

# Prevalence of Iron Deficiency Anaemia in School and College Going Students of District Shaheed Benazirabad Sindh Province, Pakistan

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## Abstract

The present study aimed to estimate the occurrence of Iron Deficiency anemia (IDA) in school and college going students (aged 11 - 18 years). Anemia is the most public health problem in school age children. It has a wide range of adverse results involving, poor cognitive performance, poor development of infants, preschool and school-aged children. Anemia also causes the impairment of physical capacity, work performance of adolescents and adults, reduction in immune competence and increased morbidity from infections in all age groups. Our study based on 1686 volunteers was randomly selected from different Government High schools and colleges. A Questionnaire was utilized for data collection. BMI was also calculated by dividing weight in kg by the square of height in meters. Hemoglobin (Hb), Hematocrite (Hct), Mean Corpuscular volume (MCV), Mean Corpuscular hemoglobin concentration (MCHC), white blood cell (WBC) and red blood cell was examined using Sysmex kx-21N hemoglobin auto analyzer (Hedwin, 2008). The total percentage of anaemic students (43.1%) and non-anaemic (56.9%) were observed in district Shaheed Benazirabad. The mean Hb level of anaemic students ( $11.1 \pm 4.94$ ) was observed. In males (12.7%) and females (30.4%) anemia was observed. The prevalence of anemia high (16.2%) was observed in the age of 14 - 16 years. The majority of anemic patients (30.2%) belonged to low income group. Area wise prevalence, in rural areas 27.8% and urban areas 15.3% volunteers anaemic was observed. Taluka wise occurrence of anaemia in taluka Sakrand was (14.6%), in taluka Kazi Ahmed (15.0%), in taluka Daur (8.0%) and in taluka Nawabshah was (5.5%). Clinically signs and symptoms showed, pale skin 57.7% and weakness 42.3% were observed in school children.

## Keywords

Iron Deficiency Anaemia (IDA), Haemoglobin (Hb), Red Blood Cell (RBC), White

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Blood Cell (WBC), Hematocrit (Hct), Body Mass Index (BMI), School Children,  
Pale Skin

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## 1. Introduction

Anaemia is the most important public health problem in school age children. World Health Organization estimated two billions people suffer from anemia in the world [1]. Besides pregnant women, children (both preschool and school-age) are the most affected group by ID because of the quick growth and the general cognitive development [2]. Anaemia is a multi-factorial health problem in which the risk factors could be nutritional (vitamin B12, folate and iron deficiencies), clinical (infectious diseases such as HIV/AIDS, tuberculosis, malaria, general inflammatory disorders and helminthes infections), socioeconomic factors (educational levels of parents and low household income) and demographic factors (age, gender, and family size) [3] [4]. Anaemia has a wide range of adverse results involving, poor cognitive performance, poor development of infants, preschool and school-aged children, impairment of physical capacity, work performance of adolescents and adults, reduction in immune competence and increased morbidity from infections in all age groups [5]. Severe anemia is a simple state causing important morbidity and mortality in children in Africa [6]. Iron deficiency is the result of an iron balance, *i.e.*, the amount absorbed by the intestine may not be satisfactory to meet body needs. However, if the supply of hemopoietic nutrients is inadequate, the bone marrow is dysfunctional and the levels of hemoglobin will be subnormal and a state of anemia will set in. Iron needs depend on age, sex, race, pregnancy, lactation and altitude, because of the different collaborating factors for the development of anemia in children, information of its prevalence, distribution and etiology are important for gaining exact measures for its stopping and control. In Pakistan, nutritional anemia has been documented to be most common type of malnutrition was present in children. According to the 1977, micronutrient research of Pakistan about 38% of the population was recognized to be anemia [7]. According to Survey of National Nutrition (1988), 65% of the Pakistani children aged 7 - 60 months were found to be anemic [8]. It also has effect on child development, mental and psychomotor development [9]. Iron deficiency anemia in Pakistan, 65 percent present in children at the age 7 to 60 years and other studies estimated dissimilar common rates *i.e.* 70 percent, 78 percent [10]. However, researcher reported that about (750 million) children are affected by Iron Deficiency Anaemia and most commonly in children and women in developed countries [11]. About 700,000 children aged 1 to 2 years are iron deficient and (240,000) had anemia iron deficiency [12]. The anemia 50% is caused by low iron intake. The major risk factors for low iron intake among young children in developing countries are malnutrition (low intake) and high requirement of iron during child development, due to the multifactorial environment, difficulty of risk factors of anemia and potential interactions among them and a single strategy to curb anemia in devel-

oping countries may have little success. An integrated strategy for anemia control and prevention is required [13]. Erythrocytes or red blood cells indicate the level of Hb while erythropoietin controls the release of RBC from bone marrow that produced from interstitial fibroblasts in the kidney. Mean while disturbance in several essential micronutrients supplements can effect on the production of new cells. B2 (riboflavin) [14] and Vitamins B6 (pyridoxine) [15] are essential for production of the globin protein whereas iron has to be integrated into the final Hb molecule [16]. The environmental factors such as oxygen, high altitude, smoking and physiological factors such as gestation influenced on the Hb availability within the blood [17].

Haemoglobin was used to assess anemia and the information collected was intended to estimate of iron shortage at birth, iron deficiency anemia and make strong intention of the predictive value of hemoglobin in Identifying iron deficiency. NHANES data (1999 to 2000) show that, the proportion of children with iron deficiency remained 2% - 5% points more than the 2010 National Health Objectives [18].

## 2. Aim & Objective

- 1) To estimate the occurrence of Iron Deficiency Anaemia in school children aged 11 - 18 years in the four talukas of District Shaheed Benazirabad (Nawabshah).
- 2) Observing relationship of Iron Deficiency Anaemia with financial status of volunteers.

## 3. Methodology

### 3.1. Study Area

This cross sectional study was conducted in District Shaheed Benazirabad (Nawabshah) during the period of January 2015 to July 2015, for obtaining data; the whole district was divided into four talukas, Sakrand, Nawabshah, Kazi Ahmed and Daur.

### 3.2. Study Plan

The Present study was planned to examine the proportion of anemia in school and college age children in relationship with Socio-economic status, age, education and dietary intake in Shaheed Benazirabad. The students were selected by visiting of different Government High schools and colleges. Boys and girls students aged 11 to 18 years were enrolled for the study. The questionnaire was designed including education, social class, age, sex, and dietary habits.

The verbal consent for acceptance of participation of parents/guardian of selected subjects in the study was obtained. Apparently normal students of both genders were selected and with no history of bleeding, blood transfusion, inflammation, infection, liver disease, malignancy and any extensive surgery. The participants were selected from rural and urban areas of District Shaheed Benazirabad (Nawabshah).

Age wise distribution of children in three Categories

- 1) 11 - 13 years,
- 2) 14 - 16 years,

3) 17 - 18 years.

### 3.3. Anthropometric Measurements

Anthropometrical and clinical examination was carried on these Students. Various anthropometric measurements used were height weight and BMI.

### 3.4. Body Mass Index

It is calculated by dividing weight in kg by the square of height in meters. The calculations were compared with standard for classification of the sample.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

Since the height of respondents was recorded in centimeters, for the calculation, BMI heights in centimeter were first converted into height in meters.

### 3.5. Classification of Body Mass Index

Based on BMI	Body index Kg/m <sup>2</sup>	Health risk associated
<b>Under weight</b>	Below 18.5	Low
<b>Normal range</b>	18.5 - 25.0	Moderate
<b>Over weight</b>	25.1 - 29.1	High
<b>Obesity</b>	30 above	Very high [19]

Monthly income of volunteer's parents was divided into three classes. The persons whose monthly income was less than Rs: 20,000/month (Poor/lower class), Rs: 20,000 - 27,000 (middle class) and more than Rs: 28,000 (middle upper class).

In present study 3 cc blood samples were taken from each of the volunteers.

A total of 1686 blood samples were collected. For the blood sample collection, the collection site was cleaned with antiseptic liquid to kill germs. The blood was drawn from vein by sterilized syringes. The blood samples were collected and poured into EDTA (ethylene diamine tetra acetic acid) tube. For the duration of the blood collection the designed questionnaire was filled from the each participant.

### 3.6. Laboratory Work

The blood samples were immediately carried to Liaquat University of Medical & Health Sciences Diagnostic Laboratory Hyderabad. Haemoglobin (Hb), Hematocrite (Hct), Mean Corpuscular volume (MCV), Mean Corpuscular Haemoglobin concentration (MCHC), white blood cell count (WBC) and red blood cell count and platelets were measured by using Sysmex kx-21N Haemoglobin auto analyzer (Hedwin, 2008). The lower limit for the hemoglobin (Hb) level was different according to sex. The cut-off value 12 g/dl for female and for boys 12.5 g/dl of Hb were considered diagnostic.

## 4. Data Analysis

The whole data was entered, checked and analyzed by using SPSS version (20) for required statistical parameters including simple mean, frequency distribution, standard deviation, and interpretation of observed results.

## 5. Results

The total numbers of 1686 volunteers were randomly selected from school and college students (11 - 18 years) with both sexes (Males 946 = 56.1% and Females 740 = 40.3%). The questionnaire were filled with clinically observation for the incidence of anemia at district Shaheed Benazirabad. However, after clinical assessment blood samples were collected for additional examination.

The prevalence of Anaemia in school and college students of District Shaheed Benazirabad population was divided into four clusters, volunteers were selected from (680 = 40.3% urban), (1006 = 59.7% Rural), (946 = 56.1% Males) and (740 = 40.3% females) from taluka Nawabshah (27.6%), taluka Sakrand (27.3%), taluka Daur (18.8%) and taluka Kazi Ahmed (27.3%) were observed in the present study. The study sample of volunteers was categorized into two groups, anemic and non anemic (**Figure 1**).

In District Shaheed Benazirabad (43.1%) students were anemic. The total anemic students (43.1%) and non-anemic (56.9%) were observed. The mean Hb level of anemic students ( $11.2 \pm 2.94$ ) was observed. The prevalence of anemia in male students (12.7%) and in female students was (30.4%) and higher prevalence found in female students as compared male students.

The prevalence of anemia in rural areas (27.8%) and urban areas was (15.3%), high prevalence anemia recorded in rural areas. The occurrence of anemia in the students of Taluka Kazi Ahmed was (15.0%) and (14.6%) in taluka Sakrand. The prevalence was high in taluka Kazi Ahmed and taluka Sakrand respectively (**Figure 1**).

**Table 1** shows that male volunteers Hb and BMI level were  $12.73 \pm 1.47$ ,  $19.63 \pm 1.22$  respectively. It was higher in male compared to female volunteers  $11.56 \pm 0.86$ , and  $17.57 \pm 0.70$  respectively.

**Table 1.** Relationship of socio-demographic characteristics with hemoglobin level and body mass index (N = 1686).

Variable	Frequency of variable		Hb gram/dL Mean $\pm$ S.D	BMI Mean $\pm$ S.D
	No.	%		
Males	946	56.1	$12.73 \pm 1.47$	$19.63 \pm 1.22$
Female	740	43.9	$11.56 \pm 0.86$	$17.57 \pm 0.70$
Urban	680	40.3	$12.52 \pm 1.65$	$19.04 \pm 1.33$
Rural	1006	59.7	$12.01 \pm 1.49$	$18.51 \pm 1.49$
Sakrand	460	27.3	$11.97 \pm 1.37$	$18.50 \pm 1.35$
Daur	300	17.8	$12.26 \pm 1.51$	$19.07 \pm 1.51$
Kazi Ahmed	460	27.3	$11.92 \pm 1.01$	$18.31 \pm 1.32$
Nawabshah	466	27.6	$12.71 \pm 1.45$	$19.15 \pm 1.46$
Total	1686	100	$12.21 \pm 1.37$	$18.73 \pm 1.45$

In residential area wise (Rural, Urban), in urban region Hb = 12.52 ± 1.65 and BMI = 19.04 ± 1.33 level were higher found as compared to rural areas.

Taluka wise, in taluka Nawabshah Hb = 12.71 ± 1.45 and BMI = 19.15 ± 1.46 were higher found as compared to Taluka Kazi Ahmed, Daur and Sakrand (Table 1).

Table 2 shows that in 14 - 16 age group 16.2% volunteers were anemic and it was found higher as compared to other age groups.

Table 3 shows that in 15,000 - 20,000 income group 30.2% volunteers were anemic, it was found high as compared to other income groups.

Table 4 shows that in males volunteers minimum Hb level = 10.3 g/dl, and maximum Hb = 15.4 g/dl, which was found higher as compared to females volunteers.

Table 5 shows that in rural areas minimum Hb level = 9.4 g/dl, and maximum Hb = 15.3 g/dl was lower found as compared to urban areas.

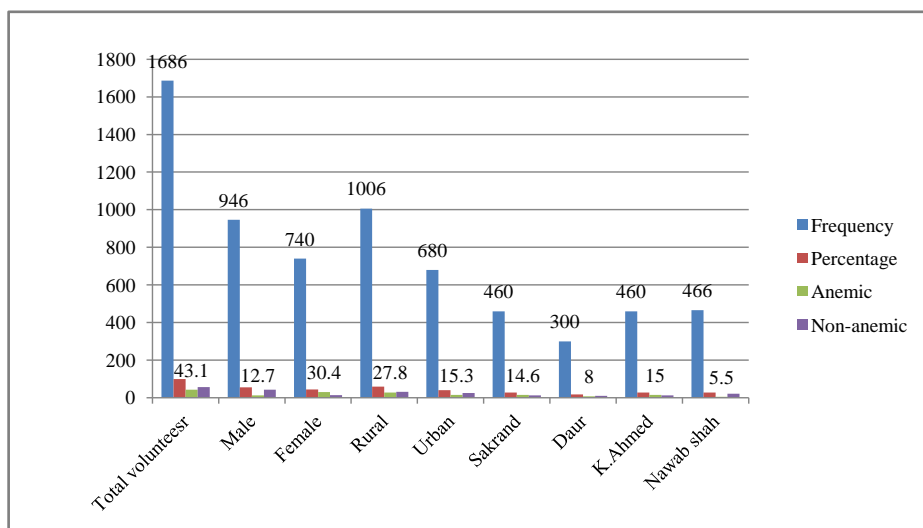


Figure 1. The prevalence of anemia, gender wise, area wise and taluka wise in district Shaheed Benazirabad.

Table 2. Age wise frequency and distributions of volunteers with Hb less than cut off value.

Variable (Age Groups)	N	%	Hb <12.0 gram/dL	
			N	%
11 - 13	638	37.84	262	15.5
14 - 16	648	38.43	272	16.2
17 - 18	400	23.74	192	11.4

Table 3. Income wise frequency and distributions of volunteers with Hb less than cut off value.

Variable (Income Groups)	N	%	Hb <12.0 gram/dL	
			N	%
15,000 - 20,000	928	55.1	510	30.2
21,000 - 27,000	518	30.7	180	10.6
28,000 - 50,000	240	14.2	40	2.3

**Table 6** represents that in 15,000 - 20,000 income group minimum Hb level = 9.4 g/dl was lowest as compared other income groups.

**Table 7** reflects that in 13 - 14 age group maximum Hb level = 15.4 g/dl was high as compared to other age groups.

**Table 8** shows that minimum Hb level = 9.4 g/dl are same in all taluka of district Shaheed Benazir Abad.

**Table 9** shows that from the total anemic volunteers, pale skin 57.7% and weakness 42.3% were observed in school going children.

## 6. Discussions

The present study was organized on 1686 school age students from 11 - 18 years included both sexes (Male and Female) of district Shaheed Benazirabad. Anemia is the most important public health problem affecting more than half of school-age children

**Table 4.** Gender wise minimum & maximum Hb level of volunteers.

Variable	N	%	Hb gram/dL	
			Minimum	Maximum
Male	946	56.1	10.3	15.4
Female	740	43.9	9.4	13.7
Total	1686	100	9.4	15.4

**Table 5.** Area wise minimum & maximum Hb level of volunteers.

Variable			Hb gram/dL	
Area	N	%	Minimum	Maximum
Urban	680	40.3	10.4	15.4
Rural	1006	59.7	9.4	15.3
Total	1686	100	9.4	15.4

**Table 6.** Income wise minimum & maximum Hb level of volunteers.

Variable (Income Groups)	N	%	Hb gram/dL	
			Minimum	Maximum
15,000 - 20,000	928	55.04	9.4	14.8
21,000 - 27,000	518	30.72	10.6	14.8
28,000 - 50,000	240	14.23	10.6	15.4

**Table 7.** Age wise minimum & maximum Hb level of volunteers.

Variable (Age Groups)	N	%	Hb gram/dL	
			Minimum	Maximum
11 - 12	638	37.84	9.5	15.3
13 - 14	648	38.43	10.2	15.4
15 - 16	400	23.74	9.4	14.8

**Table 8.** Taluka wise minimum & maximum Hb level of volunteers.

Variable (Clusters)	N	%	Hb gram/dL	
			Minimum	Maximum
Sakrand	460	27.3	9.4	15.4
Dour	300	17.8	9.4	15.4
K. Ahmed	460	27.3	9.4	15.3
N. shah	466	27.6	9.4	15.4

**Table 9.** Signs and symptoms (clinically) in anemic students.

Signs and symptoms	Anemic	Percentage
Pale skin	443	57.7
Weakness	324	42.3
Total	767	100

in growing countries. Anemia in the school age children has been conclusively observed to delay psychomotor development, poor cognitive performance, and impaired immunity and reduce working capacity. The present study estimated iron deficiency anemia in district Shaheed Benazirabad, Sindh Pakistan. The occurrence of anemia was (43.1%) including both sexes in the age of 11 - 18 years in District Shaheed Benazirabad. (**Figure 1**) The prevalence of anemia in this age was high due to the children require nutritional diet for rapid growth. The prevalence of anemia in Southeast Asia I children was (49%), in African children was (60%), in southeast Asia II children was (66%), in Latin American children was (46%), in Eastern Mediterranean children was (63%) and North America children was (7%) [20]. National Health survey for Pakistan (NHSP) in 1990-1994 proved that the nutritional anemia was presence in children under age of 05 years was (62.9%). The occurrence of anemia (51.5%) was among urban school students of Punjab [21].

In the year 1975 to 76 Survey of Nutrition in rural areas of Bangladesh about 70 percent of Bangladeshi peoples suffer from anemia with a mean Haemoglobin value of (9.7 gm/dl). Average Haemoglobin level in children (0 - 4 years) of neighboring Thailand is (11.2 gm/dl) which is considerably higher than the values found in past studies. Bhatia *et al.* (1990) reported that, 74 percent of the males and 75 percent of the school females between 5 to 14 years of age were anemic. Occurrence of anemia was also surveyed in Bangladesh urban and rural Chittagong Hill Tracts [22]. The current study shows that occurrence of anemia were higher in female students (30.4%) as compared to boys students (12.7%) in district Shaheed Benazirabad (**Figure 1**). Verma, M., *et al.*, reported that the occurrence of anemia was increased in girls 51.1% amongst the urban school students of Punjab than boys except 05 years and 10 - 12 years age. In South India district Bangalore the occurrence of anemia in females (15.3%) were higher as compared to males (12.0%). The occurrence of anemia was low in Bangalore because of school based involvement program that have been conducted 2003 [23]. The scenario on the iron status of adolescent girls in the has conducted study was also not satisfactory eva-



lated the iron status of 199 it seems that healthy male and female adolescents aged 12 to 19 years living in a fishing society in Sabah, Malaysia. The mean hemoglobin value for the females was  $(12.4 \pm 1.6 \text{ g/dl})$  with (28.6) percent of adolescents having hemoglobin level  $<12 \text{ g/dl}$ . In our results study Hb cut off mean  $12.21 \text{ g/dl}$ , however we have observed [24] [25]. Our finding shows that in male volunteers the mean values of Hb and BMI level were  $12.73 \pm 1.47$ ,  $19.63 \pm 1.22$  respectively. It was higher in male compared to female volunteers  $11.56 \pm 0.86$ , and  $17.57 \pm 0.70$  respectively. In Residential area wise (Rural, Urban), in urban region the mean value of Hb =  $12.52 \pm 1.65$  and BMI =  $19.04 \pm 1.33$  level was higher found as compared to Rural areas and in taluka Nawabshah the mean value of Hb =  $12.71 \pm 1.45$  and BMI =  $19.15 \pm 1.46$  was higher found as compared to Taluka Kazi Ahmed, Daur and Sakrand (Table 1).

About (56.5%) were anemic in Rishikesh, Utterakhand, of India in school age children. The high occurrence of anemia was (36.5%) in menarcheal girls. 90.90% anemic volunteers were belongs to lower socio-economic family. The majority common anemia was microcytic hypochromic type due to deficiency of nutrients [26]. The occurrence of anemia were higher in age group 11 - 13 years (15.5%) and in 14 - 16 years (16.2%) children as compare to age groups 17 - 18 year (11.4%), for the reason that at this age the volunteers body requires balance nutrition for rapid growth (Table 2). In an urban slum in Delhi, the occurrence of anemia judged by WHO recommended "cut off" value of Haemoglobin less then  $11 \text{ g/dl}$  was found to be 76 percent amongst preschool children were documented by Gomber *et al.*, (1998). Bentley & Griffiths (2003) were investigated the occurrence of anemia among (4032) ever-married women aged 15 to 49 years from (3872) households in Andhra Pradesh, India. In all, 32.4 percent had mild anemia  $10 - 10.9 \text{ g/dl}$  for pregnant women,  $10 - 11.9 \text{ g/dl}$  for non-pregnant women, 14.2 percent had moderate  $7 - 9.9 \text{ g/dl}$  and 2.2 percent had severe less than  $7 \text{ g/dl}$  anemia. The same has been supported by other investigators in both urban and rural regions. Present study also shows that in rural areas 27.8% and urban areas 15.3% volunteers were anemic observed, it was highly found in rural areas (Figure 1). The children are admitted in Pakistani school at the age of 05 years. At that age, there are more load on children and need more nutrition. Age wise distribution; the occurrence of anemia was high (48%) at age 09 - 12 years in Uttrakhand, Rishikesh, India and 15.5% in 05 - 08 years child The resent results were in line with the past studies. The analysis conducted in school age students of Dera Ismail khan (Pakistan) (58.8%) males were anemic with maximum at age 06 years and (70.0%) females were anemic with maximum at age 06 years (100%) and 10 years (66.6%) [27]. Our findings shows that the occurrence of anemia (30.2%) were observed in lower class income that was higher occurrence of anemia in lower class children as compared to middle class (10.6%) and upper middle class (2.3%) students (Table 3). Similarly findings reported by Villapando *et al.* Preschool and school age children of Mexico in 1999-2006. The occurrence of anemia in 1999 was 28.1%, 24.7% and 22.1% in lower, middle and upper class children respectively therefore occurrence of anemia was low (19.6%) in lower class, middle class (17.2%) and in upper class (16.6%) in 2006 below age 5 - 11 years children. Similar findings reported by Jain

and Jain, 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, Uttrakhand, India.

The occurrence of anemia in malnourished children was high (66.89%) and in nourished group were (29.09) [28]. Prevalence of anemia in school age children in age groups (05 - 12 years) was high (46%) in developed countries particularly highest rates found in Africa (49%) and in South Asia (50%). The anemia occurrence among school age children was 35% in mountainous region from Northern Morocco [29]. The incidence of anemia were (14.6%) and (15.0%) in children of taluka Sakrand and taluka Kazi Ahmed. The occurrence was high in taluka Sakrand and taluka Kazi Ahmed respectively (**Figure 1**). Gender wise in males minimum Hb level = 10.3 g/dl, and maximum Hb = 15.4 g/dl were higher found as compared to females (**Table 4**). This study also show that in rural areas minimum Hb level = 9.4 g/dl, and maximum Hb = 15.3 g/dl were lower found as compared to urban areas (**Table 5**), in lower income group minimum Hb level = 9.4 g/dl was lowest found as compared other income groups (**Table 6**). In age group 12 - 14 years the maximum Hb level = 15.4 g/dl were higher found as compared to other age groups (**Table 7**), and minimum Hb level = 9.4 g/dl are same in all taluka of district Shaheed Benazir Abad (**Table 8**). In our study Pale skin was commonly present in volunteers (**Table 9**). In Pakistan nutritional anemia has been documented to be most common type of malnutrition present in children. According to the 1977 micronutrient research of Pakistan about 38% of the population was recognized to be anemia (Micro-Nutrient Survey of Pakistan, 1977). According to Survey of National Nutrition (1988) 65% of the Pakistani children aged 7 - 60 months were found to be anemic [8]. It also has impact on child growth, mental and psychomotor development [9]. Iron deficiency anemia in Pakistan 65 percent present in children at the age 7 to 60 years and other studies estimated different common rates *i.e.* 70 percent, 78 percent [10].

## 7. Conclusion

It is concluded that in present study occurrence of anemia (43.1%) was observed, it was high in students of district Shaheed Benazirabad. The occurrence of anemia (27.8%) was mostly present in rural areas. The occurrence of anemia (14.6%) in taluka Sakrand and (15.0%) in taluka Kazi Ahmed were higher as compared to taluka Nawabshah (5.5%) and taluka Daur (8.0%). The prevalence of anemia (30.4%) was higher in female students as compared to (12.7%) male students. The majority of anemic patients (30.2%) belongs to lower income class and more anemic were observed in the age of 14 - 16 years. In the students, the incidence of anemia reduced the physiological development, immunity and reduces mental and physical activities. The anemia symptoms were difficult to diagnose, and pale skin was most common symptom of anemia in students.

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