



Iron Deficiency Anemia among School Going Children of Rural Area of Mardan Khyber Pakhtunkhwa Province, Pakistan

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ABSTRACT

Iron is essential for normal human growth, including oxygen transport, adenosine triphosphate (ATP) production, DNA synthesis, mitochondrial function, and protection of cells from oxidative damage. Iron deficiency anemia is the most prevalent hematologic disorder in school-going children. Therefore, the aim of the study was to assess the prevalence of anemia among school-going children in rural areas of Mardan Khyber Pakhtunkhwa. A total of 300 samples were taken from those children with signs and symptoms of IDA in a cross-sectional survey. Thorough physical examination, lab investigations, and clinical examination were done. The current research shows that 1 of 3rd of school-going children who had signs and symptoms of iron deficiency anemia were affected by iron deficiency anemia at the ages of 4 to 7 years (40%), 7 to 10 years (35%), and 10 to 13 years (25%), respectively. Severe anemia was rare at 10%, moderate anemia at 25% moderate anemia 25% led by the mild type of anemia with a high percentage of 65% on the basis of Hb level. lower class families were more affected by iron deficiency anemia with 60%, children of middle class were less affected by anemia with 35% while children of upper-class families were much less affected by anemia which may be due to the socioeconomic state of the family. Anemia is a serious nutritional issue with public health implications. As a result, iron supplementation as well as health and nutrition education initiatives should be expanded. The community should be encouraged to eat iron-fortified and iron-rich foods to vary their diets

Keywords: Iron; anemia; school children; deficiency; hematology

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INTRODUCTION

Iron is required for proper human development. Many vital biological activities require iron, including oxygen transport, adenosine triphosphate (ATP) creation, DNA synthesis, mitochondrial function, and cell defense from oxidative damage (Atamna et al., 2002 and McCann et al., 2007). The most common hematologic disease among school-aged children is IDA (Miller et al., 2017). It is estimated that around 2.15 billion individuals suffer from iron deficiency anemia (Sirdah et al., 2014). In a recent review of the prevalence of iron deficiency anemia in the United States, 9% of toddlers and up to 11% of adolescent girls were iron-deficient. The absorption of dietary iron is assumed to be 5-10%, but it increases 3-5 times when iron storage is depleted (Haltermann, et al., 2001 and Shinton et al., 2010). Inadequate dietary iron, iron absorption and intense exercise, along with blood loss and parasitic infections are some etiologies of iron deficiency anemia (IDA). Some consequences of IDA are growth retardation, exercise intolerance, behavioral changes, and abnormal thermogenesis. Although the prevalence of IDA has declined in industrialized countries, there have been few changes globally (Cook et al., 1994). According to a UNICEF report, two billion people suffer from anemia worldwide and most of them have IDA, especially in underdeveloped/developing countries, where 40-50% of children under age 5 are iron deficient (Ross et al., 1998). It has been reported that 46.5% of Indonesians and 30-60% of Guatemalans under the age of 5 have suffered from IDA (Soewondo, S. (1995). In Iran, 30-50% of women and children, especially those in low-income families, are suffering from iron deficiency. Anemia has been shown to affect mental development and learning capacity. In infancy it may cause a permanent loss of IQ later in life, shortened attention span, irritability, and fatigue, difficulty with concentration, lethargy, weakness and increased susceptibility to infection. Consequently, anemic children tend to do poorly on vocabulary, reading, and other tests (Kordas et al., 2004). In Saudi Arabia most of the studies on anemia were based on nutritional status and concentrated on preschool children who were under six years old (Sebai et al., 2020), so data on the nutritional status of children and adolescents in the Kingdom are insufficient (Rao & Parikh (2015). According to a World Health Organization (WHO) report, IDA is most frequent in children and women around the world, especially in non-industrialized countries. It is the only nutrient deficiency which is also significantly prevalent in virtually all industrialized nations. In addition, there are no current global figures for iron deficiency. Anemia as an indirect indicator it can be estimated that most female preschool children and pregnant women in non-industrialized countries, and at least 30-40% in industrialized countries, are iron deficient.

The main aim of the present study was to assess the prevalence of anemia among school-going children of rural area of Mardan Khyber Pakhtunkhwa, to detect prevalence of Iron deficiency anemia on the basis of socioeconomic state, to detect age wise prevalence of iron deficiency anemia, to detect prevalence of iron deficiency anemia on the basis of types.

MATERIALS AND METHODS

A cross-section survey was conducted on randomly selected school-going children with Iron deficiency anemia. The children aged were between 4 to 13 years. The samples were taken in Mardan Khyber Pakhtunkhwa after obtaining ethical approval from the School Head Teachers and the research ethics committee of faculty of medicine at Tehsil Head Quarter Hospital Takht Bhai Mardan.

Sample size

A total of 300 samples were taken from those children with signs and symptoms of Iron deficiency Anemia

Children aged

Aged wise three groups were made including 4-7, 7-10, and 10-13 years of aged

Questionnaire

Questionnaires were set to collect data about age, black tea intake, gender, education, and social classes based on monthly income¹⁴, use of unfortified cow milk, vitamin supplementation drugs, and dietary intake. The principal author validated the Pashto version of questionnaire by involving two independent bilingual translators who performed forward and back translation and an expert committee at Tehsil Headquarter Hospital Takht Bhai Mardan.

History

Data history is taken to fulfill the following

- Clinical history was taken from children and relatives including age, onset of anemia, nutritional history, and intake of iron supply.
- History of fatigue, poor activity, exertion, dyspnea. Breathlessness at rest.
- History of blood transfusion

2- Thorough Physical Examination:

- Clinical examination, general, chest, cardiac, abdominal, and neurological examination

3-Lab investigations and Tests: All patients were subjected to:

- Complete Blood Picture and reticulocyte count. Patients with microcytosis underwent the following:
- Serum Iron and ferritin

An automatic hematological analyzer and Biochemistry analyzer were used for clinical examination

Sample type

Blood samples were taken from all patients through EDTA tubes for the transporting to Hospital

Statistical analysis:

After collecting information from the selected sites of the study area through questionnaires, and the completion of laboratory tests, the Statistical analysis of data was carried out through MS Word 2010.

RESULTS AND DISCUSSION

Table 1 demonstrates that 1 of 3rd of school-aged children with signs and symptoms of IDA were afflicted at the ages of 4 to 7 years (40%), 7 to 10 years (35%), and 10 to 13 years (25%), respectively.

Table 1. Age wise prevalence of anemia

Age	Sample size	Normal	Anemic
4-7	100	60	40
7-10	100	65	35
10-13	100	75	25
total	300	200	100

Examination of patient with sign and symptoms of Iron deficiency anemia were pale skin children were more frequent, leading by weakness of children with percentage of 35% while symptoms of fatigue were very less as compare to other sign and symptoms.

Table. 2 Signs of anemia and examination of patients under the study

Symptoms	No. children (Hb < 11.5 gm/dL) N	Percentage (%)
Pale skin	55	55%
Weakness	35	35%
fatigue	10	10%
total	100	100%

Table.3 shows that severe anemia was rare with 10%, moderate anemia 25% leading by mild type of anemia high percentage of 65% on the basis of Hb level.

Table.3 Prevalence of iron deficiency anemia on the basis of types

Type of anemia	Hb level	Sample size	Percentage (%)
Severe anemia	(Hb < 7.0 g/dL)	10	10%
Moderate anemia	(Hb 7 < 10 g/dL)	25	25%
Mild type of anemia	(Hb 10 < 11 g/dL)	65	65%

Table.4 shows that children of lower-class family were more affected by iron deficiency anemia with 60%, children of middle class were less effected by anemia with 35% while children of upper-class family were very less effected with anemia which may be due to the socioeconomic state of the family. The prevalence of anemia is a severe nutritional problem of public health significance. Therefore, iron supplementation and health and nutrition education programs should be strengthened. The community needs to be encouraged to diversify their diets by consuming iron-fortified and iron-rich foods.

Table.4 prevalence of Iron deficiency anemia on the basis of socioeconomic state

Economic state	Normal Hb	Low Hb	No.sample
Lower class	40	60	100
Middle class	65	35	100
Upper class	95	5	100
Total	200	100	300

The current study shows that the 1 of 3rd of the school-going children who were sign and symptoms of iron deficiency anemia were affected with iron deficiency Anemia with age of 4 to 7 years 40(40%), 7 to 10 years 35(35%) and 10 to 13 years 25(25%) respectively. Similarly, a research work also conducted by **Arlappa et al., (2010)** A majority (81%) of the rural children of West Bengal were anemic, and the prevalence was significantly ($p < 0.001$) higher among 1–3-year-old (91%) as compared to 4–5-year-old (74.6%) children. A significantly ($p < 0.01$) higher proportion of 1+ (OR = 7.7; 95% CI: 2.6–22.4) and 2+ year children (OR = 3.0; 95% CI: 1.5–6.0) and those belonging to lower socio-economic heduled Caste and Scheduled Tribe communities were at risk for anemia (OR = 2.3; 95% CI 1.3–3.9).

Examination of patient with sign and symptoms of Iron deficiency anemia were pale skin children were more frequent, leading by weakness of children with percentage of 35% while symptoms of fatigue were very less as compare to other sign and symptoms. The current results shows that severe anemia was rare with 10%, moderate anemia 25% leading by mild type of anemia high percentage of 65% on the basis of Hb level. Same work also performed by (Ngnie et al., 2007) Risk factors for moderate to severe anemia included incomplete immunization, stunted growth, recent infection, absence of bednet, low household living standard, rural residency (Mali), low maternal education, and low community development index (Benin). In addition, multilevel analysis indicated a clustering level of anemia in communities (intra class correlation) of 14% and 19% in Benin and Mali, respectively.

The study shows that children of lower-class family were more affected by iron deficiency anemia with 60%, children of middle class were less effected by anemia with 35% while children of upper-class family were very less effected with anemia which may be due to the socioeconomic state of the family. Anemia is a major public health concern due to its high incidence and the nutritional problems it causes. So, it's important to ramp up health and nutrition education initiatives and iron supplements. A more varied diet that includes iron-fortified and iron-rich foods should be promoted to the population (Rao & Parikh (2015) similarly the anemia percentage was recorded high in lower socioeconomic family children, than middle class and upper class. The percentage of anemic children was also high in age group of 10 - 12 years. Pale skin was the most common symptom of anemia (Shakir et al., 2023) A Total of 1500 children between the ages of 4-15 years were studied. A systematic random sampling technique was applied for sample collection. A total of 1500 children between the ages of 4-15 were analyses for this study. Out of 1500 school going students 600(40%) were found positive and 900(60%) were found normal according to age. Gender wise analysis shows that in male students 210(35%) were found positive for stunting and 150 (25%) male students were underweight. In overall female students 135(22.5%) were found stunting and 105 (17.5%) were found underweight. According to age group wise between 4 to 10 years 90 (10%) female students were found stunting and 60(6.6%) were found underweight. While in the age of 11 to 15 years 48 (5.3%) students were stunting and 42 (4.6%) students were underweighted. The difference in stunted and underweight showed more boys than girls. In the Pre nursery group more boys were stunted than girls, the ratio being 70%:30%, on the contrary underweight was more in boys than in girls, with the ratio of 57%:43%. In the Primary section both stunting and underweight were more in boys as compared to the girls. The ratios were 54.8%:45.2% and 82.9%:17% respectively.

CONCLUSION

Anemia is a serious nutritional issue with public health implications. As a result, iron supplementation as well as health and nutrition education initiatives should be expanded. The community should be encouraged to eat iron-fortified and iron-rich foods to vary their diets.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

All authors equally contributed in the designing, experiments and wrote the manuscript. All authors read and approved the final manuscript.

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