

# Prevalence of Anemia in School Age Children (SAC) of District Swabi, KPK, Pakistan

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## Research

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# Abstract

**Background:** Pakistan has one of the highest prevalence's of child anemia as compared to other developing countries. This narrative about the prevalence of anemia in school age children's at district Swabi. Although Swabi has experienced rapid economic growth over the decades, significant health and nutrition problem remains unfortunately because little work has been done to track basic diseases such as anemia.

**Results:** The goal of this research is to assess the prevalence of anemia in Swabi. A total of 400 children of school age participated in this study. District Swabi was divided into four tehsils Topi, Swabi, Razzar and Lahor and 100 samples of blood of both genders were collected from each subject to measure hemoglobin level. From tehsil Swabi 60 boys and 40 girls, tehsil Topi 70 boys and 30 girls, Razar 50 boys and 50 girls and Lahor 80 boys and 20 girls, were examined in the current study. Children included in the study sample were divided into two groups, anemic and non-anemic. In tehsil Swabi 42% of school going children were anemic. The prevalence of anemia in school going children of tehsil Topi was 48%, in tehsil Razar the count of anemic children was 63% and 58% children found anemic in tehsil Lahor. The prevalence was high in tehsil Razar, Lahor, Topi and Swabi respectively. The total anemic children were 52.0% and non-anemic were 48.0%. The mean Hb level of anemic children was 10.9 Gm. %.

**Conclusion:** The presence of anemia reduces resistance, physiological development and declines physical and mental activities. The percentage of anemia in children of lower class families (fewer earnings) was higher 70% as compare to children of upper class families 32%.

# Background

Anemia is defined as reduction in the amount of red blood cells (RBCs). Simply, it means that decrease of red blood cells cause decrease in the level of hemoglobin which is termed as "anemia". Since, hemoglobin is responsible for carrying oxygen to different parts of body; therefore, reduction in the hemoglobin level leads to "anemia". Iron deficiency anemia is a foremost cause of several diseases and increased mortality across the globe and affects up to two-third of children in all over the World. [1]. Infant and young children aged 6–18 months are particularly defenseless to iron- deficiency anemia because they have higher requirement for iron due to their growing age [2]. The observations are that the marketable food strengthening works well to stop deficiencies, and the fortify-cants must not eventually change the color, surface, or flavor of the food to which they are included [3]. In 2002 iron deficiency anemia was considered one of the high rated contributing factors to the problem of anemia prevailing on World level [4]. A recent report by the WHO on the worldwide prevalence of anemia to describe thoughtfully geographic differences as[5] if there are certainly many reasons for the differences across space, one important closed relation is income. As incomes rise in any given region/country, the number of individuals having the disease of anemia typically falls [4]. Given the un-exceeded economic growth in China over the past few decades, and the rising incomes that have occupied this growth [6] one might expect health outcomes to have also improved. It is estimated that approximately 750 million children are

affected by Iron deficiency anemia (IDA). 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). 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 [7]. The iron deficiency causes microcytic anemia but folic acid, vitamin B12, hyperthyroidism and liver disease cause macrocytic anemia. Some other diseases like diarrhea, filariasis, and parasitic infection that cause blood loss also result in anemia. 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 [8]. Anemia is currently estimated to impact a quarter of the world's population [5]. Anemia has been shown to contribute to mortality; a recent meta-analysis of nearly 12,000 children from six African countries aged 28 days to 12 years indicates that for each 1 g/dL increase in Hb, the risk of death falls by 24% [9]. The global frequency of Anemia in the general population is 24.8%. It is anticipated that 1,620 million people are affected by the disease of anemia, globally [6]. A deficiency in the supply or quality of blood may cause disturbance in the quality of life and can even be a greater risk for life itself. Anemia is a condition in which blood of anemic person has least enough level of hemoglobin (Hb) or red blood cells (RBCs). Anemia has many causes as researched by the experienced and professionals of the field, due to any reason stated above. One of the most common causes is an insufficient in-take of “iron” in routine diet. Iron-Deficiency Anemia is a situation where a person has insufficient amount of iron in the blood to meet up the body demands. Iron Deficiency Anemia is the most common cause of nutritional or dietary anemia in the world. Children aged between 6–24 months are at higher risk, but risk is for the children of entire preschool age group, especially in underdeveloped and developing countries. The prevalence of anemia varies significantly by sex and age with an estimated prevalence in the most vulnerable populations ranging from 47% in pre- school children (PSC), 42% in pregnant women, 30% in non-pregnant women, and 25% in school aged children (SAC). Across age groups, long-term anemia is associated with loss of productivity from impaired work capacity, cognitive impairment, and increased susceptibility to infection [10]. According to a current region and country survey, Iron Deficiency Anemia is very common among the children of < 5 years of age. Anemia is one of the most common nutritional problems in many parts of the world, especially in less developed and developing countries. A major health effect of anemia includes impaired mental and physical development in children suffered from anemia. Less intake of iron-rich food is a risk factor for the targeted group of SAC. Other consequences include concentrated work capacity in adults and higher risk of maternal and child mortality and morbidity and bad pregnancy outcome. Anemia is clear and distinct according to World Health Organization (WHO) cut-offs as Hb level < 12.0 g/dL for female children and < 12.0 g/dL for male children under 15 years old or 13 g/dL for male children aged 15 years and over. Mild anemia was defined as Hb levels between 9.0 g/dL and the cut-off points, moderate anemia is Hb 7.0–8.9 g/dL and severe anemia is Hb < 7.0 g/dL.[11]. In children, anemia can negatively affect mental and physical growth, mental caliber, school performance and immunity [12]. In the children of preschool and school, an estimated 2.00 billion people globally are affected with the disease of “anemia”. Mostly

Youngsters are unprotected to this disease due to their rapid growth and higher need of iron. Therefore, it is a critical health concern because it affects mental growth and physical capabilities. It has also been linked with functional abnormalities [2]. The consequences of anemia can be quite cruel and are most of the time irreversible, affecting both human and socioeconomic health conditions of the region including individuals and families. Meek moderate anemia is a cause to weakened immunity, reduction in work capacity, least mental ability and an overall decreased standard of life. Severe anemia (Hb < 70 g/L) reduces a woman's capability to endure bleeding, during the time of child-birth and afterwards. It is also considered a main cause of motherly morbidity and mortality, particularly in the under developed world [13]. Anemia during aberration is also associated with higher risk of premature delivery and lower birth-weight resulting in an increase in rate of death [13]. Later on mental growth and limitation in spiritual development is also a major concern in children and childhood [14]. The condition which is determined by the expected usual range of hemoglobin in people, and is defined as obtainable in a person whose hemoglobin concentration (Hb) has fallen underneath a threshold lying at two standard deviations underneath the median for a healthy population with the same demographic characteristics, including age, sex and pregnancy status [15]. Although there are certainly many reasons for the differences across space, one important correlate is income. As incomes rise in any given region/country, the number of persons with anemia naturally falls [2]. Given the extraordinary economic growth in China over the past few decades, and the rising incomes that have accompanied this growth [6]. One might expect health outcomes to have also improved. Yet paradoxically in China, a number of indicators suggest that health and nutrition problems persist across the country [2]. There are signs that China's health system has not been flourishing in expelling many diseases and states that consist of anemia—that naturally affect countries at earlier stages of development. For example, intestinal worms still are found in large parts of China's countryside population [10] and there are reports of continued vitamin A deficiency [16]. Previous studies suggest that iron-deficiency anemia among rural areas of the population is still a widespread problem in China, especially in poor areas [17]. Anemia is a general problem in early age group in many developing countries with an estimated occurrence of 43% (Seshadri, 1997). In pre-school and school children, an estimated 2.00 billion people globally are affected with anemia. Young people are more accessible to this disease due to their rapid growth which needs high concentration of iron. Therefore, it is a critical health concern because it affects growth and physical performance. It has also been related with abnormalities of lymphocytes and neutrophils [18][2]. Hemoglobin is the stuff in red blood cells that carries oxygen to the cells of the body. The body's cells need oxygen to work and enable a person to carry out all physical and mental activities. When hemoglobin levels are low down, as in a person who is suffering with anemia, less quantity of oxygen reaches the cells to help the body's activities being accomplished. Such a situation compels the heart and lungs to work harder to recompense for the blood's low ability to carry oxygen. In normal individuals, 2:3 of total body iron is available for hemoglobin formation. The left over 1/3 gets deposited as hemosiderin and ferritin [19].

## Material And Methods

### 3.1 Study Area

The present study is conducted to investigate anemia in district Swabi out of twenty - five (25) districts of the Khyber Pakhtunkhwa province of Pakistan. Swabi is one of the famous and highly populated districts of Khyber Pakhtunkhwa Pakistan. It has 04 Tehsils; Swabi, Lahor, Topi and Razar. The district Headquarter is located at distance of 100 Km from Peshawar and 115 Km from Islamabad. Yousafzai is in majority while other tribes are Razar, Utmankeheil, Jadoon, khattak and Hindko Speaking.

### 3.2 Study Design

The present study was designed to investigate the rate of low iron causing anemia in school & pre-school children considering other factors including socio economic status, age education and dietary intake in district Swabi. For obtaining realistic and consolidated data, the study district was divided into four clusters, Swabi, Topi, Razar and Lahor. A unique questionnaire was designed for collecting the most appropriate information data. Some other research methods were used like observation, interviews of school going children by visiting different primary schools (Male and Female) and hospitals. The questionnaire included age, education, sex, social class use of unfortified milk, black-tea consumption, vitamin or supplementation drugs and dietary intake like factors. To know the socioeconomic standing / status of the people of targeted group, the entire study population was divided into 03 economic categories, including Lower class, Middle class and Upper class. There were also some refusals from people of the targeted group of study. But their number was ignorable as it was having no effect on study sample.

### 3.3 Sample Collection.

A total of 400 blood samples were collected and 100 from each cluster. For the collection of blood samples, collection site was cleaned with antiseptic liquid to clean the place from all kind of germs. Blood was taken from antecubital vein by means of sterilized and new syringes with the help of male expert (certified dispenser) from school going children (Male & Female). The drawn site was usually inside the elbow or back of the hand. The needle of the syringe was inserted with intensive care into the individual vein and the blood was collected. About 01 ml to 03 ml blood was collected and saved in red tip EDTA (Ethylene-diamine tetra acetic acid) tube. During the blood collection the designed questionnaire were also filled from the participant [7].

### 3.4 Laboratory Work

The blood samples were immediately transported to the District Headquarters Hospital (Swabi) laboratory. The hemoglobin (Hb) count was determined by automatic hematological analyzer model Symex Ks-21 having two reagents, cell pack and Stromatolyser-wwt 500 ml. The WHO classification was used to characterize anemia in children aged 5–11 years  $Hb < 11.5$  g per dL (115 g /L). The anemic patients are further categorized 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. 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 [7].

### 3.5 Data Analysis

Statistical analysis and results including Mean and Standard Deviation where applicable (desirable) are obtained through statistical package, SPSS.

## Results

A total of 400 school age children (5–12 years) with both sexes (boys and girls) were interviewed and clinically examined for the presence of anemia at district Swabi. After clinical examination blood samples were collected for further analysis. Table 4.1 shows percentage of occurrences of anemia in school age children (SAC) in whole district Swabi. The whole district was divided into four large Tehsils (Swabi, Topi, Razar and Lahor). From tehsil Swabi 60 boys and 40 girls, tehsil Topi 70 boys and 30 girls, Razar 50 boys and 50 girls and Lahor 80 boys and 20 girls, were examined in the current study. Children included in the study sample were divided into two groups, anemic and non-anemic. In tehsil Swabi 42% of school going children were anemic. The prevalence of anemia in school going children of tehsil Topi was 48%, in tehsil Razar the count of anemic children was 63% and 58% children found anemic in tehsil Lahor. The prevalence was high in tehsil Razar, Lahor, Topi and Swabi respectively. The total anemic children were 52.0% and non-anemic were 48%. The mean Hb level of anemic children was 10.9 Gm. %

Table 4.1

; Anemia percentage in school age children (SAC) (5–12 years) in district Swabi:

| Area/Tehsil | Sample Size | Anemic | Hb Mean $\pm$ SD |
|-------------|-------------|--------|------------------|
| N (%)       |             |        |                  |
| Swabi       | 100         | 42     | 9.29 $\pm$ 3.07  |
| Topi        | 100         | 48     | 9.24 $\pm$ 0.97  |
| Razar       | 100         | 63     | 9.22 $\pm$ 0.94  |
| Lahor       | 100         | 58     | 9.21 $\pm$ 0.98  |
| Total       | 400         | 211    | 9.09 $\pm$ 7.85  |

Table 4.2 shows Anemia relation with socio economic condition. The whole population was divided into three classes on the basis of monthly earnings. The people whose monthly earning was < 20,000 PKR is declared as lower class, people whose monthly income was between 20,000–30,000 PKR is declared as middle class and > 30,000 PKR is declared as upper class. The prevalence of anemia was high (70%) in the children of lower class families. 46% anemic children belong to middle class and 25% belong to upper class families. The incidence of anemia was high in lower class family children because their daily dietary intake was not balance. Same is the case in middle and upper class families' anemic children. Poor diet seemed to be the main cause of anemia in all children investigated so far.

Table 4.2

; Anemia association with socio-economic condition among school age children:

| Socio-economic condition             | Normal Hb    | Anemic       | Total   |
|--------------------------------------|--------------|--------------|---------|
| Level                                |              |              |         |
|                                      | n (%)        | n (%)        | N = 400 |
| Lower Class < 20,000 PKR             | 60 (30%)     | 140 (70%)    | 200     |
| Middle Class 20,000 to 30,000<br>PKR | 74 (61.67%)  | 46 (38.33%)  | 120     |
| Upper Class > 30,000 PKR             | 55 (68%)     | 25 (32%)     | 80      |
| Total                                | 189 (47.25%) | 211 (52.75%) | 400     |

Table 4.3 shows Clinical signs and symptoms of anemic children aged between 5–12 years within the District Swabi. Table 3 shows clear picture of the children studied and investigated in the present report. Below mentioned symptoms have observed in the children studied recently, which later on confirmed by clinical reports.

Table 4.3  
; Clinical signs and symptoms in anemic  
children:

| Sign and Symptoms | Anemic | (%)   |
|-------------------|--------|-------|
|                   | N      |       |
| Pale Skin         | 66     | 31.28 |
| Weakness          | 80     | 37.91 |
| Fatigue           | 45     | 21.33 |
| Pale Conjunctiva  | 20     | 9.48  |
| Total             | 211    | 100   |

Table 4.4 and graph 1 show the gender wise distribution of children investigated during the survey. Overall 260 boys and 140 girls have been investigated for existence of anemia, during this survey. Overall percentage of boys and girls being investigated is 65% and 35% respectively.

Table 4.4  
; Percentage of boys and girls being  
investigated during the survey:

| Area/Tehsil | Sample Size | Boys | Girls |
|-------------|-------------|------|-------|
| Swabi       | 100         | 60   | 40    |
| Topi        | 100         | 70   | 30    |
| Razar       | 100         | 50   | 50    |
| Lahor       | 100         | 80   | 20    |
| Total       | 400         | 260  | 140   |

Table 4.5 and graph 2 shows the observations of normal and anemic children with respect to their genders. The ratio of anemic children is greater in girls than in boys' children, which is 63% in boys and 70% in girls. This table gives a gender wise overview of the detailed survey being carried out.

Table 4.5  
; Gender wise observations of Normal & Anemic children:

| Gender | Total | Anemic | Normal |
|--------|-------|--------|--------|
| Boys   | 260   | 164    | 96     |
| Girls  | 140   | 98     | 42     |

Table 4.6 and graph 3 shows the complete details of anemic and non-anemic school going children of district Swabi. In total 42% of children are found anemic in Tehsil Swabi, 48% in Tehsil Topi, 63% in Tehsil Razarr and 58% in Tehsil Lahor. The complete list of schools from where data of children have collected is stated as below. Overall 20 children from each school have investigated and monitored with respect to the existence of Anemia. Results are as under:

Table 4.6

; School wise distribution of Children investigated during the study:

| Schools          | Tehsil | Total | Anemic | Normal |
|------------------|--------|-------|--------|--------|
| GPS Swabi No.1   |        | 20    | 7      | 13     |
| GPS Maneri Payan |        | 20    | 9      | 11     |
| GPS Kala         |        | 20    | 10     | 10     |
|                  | Swabi  |       |        |        |
| GPS Mian Dairi   |        | 20    | 7      | 13     |
| GPS Gharr        |        | 20    | 9      | 11     |
| GPS Botaka       |        | 20    | 10     | 10     |
| GPS Topi         |        | 20    | 7      | 13     |
| GPS Parkhe       |        | 20    | 8      | 12     |
|                  | Topi   |       |        |        |
| GPS Matuna       |        | 20    | 11     | 9      |
| GPS Taj Khan     |        | 20    | 12     | 8      |
| GPS Gohati       |        | 20    | 12     | 8      |
| GPS Char Bagh    |        | 20    | 14     | 6      |

| Schools              | Tehsil | Total | Anemic | Normal |
|----------------------|--------|-------|--------|--------|
| GPS Tarakai          |        | 20    | 10     | 10     |
|                      | Razarr |       |        |        |
| GPS Sikandari        |        | 20    | 14     | 6      |
| GPS Mughalkot        |        | 20    | 13     | 7      |
| GPS Qasim Ali        |        | 20    | 12     | 8      |
| GPS Yar Hussain No.1 |        | 20    | 10     | 10     |
| GPS Shagai           |        | 20    | 14     | 6      |
|                      | Lahore |       |        |        |
| GPS Urmal Dairi      |        | 20    | 12     | 8      |
| GPS Naiknaam         |        | 20    | 10     | 10     |

## Discussion

The present study was based on 400 school age children (5–12 years) with both sexes (boys and girls) were interviewed and clinically examined for the presence of anemia at district Swabi. After clinical examination blood samples were collected for further analysis. The whole district was divided into four large clusters. Tehsil Swabi, Topi, Razar and Lahor in the study. From tehsil Swabi 60 boys and 40 girls, tehsil Topi 70 boys and 30 girls, Razar 50 boys and 50 girls and Lahor 80 boys and 20 girls, were examined in the current study. Children included in the study sample were divided into two groups, anemic and non-anemic. In tehsil Swabi 42% of school going children were anemic. The prevalence of anemia in school going children of tehsil Topi was 48%, in tehsil Razar the count of anemic children was 63% and 58% children found anemic in tehsil Lahor. The prevalence was high in tehsil Razar, Lahor, Topi and Swabi respectively. The total anemic children were 34.0% and non-anemic were 65.9%. The mean Hb level of anemic children was 10.9 Gm. %. According to [20] reported 90.1% prevalence of anemia among adolescent girls from 16 districts of India which is similar to the present study. According to the results of

the National Survey, the prevalence rates of anemia in indigenous children nationally were approximately double those reported for non-indigenous Brazilian children in the same age group. According to the first nationwide survey assessing the occurrence of anemia in children < 5 years of age in Brazil, the National Survey on Demography and Health of Women and Children (Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher – PNDS), which did not systematically include indigenous populations, the reported prevalence rates for anemia and moderate/severe anemia were 20.9% and 8.7%, respectively. The pattern of inequality in the occurrence of anemia in indigenous and non-indigenous children in Brazil is also quite pronounced when comparing the frequencies observed among the four geopolitical regions of the country studied in the National Survey.

## Conclusion

It is concluded from the present study that the problem of anemia was far above the ground in school age children. The percentage of anemia among school age children was high (52.75%) in district Swabi. In different tehsil, the incidence was high (63%) in Razar and Lahore (58%). These are rural region of the district Swabi. It means that the anemia was more prevalent in rural region than in urban area. While in other two regions of the district it was 48% in Topi and 42% in tehsil Swabi. Graph 1 shows a clear picture of current study' observations. In children the presence of anemia reduces resistance, physiological development and declines physical and mental activities. The percentage of anemia in children of lower class families (fewer earnings) was higher 70% as compare to children of upper class families 32%. It clearly shows that balanced diet has a great impact on children's health. It/ is hence concluded that higher rate of anemia is observed where there is lower income of family and lesser health facilities. At the other hand, the present study shows the reduced anemia where family income is higher and so are the health facilities.

## Abbreviations

SAC  
school age children  
RBCs  
Red blood cells  
Hb  
hemoglobin  
Pkr  
Pakistani rupees.  
IDA  
iron deficiency anemia  
(PSC)  
pre- school children

# Declarations

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## Authors' contributions

Statement of authorship:

The entire sample collected and tested in the laboratory, analyzed all data, and wrote the manuscript, data analyzed and designed the study. All authors read and approved the final manuscript.

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University of Swabi (department of zoology). The funding source plays no role in the design of this study, the collection, analysis, and interpretation of these data, or in the writing of this manuscript.

## Availability of data and materials

The data and materials were not available on any website.

## Ethics approval

This field study was conducted by the permission of university and department. The data which is for the prevalence of anemia in school age children was collected properly, the respondents were cooperative and gives their bloods for testing in the laboratory very cooperatively

**Competing interests:** The authors declare that they have no competing interests.

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