SUMMARY OF MINOR RESEARCH PROJECT
ZOOLOGY [SCIENCE]

UGC SANCTION NO: F.No.8-3(73)/2011(MRP/NRCB) Dated: 15-12-2011

Title of the Project:

ASSESSMENT OF IRON STATUS OF FEMALE COLLEGE STUDENTS (18-23 YEARS) IN AMRITSAR DISTRICT OF PUNJAB, INDIA

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SEPTEMBER, 2013

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Anemia is a condition characterized by a reduction in the total circulating hemoglobin. There are different types of anemia, which are classified according to the cause of the anemia: a default in the production of red blood cells may be attributable to an iron, vitamin B12 or folate deficiency. An abnormal destruction of red blood cells as observed in the course of chronic diseases or in the case of a hereditary disease may also cause anemia. However, Iron deficiency anaemia (IDA) is the most widespread type of anemia and its etiology is multifactorial. Among women, IDA is primarily prevalent during childbearing years and adversely affects pregnancy outcomes, increasing maternal and infant morbidity and mortality. IDA is generally associated with pallor, weakness and tiredness. This disorder has a negative impact on immune status and physical work capacity. It can impair cognitive performance in all individuals. The main risk factors of IDA are: inadequate iron intake (due to an iron-deficient diet or inadequate absorption), increased iron requirements, and blood loss. Indeed, the daily diet must include sufficient amounts of high bioavailable iron.

Iron deficiency anaemia is the state where in iron content of the body is below normal, low transferring saturation & ferritin as well as high iron binding capacity. As per WHO iron deficiency anaemia affects 1.3 billion people worldwide amongst which 43% are preschool children, 51% are pregnant women and 37% are school age children (WHO, 2001). Recent estimates of iron deficiency anaemia show that 52% of Indian women aged 15–49 years are anaemic (WHO, 2001). 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 .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 (World development report investing in health, 1993). Its estimated prevalence in South-East Asia is 50% to 70% (Garcia & Mason,1992).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 (Webb & Oski, 1974). 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 (Bothwell &Mallett, 1955; Godfrey & Redman; Scholl &Hediger, 1922). 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.

Objective:

The objective of this study was to determine the prevalence of iron deficiency and iron deficiency anemia among the female college students (18-23 yrs).

MATERIALS AND METHODS:

The present study was carried out in 121 apparently healthy female students of age group 18-23 years selected from local colleges at Amritsar. Prior permission was taken from the ethical committee of the institutes. Informed consent was obtained from the students. The detailed history of the subjects was taken to exclude any genetic disorders like thalassemia, sickle cell anaemia and G6PD deficiency. Blood .Samples were collected in morning hours between 8.30-9.30 A.M in EDTA vials and processed by cell counter for haemoglobin, blood indices i.e. MCV, MCH & MCHC. Two millilitres 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 Autoanalyzer Hitachi 902. Transferrin saturation was calculated using this data. Serum iron was assayed colourimetrically using the ferrozine method. Serum ferritin was assayed by immunoturbidometry using latex particles coated with antibodies to ferritin (Dia-Sys Diagnostics, Germany). Transferrin saturation was calculated using the formula: serum iron/ TIBC x 100. Levels of SI < 50 μg/dL and TIBC > 400 μg/dL were adopted as indicative of deficiency. Values of SF < 15 ng/mL were considered deficient. The transferrin saturation(%T-SAT) with values < 16% was considered deficient (W.H.O.,2001) The criteria for anaemia was WHO cut-off values of Hb as 12gm% in females, iron deficiency (ID) is defined as Hb >12g/dl plus at least 2 abnormal values of 3 iron status indicators SF <15μg/L, TS <16% and MCV <80fl; anaemia is defined as Hb <12g/dl; iron deficiency anaemia (IDA) is a combination of iron deficiency and Hb <12g/dl.

STATISTICAL ANALYSIS:

Statistical analysis was performed using commercially available statistical software (SPSS 16.0). Descriptive statistics were presented as means ± standard deviation (SD). Differences were

assessed using t-test and a one-way analysis of variance (ANOVA). When a significant overall effect was detected, data was subjected to post-hoc analysis using Tukey's HSD. Pearson's Correlation was used to determine the association in various haematological parameters. . A minimum *p*-value of 0.05 was the necessary condition for statistical significance.

RESULTS AND DISCUSSION:

Out of 121 female students according to WHO cut- off values of Hb there were 38.01 % cases in mild category(Hb 10-11.9g/dl), 8.26% in moderate(Hb 7.0-9.9g/dl) and 0% cases in severe category(Hb <7.0g/dl). The mean & standard deviation of Hb, MCV, MCH & MCHC, Serum iron, TIBC, TS & serum ferritin of all 121 cases were calculated.

There were 30 cases of frank IDA (Hb< 12gm%, MCV< 80fl, transferrin saturation < 16% & ferritin < 15ng/ml) and 7 cases of Anaemia without iron deficiency (Hb <12g/dl), 12 cases of iron deficient (Hb >12g/dl plus at least 2 abnormal values of 3 iron status indicators i.e. SF<12 g/L, TS <16% and MCV <80fl. The remaining 72 were normal cases who showed normal Hb, blood indices as well as normal iron status. Considering the data age-wise, the mean Haemoglobin levels were the highest in older group i.e. 22-23 yrs. In the younger groups, the mean Haemoglobin level was below the cut off point of 12g/dl.

ANOVA w.r.t. female students from three age groups i.e.18-19 yrs,20-21 yrs and 22-23 yrs differed significantly w.r.t SI($p<.01$),TIBC ($p<.05$) and % T-SAT($p<.01$).However ,other indicators such as BMI,HB,SF,RBC,HCT,MCV,MCH,MCHC and RDW did not exhibit any significant difference w.r.t. age. Female students of age group 18-19 yrs.had highest serum iron (SI) and % transferrin saturation(%T-SAT)whereas those of age group 20-21 yrs had highest total iron binding capacity (TIBC).However, females from age group 22-23 yrs had highest (12.05g/dl) mean Haemoglobin (HB). The ANOVA w.r.t Normal ,ID,Anaemic,and IDA groups

showed that these groups differed significantly w.r.t HB($p<.01$), SF($p<.01$),MCV($p<.01$) ,MCH($p<.01$), RDW($p<.01$).

A perusal of correlations among various iron assessment parameters in female students indicated the direct relationship between SI and %T-Sat. This finding is plausible since %T-Sat is a parameter arrived at from the relationship between SI and TIBC. Therefore, when SF is reduced and/or TIBC increased, %T-Sat tends to exhibit reduced values, confirming deficiency. In turn, when the quantity of circulating iron increases and/or TIBC decreases, the %T-Sat will indicate that the proportions of transferrinemia levels are adequate. This association between body iron reserves, transferrinemia and erythropoiesis was also observed by Hershko et al.,1981 in children between 1 and 6 years old from a rural area in Israel.

As per WHO guide lines of cut-off values of Hb the overall prevalence of anaemia was 22.90 %. Toteja GS et al (2002) showed the prevalence in adolescent girls as 90.1%, Kapoor & Aneja et al (1992) as 50.8% & NFHS-3 55% .The prevalence of anaemia is less in our study as compared to above studies as the cases belonged to urban & educated class. On grading anaemia as per WHO cut-off values of Hb there were 38.01 % cases in mild category (Hb 10-11.9g/dl), 8.26% in moderate (Hb 7.0-9.9g/dl) and 0% cases in severe category(Hb <7.0g/dl).Our findings are in consonance with the study of Sanjeev chaudhari et al(2008) where the females were from urban area 69.2% had mild anemia while 30.8% had moderate anemia but none of the subjects had severe anemia . Hence, iron deficiency anemia is a major type of anemia affecting almost half of these women. The prevalence of iron deficiency anaemia (IDA) was 24.13% and that of iron deficiency (ID) state was 9.91% in the present study .These results correspond with the conclusion of the WHO indicating that even though there are many causes of anemia, dietary iron deficiency is usually either the main or a major contributing factor (WHO, 2001). In view of

these findings it is evident that a significant proportion of the apparently healthy female students belonging to the higher socio-economic classes suffer from anemia and may have latent iron deficiency even if not anemic. The possible reason for this could be the poor bio- availability of iron in the Indian diets (Desai and Chaudhary, 1993). The teenagers prefer junk food and are missing out on high fibre and proteinaceous diet. Moreover, iron fortified foods are not readily available in Punjab .Studies have reported the higher prevalence of anemia among vegetarian children (Verma et al,1999) which further adds to the already existing evidence indicating that vegetarian diets are a poor source of iron. 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. The ID and IDA cases were suggested to improve upon their iron status by using haematinics and others anaemic without iron deficiency were advised to get the B12 and folate levels checked and to rule out any infection causing anaemia.

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 Anaemia suggests the need of screening the vulnerable group of 18-23 years of females, so that iron deficiency anaemia can be prevented.

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