



PREVALENCE OF IRON DEFICIENCY ANEMIA AMONG INDIAN ADOLESCENT SCHOOL GIRLS: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE CENTRE.

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ABSTRACT

Background: The adolescent population in India, is facing a series of serious nutritional challenges which are not only affecting their growth and development but also their livelihood as adults. The objectives of this study were to estimate the prevalence of iron deficiency anemia among adolescent school girls, and to study the socio-demographic factors associated with anemia. **Materials & Methods:** A cross-sectional study conducted in a school, nearby our tertiary care centre. A total of 100 participated girls (12-16 years) included in this study. Independent sample t-test was used for continuous variables and the chi-squared test for categorical variables. The severity of anemia calculated as per guidelines provided by the WHO. **Results:** Out of 100 students participated in the study, 46 (46%) female students were anemic; 20 (20%), 55 (55%), 20 (20%), and 5 (5%) students were anemic in underweight, normal, overweight, and obese body mass index (BMI) groups, respectively. These results were statistically significant ($P < 0.01$). There was no difference in prevalence of anemia in different groups of BMI and socioeconomic status. **Conclusion:** Students taking vegetarian diet were more vulnerable to anemia than students taking mix diet. It needs to increase awareness of iron deficiency anemia in adolescent girls and their parents.

KEYWORDS : Prevalence, Iron deficiency anemia, Adolescent, BMI

INTRODUCTION:

Anemia is defined as the lack of red blood cells or dysfunctional red blood cells in the body. It leads to reduced oxygen flow to the body's organs. In adolescent girls, iron deficiency anemia has serious health implications¹ and it increases due to increased iron demands during puberty, menstrual losses, and limited dietary iron intake². The deficiency of iron affect the physical and mental functions, and impair intellectual performance, limits growth and delays the onset of menarche, which leads to cephalopelvic disproportion³. In India, iron deficiency anemia has the highest prevalence among adolescent females. According to previous studies^{1,4}, 60- 70% of Indian adolescent girls are anemic with haemoglobin (Hb) level $< 12\text{gm/dl}$.

Inadequate nutrition in adolescent age, has the serious consequences throughout their reproductive age and beyond. Most of the Indian girls get married and get pregnant even before the growth period is over that doubles the risk of anemia⁵. In the school adolescent girls, school performance, attendance, and physical work capacity affected by chronic anemia⁶.

In India Iron-deficiency anemia is the most common form in women, children, and adolescents resulting from inadequate intake and low absorption of dietary iron^{7,8}. In 1970, the National Nutritional Anemia Prophylaxis Programme (NNAPP) launched in India. Under this program, iron and folic acid tablets were distributed to pregnant women. No impact of this program on the prevalence of anaemia was observed in an evaluation⁹, conducted during 1985-86. Consequently, certain modifications were made in the NNAPP to make it more effective and efficient¹⁰.

Iron requirements increases when the expansion of the total blood volume, the increase in lean body mass, and the onset of menses in young females. In the preadolescents iron requirements increase from level of $\sim 0.7\text{-}0.9\text{ mg Fe/d}$ to 2.2 mg Fe/d and more in heavily menstruating young women. The requirements increases with the timing and size of the growth spurt as well as sexual maturation, and the onset of menses¹¹.

Regular nutritional education sessions should be carried out to increase awareness in adolescent girls regarding anemia¹².

Very few studies were conducted previously regarding the data on the prevalence of iron deficiency anemia among adolescent girls in Jodhpur city (Rajasthan). It will helps in identifying the quantum of this problem and planning involvement to increase Hb level of adolescent girls through iron prophylaxis, dietary modification and helminth control. This will provide better school performance and safe motherhood in future. The present study was conducted to highlight the problem of iron deficiency anemia in adolescent girls and to study socio-demographic factors related to anemia.

MATERIALS AND METHODS:

This study was conducted during the years 2017 to 2019 in the Department of Physiology, Dr. S.N. Medical College, Jodhpur, Rajasthan. A cross-sectional study was designed and a sample size of 100 female adolescent girls (age between 12 - 16 years) were taken for study, according to inclusion criteria. Prior to initiation of this study, approval of institutional ethical committee was received. The ethical committee granted permission to conduct the study. The participants were first given an explanation about the purpose and procedure of the experiment and then written informed consent was taken from all the subjects before they underwent the study procedure.

Inclusion Criteria:

- Age between 12-16 years.
- Haemoglobin grade 7 and 12 were included in the study.
- Willingness to participate in the study.

Exclusion Criteria:

- Age below 12 years and above 16 years.
- physically and mentally unfit subjects.
- Hypertensive, and diabetic.
- Uncooperative.
- Students who were absent.

The general information including bio-data, parents' education, occupation, and income collected to estimate

socioeconomic status using Kuppuswamy scale¹³. The students were directed for the measurement of height and weight to evaluate their nutritional status with the help of BMI according to cut off directed by the WHO¹⁴.

Haematological Assessments:

Sahli's acid haematin method was used for the estimation of Hb level. Capillary blood collected from the study participants by pricking the finger tips by Lancet. A separate lancet was used for each individual to avoid cross infection. Aseptic conditions maintained during the procedures. Hb estimation was done using Hb cuvette. Hemocue strips used for each participant and same calibrated instrument was used throughout the study. Anemia was classified according to WHO cut-off points as mild anemia (10.0-12.0 g %), moderate anemia (7.0-10.0 g %) and severe anemia (<7.0 g %).

Statistical Analysis:

Statistical analysis was undertaken using SPSS v10.0 and MS Excel 2013. In the present study, initially frequencies of all variables were taken followed by comparison of various variables. Appropriate statistical tests were used for finding the association and trend. Independent sample t-test was used for continuous variables and the chi-squared test for categorical variables. The level of significance applied was 95.0% (p-value < 0.05).

RESULTS

Data were analysed and results were tabulated. Out of 100 students participated in the study, 46 (46%) were anemic, in which 34 (73.91.2%) females were mildly anemic, 10 (21.73%) females were moderately anemic, and 2 (4.34%) was suffering from severe anemia. [Tables 1, 2 and fig. 1]

We observed that 34 (34%) students from middle socioeconomic status and 12 (12%) students from upper socioeconomic status were anemic. [Table-4]

In the present study, 20 (20%), 55 (55%), 20 (20%), and 5 (5%) students were anemic in underweight, normal, overweight, and obese BMI groups, respectively. The results were statistically significant (P < 0.01). [Table-5 & fig. 2]

We noted that 25 (25.00%) students, who were taking vegetarian diet and 21 (21.00%) students, who were taking mix diet, suffered from anemia. These results were statistically significant (P < 0.01) [Table 6]

Table -1. Distribution Of Study Participants Based On Presence Or Absence Of Iron Deficiency Anemia.

Iron deficiency Anemia	Female	Total (%)
Present	46	46%
Absent	54	54%
Total	100	100

Source: Original

Table -2. Distribution of study participants according to Haemoglobin level.

Severity of anemia	Female (No. of girls)	Total (%)
Mild (10-12gm/dl)	34	73.91%
Moderate (7-10gm/dl)	10	21.73%
Severe (<7gm/dl)	2	4.34%
Total	46	46%

Source: Original

Table-3. Distribution Of Study Participants Based On Their Consumption Of Green Leafy Vegetables.

Consumption Frequency	Anemia		No Anemia		Total (%)
	No.	(%)	No.	(%)	
Daily	15	30	35	70	50
Once weekly	12	54.54	10	45.45	22
Twice weekly	11	64.70	6	35.29	17

Thrice weekly	8	66.66	3	25	11
Total	46		54		100

Source: Original

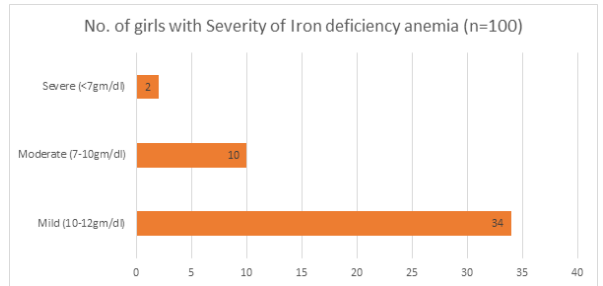


Fig1. Showing The Distribution Of Study Participants According To Grading Of Iron Deficiency Anemia. Source: Original

Table-4. Prevalence Of Iron Deficiency Anemia In Relation With Socioeconomic Status.

Anemia	Lower	Middle	Upper	Total
Present	0	34	12	46
Absent	3	41	10	54
Total	3	75	22	100

Source: Original

Table-5. Distribution Of Adolescent Girls Based On BMI.

BMI	Female	Total (%)
Underweight	20	20%
Normal	55	55%
Overweight	20	20%
Obese	5	5%
Total	100	100%

Source: Original

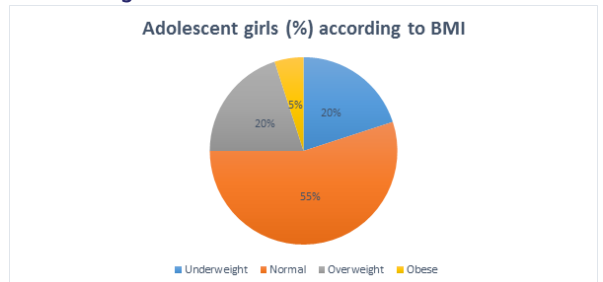


Fig 2. Pie Chart Showing Distribution Of Study Participants According To BMI. Source: Original

Table-6. Type Of Diet And Occurrence Of Iron Deficiency Anemia.

Anemia	Veg. diet (%)	Mix diet (%)	Total (%)
Present	25 (25%)	21 (21%)	46 (46%)
Absent	20 (20%)	34 (34%)	54 (54%)
Total	45 (45%)	55 (55%)	100

Source: Original

DISCUSSION:

The present study carried out in 100 healthy school going adolescent female in the age range of 12-16 years, to estimate the prevalence of anemia among adolescent girls, which in turn gives the information about the socio-demographic factors associated with anemia, and to analysis the severity of the anemia and it's possible causes. It is a long-standing problem in India with high prevalence of anemia in adolescents. India has the world's highest prevalence of iron deficiency anemia among women, and 46% of the adolescent girls being anemic.

In the present study, 46% of females were anemic. 34 (73.91%) females were mildly anaemic, 10 (21.73%) females were moderately anemic, and 2 (4.34%) was suffering from severe

anemia. The similar results observed in a study carried out by Chaudhary and Dhage¹⁵ at an area under Urban Health Training Centre of a medical college, Nagpur, they found prevalence of anemia 35.1% among a total of 296 adolescent females (10-19 years old). Although, our findings differ from the study done by Bulliy et al.¹⁶ who found 96.5% prevalence among non-school going adolescent girls in three districts of Orissa, of which, 45.2%, 46.9%, and 4.4% had mild, moderate, and severe anemia. Medical students are from the well to do families and non-school going adolescent females from poverty hit families and may have dietary difference as cause for higher prevalence of anemia in among these adolescent girls.

In our study, we found that the no significant difference in the prevalence of anemia in different BMI groups. Similar results were found in a study done by Ugwuja et al.¹⁷. Previously studies found the occurrence of anemia, in both undernourished and over nourished individuals^{18,19}. In contrast to our study, some studies have associated anemia with low BMI^{20,21}.

In our study, we found that iron deficiency anemia is more common in students on vegetarian diet than on mix diet. Similar findings observed in a study done by Chaturvedi et al.²².

In the present study, we found that a statistically insignificant association of anemia and socioeconomic status though the amount of data to arrive at this conclusion is less. Similar results are found in a study done by Ugwuja et al., it shows that educational status and occupation had no effect on anemia prevalence¹⁷.

According to NFHS-3 more than 39% adolescent girls (15-19 years) are mildly anemic while 15% and 2% suffer from moderate and severe anemia respectively²³. Our study is not conducted on a large study group. To make it statistically more reliable, it should be conducted among sufficiently large study groups.

It was observed that prevalence of anemia varies with the knowledge about prevention of anemia & the frequency of iron rich source viz. green leafy vegetable. It was observed that knowledge and awareness responsible for status of anemia up to certain extent. Girls having knowledge about sources of iron rich food and prevention of anemia were less anemic than the girls not having knowledge, although statistically it was not significant ($P > 0.05$).

Strengths Of The Study:

This study gives an information regarding prevalence of anemia among school adolescent population which was rarely evaluated in India. BMI was determined based on Z-score recommended by WHO, for Adolescents.

Limitations Of The Study:

One of the major limitation of our study was small sample size. The small sample size has an influence on the evaluation of outcomes, as it can overrate the results and thus may interfere to conclude more significant study results. Assessment of energy, protein and other macro or micro nutrient intakes was not done because of limited resource available.

CONCLUSION:

In our study, we found that prevalence of iron deficiency anemia among Indian adolescent school girls was quite common. Although, majority among these girls were showing mild anemia. Prevention of iron deficiency anemia in adolescent school girls should be supported through nutritional education and various national level anemia prophylaxis programmes and improve the socio-economic

status of the population through poverty alleviation programmes. Further researches, with large number of subjects, are required to conclude more significant results.

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REFERENCES:

- Seshadri S. Nutritional anaemia in South Asia. In: Gillespie SK, ed. *Malnutrition in South Asia: A regional profile*. UNICEF Regional Office for South Asia, 1997:75-124.
- Kahlon N, Gandhi A, Mondal S, Narayan S. Effect of iron deficiency anemia on audiovisual reaction time in adolescent girls. *Indian J Physiol Pharmacol*. 2011;55(1):53-9.
- Brabin L, Brabin B J. The cost of successful adolescent growth and development in girls in relation to iron and vitamin A status. *Am J Clin Nutr*. 1992;55:955-8.
- Institute for Health Management, Pachod (IHMP) and International Center for Research on Women (ICRW) project study: Reducing Iron-Deficiency Anemia and Changing Dietary Behaviors among Adolescent Girls in Maharashtra, India (2000-2003).
- Devi S, Deswal V, Verma R. Prevalence of anemia among adolescent girls: a school based study. *Int J Basic Applied Med Sci*. 2015;5(1):95-8.
- Leenstra T, Kariuki SK, Kurtis JD, Oloo AJ, Kager PA, Kuile FO. Prevalence and severity of anemia and iron deficiency: cross-sectional studies in adolescent school girls in western Kenya. *Eur J Clin Nutr*. 2004;58(4):681-91.
- Rao BSN. Studies on iron deficiency anaemia. *Indian J Med Res* 1978;suppl 68:58.
- Toteja GS, Singh P. *Micronutrient profile of Indian population*. New Delhi: Indian Council of Medical Research, 2004.
- ICMR Task Force Study. *Evaluation of the National Nutritional Anaemia Prophylaxis Programme*. New Delhi: Indian Council of Medical Research, 1989.
- Vir SC. Iron deficiency anaemia control—a public health programme priority. *Proc Nutr Soc India* 2000; 47:45-73.
- Beard JL. Iron requirements in adolescent females. *The J nutri*. 2000;130(2):440S-2S.
- Kulkarni MV, Durge PM, Kasturwar NB. Prevalence of anemia among adolescent girls in an urban slum. *National J Comm Med*. 2012;3(1):108-11.
- Bairwa M, Rajput M, Sachdeva S. Modified Kuppuswamy's socioeconomic scale: Social researcher should include updated income criteria, 2012. *Indian J Community Med*. 2013;38(3):185-6.
- Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht²) and triceps skinfold thickness. *Am J Clin Nutr*. 1991;53(4):839-46.
- Chaudhary SM, Dhage VR. A study of anemia among adolescent females in the urban area of Nagpur. *Indian J Community Med*. 2008; 33 (4):243-5.
- Bulliy 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*. 2007; 19(4):395-406.
- Ugwuja EI, Ogbonnaya LU, Obuna AJ, Awelegbe F, Uro-Chukwu H. Anemia in relation to body mass index (BMI) and socio-demographic characteristics in adult Nigerians in Ebonyi state. *J Clin Diagn Res*. 2015;9(1):LC04-7.
- Gupta VM, Shukla KK. Epidemiology of anemia in preschool children from a rural and a slum community, Varanasi. *Indian J Prev Soc Med*. 1985;15:85-9.
- Agarwal DK, Bhardwaj B, Singla PN, Tripathi AM, Agarwal KN. Etiology of maternal and early childhood deficiency anemia. *Indian J Pediatr*. 1986;53(3):389-95.
- Alquaziz AM, Gad Mohamed A, Khoja TA, Alsharif A, Shaikh SA, Al Mame H, et al. Prevalence of anemia and associated factors in child bearing age women in Riyadh, Saudi Arabia. *J Nutr Metab*. 2013;2013:636585.
- Trinh LT, Dibley M. Anaemia in pregnant, postpartum and non pregnant women in Lak district, Daklak province of Vietnam. *Asia Pac J Clin Nutr*. 2007;16(2):310-5.
- Chaturvedi D, Chaudhuri PK, Priyanka, Chaudhary AK. Study of correlation between dietary habits and anemia among adolescent girls in Ranchi and its surrounding area. *Int J Contemp Pediatr*. 2017;4(4):1165-8.
- Press Information Bureau, Government of India, Ministry of Health and Family Welfare. *Adolescent Anaemia*. 2013;13:181ST.