iron deficiency anemia, where Hb concentration falls below a statistically defined threshold [9].

Iron deficiency anemia attributes to countless deaths worldwide annually. Most of the anemia burden is born-by Africa and Asia alone which is approximately 71% [10]. Once iron deficiency sets in, it hampers the psychomotor and cognitive development of a child. Disease burden increases and work capacity decreases. Furthermore, such children absorb bivalent metals at a higher rate, for example, lead, indirectly increasing the chances of metal poisoning [11]. In fact, anemia caused due to iron deficiency is considered the most common nutritional deficiency even in many developed countries. Further, it has tremendous hazardous effects on developing countries with huge economic and health consequences. Doda district is one of the far-flung mountainous districts of the Union Territory of Jammu and Kashmir, where data about the prevalence of IDA is limited, so we performed this study to get data about the prevalence and risk factors of nutritional iron deficiency anemia, along with severity and predictors in children.

METHODS

This study was conducted from February 1, 2021 to February 28, 2022, in Government Medical College Doda (Jammu and Kashmir), India, in subjects aging 6 months–12 years visiting OPD clinic for various purposes from the concerned peripheral districts. Five hundred children were included in the study. Multistage sampling technique was used in selection of children to be studied. Socioeconomic and demographic data were taken by interviewing the guardians of the child using a specific questionnaire. History of chronic/severe disease

and recent use of hematinic for the past 2 weeks before data collection were excluded from the study.

Data collection
Pretested questionnaire was assembled based on inquiries about dietary patterns and sociodemographics. Furthermore, anthropometry was done and recorded alongside laboratory data. The data was collected by the doctor and the helping staff in OPD under the supervision of an OPD consultant/senior resident.

Dietary assessment
The dietary pattern of the children was difficult to assess. Food frequency questionnaires were made and questions were asked keeping the list of categories in mind such as grains, vegetables, meat (protein), fruits, fat/oils and other junk foods based on availability of the food in the vicinity. The quality of food was determined by the above questionnaire. This led to the broad classification of the population into vegetarians, non-vegetarians and mixed.

Anthropometric measurements
Anthropometry includes height/length and weight. Body weight was measured by a battery-powered digital scale and height/length was measured by traditional measuring tape using a conventional method that is against the wall with an even floor or by lying on the examination table. The nutritional status of children was assessed by determining weight-for-age z scores, height-for-age z scores, and body mass index-for-age Z scores. Minus two standard deviations (−2) and (−3) below the median of the reference population were considered moderately and severely malnourished, respectively.

Blood sample collection and analysis
Children participating provided approximately 5 mL of venous blood in two test tubes. Two milliliters (2 mL) was taken into one containing EDTA and was utilized for the complete blood count (Other hematological parameters) and peripheral blood film (PBF). Tests were performed using an ABX PENTRA ML hematology analyzer (HORIBA ABX SAS, France). Another 3 ml of venous blood was drawn for a biochemical investigation into a plane test tube and serum was separated for analysis.

Definition of anemia
Mild anemia was defined as the Hb concentration between 10 and 12 g/dl, moderate anemia between 7 and 9.9 g/dl, and severe anemia as Hb concentration lower than 7 g/dl. Microcytic hypochromic picture was considered to be consistent with iron deficiency. Ferritin level lower than 10 mmol was consistent with iron deficiency anemia.

Quality maintenance
Standard operating procedures were strictly followed during specimen collection and laboratory procedures. The manufacturer's instructions were kept under consideration before performing laboratory analysis. Control reagents are used for the hematology and clinical chemistry analyzers regularly to check the reproducibility of the results.

RESULTS

Data were manually collected using questionnaire sheets and interviews. Further data were entered into the computer. Later SPSS Version 20 was utilized for analysis. Summarization of data was done through descriptive statistics. Bivariate/multivariable logistic regression analysis was done to identify the independent predictors of nutritional iron deficiency anemia. All variables with $p<0.05$ were considered statistically significant.

Five hundred children (54.8% female and 45.2% male) participated in the study (Table 1). The mean age of the children was 4.02 years. The educational status of parents revealed that 149 (29.8%) of their fathers had achieved primary education and 351 (70.2%) had primary education or more. Most of the parents of study subjects (60.1%) had monthly income <5000 INR and 39.8% had monthly income >5000 INR) (Table 2).

Dietary habit and anthropometric measurements
The most common food grain utilized by children was rice and it was used as a staple food. However; the other foods available such as fruits, protein, ghee, oil, and other possible sources of calories were not taken as frequently as rice. The mean weight and height of the children were 11.1 kg and 110 (±0.12) cm, respectively.

Prevalence and severity of iron deficiency anemia
The prevalence of anemia was determined by the estimation of Hb level. The overall prevalence of anemia was 388 (77.6%) (Chart 1). Further, classification of anemia divided children into mild, moderate, and severe anemia and estimation was 78 (15.6%), 289 (57.6%), and 21 (35.2%), respectively (Chart 1). PBF showed varied pictures depicting different types of anemia that includes a normocytic normochromic picture, microcytic hypochromic picture, anisocytosis and poikilocytosis, and large oval red blood cells macro-ovalocytes.

Predictors of iron deficiency anemia
Those predictors thought to have a relation with anemia were checked with bivariate logistic regression analysis and tests revealed low family monthly income, negligible protein food intake, decreased dairy product consumption, and less calorie intake were responsible predictors for the development of anemia (Table 3).

DISCUSSION

Nutritional deficiencies are a major health problem that burdens the health sector in many ways. It increases morbidity and mortality in children. Iron deficiency is one of the main micronutrient deficiencies

Table 1: Demographic and nutritional variables of children under study

Variable	Total	500
	Number	Percentage
Age		
≥6 m–<12 m	106	21.2
≥12 m–<24 m	133	26.6
≥24 m–≤12 years	261	52.2
Sex		
M	226	45.2
F	274	54.8
Nutritional status		
Malnourished	89	17.8
Well-nourished	392	61.4
Obese	19	3.8
Diet		
Vegetarian	84	16.8
Non-vegetarian	416	83.2

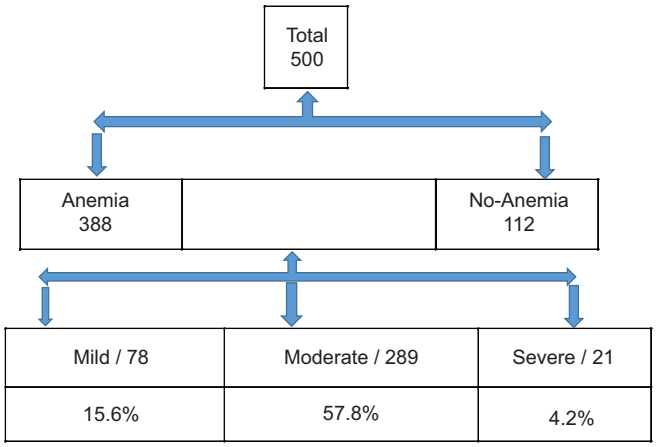
Table 2: Characterization of children under study as per family status and medication

Variable	Total	500
	Number	Percentage
Father's education		
Primary or more	149	29.8
Primary or less	351	70.2
Income		
>5000 Rs./month	199	39.8
<5000 Rs./month	301	60.2
Anti-helminthic		
Taken	180	17.8
Not taken	320	36

Table 3: Bivariate analysis showing a relationship between certain variables and anemia in children

Variable	Total (%)	Anemia (%)		p-value
	500	Yes	No	
Age				
6 m–12 m	21.2	42.6	57.4	S
12 m–12 years	78.8	33.7	66.3	
Sex				
M	45.2	40.6	59.4	S
F	54.8	34.6	65.4	
Father's education				
Primary or more	29.8	38.4	61.6	S
Primary or less	70.2	74.2	25.8	
Income				
≥5000 Rs	39.8	45.2	54.8	S
≤5000 Rs	60.1	64.3	35.7	
Diet				
Vegetarian	16.7	60.1	39.9	S
Non-vegetarian	83.3	36.2	63.8	
Anti-helminthic				
Taken	35.9	40	60	S
Not taken	64.1	76.4	23.6	

p<0.05 as significant



Overall Prevalence: 388/500×100 = 77.6%.

Chart 1: Flow chart showing overall prevalence of anaemia among children

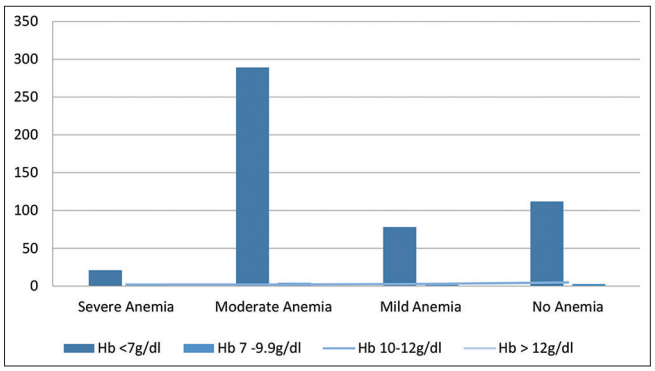


Chart 2: The number of children with a type of anemia

identified globally. It usually involves infants, children, and women of childbearing age [12] out of which 15.6% having mild anemia 57.8% moderate and 4.2% having severe anaemia (Chart 2). Our study revealed the overall prevalence of anemia to be 77.6%. This explains the gravity of the situation which is apparently in hidden form. Severe anemia among children was probably due to simultaneous deficiency of multiple nutrients, calories, and disease occurrences. Economic constraints, reaching the health facility and lack of awareness of the condition were responsible for the deprived addressal of the condition. The prevalence of anemia in the present study is more than the national average and other developing countries (46%) [13].

The study revealed that children of low-income families (<5000 INR) are more likely to develop anemia than those with higher family incomes. Multiple studies have also shown that the children living with poor families are more anemic compared to those with higher incomes. Probable causes are decreased food intake with a less calorie diet, poor sanitation, higher parasite infection, low health complaints addressal, and lack of access to varieties of food Items [14-16].

Measurement of serum vitamin B12 and folate levels was not done and it was a major limitation; however, the macrocytic picture was helpful in the determination of the cause of their deficiency.

Secondly, subclinical infections other than intestinal parasites and malaria have not been evaluated, thus limiting the study's generalizability for possible risk factors.

CONCLUSION

Iron deficiency anemia is very common in children of Doda than the national average and needs mass awareness to address the problem. Consumption of foods rich in iron, protein, and other nutrients needs to be encouraged. The parasitic infection needs timely deworming and proper emphasis be given to reducing at least the risk factors identified. Besides, food supplementation and fortification and promoting women's education are other strategies.

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CONFLICTS OF INTEREST

All authors declare that they have no conflicts of interest.

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None.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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