Original Research Article

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Prevalence of anemia among school girl children and effectiveness of supplementation intervention

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ABSTRACT

Background: Iron deficiency anemia (IDA) is a major public health issue worldwide, especially in developing countries. Anemia prevalence in young children, particularly girls, continues to remain high in most parts of India and Asia. Aims and objectives were to study the prevalence of anemia (IDA) among school girl children of age group between 5-16 years and to assess the effectiveness of iron-folic acid supplements and iron rich diet.

Methods: The study was conducted among 558 school girls in the age group between 5-16 years (1st to 10th standard) at a Kendriya Vidyalaya in Punjab. The study group was checked for their hemoglobin level. Health education regarding prevention of anemia was imparted to girls and their parents followed by daily iron-folic acid supplement. Their hemoglobin was again checked after three months of supplementation.

Results: The prevalence of anemia in the study group was 65%. After the intervention, the Hb level was significantly increased as shown by increase in mean and SD of Hb% from 9.75±1.24 to 11.66±0.98. The data was analyzed in two age groups, 5-10 years and 11-16 years, to check for any significant variation in their Hb levels. Though there was difference in prevalence of anemia in these age groups, the difference was not statistically significant.

Conclusions: The study showed that prevalence of anemia is 65% and is still one of the major public health issues among school going girl children of all age. In addition to pre-school and adolescent girls, we also need to focus on pre-puberty girls, as anemia is equally prevalent among them.

Keywords: Anemia, Iron and folic acid supplementation, School girl children

INTRODUCTION

Worldwide, in comparison to any other health issues, anemia is the major problem of massive public health significance. Iron deficiency anemia is one of the most common nutritional diseases frequently reported all over the world, though it is more common in the developing countries. Large proportion of population of south East Asia is facing anemia and its long term consequences as health burden, and is prevalent across all age groups, socio-economic status and among female sex group in particular. Anemia prevalence in young girl children

continues to remain over 70% in most parts of India and Asia. 1,2

Many reasons have been put forward as factors leading to anemia among girl children, such as, economic status, ethnic customs, social practices of gender preference, parasite infestation, menstrual blood loss, and most importantly deficiency of nutrients which are essential for haemoglobin production. Iron, Folic acid and vitamin B_{12} are main nutrients required for synthesis of hemoglobin whose concentration will be reduced due to deficiency of such nutrients. Of these nutrients, iron deficiency is the major contribution as a cause of anemia

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worldwide. Over 30% of the world's population- is anemic, mainly due to iron deficiency; and in developing countries this figure is frequently exacerbated.³

Main causes for iron deficiency anemia are poor intake of iron rich food, low bio-availability, poor absorption due to presence of inhibitors which prevent iron absorption or due to non-availability of enhancers and blood loss. In addition to non-vegetarian food items which are rich in iron, Table 1 below provides the list of plant iron rich foods, including these items in daily diet will enhance iron intake.

Table 1: Plant foods rich in iron.

Cereals and milletsBajra (Indian millet, Pennisetum typhoideum)8.0Samai (little millet, Panicum miliare)9.3Rice bran35Wheat germ6.0Pulses and legumes8.6Soybean10.4Chickpea, roasted9.5Cowpea8.6Lentil7.6Peas, dry7.1Horse-gram (Dolichos biflorus), whole6.8Green leafy vegetablesAmaranth, beet, cauliflower, chekkur manis, chickpea, cowpea, mint, manathakkali, mukarrate keerai, mustard, parsley, coriander, radish, fenugreek, shepu, turnip15.6-40Lotus stem, dry60.6Karonda, dry39.1Sundakai, dry22.2Onion stalks7.4Plaintain greens6.3Nuts and oil-seed6Garden cress seeds100Coconut meal, deoiled69.4Niger seeds56.7Gingelly seeds9.3Mustard seeds7.9Dry fruits pistachio nuts7.7Blackcurrants8.5Dates7.3Condiments and spicesTurmeric67.8Mango powder45.2Tamarind pulp17Poppy seeds15.9	Contained in raw edible portion	mg/100 gm
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The bioavailability of iron for absorption can be achieved by avoiding intake of inhibitors and including enhancers along with iron rich diet. The factors which inhibit the iron bioavailability and its absorption are phytates and other inositol phosphates (e.g. bran products, bread made from high-extraction flour, pasta products, cocoa, nuts, soybeans and peas), iron-binding phenolic compounds (e.g. tea, coffee, cocoa, certain spices and most red wines), calcium (e.g. milk, cheese) and soy proteins. The factors which enhance iron bioavailability and absorption are ascorbic acid (e.g. citric fruit and juices, potatoes and certain vegetables), meat, chicken, fish, other sea foods, fermented vegetables (e.g. sauerkraut) and fermented soy sauces. Cooking in iron vessels, consuming iron rich vegetables and fruits in raw form, avoiding overcooking and reheating are other factors which enhances bioavailability of iron.^{4,5}

Many Government programmes focus on reducing the burden of anemia among school children by provision of iron supplement, deworming, mid-day meal, food fortification and many other programmes but goal still needs to be achieved. This study was intended to analyze the prevalence of anemia and effectiveness of iron-folic acid supplements with iron rich diet intervention among school girls in the age group of 5 to 16 years (pre-puberty and puberty).

Aim

This study is aimed to assess prevalence of anemia (IDA) among school girl children of age group between 5-16 years, to assess the effectiveness of iron-folic acid supplements and iron rich diet in improving their hemoglobin level.

METHODS

This was a prospective pre-post interventional study design, conducted from February 2019 to May 2019 at one of the Kendriya Vidyalaya in Punjab. The subjects were girl children of the school in the age group of 5 to 16 years (1st to 10th standard students). In total 558 girls participated in the study. All these girl children were surveyed for anemia after taking informed consent from school administrative authorities and parents of each child. Approval of organizational ethics committee was taken for the study. All girls were given a supervised single dose anthelminthic (tablet albendazole 400 mg). Hemoglobin estimation was done by obtaining 2 ml of venous blood by venipuncture and analyzed by cyanmethemoglobin method. Grading of anemia was done by hemoglobin levels as per DLHS (district level house survey) guidelines, that is, hemoglobin level between 10.0 and 11.9 gm/dl is mild anemia, 8.0-9.9 gm/dl is moderate anemia and below 8.0 gm/dl is severe anemia.⁶ Health education and coordination meeting was held with all anemic girl students and their parents. They were informed about problem due to anemia, importance of taking iron supplementation and regular follow-up. All

were advised iron rich diet as advised by the dietician and medication to be followed for next three months. The girls, who were anemic, were given iron and folic acid tablets (dose based on their body weight) for daily consumption at home after meals. Children who could not tolerate medicine were advised to gradually increase the dose from its half strength. The consumption of iron tablets and adherence to dietary guidelines was ensured by fortnightly feedback from students and monthly meeting with parents. Also, correction of faulty dietary practices if any was done at the same time. After 3 months of completion of treatment, hemoglobin level (Hb) was estimated by the same method for all anemic girls.

Inclusion criteria

School girl children in the age group of 5 to 16 years and willing to participate in the study.

Exclusion criteria

Girl children below 5 years of age, above 16 years of age, with chronic diseases. Children previously diagnosed and on treatment for anemia. Children with previous blood transfusion.

Statistical analysis

The descriptive analysis of available data was carried out. The distribution pattern of both before and after data was checked by applying Kolmogorov-Smirnov and Shapiro-Wilk tests which showed that data was not normally distributed. Hence, non-parametric statistical analysis was done to find the statistical difference in hemoglobin levels before and after intervention using Wilcoxon Signed Ranks Test. The age group specific variation in Hb% in two age groups 5 to 10 years and 11 to 16 years was also checked using Kruskal-Wallis test. A p value <0.05 was set as cut-off value for statistical significance. The data was analyzed using MS Excel and IBM SPSS 20.0 version.

RESULTS

A total of 558 school going girls in the age group from 5 to 16 years were participated in the study. It was observed that out of 558 girls, 196 (35.12%) girls had normal, 147

(26.34%) had mild, 195 (35%) had moderate, and 20 (3.58%) had severe anemia. Overall prevalence of anemia among girls under study was 65% (n=362) as shown in Figure 1. The mean, SD, minimum and maximum of age, Hb% before and after intervention are given in Table 2.

Table 2: Descriptive statistics (n=558).

	Mean±SD	Minimum	Maximum
Age	10.64 ± 2.67	5	16
Hb% before	9.75±1.24	7.00	12.00
Hb% after	11.66±0.98	7.50	14.30

All anemic girls were studied in two age groups, that is, 5-10 years and 11-16 years to analyze any significant age specific variation in their hemoglobin level. Their hemoglobin level and anemic status before and after are given in Table 3. Before intervention, there were 20 (3.58%), 195 (35%), 147 (26.34%) and 196 (35%) severe, moderate, mild anemic and normal girls respectively whereas, after intervention, same were improved to 1 (0.17%), 19 (3.4%) and 229 (41%) and 309 (55.37%) respectively. Results showed that 19 (95%) out of 20 severe anemic girls, 176 (90.25%) girls out of 195 moderately anemic girls showed improvement. From the report it is clear that 113 out of 336 anemic girls (33.63%) achieved normal hemoglobin. Wilcoxon Signed Ranks test showed statistically very significant difference (p value <0.001) in Hb% before and after intervention. However, the Kruskal-Wallis test showed no significant difference (p value >0.05) in age specific variation of Hb% in two age groups.

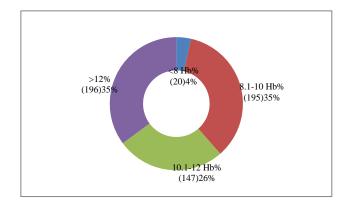


Figure 1: Prevalence of anemia based on Hb%- before intervention.

Table 3: Hb (gm%) level of anemic girls at different age group- before and after intervention.

	Less than 8		8.1-10.0		10.1-12.0		More than 12		Total
	Before	After	Before	After	Before	After	Before	After	
5 to 10	9	0	102	9	60	108	102	156	273
11 to 16	11	1	93	10	87	121	94	153	285
Total	20	1	195	19	147	229	196	309	558

DISCUSSION

The present study was conducted to assess prevalence of anemia (IDA among school girl children in the age group of 5-16 years, by checking their Hb level and to analyze the effectiveness of iron supplementation with iron rich diet and iron-folic acid tablets by recheck of their Hb level after intervention. Total 558 girls were in this study group, of which, two third of girls (362, 65%) were having anemia and one third (196, 35%) girls were normal which indicates anemia is still one of the major public health problem among school going girl children.^{1,7} The prevalence of anemia is slightly higher than those of other similar studies.⁸⁻¹¹ The proportion of mild, moderate, and severe anemia found in our study was 26.34%, 35% and 3.58% respectively. Other studies also showed similar proportion of anemia; however, they had lesser of severely anemic cases compared to our study.^{8,9} Data from National Family Health Survey-4 report (NFHS-4) was also compared with our results. NFHS-4 report provides data on anemia among 6-59 months children and 15 to 49 years women (pregnant and non-pregnant), but data regarding 5-16 years age group school going girls was not available. As per NFHS-4 report, among 6-59 months children, overall, mild, moderate and severe anemia are 59%, 28%, 29% and 2% respectively; and that for 15-49 years women are 53%, 40%, 12% and 1% respectively. 12 In our study, anemia prevalence and its severity is more than that reported in NFHS-4.

In the present study, the prevalence of anemia among two age groups (5-10 years and 11-16 years) though showed difference but was not statistically significant. However, other studies showed higher prevalence among those girls who have attained menarche. ^{13,14} Majority of studies (including NFHS) are done either on pre-school or adolescent girls, but very few studies included all age group of school going girls. It appears from the study that girl children of 5-10 years group were also anemic at par with adolescent girls and hence it is very important to focus on all school going girls.

Out of a total of 558 girls, 362 were anemic and after deworming, iron rich diet and iron and folic acid supplementation for 3 months, 113 became normal. The proportions of girls having mild, moderate, and severe anemia after intervention were 41%, 3.4% and 0.17%. Also majority of moderate to severe anemic girls became mildly anemic or normal, a shift towards normalcy. This shift was statistically very significant as shown by statistically significant increase in mean and standard deviation of Hb% from 9.75±1.24 before to 11.66±0.98 after intervention (mean Hb increased by 1.91 gm%). These were similar to those obtained in any other studies.¹³ The girls who were still in anemic state after intervention and their parents were explained about the effectiveness of intervention in this study and were motivated to continue supplements and iron rich diet till it comes to normal range. There was only one girl with severe anemia after the intervention in our study and she was referred for further evaluation to find out any other cause of anemia. Few girls in the course of study felt side effects of iron supplement tablet such as nausea, constipation and metallic taste. They were advised to gradually increase the dose from its half strength and advised to take medicine after food, which results in tolerating the medicine successfully and all of them continued supplements.

Limitations of the study are girls with normal hemoglobin were not followed up and there was no control group in this before-after comparison study which may reduce the validity/reliability of findings regarding effects of intervention. This study could have designed to include possible contributing factors for anemia which would have helped in explaining why there is no significant difference in age specific variation of Hb% in two age groups.

CONCLUSION

The study showed that prevalence of anemia is 65% and is still one of the major public health issues among school going girl children. Although there are many specific actions by government authorities like treatment and prevention of parasitic infections, weekly iron supplementation, nutritional education to prevent irondeficiency anemia among school children, the impact of anemia and its long-term consequences are still a major public health problem. In addition to pre-school and adolescent girls, we also need to focus on pre-puberty girls, as anemia is equally prevalent among them as shown in this study. It is important to include parents along with children during any such interventions. Supplemental intervention will effectively improve Hb level and reduce the load of anemia and its ill effects in the community.

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