

## “Study of iron status in female medical students”

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**ABSTRACT:**

**Introduction:** Nutritional anaemia most commonly affects young females due to increased demands, inadequate and improper dietary habits and menstrual loss, so this study was undertaken in 358 female medical students of age group 17-22 years to assess their iron status.

**Methods:** Blood samples were processed for haemoglobin, Mean corpuscular volume-MCV, Mean corpuscular haemoglobin- MCH, and mean corpuscular haemoglobin concentration-MCHC, Serum iron, total iron binding capacity- TIBC and serum Ferritin.. Transferrin saturation was calculated from the data of serum iron and TIBC. Peripheral smears were studied for RBC morphology. Statistical analysis was done by unpaired t test taking  $p < 0.05$  into consideration. The subjects having haemoglobin  $< 12\text{gm}\%$  were labeled as anaemic as per WHO cut-off values, those having anaemia with  $\text{MCV} < 78\mu\text{m}^3$ , transferrin saturation  $< 16\%$  serum ferritin  $< 12\text{ngm/ml}$  and microcytic hypochromic RBCs on peripheral smear were labelled as Iron deficiency anaemia and those with Haemoglobin  $\geq 12\text{gm}\%$ ,  $\text{MCV} > 78\mu\text{m}^3$ , transferrin saturation  $< 16\%$ , ferritin  $< 12\text{ngm/ml}$  and normocytic normochromic RBCs on peripheral smear were categorized as having Latent anaemia.

**Results:** The overall prevalence of anaemia was 22.90%, prevalence of iron deficiency anaemia (IDA) was 18.58 %, that of Latent anaemia (LA) was 16.51% and 5.30% belonged to other anaemias. Normal iron status was seen in 66.75%.

**Conclusion:** Anaemia is mostly due to iron deficiency and is also seen in urban and educated young females.

**Key words :** haemoglobin , transferrin saturation, ferritin.

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**INTRODUCTION:**

Iron deficiency anaemia is the state where in iron content of the body is below normal, low transferrin saturation & ferritin as well as high iron binding capacity. As per WHO iron deficiency anaemia affects 1.3 billion people world wide amongst which 43% are preschool children, 51% are pregnant women and 37% are school age children<sup>1</sup>. It primarily affects women but significant number of young men are also anaemic in developing countries Recent estimates of iron-deficiency anaemia show that 52% of Indian women aged 15–49 years are anaemic<sup>1</sup>. National Family Health

Survey (NFHS)-3 show prevalence of anaemia in 56.2 per cent of women of 15-49 yr, 79.2 per cent amongst children aged 6-35 months, 57.9 per cent in pregnant women and 24.3 per cent in men aged 15-49 yr<sup>2</sup>. Women are vulnerable part of society due to poor intake & absorption, increased requirements, menstrual loss & adolescent pregnancies. Iron deficiency anaemia is the most common form of malnutrition in the world and is the eighth leading cause of disease in girls and women in developing countries<sup>3</sup>. Its estimated prevalence in South-East Asia is 50% to 70%<sup>4,5</sup>.

Correction of Iron deficiency (Latent anaemia) & Iron deficiency anaemia (IDA) have become critical goals all over the world because of their negative consequences like decreased immunity, increased morbidity and impaired cognitive performance. On comparing IDA and scholastic achievements in young adolescents in Philadelphia, the score of anaemic subjects was significantly lower than those of non-anaemic subjects<sup>6</sup>. It is important to ensure that satisfactory iron status be maintained in young females before they go for pregnancy to prevent premature births, low birth weights and perinatal mortality<sup>7,8,9</sup>. IDA through its effects on cognition and educational achievements among young students impairs work performance, endurance, productivity and ultimately economic prosperity. The combination of high prevalence rates and inadequate preventive programmes highlight the need for new effective sustainable strategies to control IDA.

In view of the above this study was undertaken to find out the prevalence of iron deficiency anaemia and latent anaemia in female medical students.

#### **MATERIAL AND METHODS :**

The present study was carried out in 358 apparently healthy female students of age group 17-22 years of medical college at Indore. Prior permission was taken from the ethical committee of the institute. The detailed history of the subjects was taken asked to find out their socioeconomical class by Kuppuswamy<sup>10</sup> scale and to exclude any genetic disorders like thalassemia, sickle cell anaemia and G6PD deficiency. They were examined clinically to rule out any systemic disease.

Blood samples were collected in morning hours between 8.30- 9.30 AM in EDTA vials and processed by Sysmex cell counter for haemoglobin, blood indices

i.e. MCV, MCH & MCHC. Two milliliters of blood was drawn in plain glass tubes and was centrifuged for serum which was used to determine serum iron and total iron binding capacity by autoanalyser Hitachi 902. Transferrin saturation was calculated using this data. Ferritin was estimated by automated chemiluminescence system.

Peripheral smears were prepared by finger prick on clean glass slides, stained with Leishman's stain and studied to assess haemoglobin concentration, RBC morphology for anaemia typing and leucocyte abnormalities like eosinophilia.

The criteria for anaemia was WHO cut-off values of Hb as 12gm% in females, for IDA Hb < 12gm%, MCV < 78 cu micron, Ferritin < 12ng/ml and transferrin saturation < 16%. and microcytic hypochromic RBCs on peripheral smears and that for Latent anaemia was Hb  $\geq$  12, MCV > 78 cu $\mu$ , transferrin saturation < 16% and ferritin < 12ng/ml.<sup>1</sup>

#### **STATISTICAL ANALYSIS :**

Mean and Standard Deviation of the data were calculated which were further analyzed by unpaired student's t test for t and p values. P value < 0.05 was taken as significant.

#### **RESULTS :**

Out of 358 female students according to WHO cut-off values 82 were anaemic & 276 were nonanaemic. On grading anaemia as per WHO cut-off values of Hb there were 62.19 % cases in mild category, 29.26% in moderate and 8.53% cases in severe category. The mean & standard deviation of Hb, MCV, MCH & MCHC, Serum iron, TIBC, TS & serum ferritin of all 358 cases has been shown in Table No. 1.

On comparing the data between anaemics and

and nonanaemics all the parameters showed significant differences as shown in Table No. 2.

On comparing the socioeconomic status with the prevalence of anemia in the present study (22.90%), out of total 82 anemic cases 35.65 % belonged to lower(class III) socioeconomic group, 18.11 % to middle(class II) and 11.82% to higher group(class I) which indicates a significant association between anemia and socioeconomic status as shown in Table No. 3.

On the basis of ferrokinetic analysis the study group was divided into three groups as iron deficiency anaemia-IDA, Latent anaemia - LA and normal group. There were 63 cases of frank IDA (Hb< 12gm%, MCV< 78cu $\mu$ , transferrine saturation < 16% & ferritin < 12ng/ml along with microcytic hypochromic RBCs on peripheral smears) and 56 cases of LA ( Hb  $\geq$  12gm%, MCV $\geq$ 78cu $\mu$  but transferrine saturation <16% & ferritin <12ngm/ml with normocytic normochromic RBCs on peripheral smears). The remaining 220 were normal cases who showed normal Hb, blood indices as well as normal iron status. Their peripheral smears also showed normocytic normochromic RBCs.

On comparing cases of iron deficiency anaemia with those of latent anaemia all the parameters showed highly significant differences except TIBC and serum ferritin as shown in Table No. 4.

The prevalence of iron deficiency anaemia was 18.58%, that of Latent anaemia was 16.51% and normal iron status was seen in 66.75%. Nineteen cases i.e. 5.30% belonged to other anaemias.

The 63 anaemic cases were put on haematinics Ferrous fumarate 350 mg(elemental iron 112 mg), 1.5 mg folic acid, 15  $\mu$ gm vitamin B12 and 150 mg vitamin C for three months. At the end of three months Haemogram was repeated. Amongst these 52 cases showed

improvement in their Hb levels and blood indices but 11 cases did not improve which were asymptomatic cases. They were referred to the department of Medicine and further investigated. Stool for occult blood was negative. Upper and lower GI endoscopy was performed which showed gastritis in 9 cases and were positive for H pylori. The remaining 2 cases were normal.

#### **DISCUSSION :**

As per WHO guide lines of cut-off values of Hb the overall prevalence of anaemia was 22.90 %. Toteja GS et al showed the prevalence in adolescent girls as 90.1%<sup>11</sup>, Kapoor & Aneja et al as 50.8%<sup>12</sup> & NFHS-3 55%<sup>2</sup>. The prevalence of anaemia is less in our study as compared to above studies as the cases belonged to urban & educated class<sup>13,14</sup>.

On grading anaemia as per WHO cut-off values of Hb there were 62.19 % in mild category, 29.26% in moderate and 8.53% cases in severe category<sup>1</sup>. The prevalence and grading of anaemia in young females by various studies is shown in Table No. 5. Regarding occurrence of mild, moderate and severe anaemia our findings are in consonance with the study of Sanjeev chaudhari et al where the females were from urban area while in other studies they were from slum areas<sup>15,16,17,18</sup>. There was significant association between anaemia and socioeconomic status in our study as shown in table No. 3. This is in agreement with the above studies which show a significant number of anemics in the lower socioeconomic group which might be due to unawareness about nutrition, poor hygienic conditions, malnutrition and worm infestation<sup>15,16,1</sup>.

A study in a group of patients with iron deficiency anaemia showed that 16% saturation of plasma transferrin or less implies an inadequate supply of iron

to the marrow and is associated with hypochromic microcytic anaemia<sup>19</sup>. Iron stores are depleted during evolution of iron deficiency, before serum iron and erythrocytes are significantly affected. Measurement of iron stores are most sensitive index of iron status of the individual. Level of serum ferritin is a reflection of iron stores<sup>20</sup>. On ferrokinetic studies the cases of frank iron deficiency anaemia showed low concentration of serum ferritin which is characteristic only of iron deficiency. However, values may be in the normal range despite the presence of iron deficiency, particularly in patients who have concurrent inflammatory disease<sup>21,22</sup>. Microcytic component is usually due to iron deficiency anaemia which is a prominent feature in smears of anaemic cases of our study<sup>23</sup>. Anisocytosis is the earliest change seen on peripheral smears in iron deficiency anaemia which was seen in smears of our cases<sup>24</sup>.

Diagnosis of iron deficiency anemia is difficult only on observations of peripheral smear, unless the morphologic changes are very much pronounced<sup>25</sup>. Despite the technical advances provided by the current electronic cell counters review of peripheral blood smear remains a critical aspect for the diagnostic evaluation of anaemia.

The prevalence of iron deficiency anaemia was 18.58% and that of iron deficiency state was 16.51% in the present study. A study by Thankachan et al in young women of low socioeconomic group showed the prevalence rates of IDA as 39% and that of LA 62%<sup>26</sup>. A study in nursing students at Mumbai showed prevalence of IDA as 20.3% and that of LA as 27.5%<sup>27</sup>. Prevalence of iron deficiency anaemia was slightly higher than latent anaemia in our study. These studies and the present study suggest that routine screening of females of this age group should be carried out to

prevent the impairment of cognitive performance, scholastic achievements and later on ill effects of anaemia before a female goes for pregnancy and lactation.

Out of 63 IDA cases 52 cases showed improvement with haematinics and 11 showed no improvement at the end of three months. On further evaluation by the medicine department nine were found to be suffering from gastritis and H pylori infection on GI endoscopy & two were normal. This also suggests that gastrointestinal evaluation is must for asymptomatic IDA not responding to iron therapy<sup>28,29</sup>.

**CONCLUSION :** From the present study we may conclude that the prevalence of Iron deficiency in urban and educated class suggests the need for increasing awareness regarding diet, the ill effects and need to prevent it. High prevalence of Latent Anaemia suggests the need of screening the vulnerable group of 15-49 years of females, so that iron deficiency anaemia can be prevented. H . pylori infection should be given a thought in intractable Iron Deficiency Anaemia<sup>28,29</sup>.

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**Tables & Contents:**

**Table No. 1**

**Haematological parameters of entire study group**

Parameter	Total 358	
	Mean	SD
Hb Gm %	12.35	1.72
MCV cu $\mu$	84.63	9.43
MCH pg	27.24	4.12
MCHC %	32.03	2.11
SE Fe $\mu$ gm/dl	75.17	17.60
TIBC $\mu$ gm/dl	401.30	89.06
TS %	20.27	8.20
Ferritin ngm/ml	20.64	8.60

**Table No. 2**

**Comparison of Haematological parameters in anaemics and Nonanaemics**

Parameter	Anaemics- 82		Nonanaemics -276		t Value	P value
	Mean	SD	Mean	SD		
Hb Gm %	9.88	1.65	13.08	0.83	23.77	0.0001
MCV cu $\mu$	77.75	15.00	86.67	5.56	8.18	0.0001
MCH pg	22.35	6.03	28.33	2.46	10.55	0.0001
MCHC %	30.15	2.61	32.59	1.55	10.52	0.0001
SE Fe $\mu$ gm/dl	60.99	23.62	79.37	12.65	9.22	0.0001
TIBC $\mu$ gm/dl	452.16	115.3 8	386.20	73.32	6.18	0.0001
TS %	15.60	10.66	21.65	6.73	6.16	0.0001
Ferritin ngm/ml	14.56	10.19	22.44	7.14	7.88	0.0001

**Table No. 3**

**Showing association of anaemia and socioeconomic status**

Socioeconomic Class	No. of Anaemics	No. of Nonanaemics	Total Cases	Prevalence of anaemia
III	46	81	127	36.22%
II	25	113	138	18.11%
I	11	82	93	11.82%

**Table No. 4**

**Haematological parameters in IDA and Latent Anaemia**

Parameter	IDA No. 63		LA No. 56		t Value	P value
	Mean	SD	Mean	SD		
Hb Gm %	9.59	1.65	12.40	0.46	12.30	0.0001
MCV cu $\mu$	70.39	6.13	83.18	5.07	12.31	0.0001
MCH pg	20.60	2.50	26.20	2.15	13.03	0.0001
MCHC %	29.29	2.21	31.25	1.53	5.55	0.0001
Se Fe $\mu$ gm/dl	50.77	15.27	64.96	6.28	6.48	0.0001
TIBC $\mu$ gm/dl	501.98	78.15	470.82	42.29	2.66	0.009
TS %	10.17	2.92	13.81	0.82	9.01	0.0001
Ferritin ngm/ml	9.16	1.88	10.60	2.32	3.73	0.0003



**Table No. 5**  
**Prevalence of anaemia in various studies**

Name of the Study	Prevalence of anaemia %	Mild Anaemia %	Moderate Anaemia %	Severe Anaemia %
Present study	22.90	62.19	29.26	8.53
Vittul K Gupta et al <sup>15</sup>	89.5	49.8	38.2	1.5
Shardha Sidhu et al <sup>16</sup>	70.5	30.57	27.17	12.83
Sanjeev chaudhari et al <sup>17</sup>	35.1	69.2	30.8	0
Mehta M.N. et al <sup>18</sup>	63.8	36.6	22.4	4.8

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