# FACTORS AFFECTING SERUM FERRITIN LEVEL IN SCHOOL GOING CHILDREN OF DISTRICT BANNU

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## ABSTRACT

***Objective:*** *To investigate the factors affecting serum ferritin level in school going healthy children in Distt Bannu, Khyber Pakhtunkhwa and to know the potential risk in children associated with hypoferritinemia, leading to microcytic hypochromic anemia in our population.*

***Methodology:*** *This cross sectional study was carried out at Institute of Kidney Diseases (IKD) Hayatabad Medical Complex Peshawar in one year time from March 2010- March 2011. A total of 113 healthy children of both genders were selected with no history of bleeding, blood transfusion, any extensive surgery or infections. 05cc blood sample was taken from each child. Out of which, 03cc were used for ferritin estimation by using the Roche Elecsys 2010 Immunoassay Analyzer, while 02cc were used for basic hematological examination, using Sysmex k-1000.*

***Results:*** *There was no significant relationship between serum ferritin of boys and girls (p>0.05).However boys had high ferritin level as compared to girls. While comparing serum ferritin in rural and urban areas it has been observed that serum ferritin was high in rural areas. Moreover serum ferritin was positively correlated with hygienic conditions (p=0.01) and dietary intake (p=0.00).*

***Conclusion:*** *The finding of our study reveals that serum ferritin level is quite low in female population in both urban and rural areas, hence anemia and low iron status are more prevalent in female population. Environmental conditions, socioeconomic factors and diet habits are the main factors, which affect ferritin level in children.*


***Key Words:*** *Serum Ferritin, School going children, Microcytic hypochromic anemia*

This article may be cited as: Khan MS, Shahnaz, Sultana R, Ali I. Factors affecting Serum Ferritin level in School going children of District Bannu. J Postgrad Med Inst 2012; 26(3): 237-41.

## INTRODUCTION

Ferritin is colorless protein and is finely dispersed in tissues, where it is not ordinary visible microscopically. It is composed of spherical outer shell of an iron-free protein, apoferritin, and an inner core of trivalent iron $Fe^{+3}$ (oxidized)[1]. Ferritin shows symptoms of stored iron in the body. In iron deficiency anemia, malabsorbtion or blood loss during bleeding, infection, injury or heavy periods during menstruation in females or in insufficient diet, the iron ferritin level become low.[2] High concentration of serum ferritin(>1000 ng/ml) may be due to various reasons which are not related to the amount of iron in our body.[3,4] Serum ferritin is also associated with behavioral changes, developmental level in preschool children (autistic problem). Iron deficiency anemia (IDA) and iron deficiency (ID) was also high reported in autistic spectrum diseases especially in children[5,6]. Iron deficiency anemia is also related to cognitive diseases of young children. There is an association between hemoglobin and cognitive function in children having iron deficiency anemia but, however, with normal serum ferritin concentration it did not change[7]. It has been found that severe anemia mostly affects children during the first year of life.

For the diagnosis of iron deficiency anemia in infants different laboratory tests were performed including serum ferritin, mean cell volume and hemoglobin[8].

The association between serum ferritin and

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Date Received: June 22, 2011
Date Revised: February 23, 2012
Date Accepted: March 1, 2012

different parameters/variables like Hb, PCV, MCV, MCH, MCHC, RBC, age, gender, location, diet, etc has been intensively reported in children in the past. In many developing countries iron deficiency anemia is associated with low ferritin concentration and Serum ferritin less than 12ng/ml is a powerful indicator in the diagnosis of anemia.

Keeping these in mind, the present study was designed to investigate the factors affecting serum ferritin level in school going healthy children in Distt Bannu, Khyber Pakhtunkhwa and to know the potential risk in children associated with hypoferritinemia, leading to microcytic hypochromic anemia in our population.

## METHODOLOGY

In this Cross sectional study 113 apparently healthy children of both genders were selected with no history of bleeding, blood transfusion, any extensive surgery or infections from urban and rural areas of Bannu. These children were randomly selected from local community of different areas of District Bannu. The general physical checkup of all the children including height and weight were performed. After that 5cc blood sample was taken from each of the child.

To obtain serum ferritin estimation, blood was centrifuged at 3000 revolutions per minute (rpm) for ten minutes in an electric centrifuge to obtain serum. The rest of blood sample was collected in an anticoagulant container for the determination of hematological parameters and for morphological studies of RBC's. The blood was mixed promptly but gently and thoroughly with the anticoagulant to prevent frothing and damage to cells. Ethylene diamine tetra acetic acid (EDTA) was used in the concentration 1.5 mg/ml of blood, as recommended for routine hematological work.

Serum ferritin levels were determined in blood samples by using the Roche Elecsys 2010 Immunoassay Analyzer. Basic blood studies were performed by evaluating Hb concentration, PCV, MCV, MCHC and RBC.Blood samples mixed with anticoagulant EDTA and investigation was performed by Sysmex k-1000 auto analyzer. The work was carried out at Institute of Kidney Diseases (IKD) Hayatabad Medical Complex Peshawar.

**Operational definitions:**

Optimal nutrition: means giving the body the key nutrients in right amount in right time.

Hygienic Conditions: means proper living habits, cleanliness & ventilation.

Low & high diet intake: Food low in calories & RDA, while high diet means food high in calories & RDA.

Proper & improper sanitation: means proper disposal of waste & self hygiene, while improper sanitation is blocked drains, lack of toilet facilities & water for cleaning.

SPSS computer software version 16 was used for mean and S.D calculation. Chi square for qualitative & t test for quantitative analysis were used for level of significance.

## RESULTS

Age wise distribution of children (5-12 years) and serum ferritin and different hematological parameters like Hb, MCV, PCV, MCH, MCHC and RBC are presented in Table1. It can be observed that serum ferritin and other parameters were high in the age of 11-12 years while low values were recorded at the of age of 5-6 years.

Table 2 represents a gender wise distribution of children including (5-12 years) of both male and female sexes belonging from both rural and urban regions. It shows that boys have high ferritin level as compared to girls. t test was

**Table 1: Serum Ferritin, Hb, PCV, MCH and MCHC in Various Age Groups**

| Age (years) | n | Serum Ferritin | Hb | PCV | MCV | MCH | MCHC | RBC |
|---|---|---|---|---|---|---|---|---|
| 5-6 | 33 | 41.11±2.16 | 11.53±1.35 | 39.99±1.23 | 45.69.±.3.46 | 25.1±2.42 | 29.1±6.25 | 4.66 ±.44 |
| 7-8 | 29 | 48.79± 3.14 | 11.61± .922 | 39.74±6.633 | 57.01±5.35 | 26.2 ±2.06 | 29.4±2.39 | 4.68 ±.46 |
| 9-10 | 28 | 51.70± 4.55 | 11.57±1.09 | 40.70± 1.33 | 86.1.±6.25 | 29.6±2.70 | 29.9±2.49 | 4.55 ±.28 |
| 11-12 | 23 | 58.76 ±3.35 | 12.41± .972 | 41.48± 4.39 | 88.7± 6.31 | 31.6±2.06 | 30.6±2.39 | 4.58 ±.607 |

**Normal Values:** Hb(5-12 yrs): 12-14 gm/dl; PCV: 39-52 % MCV: 78-97 fl; MCH: 27-32 pg MCHC: 32-36 g/dl; RBC count: 4.5-5.5 m/cmm Ferritin level: 13-150 ng/ml

**Table 2: Gender- wise Distribution of Healthy Population in Bannu Region**

| Urban population (n =33) | | | | | Rural population (n=80) | | | | Statistics |
|---|---|---|---|---|---|---|---|---|---|
| S. No | Gender | n | %age | Ferritin (Mean±SD) | Gender | n | %age | Ferritin (Mean±SD) | "t" test |
| 1 | Boys | 14 | 42.42 | 38.11±2.16 | Boys | 52 | 65 | 45.11±2.16 | p<0.05 |
| 2 | Girls | 19 | 57.58 | 29.80±2.34 | Girls | 28 | 35 | 41.11±2.16 | p<0.001 |

**Table 3: Distribution of children on Nutritional and Hygienic Basis in Urban, Rural Region of Bannu**

| | Nutritional Basis | | | | | Hygienic Basis | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | Low Dietary Intake (%) | n | Normal/High Dietary Intake (%) | Chi-square test | n | Proper sanitation (%) | n | Improper sanitation (%) | Chi-square test |
| Urban Region | 11 | 33.33 | 22 | 66.66 | .000 | 22 | 66.66 | 11 | 33.33 | .001 |
| Rural Region | 54 | 67.50 | 26 | 32.5 | | 5 | 6.25 | 75 | 93.75 | |

**Table 4: Distribution of Children on the Basis of Socioeconomic Factors**

| Father income | | | | | | Mother education | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| n | Serum ferritin (income up to 5000) | n | Serum ferritin (income 5000-20000) | n | Serum ferritin (income> 20000) | n | Serum ferritin (Primary) | n | Serum ferritin (secondary) | n | Serum ferritin (tertiary) |
| 25 | 44.88±3.48 | 66 | 48.52±3.01 | 22 | 51.89±3.41 | 86 | 35.55±3.0 | 17 | 40.88±3.4 | 10 | 42.10±2.3 |

applied on it and shows significant relation ship between them (p>0.05).

Nutritional and hygienic conditions in urban and rural areas and their effect on serum ferritin are shown in Table 3. There was a positive relation between serum ferritin and diet (p=.001). It has been concluded that children in rural region have normal dietary intake as compared to urban region. However there was also a positive correlation between environmental conditions like hygienic factors including proper sanitation and improper sanitation and ferritin values (p=0.00).So these two factors also affect the ferritin level in children. Socioeconomic factors like father income and mother education is also an important factor effecting ferritin concentration. Table 4 represents distribution of children on the basis of father income and mother education and their serum ferritin value.

## DISCUSSION

In this study serum ferritin concentration were determined separately for boys and girls in both urban and rural regions.Statistical data shows that there is no significant relation between them.Although according to some reporters serum ferritin is sex dependent and boys have higher serum ferritin concentration as compared to girls. The same has been supported by other investigators, in both urban and rural regions, females were more attributed to anemia.[9]In children, severe anemia can impair growth and mental development. Children with severe iron-deficiency anemia may also have an increased risk for stroke. The low Hb and MCV are associated with low serum ferritin concentration in anemic children[10]. In the population survey it has been reported that children and women of childbearing age are more affected. It was found that iron

deficiency anemia may vary from 17% to 70% in pre-school children, while in adolescents it may vary between 14% to 42% and in child bearing age from 11% to 40%[11]. The prevalence of iron deficiency anemia in children occurs due to low serum ferritn and low blood hematological parameters, the same has been shown in the present study.

The normal range of serum ferritin is dependent on several variables including methodology, age and sex.Serum ferritin is also dependent of hemoglobin, serum iron, and transferrin[12]. In the developed world iron deficiency is mainly a single nutritional problem. However balanced diet and hygenic condition also effect serum ferritin concentration and causing iron deficiency and other disesases.In this study it has been shown that children likes junk foods had low serum ferritin ,Hb and other parametrs. Iron deficiency is an important determinant of anemia and significant positive correlation has been reported between the levels of Hb and serum ferritin[13].

Iron deficiency caused by diet is un-common in healthy adults in countries where meat is an important part of the diet[14]. Our study also showed that economic status and parents education also effecting serum ferritin and it has been reported in our study, that the children with low diet have low concentration of serum ferritin in both urban and rural areas. Children in lower-income homes are at higher risk than those in higher income homes. Whatever the underlying cause may be, poor socio-economic conditions, lack of health education and inadequate health facilities in rural areas of the developing countries are important contributors. Lower iron status of our population is due to environmental, socio-economic and dietary factors. Socioeconomic factors like father income, literacy and numbers of family members are the common factors of causing iron deficiency anemia. It has been examined that folic acid and vitamin B12 deficiency also affect total iron intake and anemic status.[15] High fetal mortality is common in anemic pregnant females[16]. So babies after birth have low weight, low hemoglobin and stored iron levels as compared to non anemic women in gestational stages[17]. So socioeconomic status and mother education plays a very important role.

## CONCLUSION

The finding of our study reveals that serum ferritin level is quite low in female population in both urban and rural areas, hence anemia and low iron status are more prevalent in female population. Environmental conditions, socioeconomic factors and diet habits are the main factors, which affect ferritin level in children. so, it is suggested that iron supplementation program should be introduced for such children through primary health care clinics or by community health workers.

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## CONTRIBUTORS

MSK conceived the idea and planned the study. S, RS & IA did the data collection and analyzed the study. All the authors contributed significantly to the research that resulted in the submitted manuscript.