

Iron Deficiency Anemia in School Age Children in District Karak Khyber Pakhtunkhwa Province, Pakistan

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Abstract

The present study aimed to estimate the prevalence of iron deficiency anemia (IDA) in school-going children. Both Iron deficiency and iron deficiency anemia have considerable adverse effect on human health. Among the different negative health concerns, including stunt development, less developed immunity, lower IQ level, no proper physical work capacity, more fatigue, maternal mortality rates, young ones born with low birth weight, birth complications and infant mortality rates are some of the remarkable health concerns posed by iron deficiency level. Our study sample was consisting of 420 school age children of both genders. The blood samples were collected in EDTA (Ethylenediaminetetraacetic acid) tubes from different school and health maternity centres by trained and veteran persons. Questionnaires were utilised for the data collection, at the time of blood samples collection. Hemoglobin (Hb), hematocrite (Hct), Mean Corpuscular Volume (MCV), Mean Corpuscular hemoglobin concentration (MCHC), white blood cell and red blood cell (RBC) were determine by automatic hematological analyzer model Symex Ks-21 having two reagents, cell pack and Stromatolyser-wwt 500 ml. The total percentage of anemia recorded in school age children was 34.0%. In tehsil Banda Daud Shah, the incidence of anemia was high up to 43.6% while in tehsil Takhti Nasrati and Karak was 32.1% and 26.4% respectively. The percentage was higher in girls (38.9%) than in boys (31.0%). The anemia percentage was recorded high (55.8%) in lower socioeconomic family children, than middle class (32.2%) and upper class (17%). The percentage of anemic children was also high (40%) in age group of 10 - 12 years. Pale skin was the most common symptom of anemia.

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Keywords

Iron Deficiency Anemia (IDA), Red Blood Cells (RBC), Hemoglobin (Hb), Hematocrit (Hct), Ethylenediamine Tetraacetic Acid (EDTA)

1. Introduction

Anemia is a blood disorder in which the hemoglobin (Hb) concentration is less than the normal Hb concentration for age, sex, physiological condition and altitude. Iron deficiency is the most common cause of anemia [1]. There are different types of anemia including Hemorrhagic anemia due to excessive loss of blood, Hemolytic anemia due to red blood cell destruction and hematopoietic anemia due to less production of RBC. There are many causes of anemia but the most common cause is iron deficiency [2]. Iron deficiency anemia is one of the most common and prevalent, nutritional health problems in infants and young children across the developing world. Approximately 1200 million people are anemic across the globe [3]. According to WHO report, half of all anemia is due to iron deficiency. It is estimated that 43% of the young children are iron deficient worldwide and the greatest are between age of 1 - 2 years children. In Pakistan 65% children had IDA at the age 07 - 60 years and other studies estimate different prevalent rates *i.e.* 70%, 78% [4] [5].

It is estimated that approximately 750 million children are affected by IDA [6]. This is most common in children and women in developing countries. It is believed that 700,000 children aged 1 - 2 years are iron deficient (ID) and 240,000 have iron deficiency anemia (IDA) [7]. There are many causes of anemia but the common causes are the deficiency of essential nutrients as Iron, Vitamin B12 and Folic acid. Other factors include blood loss, repeated pregnancy in women, worm infection, hemolysis, suppression of red corpuscles synthesis by bone marrow and gastrointestinal blood loss [8] [9]. The iron deficiency causes microcytic anemia but folic acid, vitamin B₁₂, hyperthyroidism and liver disease cause macrocytic anemia [10]. Some other diseases like diarrhea, filariasis, and parasitic infection that cause blood loss also result in anemia [11]. The cut-off value for hemoglobin level is varying by age, physiological status and race. The Recommended cut-off value for anemia in children aged from 06 - 59 months is 110 g/L, 5 - 11 years 115 g/L, 12 - 14 years 120 g/L, adult males 130 g/L [12].

The cut-off point for children <5 years of age is 11 g/dl; 7 - 10.9 g/dl and <7 g/dl Hb represent moderate and severe anemia respectively [13]. The prevalence of ID in Turkey is 48% in infants, 21% to 42% in children and 14.7% in adult but that of IDA is 3.1% in children of age 06 - 16 years and 13.5% pregnant women [14]. In Canadian general population the prevalence of IDA in children is low 3.5% to 10.5% while in aboriginal populations is very high 14% to 50% [15]. The high prevalence of IDA in these populations is due to high consumption of evaporated milk, cow's milk after six month age; prolong exclusive breastfeeding, burden of *Helicobacter pylori* infection, low socioeconomic states, and children of Chinese background, low birth weight infant and cow's milk consumption before 1 year age [5]. The iron deficiency anemia affects 02 billion peoples worldwide [16]. The prevalence of IDA is 05% worldwide but 18% among adult women and 10% in adult men in developing countries [17].

2. Methodology

2.1. Study Area

There are 25 districts in Khyber Pakhtunkhwa but the present study was conducted to investigate anemia in district Karak Khyber Pakhtunkhwa Pakistan. Karak is one of the Southern districts of Khyber Pakhtunkhwa Pakistan. It has 03 Tehsil; Karak, Takht-E-Nasrati and Banda DaudSha. The district Headquarter is located at a distance of 123 Km from Peshawar, 112 Km Kohat and 56 Km from Bannu. There is only one tribe of Pashtuns "KHATTAK" lives in District Karak.

2.2. Study Design

The present study was designed to investigate the rate of low iron causing anemia in children in association with socio economic status, age education and dietary intake in district Karak. For obtaining credible and consolidat-

ed data, the study district was divided into three clusters, Karak, Takht-E-Nasrati and Banda DaudSha. A questionnaire was designed for this purpose. Some other research methods were used like observation, interviews from school going children by visiting of different primary schools (Male and Female) and hospital. The questionnaire included age, sex, social class, education, use of unfortified cow milk, black tea intake, vitamin supplementation drugs and dietary intake like factors. To know the socio economic status of the people, the study population was divided into 03 economic classes, including Lower, Middle and Upper class. There were also some refusals from respondents. But their number was quite insignificant, having no effect on study sample size.

2.3. Sample Collection

A total of 420 blood samples were collected and 140 from each cluster. For the collection of blood samples, collection site was cleaned with antiseptic liquid to kill germs. Blood was drawn from antecubital vein by means of sterilized syringes with the help of male expert from school going children and female nurse from female children. The drawn site was usually inside the elbow or back of the hand. The needle was carefully inserted into the individual vein and the blood was collected. About 01 - 03 ml blood was collected and poured into red tip EDTA (ethylene diamine tetra acetic acid) tube. During the blood collection the designed questionnaire were also filled from the participant.

2.4. Laboratory Work

The blood samples were immediately transported to the Khyber Teaching Hospital (KTH) laboratory. The hemoglobin (Hb), hematocrite (Hct), mean corpuscular volume (MCV), mean corpuscular Hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), red blood cell count (RBC), white blood cell count (WBC), and platelet count were determined by automatic hematological analyzer model Symex Ks-21 having two reagent, cell pack and Stromatolyser-wwt 500 ml. The WHO classification was used to characterize anemia in school going children (5 - 11 years) Hb < 11.5 g per dL (115 g /L). The anemic patients were further divided into Mild anemia (11.0 - 11.9 g/dl) and 10 - 10.9 g/dl, Moderate anemia (10.0 - 10.9 g/dl) and 7.0 - 9.9 g/dl and severe anemia <10.0 g/dl and <7.0 g/dl respectively [18]. The individual whose Hb level was less than the standard level, a smear was prepared and observed under microscope. The low MCV and abnormal, small and pale RBC is microcytic anemia and consider iron deficiency anemia.

2.5. Data Analysis

Data collected was subjected to statistical package, SPSS for desired statistical application, including simple mean and standard deviation.

3. Results

A total of 420 school age children (5 - 12 years) with both sexes (boys and girls) were interviewed and clinically examined for the presence of anemia at district Karak. After clinical examination blood samples were collected for further analysis.

Table 1 shows Anemia percentage in school age children (SAC) in whole district Karak. The whole district was divided into three large clusters. Tehsil karak, takht-e-Nasrati and Banda Daud Shah. From each cluster 140 (33.33%) children were involved in the study. From tehsil Karak 80 boys and 60 girls, tehsil takht-e-Nasrati 83 boys and 57 girls, and Banda Daud Shah 90 boys and 45 girls were examined in the present study. children of the study sample were divided into two groups, anemic and non-anemic. In tehsil Karak 26.4% of school going children were anemic. The prevalence of anemia in school going children of tehsil Takht-E-Nasrati was 32.1% and 43.6% in tehsil Banda Daud Shah. The prevalence was high in tehsil Banda Daud Shah, tehsil Takh-E-Nasrati and tehsil Karak respectively. The total anemic children were 34.0% and non-anemic were 65.9%. The mean Hb level of anemic children was 10.7.

Table 2 shows Anemia relation with socio economic condition. The whole population was divided into three classes on the basis of monthly income. The people whose monthly income was <15,000 (lower class), =15,000 - 20,000 (middle class) and >20,000 (upper class). The prevalence of anemia was high (55.8%) in the children of lower class parents. 32.2% anemic children belong to middle class and 17% belong to upper class parents. The incidence of anemia was high in lower class family children because their daily dietary intake was not balance.

Table 1. Anemia percentage in school age children (SAC) (5 - 12 years) in district Karak.

Area/Tehsil	Sample Size	Anemic (Hb < 11.5 g/dL or 115 g/L)	Hb Mean \pm SD
		n (%)	
Karak	140	37 (26.4)	10.3 \pm 1.3
Takht-e-Nasrati	140	45 (32.1)	10.0 \pm 1.02
Banda Daud Shah	140	61 (43.6)	9.5 \pm 1.67
Total	420	143 (34.0)	10.7 \pm 2.00

Table 2. Anemia association with socio-economic condition among school age children.

Socio-economic condition	Normal Hb level	Anemic (Hb < 11.5 g/dL)	Total
	n (%)	n (%)	n = 420
Lower class < 15,000	53 (44.2)	67 (55.8)	120
Middle class = 15,000 up to 20,000	105 (67.7)	50 (32.2)	155
Upper class > 20,000	119 (82.0)	26 (17.9)	145
Total	277 (65.9)	143 (34.0)	420

Table 3 shows Gender wise distribution of anemic children. In tehsil Karak 25% boys and 28% girls have low Hb value than normal and were anemic. 30.1% boys and 35.0% girls was anemic in tehsil Takht-e-Nasrati and 36.1% boys 57.8% girls in tehsil Banda Daud Shah. The incidence was high in tehsil Banda Shah. The prevalence of anemia was more in girls than boys. The total numbers of anemic girls were 28.3% in tehsil Karak, 35.0% in tehsil Takht-e-Nasrati and 57.8% in tehsil Banda Daud Shah. The total percentage of anemia was 38.9% in girls and 31.0% in boys. The percentage was more in girls than boys.

Table 4 shows Age wise distribution of anemic children. According to age, the children were divided into three groups. The percentage of anemia in children at age (10 - 12 years) was high (40%) than other age groups. The incidence of anemia was 27%, 32.1% and 40% from age (5 - 8), (8 - 10) and (10 - 12) years respectively. The mean Hb level of anemic children's age (5 - 8 years) was 10.6, children (8 - 10 years) were 10.02 and 10 - 12 years was 9.5. The data is shown in **Table 4**.

Table 5 shows Hemoglobin status of anemic children under age of 5 - 12 years by its severity. The anemia was classified into three groups, Mild, Moderate and Sevier anemia. 46.8% of children was mild anemic. While the percentage of moderate anemia and severe anemia was 40.5% and 121.6% respectively. The distribution data is clearly seen in **Table 5**.

4. Discussion

The present study was based on 420 school age children ranging from 05 - 12 years included both sexes (Male and Female) of district Karak. Anemia is one of the widespread health problems among children and pregnant women especially in developing countries. The present study estimated iron deficiency anemia in district Karak, in Khyber Pakhtunkhwa Pakistan. The percentage of anemia in children of both sexes (age 05 - 12 years) was 34.0% in district Karak. The anemia percentage in this age was high because the children require nutritional diet for rapid growth. The prevalence of anemia in children at Africa was 60%, Latin America (46%), Eastern Mediterranean (63%), Southeast Asia I (49%), southeast Asia II (66%) and north America 7% [19]. In Pakistan the survey conducted by National Health survey for Pakistan (NHSP) in 1990-1994 shows that the nutritional anemia in children under age of 05 years was 62.9%. The prevalence of anemia among urban school children of Panjab was 51.5% [20].

The incidence of anemia was high in girls (38.9%) as compared to boys (31.0%) in district Karak, because most of the parents prefer to male children as compared to female children. According to Verma *et al.* [20] the prevalence of anemia was high in girls 51.1% among the urban school children of Panjab than boys except 05 years and 10 - 12 years age. In Bangalore district of South India the prevalence of anemia in girls (15.3%) was also high than boys (12.0%) The low prevalence in Bangalore was due to school based intervention program that have been conducted 2003 [21]. In Rishikesh, Utterakhand, India the percentage of anemia was 56.5% in school age children. There was high proportion (36.5%) in menarcheal girls. 90.90% anemic children were belonging to lower socio-economic family. The most common anemia was microcytic hypochromic type. It indicates that it is

Table 3. Gender wise distribution of anemic children.

Gender/Tehsil	Normal Hb level	Anemic (Hb < 11.5 g/dL)	Total
	n (%)	n (%)	n = 420
Karak			
Boys	60 (75)	20 (25)	80
Girls	43 (71.7)	17 (28.3)	60
Takht-e-Nasrati			
Boys	58 (69.8)	25 (30.1)	83
Girls	37 (64.9)	20 (35.0)	57
Banda Daud Shah			
Boys	60 (63.2)	35 (36.8)	95
Girls	19 (42.2)	26 (57.8)	45
Total			
Boys	178 (69)	80 (31.0)	258
Girls	99(61.1)	63 (38.9)	162

Table 4. Age wise hemoglobin status of all school age children.

Age in years	Normal Hb level	Anemic (Hb < 11.5 g/dL)	Hb Mean \pm SD	Sample Size
	n (%)	n (%)		n = 420
5 - 08	80 (72.7)	30 (27.3)	10.6 \pm 1.01	110
8 - 10	95 (67.8)	45 (32.1)	10.02 \pm 1.15	140
10 - 12	102 (60)	68 (40.0)	9.5 \pm 1.32	170
Total	277 (65.9)	143 (34.0)	10.7 \pm 2.00	420

Table 5. Clinical signs and symptoms in anemic children.

Sign and Symptoms	Anemic (Hb < 11.5 g/dL)	Percentage (%)
	n	
Pale Skin	67	46.9
Weakness	47	32.9
Fatigue	23	16.1
Pale Conjunctiva	6	4.2
Total	143	100

due to lack of nutrient [22].

The percentage of anemia was high in age groups (10 - 12 years) 40% and in (08 - 10 years) 32.1% children as compared to age groups (05 - 08 years) 27% child because at this age the children body requires balance nutrition for rapid growth. In Pakistan the children are admitted in school at the age of 05 years. At that age, there are more burdens on children and need more nutrition. According to age wise distribution; the prevalence of anemia was high (48%) at age 09 - 12 years in Rishikesh, Uttarakhand, India and 15.5% in 05 - 08 years child [22]. The present findings were in line with the previous studies. The survey conducted in school age children of Dera Ismail Khan (Pakistan) by Ramazan *et al.*, [23] shows that (58.82%) boys were anemic with maximum at age 06 years and (70%) girls were anemic with maximum at age 06 years (100%) and 10 years (66.66%).

The incidence of anemia was high in lower class (55.8%) children followed by middle class (32.2%) and upper class (17%) children in the present study. Similar findings were reported by Villalpando *et al.* [24] in Mexican preschool and school age children in 1999-2006. In 1999 the percentage was 28.1%, 24.7% and 22.1% in lower, middle and upper class children respectively thus percentage of anemia was reduced (19.6%) in lower class, middle class (17.2%) and in upper class (16.6%) in 2006 under age 5 - 11 years children. Similar findings were recorded by Jain and Jain, [22] show that anemia was more common (90.90%) in the children belonging to the lower socio economic level and 37.5% children of upper and middle class were anemic in Rishikesh, Uttarakhand, India. The prevalence of anemia in undernourished children was high (66.89%) and in nourished

group were (29.09) [22]. It is estimated that the incidence of anemia in school age children in age groups (05 - 12 years) was high (46%) in developing countries especially highest rates found in Africa (49%) and in South Asia (50%). The anemia prevalence among school age children was 35% in mountainous region from Northern Morocco [25].

The percentage of Mild anemia (Hb 10 to <11 g/dL) (46.8%) in children was high followed by moderate (Hb 7 to <10 g/dL) (45.5%) and severe anemia (Hb < 7 g/dL) (12.6%). The percentage of mild anemic (11.2%), moderate anemic (2.1%) and severe anemic were (0.3%) in school age children of Bangalore which was similar to the present study [21]. Mild anemia > Moderate anemia > Severe anemia.

5. Conclusion

It is concluded from the present study that the problem of anemia was high in school age children. The percentage of anemia among school age children was high (34.0%) in district Karak. In different tehsil, the incidence was high (43.6%) in Banda Daud Shah. This is urban region of the district Karak. It means that the anemia was more prevalent in rural region than in urban area. While in other regions of the district it was 32.1% in Takht-e-Nasrati and 26.4% in tehsil Karak. In children the presence of anemia reduces immunity, physiological development and reduces physical and mental activities. The percentage of anemia was higher in girls (38.9%) than boys (31.0%) and more in lower class (55.8%) family children. According to age-wise, 10 - 12 years children were more anemic. Most of the children were mild anemic. The symptoms of anemia were difficult to detect and diagnose but the Pale skin was the most common symptom of anemia.

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