SERUM FERRITIN STATUS IN MICROCYTIC HYPOCHROMIC ANAEMIC MEDICAL STUDENTS

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ABSTRACT

Background: *Microcytic hypochromic anaemia is common in young adults , specially in females. It is important to know the serum ferritin status of the medical students who will be involved, in future, with the health care delivery system and to prevent anaemia among them.* ***Objective:*** *To observe the serum ferritin status in microcytic hypochromic anaemic medical students.* ***Methods:*** *This cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College, Dhaka from July 2009 to June 2010. A total number of 516 apparently healthy young adults of both sexes, age ranged from 18 to 22 years , were selected for the study from two medical college in Dhaka city. Of them, 276 were nonanaemic (control group A) and 240 were anaemic (study group B). Again , anaemic (B) subjects are divided into anaemic female (B_1) and anaemic male (B_2) . Among the anaemic (B) subjects, 170 had normocytic normochromic , 68 had microcytic hypochromic and 2 had macrocytic hypochromic anaemia. Serum ferritin was estimated by Micro-particle Enzyme Immunoassay in subjects (68 in number) who were suffering from microcytic hypochromic anaemia. The statistical analysis was done by using unpaired 't' test , Pearson's correlation coefficient test as applicable.* ***Result:*** *The mean serum ferritin level was almost similar and showed no statistically significant difference between group B_1 and B_2. Again, a significant positive correlation of serum ferritin level with haemoglobin was observed in both female and male in microcytic hypochromic anaemic group.* ***Conclusion:*** *This study reveals that serum ferritin level is one of the most sensitive and accurate indicator indicating iron status and thus microcytic hypochrmic anaemia.*

Keywords: *Serum ferritin, Microcytic hypochromic aneamia, Medical students*

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INTRODUCTION

The most widespread nutritional problem in the world is anaemia. At least one billion people have been estimated to be anaemic which is 10%-20% of the world population.[1,2] Iron deficiency anaemia and vitamin A deficiency are probably the most common micronutrient deficiencies in the developing countries.[3]

Iron deficiency anaemia is characterized by a defect in haemoglobin synthesis, resulting in abnormally small sizes of red blood cells (microcytes) containing decreased amount of haemoglobin.[4]

Physiological processes during puberty are particularly linked to increase requirements for iron and zinc to meet the increased demand for erythropoiesis as well as high growth rate.[5,6] Iron is also an essential nutrient for skeletal growth and iron deficiency may acts as a limiting factor for growth during adolescent.[7]

Iron deficiency anaemia causes limitation in intellectual development in children and impaired work performances in adults which together constrain social and economic development.[8,9,10] Rapid growth along with fast lifestyle and poor dietary choices can result iron deficiency anaemia.[11,12] During adolescence, requirement of iron is increased in male for increasing blood volume, muscle mass and myoglobin, whereas in female due to increased demand for growth and loss of iron at the onset of menstruation.[13,14,15]

Serum ferritin considered to be the most sensitive indicator of iron status.[16,17] Its concentration is usually lower in iron deficiency and low level reflects depleted body iron stores.[18] The level of serum ferritin below 15 µg/L is considered to be iron depleted.[19]

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So, Serum ferritin levels were estimated only in microcytic hypochromic anaemic subjects to find out their satus in anaemia.[20] The measurement of serum ferritin is useful as it reflects the total iron stores of the body.[21] Low serum ferritin level in addition to low haemoglobin or haematocrit confirms the diagnosis of iron deficiency anaemia.[8,22,11]

Several studies have been carried out about serum ferritin level among different population groups in Bangladesh but the young adults did not get much attention in those studies. Early adulthood is an important stage of physical and mental development in life. The changes that occur in an individual during this period are accompanied by progressive achievement of biological maturity. Moreover, for female this is the period of preparation for motherhood. Health and nutritional status of female population in this period may have great impact on the quality of the next generation. So, the present study has been designed to observe the serum ferritin status among the urban and educated young adults, age ranged from 18 to 22 years. It is expected that the result of the study would give a base line information regarding microcytic hypochromic anaemia and also be helpful to make a medical health plan for management and prevention of microcytic hypochromic anaemia in young adult.

METHODOLOGY

This cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College, Dhaka, between July 2009 to June 2010. A total number of 516 young adults of both sexes, age ranged from 18 to 22 years, were selected for the study from Sir Salimullah Medical College and Bangladesh Medical College, Dhaka. Their haematological parameters (Hb , TC of RBC, PCV) were done for detection of anaemia. Of them, 276 were nonanaemic (control group A) and 240 were anaemic (Study group B). Group A (control) divided into group A_1 consists of nonanaemic female and group A_2 consists of nonanaemic male. Again, Group B is divided into B_1 consists of anaemic female and B_2 consists of anaemic male. Among the anaemic (B) subjects, 170 had normocytic normochromic, 68 had microcytic hypochromic and 2 had macrocytic hypochromic anaemia. Serum ferritin was estimated in subjects (68 in number) who were suffering from microcytic hypochromic anaemia to find out their status . Protocol of this study was approved by the Institutional Ethics committee (IEC) of Sir Salimullah Medical college , Dhaka. Subjects having history of chronic illness specially haematological diseases and history of taking drug like haematinics, antibiotic, recent history of taking blood transfusion and blood donation were excluded from study. After selection of the subjects , the objectives and benefits of the study were explained to each subjects and written informed consents were taken from the subjects. Detail personal, marital status, dietary, medical, family, socioeconomic, occupational and drug history of each subject were recorded in a prefixed questionnaire and physical examinations were also done and documented. Height and weight of the subjects were measured for the calculation of BMI. With all aseptic precaution 5 ml of venous blood was drawn from antecubital vein by a disposable plastic syringe. Blood was transferred to an acid washed centrifuged tube then serum was separated by centrifugation at a rate of 3000 r.p.m for 5 minutes and supernatant serum was collected in a labelled eppendroff tube to preserve in a refrigerator for estimation of serum ferritin. All the parametric variables were expressed as mean $\pm$ SD (Standard deviation). The statistical analysis was done by unpaired 't' test and Person's correlation test by using "SPSS" program version -15.

RESULTS

All the values were almost similar and no statistically significant differences of ages and BMI were observed among the groups **(Table I).**

Table I

Mean ± SD of Age and BMI in different groups (n=516)

Groups	n	Age (years)	BMI (kg/m^2)
A_1	131	20.03 ± 1.41 (18-22)	22.63 ± 2.19 (17.58-28.3)
A_2	145	20.01 ± 1.38 (18-22)	22.77 ± 2.03 (19.11-28.19)
B_1	135	19.92 ± 1.39 (18-22)	22.59 ± 2.46 (16.63-28.19)
B_2	105	19.70 ± 1.32 (18-22)	22.83 ± 2.58 (16.63-28.13)

Results are expressed as Mean ± SD. Statistical analysis was done by unpaired "t" test. Figure in parentheses indicate ranges.

Control group
Group A_1 = Non anaemic female
Group A_2 = Non anaemic male
Study group
Group B_1 = Anaemic female
Group B_2 = Anaemic male

n = Number of subjects.

The mean Hb and PCV levels of the subjects were significantly ($p<0.001$) higher in nonanaemic male (group A_2) and anaemic male (group B_2) in comparison to those of nonanaemic female (group A_1) and anaemic female (group B_1) respectively. Again, these levels were significantly ($p<0.001$) higher in nonanaemic female and male (group A_1 and A_2) than those of anaemic female and male (group B_1 and B_2) respectively. Moreover, mean Total count of RBC of the subjects were higher in nonanaemic male and anaemic male (group A_2 and B_2) when compared to those of nonanaemic female and anaemic female (group A_1 and B_1) respectively. However, the differences were statistically significant ($p<0.001$) between nonanaemic female vs male (A_1 vs A_2) whereas non significant between anaemic female vs male (B_1 vs B_2). Again, this RBC count were significantly ($p<0.001$) higher in nonanaemic female and male (A_1 and A_2) than those of anaemic female and male(B_1 and B_2) respectively. **(Table II)**

Table II
Hemoglobin (Hb), PCV and TC of RBC in different groups (n=516)

Groups	n	Hb (g/dl)	PCV (%)	TC of RBC (million/cumm)
A_1	131	13.04 ± 0.87 (12.0-16.9)	38.68 ± 2.43 (34-50)	4.56 ± 0.37 (3.9-6.1)
A_2	145	14.36 ± 1.04 (13.0-17.3)	42.23 ± 2.94 (36-49)	4.94 ± 0.39 (4.2-6.1)
B_1	135	10.31 ± 1.09 (7.7-11.9)	31.41 ± 2.74 (23-37)	3.83 ± 0.45 (2.6-5.3)
B_2	105	11.00 ± 1.27 (8.1-12.9)	33.30 ± 3.66 (25-44)	3.92 ± 0.52 (3.1-6.1)

Statistical analysis

	p value		
A_1 vs A_2	0.000***	0.000***	0.000***
B_1 vs B_2	0.000***	0.000***	0.138^{ns}
A_1 vs B_1	0.000***	0.000***	0.000***
A_2 vs B_2	0.000***	0.000***	0.000***

Results are expressed as Mean ± SD. Statistical analysis was done by unpaired "t" test. Figures in parentheses indicate ranges.

Control group
Group A_1 = Non anaemic female
Group A_2 = Non anaemic male
Study group
Group B_1 = Anaemic female
Group B_2 = Anaemic male

n = Number of subjects.
ns = Non significant. *** = Significant at $p<0.001$.

Table III
Serum Ferritin (SF) level in microcytic hypochromic anaemic subjects (n=68)

Groups	n	SF (µg/L)
B_1	44	11.74 ± 3.54 (6.07-23.45)
B_2	24	13.07 ± 4.77 (7.87-27.55)

Statistical analysis

	p value
B_1 vs B_2	0.193^{ns}

Results are expressed as Mean ± SD. Statistical analysis was done by unpaired "t" test. Figures in parentheses indicate ranges.

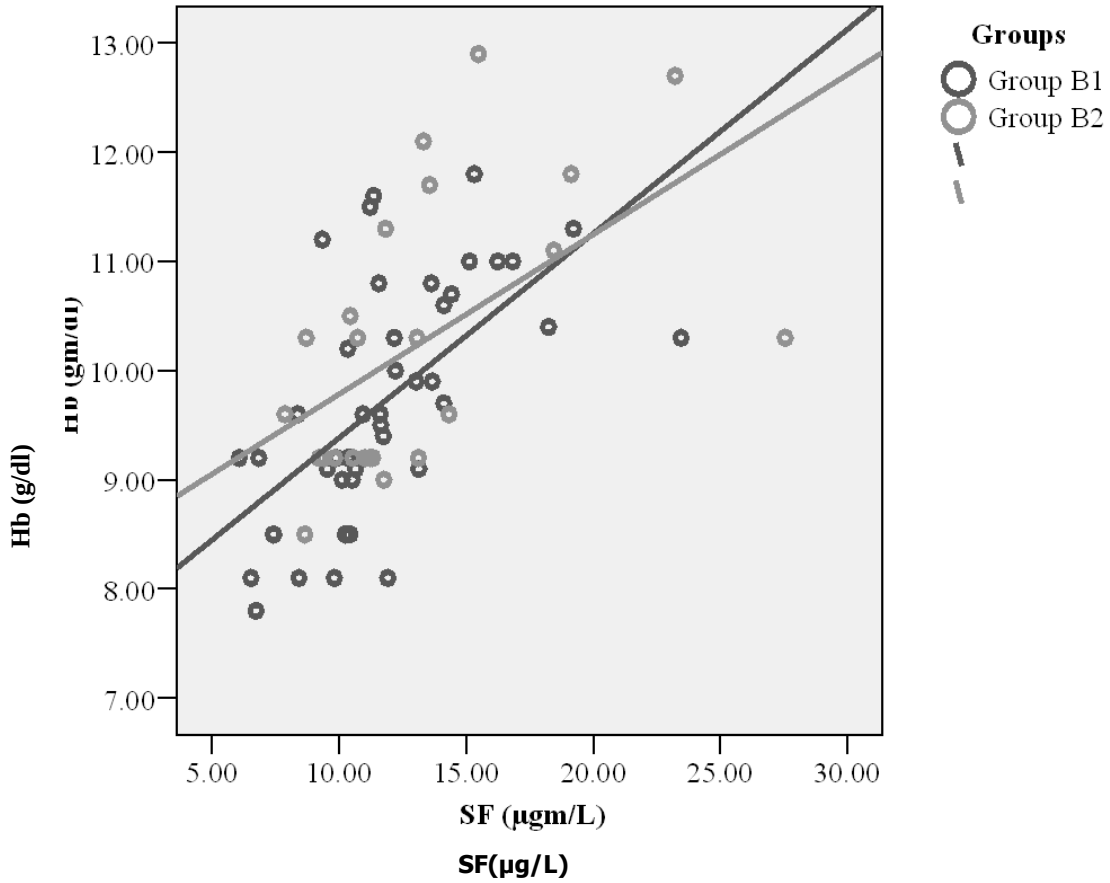
Group B = Anaemic subjects (Study group)
Group B_1 = Anaemic female
Group B_2 = Anaemic male

n = Number of subjects.
ns = Non significant. *** = Significant at p<0.001.

Serum ferritin level was almost similar and showed no statistically significant difference between anaemic female and male (group B_1 and B_2) **(Table III).**

Serum ferritin level showed significant positive correlation with haemoglobin in anaemic female and male (group B_1 and B_2) **(Figure 1).**

Figure 1
Correlation of serum ferritin with Hb in microcytic hypochromic anaemic subjects (n=68)



Study group
Group B_1 = Anaemic female (n=44)
Group B_2 = Anaemic male (n=24)

DISCUSSION

In this study, serum ferritin level was almost similar and showed no statistically significant difference of this value between anaemic female and anaemic male. This finding is in agreement with some researcher.[23] Again serum ferritin level showed significant positive correlation with Hb in both anaemic female and anaemic male. Similar observation is also made by other investigators.[8,24]

It is suggested that in this subcontinent peoples consume similar kind of diet. The staple diet is a mixture of cereals, pulses and vegetables. Bioavailability of iron from cereals and vegetables is low because of the presence of phytates, oxalates and tannate that react with iron to form insoluble compound and thus hampered iron absorption.[25]

The prevalence of anaemia was higher among female than male because of blood loss during the

reproductive years.[26] Decreased rate of erythropoisis[27] and restricted diet may be associated predisposing factors for high prevalence of anaemia in females.[28]

The serum ferritin level is the most specific biochemical test that correlates with total body iron stores.[19] A low serum ferritin level reflects depleted iron stores and hence is a precondition for iron deficiency.[29] Again, it is suggested that the intake of dietary protein and iron are significant determinants of serum ferritin level.[24] The prevalence of iron deficiency anaemia is high worldwide, especially in developing countries.[30] It occurs may be due to chronic blood loss, dietary insufficiency, poor socio-economic condition and worm infestation. Moreover, the role of diet in the etiology of iron deficiency must be emphasized. Polyphenol containing beverages such as tea, coffee are known to reduce non haeme iron bioavailability by the formation of insoluble complexes.[31] The adolescents are more vulnerable to iron deficiency may be due to increase iron requirements for rapid growth.[32] Iron needs are highest in males during peak pubertal development because of a greater increase in blood volume, muscle mass and myoglobin. Iron deficiency anaemia was more prevalent in female than male due to their less consumption of iron containing food.[33] In female after menarche, iron needs continue to remain high because of menstrual blood loss.[34]

In the present study, Microcytic hypochromic anaemia was present in some study subjects which is 32.6% among anaemic female and 22.9% among anaemic male, may be due to lower iron store as the measured value of serum ferritin and Hb are lower. These decreased levels most likely due to deficient intake of iron containing food. Menstrual loss of iron is an additional factor for iron deficiency anaemia in female.

CONCLUSION

From this study it concludes that serum ferritin is one of the most sensitive and accurate tests indicating iron status and thus microcytic hypochrmic anaemia. The study also shows that significant number of urban educated medical students are anaemic. So the study suggests the need for increasing awareness regarding diet, the ill effect to prevent it and the latent anaemia suggests the need of doing screening ferritin status among this young population group.

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