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# A CROSS SECTIONAL STUDY ON DEFICIENCIES OF DIFFERENT MICRONUTRIENTS & MACRONUTRIENTS IN ADOLESCENTS IN THE ASSESSMENT OF NUTRITIONAL ANAEMIA

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**ABSTRACT** **INTRODUCTION:**The prevalence of anaemia is disproportionately high in developing countries than developed countries. It has mainly been ascribed to poverty, inadequate diet, certain diseases, pregnancy and lactation, and poor access to health services in developing countries .Prevalence of anaemia in adolescents in India have been reported in limited studies available from 16.25% to 96.5%. Nutritional anaemia constitutes the most important cause of anaemia in adolescents. It is mainly due to deficiency of Iron, Vitamin B12 and Folate. Megaloblastic Anaemia is increasing resulting from deficiency of folate and B12 appears to be increasing over the last two decades.
**METHODS:**Study was designed as a cross sectional study . Sample size came out to be 194 which was round off to 200 . Subjects were selected based on the inclusion criteria set and evaluated with aid of laboratory investigation of blood samples collected from subjects. Information was analysed by using the Microsoft Excel and SPSS . Chi square test was used for analysis.
**RESULTS:**It was found out that Folate deficiency was the most common followed by Vitamin B12 deficiency & then irons deficiency. Also low intake of all the three nutrients is a significant determinant towards causing nutritional anaemia. Other factors found to influence the prevalence of anaemia were history of worm infestation, Low SES, calorie intake and folate intake.
**CONCLUSION:** In the formative period of life when the maximum amount of physical, psychological and behavioral changes takes place and this is a vulnerable period in the human life cycle for the development of nutritional anaemia, which has been constantly highlighted by public health programs .Studies are needed on this issue to highlight the importance.

**KEYWORDS :** Nutritional Anemia , Adolescents , Folate , Vit B12

## INTRODUCTION

The prevalence of anaemia is disproportionately high in developing countries like India. It has mainly been ascribed to poverty, inadequate diet, certain diseases, pregnancy and lactation, and poor access to health services in developing countries. Prevalence of anaemia in adolescents in India have been reported in limited studies available from 16.25% by Basu et. al[1] to 96.5% by Bulliyya et al.[2]

Nutritional anaemia constitutes the most important cause of anaemia in adolescents. It is mainly due to deficiency of Iron, Vitamin B12 and Folate. Young people are particularly susceptible to develop anaemia because of their rapid growth and associated high iron requirements. Girls lose considerable amount of blood during menstruation.

Also adolescent's eating behavior is guided by many factors such as personal self-esteem, body image making them skip meals to reduce weight and peer pressure indulging them in unhealthy food habits making them prone to nutritional anaemia.

In a study by Patra et al on severely anaemic adolescents admitted in a tertiary care hospital, megaloblastic anaemia was most common type of anaemia (42.5%) and iron deficiency accounted for 15% cases[3].The awareness regarding anaemia and appropriate diet is extremely poor in adolescents, which is made worse by the lucrative promotional campaigns of various junk foods. This is the formative period of life when the maximum amount of physical, psychological and behavioral changes takes place and this is a vulnerable period in the human life cycle for the development of nutritional anaemia, which has been constantly neglected by public health programs. Few studies are done in this area to highlight the importance on this issue

## METHEDOLOGY

The study was conducted in the Department of Pathology, RIMS Medical College; during May 2019 to July 2019, as a cross-sectional observational study After local ethical committee approval . Adolescents coming to outpatient department or admitted in the hospital satisfying the following criteria were included in the study.

## INCLUSION CRITERIA:

1. Age group: 10-18yr age.
2. Haemoglobin levels below the following cut-off values:
- Girls aged 10-18yrs Hb <12gm/dl.
- Boys aged 10-14yrs Hb <12gm/dl.
- Boys aged 15-18yrs Hb <13gm/dl.

## EXCLUSION CRITERIA:

1. Those receiving haematinics in past 4 weeks.
2. Those who received blood transfusion in past 4 weeks.
3. Those with known haematological or any other systemic disorder (Sickle Cell Anemia , thalassemia etc.) and/or evidence of apparent chronic infection (Tuberculosis, malaria etc.).

Systemic diseases causing anaemia were excluded. Detailed history with special reference to menstrual history in females was taken and recorded in a pre-designed Performa.

## RESULTS

A total of 200 cases from 10-18 years age group were included in the study. In the study it was found out that 50.5% were mildly anaemic out of which 56% were males and 44% were females, 29% moderately anaemic of which 47% were males and 53% were females and 20.5 % subjects severely anaemic of which 39% were males and 61 % were females.

19.5 % of study subjects were vegetarian and 80.5% of subjects were non-vegetarian and food habit was significantly correlated with severity of anaemia. While only 15 % of mild anaemic were vegetarians and around 41% of severely anaemic consumed a vegetarian diet.

The Mean Haemoglobin level is 9.36 gm./dl which falls in

Moderate anaemia category. Mean MCV is 85.27 fl. which suggests high prevalence of normocytosis irrespective of variation in cut-offs in different age groups. Mean serum B12 level is 230.27 pg./ml, mean serum ferritin is 101.28 ng/ml and mean serum folate is 134.66 ng/ml.

The mean intake of all the three micronutrients; Iron, Vit.B12 and Folate, declined significantly as the severity of anaemia increased.

It was also found out that iron deficiency (isolated or in combination) was present in 81(40.5%) of subjects, 100(50%) subjects had Vitamin B12 deficiency (isolated or in combination) and 159(79.5%) subjects had folic acid deficiency. Folic acid deficiency (isolated or in combination) reduced from 79.5% to 29%% when the cut-off was reduced to 3 ng/ml. Among these micronutrients only Vitamin B12 deficiency is significantly associated with severity of anaemia (p-value <0.05) but not iron or folate deficiency. [Fig.2]

It was also found out that majority of the subjects of mild anaemia (79%) had normocytic anaemia while in severe anaemia 31 % had microcytic anaemia, 31 % dimorphic and 26 % macrocytic anaemia. [Fig.3]

Also as the menarche is achieved proportion of cases significantly shift from mild (57.5%) to moderate anaemia (39.3%).

In univariate analysis, history of worm infestation, Socioeconomic status , calorie intake and folate intake were significantly associated with hemoglobin levels.

## DISCUSSION
Prevalence of anaemia is very high in India, particularly among pregnant and lactating women, and preschool children[4].Limited data is available on nutritional anaemia in adolescents. Present study was undertaken to find out etiology and socio-demographic correlates of nutritional anaemia in adolescents.

The study was a hospital based study on 200 adolescents attending a tertiary care center hospital with 1:1 male:female ratio. 39% of girls were premenarcheal and 61% had attained menarche.

In a community based study conducted by Rajaratnam et al also noticed a decrease in prevalence of anaemia in adolescents in Tamil Nadu from 46.5% in 13-14yr age group to 42% in 17-19yrs age group, which was in contrast to study conducted by Biradar et al in Karnataka which showed a increasing prevalence of anaemia in adolescents with increasing age, with prevalence being 39% in early adolescence (10-14yrs) to 60% in late adolescence (15-19yrs). However in our study of 200 anaemic adolescents 69.5% belonged to early adolescence (10-13.9yrs), 25.5% were in mid adolescence (14-16.9yrs) and only 5% were in late adolescence (17-18.9 yrs).[5,6,7]

Prevalence of anemia was significantly higher amongst girls as compared to the boys in community based studies conducted by Basu et al, Jayasree et al, Baral et al.[1,7] While in our study almost equal number of males (49.5%) and females (50.5%) were found to be anaemic which was corroborated with a similar hospital based study by Sinha et al in Nepal.[8] Inspite of high prevalence of anaemia in females in community, an equal proportion probably reflects the preferential male caring society of ours.

Among the study subjects 50.5% had mild anaemia, 29 % had moderate anaemia and 20.5% had severe anaemia. The community based studies such as by Rajaratnam et al, Kaur et al, Rita Singh, Choudhary et al. Biradar et al, Bulliya et al revealed high proportion of mild anaemia followed by moderate anaemia, while only small percentage of adolescents had severe anaemia.[2,5,6,9,10]

Our study shows a high proportion of severely anaemic cases which can be attributed to hospital based nature of study which is in accordance with a similar hospital based study in children by Sandeep Ray.[11]

Mean iron intake was 10.5 mg/day. Iron intake was deficient in 99.5% of anaemic adolescents and a significant association was found of low iron intake and severity of anaemia in adolescents. In a community based study by Kaur et al in Wardha 90% of adolescents girls consumed less than RDA for iron and a significant correlation was found of low iron intake with anaemia in adolescents.[10]

In a study conducted by Foo et al 98% of adolescents failed to meet Malaysian RDA for Iron Intake.[12]

Diet of 14.5% of adolescents were deficient in Vitamin B12 and 62.5% were deficient in Folate and a significant association was found between low dietary intake of these nutrients and severity if anaemia.

In our study 19.5 % of study subjects were vegetarian and 80.5% of subjects were non- vegetarian and vegetarianism was significantly correlated with severity of anaemia which was similar to the findings of various studies (Verma et al, Kaur et al). In India poor bioavailability of dietary iron along with low iron intake of haem iron from animal food is the major cause for iron deficiency anaemia. Dietary modifications such as promoting iron absorption enhancers such as Vitamin C rich foods or reducing the ingestion of inhibitors (phytates, tannins, oxalates) are beneficial.[10,15]

In our study Vitamin B12 deficiency was found in 50% of anaemic adolescents. This is slightly higher than those obtained by Khatib et al (44%) in pregnant women and by Sandeep Ray (43%) in preschool children. However Ahmed et al had observed Vitamin B12 deficiency in 7% of anemic adolescent girls of Bangladesh.[11]

Folate deficiency was found in 79.5% of subjects which was slightly higher than that obtained by Ishraga et al (66%) but was much more than that obtained by Khatib et al (44%), Ahmed et al (25%) and Sandeep Ray (14%).[11, 13] In our study Vitamin B12 deficiency is significantly associated with severity of anaemia which is corroborated by the findings of Patra et al that the main cause of severely anaemic adolescent children admitted in a tertiary care center was megaloblastic anaemia.[3]

In our study based on MCV and examination of peripheral smear, anaemia was classified into 4 types: microcytic (27.5%), normocytic (55%), macrocytic (8.5%) and dimorphic (9.0%). In a community based study by Chaudhary et al on adolescent girls 34.3% had normocytic hypochromic picture, 3.3% had microcytic hypochromic picture, 2.1% had dimorphic picture while rest (60%) had normocytic normochromic picture.

In a study conducted on adolescent girls by Dhage et al microcytic hypochromic picture was present in 71% of anaemic adolescents, normocytic hypochromic in 14%, dimorphic in 13% anaemic adolescents. In our study dimorphic/ macrocytic picture was more which was correlated with high prevalence of Vitamin B12 and Folate deficiency in our study group.[3,16]

Out of 101 girls 40 were premenarcheal while 61 had attained menarche. Attainment of menarche was associated with a

shift of cases from mild to moderate anaemia which was statistically significant. Various studies have also demonstrated a significant association between anaemia and attainment of menarche (Rajaratnam et al, Verma et al, Kaur et al) which supports our result.[5,10]

A significant association was also found between severity of anaemia and worm infestation similar to findings of Kaur et al Rao et al. This reaffirms the 6 monthly deworming in adolescents as advised by national policies.[10,17]

## CONCLUSION

Folate deficiency was the most common followed by Vitamin B12 deficiency & then irons deficiency. Low intake of all the three nutrients is a significant determinant towards causing nutritional anaemia. Supplementation with not only iron and folic acid but also Vitamin B12 is required through national programmes.

History of worm infestation is a significant risk factor which should be taken care off. Standard of living of whole society should be improved to decrease prevalence and severity of anaemia.

## REFERENCES

1.    Basu S, Basu S, Hazarika R, Parmar V. Prevalence of anemia among school going adolescents of Chandigarh. Indian Pediatr. 2005 Jun; 42 (6): 593-7.
2.    Bulliyya G, Mallick G, Sethy GS, Kar SK. Hemoglobin status of non-school going adolescent girls in three districts of Orissa, India. Int J Adolesc Med Health. 2007 Oct-Dec; 19 (4): 395-406: 22-6.
3.    Patra S, Pemde HK, Singh V, Chandra J, Dutta A. Profile of adolescents with severe anemia admitted in a tertiary care hospital in northern India. Indian J Pediatr. 2011 Jul; 78 (7): 863-5.
4.    WHO. Iron Deficiency Anaemia Assessment Prevention and Control: A Guide for Programme Managers. 2002;WHO/NHD/01.3.Geneva: WHO
5.    Sampathkumar V, Rajaratnam A. Prevalence of anaemia andhookworm infestation among adolescent girls in one rural block of TamilNadu Indian J Matern Child Health. 1997 Jul-Dec; 8 (3-4): 73-5.
6.    Biradar S.S., Birafar S.P., Alatagi A.C., Wantamutte A.S., Malur P.R. Prevalence of Anaemia among Adolescent Girls: A One Year Cross-Sectional Study. Journal of Clinical and diagnostic Research. 2012; 6 (3): 372-7.
7.    Jayasree P, Sushamabai S, Abraham S, Mathew A, Kadam RM, Varghese BA. Epidemiological factors affecting anaemia prevalence in rural adolescents in South India. Pushpagiri Medical Journal. 2012; 3 (2): 99-102.
8.    Sinha AK, Karki GMS, Karna KK. Prevalence of Anemia amongst Adolescents in Biratnagar, Morang Dist. Nepal. International Journal of Pharmaceutical & Biological Archives 2012; 3(5): 1077-1081. 2012; 3 (5): 1077-81.
9.    Singh R. Socio-demographic factors causing anaemia in adolescent girls in meerut. Health and Population-perspectives and Issues. 2008; 31 (3): 198-203.
10.   Kaur S, Deshmukh P, Garg B. Epidemiological Correlates of Nutritional Anemia in Adolescent Girls of Rural Wardha. Indian Journal of Community Medicine. 2006; 31 (4): 255.
11.   Ray S. Determinants of nutritional anemia in children less than five years age. Thesis for MD Paediatrics, Delhi University, 2012.
12.   Foo LH, Khor GL, Tee ES, Prabakaran D. Iron status and dietary iron intake of adolescents from a rural community in Sabah, Malaysia. Asia Pac J Clin Nutr. 2004; 13 (1): 48-55.
13.   Ahmed F, Khan MR, Banu CP, Qazi MR, Akhtaruzzaman M. The coexistence of other micronutrient deficiencies in anaemic adolescent schoolgirls in rural Bangladesh. Eur J Clin Nutr. 2008; 62 (3): 365-72.
14.   Abdelrahim, II, Mahgoub HM, Mohamed AA, Ali NI, Elbashir MI, Adam I. Anaemia, folate, zinc and copper deficiencies among adolescent schoolgirls in eastern Sudan. Biol Trace Elem Res. 2009 Dec; 132 (1-3): 60-6.
15.   Verma M, Chhatwal J, Kaur G. Prevalence of anemia among urban school children of Punjab. Indian Pediatr. 1998 Dec; 35 (12): 1181-6.
16.   Chaudhary SM, Dhage VR. A study of anemia among adolescent females in the urban area of nagpur. Indian J Community Med. 2008 Oct; 33 (4): 243-5.
17.   Rao V, Aggrawal M, Yadav R, Das S, Sahare L, Bondley M, et al. Intestinal parasitic infections, anaemia and undernutrition among tribal adolescents of madhya pradesh. Indian Journal of Community Medicine. 2003; 28 (1): 22-6.