

Gender Predisposition of Anemia in Children with Nutritional Rickets

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Abstract

Objective: To find out association of gender with anemia in children with rickets.

Methods: This was a cross-sectional study, conducted in the Pediatrics Department, Allied Hospital, Faisalabad and spanned over 6 months i.e. from January to June, 2017. A total of 80 children (40 patients of rickets with anemia and 40 controls) from pediatric outdoor, meeting the inclusion and exclusion criteria, were enrolled with written informed consent from the parents. Blood samples for evaluation of anemia and nutritional rickets with wrist X-rays were performed. Data was recorded on a proforma and entered in SPSS. Statistical tests were applied with p value ≤ 0.05 .

Results: In present study, 21 (52.5%) patients and 13 (32.5%) controls were male, whereas 19 (47.5%) patients and 27 (67.5%) controls were females. The mean hemoglobin level in cases was 9.4 ± 1.53 while 11.08 ± 1.89 in controls. In boys, 17 out of 21 cases had anemia, whereas in girls, 11 out of 19 cases had anemia. Similarly, in boys, 4 out of 13 controls had anemia, whereas in girls, 11 out of 27 controls had anemia.

Conclusion: The study concluded that the prevalence of anemia in children having nutritional rickets is significantly greater than in healthy age-matched children, with anemia more prevalent in boys as compared to girls.

Keywords: anemia, nutritional rickets, hemoglobin, vitamin D

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Introduction

Anemia is decrease in concentration of hemoglobin (Hb) below reference level. It is also defined as a low Hb concentration or RBC volume, as compared to age-matched healthy individuals.¹ According to WHO, anemia is a Hb < 13 gm/dL in adult males and < 12 g/dL in adult females.² Clinical features of anemia generally manifest when Hb level decrease below 7-8 gm/dL.³ Furthermore, iron deficiency anemia is prevalent in our local population (both adults and children).⁴ In a recent survey, 62.1% of children were

found to be anemic and this observed frequency of anemia is significantly higher than in other populations.⁵ Anemia is often observed in children during the periods of rapid growth. Anemia is more common in children with rickets than in children who do not have rickets.⁶ The diagnosis of nutritional rickets is made by history and clinical features (physical examination, biochemical testing and x-ray findings). At the early stage, there is osteopenia; hypocalcaemia; hypophosphataemia; an increase in serum alkaline phosphatase; an increase in PTH levels; and a decrease in plasma 25-hydroxycholecalciferol.⁶ As children of both genders are affected especially in developing countries, therefore various studies have been done to find the association of gender with anemia. The purpose of this study is to find gender predisposition of anemia among children having nutritional rickets.

Material and Methods

This study was aimed at finding out association of gender

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with anemia in children having nutritional rickets. A child was labeled to have anemia if the estimated hemoglobin is <11 g/dL. The children of both genders coming to pediatric OPD, between the age of 2-12 years with clinical signs of rickets who met the inclusion and exclusion criteria, were recruited. This was a cross-sectional study, which was conducted in the Pediatrics department of Allied Hospital, Faisalabad. The study duration was 6 months after the approval of research synopsis ie. from January to June, 2017. Non-probability, convenient sampling was used. Sample size was calculated, using the formula: $n = z^2 \cdot P(1 - P)/m^2$. Inclusion criteria was children of both genders, between ages 2-12 years who were having nutritional rickets, as per diagnostic criteria. Exclusion criteria was children who were receiving phenytoin for 4 weeks during last 6 months or children with disturbed liver/renal function tests. Forty cases of rickets along with 40 controls, were selected from OPD of Pediatrics Department Allied Hospital, Faisalabad. Written informed consent and detailed history was obtained from parents of each patient and control. A total of 5 mL of whole blood was taken for the evaluation of anemia. The diagnosis of anemia was made on Hb levels and other parameters (MCV, MCH, MCHC, Fe, TIBC). Blood samples were also used to evaluate serum calcium, phosphorus, 25-OH vitamin D and alkaline phosphatase. Also an X-ray wrist was performed for assessment of rickets. The whole data, recorded on proforma, was entered in SPSS-19. The numerical variables of age and hemoglobin were presented by mean \pm SD, while the categorical variables of gender and anemia were presented by percentage and frequency. The whole data was stratified for gender and age and post-stratification odds ratio (OR) and chi square (2) test were applied. A p-value of ≤ 0.05 was taken as statistically significant.

Results

In present study, 80 children (40 patients and 40 controls) were recruited. Study subjects were divided according to gender, which showed that 32.5% children (n=13) in controls and 52.5% children (n=21) in cases were male, while 67.5% children (n=27) in controls and 47.5% children (n=19) in cases were females (Table 1). The mean hemoglobin in controls was 11.08 ± 1.8 gm/dL while that in cases was 9.4 ± 1.5 gm/dL (p-value 0.0001). Also we compared for anemia in cases against controls. The comparison showed that 15 children in controls and 28 children in cases were having anemic, while

25 children in controls and 12 children in cases were having no anemia. In boys, 17 out of 21 cases had anemia, while in girls, 11 out of 19 cases had anemia. Similarly, in boys, 4 out of 13 controls had anemia, while in girls, 11 out of 27 controls had anemia. The results were significant for boys but did not show a significant difference for girls. The data was stratified for gender to address effect modifiers and odds ratio was calculated as 1.7, showing that boys had significantly greater chance of

Table 1: Gender distribution among cases and controls

	Cases	Controls	Total
Boys	21	13	34
Girls	19	27	46
Total	40	40	80

Table 2: Stratification for frequency of anemia with regards to gender

	Boys		P value
	Anemia		
	Yes	No	
Cases (21)	17	4	0.003
Controls (13)	4	9	
Total (34)	21	13	
	Girls		P value
	Anemia		
	Yes	No	
Cases (19)	11	8	0.25
Controls (27)	11	16	
Total (46)	22	24	

having anemia in both cases and control groups. These results were also evident with p value significant for boys (Table 2).

Discussion

Anemia poses a major health burden on community, and affects mainly poor or developing countries. Anemia also causes a negative impact on physical and social growth of children.^{7,8} According to 2015 research by WHO, the greatest impact of anemia is seen in pediatric age group.⁹ These consequences of anemia are worse in growing children as they limit not only the physical,¹⁰ and mental growth,¹¹ but also social¹² and behavioral development.¹³ Anemia can result from decreased consumption of both micronutrients and macronutrients eg. folic acid, iron and vitamin B12, which are necessary for the formation of RBCs.¹⁴ Rickets is a disease that affects both children and adolescents in periods of rapid

growth. A significant association between nutritional rickets and anemia has been described worldwide. The results of our study were significant for boys but did not show a significant difference for girls. The data was stratified for gender to address effect modifiers and odds ratio was calculated as 1.7, showing that boys had significantly greater chance of having anemia in both cases and control groups. A study conducted in Ethiopia by Melku et al in 2018 is consistent with our results. Their results showed that the prevalence of anemia was higher among male children especially who were stunted or having deficiency disease like rickets. Hence they concluded that chances of anemia were higher among boys and malnourished individuals.¹⁹ Another Some other studies have also shown the risk of anemia is more in pre-pubertal boys than girls.^{20,21} Overall, malnutrition is a much prevalent among children, especially in Asian countries^{22,23,24,25} that may result in nutritional deficiency anemia in growing male children. This study can be comparable to other international studies because of differences of methodology, study duration, and geographic location.

Conclusion

The study concluded that the prevalence of anemia in children having nutritional rickets is significantly greater than in healthy age-matched children, with anemia more prevalent in boys as compared to girls. A prospective study with more sample size can be done to generalize the results.

Conflict of Interest

None

Funding Source

None

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Authors Contribution

SSS: Conceptualization of Project

FS: Data Collection

QM: Literature Search

QM: Statistical Analysis

JA: Drafting, Revision

SA: Writing of Manuscript