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PREVALENCE OF ANEMIA AMONG ADOLESCENT GIRLS IN SELECTED AREA OF BIHAR

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ABSTRACT

Background: Anemia is a worldwide problem mostly affecting adolescent girls. Developing countries shows very high prevalence rate of anemia in adolescent girls and India its prevalence rate varies from 46% to 98%. This research investigates the prevalence of anemia among girls of Motihari town. **Method:** After collection of baseline data clinical examination was done. Haemoglobin level of subjects was estimated by using Cyanmethaemoglobin method. **Results:** Result shows 66 percent prevalence rate of anemia among adolescent girls. Mean height and weight of adolescent girls werecompared with respective NCHS standards and only mean weight shows a significant difference between them. BMI shows 56 percent girls were underweight. Clinical signs and symptoms of anemia were seen in 45 percent adolescent girls. **Conclusion:** Low family income and large family sizes are associated factors for the prevalence of anemia. Ignorance of female child in most families is another cause of anemia in growing girls. Measures should be taken by government and NGO's towards improving the iron status of adolescent

girls.

INTRODUCTION

Adolescent girls are very important section of our society as they are future mother and homemakers. Adolescent's aged between 10-19 years accounts for more than one fifth of the world's population. In India 21.4 percent of population is formed by this age group (Saroja, 2003). The word adolescence is a Latin word which means "to grow to maturity". World Health Organization (WHO) defines it as the period of life extending across the ages between 10-19 years. The period of adolescence is a period of changes in growth rates, body composition and marked physiological and endocrinal changes. It is also a period between childhood and adulthood with accelerated physical, biochemical and emotional development. It involves rapid increase in height and weight, hormonal changes leading to sexual maturation. During this period body needs more calories and nutrients like protein, calcium, iron, folate and zinc. Iron and calcium are particularly important nutrients during adolescence (Swarnalatha and Yegammai 2006). Adolescent girls with accelerated growth and rapid skeletal development may suffer from iron deficiency due to inadequate food intake. Low iron store throughout childhood may result in a delayed menarche and impaired immune response (Verma, 2004).

Anemia is a major public health problem worldwide affecting both sexes and all age groups. Nutritional anemia is more prevalent all over the world with an estimation of one billion people being iron deficient (United Nations 1992). In India nutritional anemia is a major health problem. Further the prevalence of anemia among pregnant women is in the range of 33% to 89% and more than 60% among adolescent girls (Sood SK 1975, ICMR Task Force Study, ICMR Task Force Study1992, Christian P 1989, Agarwal DK 1987, Sarin AR 1995). Physical work capacity and reproductive physiology in adolescent girls are affected due to anemia (Seshadri S. 1997). Adolescence is a vulnerable period in human life cycle for the development of nutritional anemia. The adolescent's girls are more prone to anemia especially in developing countries like India. In India female children are generally neglected in those families with limited resources (Sanjeev M). Loss of blood in menstrual cycle adds more burden to them. Studies show significantly depressed immune response in Indian children aged 1-14 year with

haemoglobin concentration below 10g/dl (Dallman 1989).

Anemia occurs due to deficiency in the size or number of erythrocytes, or the amount of haemoglobin they contain limits the exchange of oxygen and carbon dioxide between blood and the tissue cells. Anemia generally occurs due to lack of iron, vitamin B$_{12}$ and folic acid, other types result from a variety of conditions such as hemorrhage. Anemia is a state of deficiency of nutrients needed for the synthesis of haemoglobin (Hb) and this deficient state is associated with health consequences (Agarwal et. al 2003). It is also recognized as a major public health problem affecting 17, 88,600 people worldwide of which majority are from the developing world (Jyoti et.al 2000).

Bruner in 1996 carried a randomized controlled iron supplementation trial in iron deficient adolescent girls. He found that girls receiving iron supplements performed better on verbal test showing good learning and memory than girls with similar iron status receiving a placebo. Adolescent girl suffering from iron deficiency in United States had twice risk of scoring below average in math than children with adequate iron status (Halterman, 2001). On a global level approximately 18 million girls under age of 20 give birth each year. It is estimated that at least 25% of women in developing countries have their first child by 19 years of age (WHO, 2012). In India significantly high percentage of adolescent girls especially from rural and semi-urban areas are iron deficient. These girls during pregnancy suffer with negative reproductive health effects like short stature. Maternal short stature is a risk factor for obstructed labor during delivery because of cephalopelvic disproportion (CPD) in which infant head is too large to pass through mother's pelvis (Tsu VD,1992). Girls suffering from CPD need cesarean for delivering the baby and if proper delivery care is not available it leads to maternal mortality. Kakkar in 2011 reported iron deficiency anemia as the most common form of malnutrition and its early intervention during adolescence (girls) can prevent high morbidity and mortality of these future mothers.

MATERIALS AND METHODS

Present study was planned to assess the nutritional status of adolescent girls and to find out the prevalence of anemia in adolescent girls. This study was conducted in Motihari town of Bihar. The purpose of selection of this town for the field study is the rapid change in its population, lifestyle and food pattern. A total number of 100 adolescent girls were selected

in age groups of 13 to 18 years. A visit was made to different schools and colleges to trace out suitable schools keeping in mind the objective of the study. Both private and government schools were visited and teachers were explained about the plan to carry out the present study. With prior permission of teachers of the schools and colleges the students of respective age group were consulted. A questionnaire was made including following information:

i.   General profile

ii.   Anthropometric status

iii.   Clinical status

iv.   Haemoglobin assessment

General information includes name, age, type of family, family size, occupation and family monthly income. Anthropometric assessment is very important criteria for the assessment of nutritional status as it shows the variation of physical dimensions.

Height and weight of respondents was compared with the 50th percentile of NCHS values. Body mass index were calculated by using anthropometric measurements. Clinical examination was also done of each subject to find out any sign of anemia. Eyes, nails, lips, tongues, gums, teeth and general appearance were examined and recorded. The procedure of **Gibson** (1990) was followed for the clinical survey. Each signs were allotted scores and higher scores meant more were the signs. The classifications of score for nutritional status were done on the basis of following:

i.   Scores ≤ 2 = Good nutritional status

ii. Scores between 3 and 5 = Fair nutritional status iii.

Iii Scores 6 or above = Poor nutritional status

Haemoglobin level of subjects was estimated by using Cyanmethaemoglobin method prescribed by **Decie and Lewis** (1984), **INACG** (1985), **ICMR** (2001). The WHO cut off values published by **ICMR Task Force** (2001) for assessment of anemia in adolescent girls were used for the study. A single standard reading was taken then following formula was used for calculation:

$$Hb\ conc(g/dl) = \frac{OD\ of\ the\ sample}{OD\ of\ the\ Hb\ standard} \times \frac{conc.of\ standard}{1000} \times dilution\ factor$$

$$The\ dilution\ factor = \frac{volume\ of\ reaction\ mix}{volume\ of\ blood\ used} = \frac{5\ ml + 0.02\ ml}{20.02\ ml}$$

Table 1: Hb level (g/dl) indicative of anemia

Subjects	Non-anemic	Anemic	Mild-anemic	Moderate-anemic	Severe-anemic
Non- pregnant adolescent girls	>12	<12	11.9-10	7-10	<7

Statistical analysis: The collected data were analyzed with the help of the following tests:

☐ Percentage ☐ Mean

☐ Standard deviation ☐T- test

RESULTS

The study population comprised of 100 samples of adolescent girls from semi-urban areas. General information was recorded under which age, monthly income, type of family, occupation of family and food habit was taken. Maximum respondent (40 percent) belonged to 16 years of age group and minimum from 18 years. When the entire respondent was considered together the age range varied from 14 to 18 years. Maximum respondent (50 percent) had a monthly income in between Rs. 10,000 to 20,000. As per data collected and shown in table 2 majority of family belonged to nuclear family i.e. 65 percent and only 35 percent of them belonged to joint family. Agriculture was found to be the main family occupation in maximum respondents (55 percent). Table 2 also showed that most of the respondents (45 percent) were vegetarian.

Table 2: General profile of adolescent girls.

S .No.	Particulars	Adolescent girls N=100	Adolescent girls percentage (%)
1.	**Age (years)**		
	13 years	-	-
	14 years	10	10
	15 years	25	25
	16 years	40	40
	17 years	20	20
	18 years	5	5
2.	**Monthly income**		
	< 10,000 Rs.	35	35
	10,000 to 20,000 Rs.	50	50
	>20,000 Rs.	15	15
3.	**Type of family**		
	Nuclear	65	65
	Joint	35	35
4.	**Occupation of the family**		
	Agriculture	55	55
	Business	25	25

	Other	20	20
5.	**Food habit**		
	Vegetarian	45	45
	Non –vegetarian	25	25
	Eggitarian	20	20
	Omnivorous	10	10

Anthropometric measurement of subjects surveyed, in general were not satisfactory. The anthropometric measurements taken were shown in table 3.1, 3.2 and 3.3. Table 3.1 shows the mean height (cm) of adolescent girls in comparison with NCHS standard. Highly significant difference was seen in between mean height of adolescent and NCHS standards. Table 3.2 shows the mean weight (kg) of adolescent girls in comparison with NCHS standard. The weight of adolescent girls were less than the NCHS 50th percentile standard value in all age groups. On applying t-test it was found that there was significant difference between the calculated mean weight and NCHS standard values.

Table 3.3 shows the BMI classification of adolescent girls. Maximum respondents, 56 percent were underweight followed by 19 percent with ideal body weight, 13 percent with Overweight, 08 percent with obese grade I and minimum respondent 4 percent were in obese grade II. Various clinical symptoms of anemia were present among the study subjects. The eyes, nails, lips, tongues, gums, teeth and general appearance of each respondent were examined. In clinical examination breathlessness and muscular weakness were experienced by more than one third of adolescent girls. Anorexia was experienced by 35 percent of the adolescent girls were as yellowing of eyes was seen in 43 percent of adolescent girls. According to score card we used higher the scores meant more were the clinical signs. Table 4 shows the clinical scores attained by the adolescent girls. According to this maximum respondent, 45 percent had a clinical score in between 3 to 5 which means that they had significant clinical signs and had a fair nutritional status, 28 percent had less than 2 clinical score indicating good nutritional status and minimum respondents 27 percent had more than 6 clinical scores that mean poor nutritional status.

Table 3.1 Comparison of mean height of adolescent girls (13-18 years) with NCHS standard.

Age (yrs)	No. of respondents	Observed mean(cm) ±SD	50th percentile NCHS std.	Differences	t-value	p-value
13	-	-	159	-		
14	10	157.2±1.34	161.2	-3.98	9.43	<0.0001

15	25	158.8±2.05	162.7	-3.9	9.51	<0.0001
16	40	158.2±2.82	162.7	-4.46	10.09	<0.0001
17	20	160.1±1.32	162.7	-2.56	8.80	<0.0001
18	5	161.6±1.41	162.7	-1.14	1.74	=0.1560

Table 3.2 Comparison of mean weight of adolescent girls (13-18 years) with NCHS standard.

Age (yrs)	No. of respondents	Observed mean(kg) ±SD	50th percentile NCHS std.	Differences	t-value	p-value
13	-	-	48.3	-		
14	10	45.6±1.86	52.1	-6.5	11.05	<0.0001
15	25	40.2±1.32	55.0	-14.8	56.06	<0.0001
16	40	49.8±3.45	56.4	-6.6	12.09	<0.0001
17	20	50.6±2.67	56.4	-5.8	9.71	<0.0001
18	5	51.4±0.65	56.4	-5	17.20	<0.0001

Table 3.3 BMI classification for adolescent girls (13-18 years).

SI.No.	BMI Classes	Presumptive diagnosis	Adolescent girls N = 100	%= 100
1.	< 18.5	Under weight	56	56
2.	18.5 – 22.9	Ideal BMI	19	19
3.	> 23.0	Over weight	13	13
4.	> 25.0	Obese grade I	08	08
5.	> 30	Obese grade II	04	04

Table 4 Clinical scores attained by adolescent girls (13-18 years).

SI. No.	Clinical score	Adolescent girls N= 100 % = 100	
1.	≤ 2	28	28
2.	3-5	45	45
3.	6 or above	27	27

The mean haemoglobin level (g/dl) in the adolescent girls of Motihari town was 9.23. This is far below the normal value of 11-13 g/dl recommended by WHO (2000). Table 5 shows that overall anemia was 66 percent among the adolescent girls of motihari town. Maximum respondents 39 percent were mild anemic (10-11.9 g/dl), 34 percent were normal (>12 g/dl), 18 percent were moderate anemic (7-10 g/dl) and minimum respondents 9 percent were severe anemic (< 7g/dl).

Table 5 Prevalence of anemia among adolescent girls (13-18 years).

SI. No.	Groups	Adolescent girls N= 100 % = 100	
1.	Normal (>12g/dl)	34	34
2.	Mild anemic (10-11.9g/dl)	39	39
3.	Moderate anemic (7-10 g/dl)	18	18
4.	Severe anemic (< 7g/dl)	09	09

DISCUSSION

Nutritional anemia is global in occurrence but it is more of a concern in developing countries like India where the prevalence of anemia is very high. Inadequate and improper dietary habit is the basic reason for its occurrence. Various studies conducted in different states of rural India reported a prevalence of anemia from 46% to 98% (Kanani S.1994, Pathak P. 2004, Sampath kumar V. 1997.

Mean height and weight of respondent of different age groups is less in comparison to NCHS values. Similar results were found by Kamble in 2003, who showed 50 percent girls with less than normal values. Another study done in Manipur on 100 adolescent girls (13-18years) reported that the mean height and weight of adolescent girls were below the standard values (Kowsalya 2008). Only 19% of girls were having normal BMI and remaining 81% were malnourished. According to our study 56% respondents were undernourished which is similar to the findings of Dhingra(2011) who also reported 50 % respondents below normal BMI range and only 11.8 % with normal body weight.

Data on clinical signs of anemia revealed that feeling breathlessness and muscular weakness were experienced by more than one third of adolescent girls. Clinical signs were also seen in maximum respondents. These findings were similar with the findings of **Kotecha (2009)** who also reported around 75 percent prevalence of anemia. These findings were similar with **Kumar** (2006) who carried the clinical examination of 80 adolescent girls from Allahabad and observed the various signs and symptoms of anemia among adolescents like breathlessness, tiredness and pale nails.

According to our study 66 percent of adolescent girls are suffering from anemia. These findings were similar with Sen and Kanani (2005) who also reported 67 percent prevalence of nutritional anemia among young adolescent girls in Gujarat. Another study conducted in Wardha district showed 59.8 percent prevalence of anemia among adolescent girls (Kaur 2006). **Sidhu** in 2005 also showed 30.57 percent adolescent girls with mild anemia, 27 percent with moderately and 12 percent with severe anemia in Punjab.

CONCLUSION

The prevalence of anemia is very high among adolescent girls of Motihari town. It is concluded that due to low family income consumption of food is low in adolescent girls. Low family income and large family size are strongly associated factors for high

occurrence of anemia among adolescent girls of Motihari. A less noted yet commonly observed reason is negligence towards female child. There is a deep rooted desire for male child in India and family size gets bigger in this pursuit. In bigger families, the need of male child gets higher priority and hence with limited resources, the girl child gets neglected. This is the root cause of poor nutrition of the girls and the subsequent occurrence of anemia in adolescent girls. Government and NGOs could work towards this and try to improve the status of girls in society. Every parent has to understand that their daughter is the creator of new generation. Measures such as supplementation with iron and folic acid tablets, iron fortification foods and popularization of iron and protein rich food products may be taken in order to improve the dietary consumption of calories, protein, iron, carotene and vitamin C which are the nutrients, required for blood formation and control of anemia. Government and NGOs should promote rural development programs, self employment and women empowerment programs like supplementary feeding programs, subsidized food or public distribution system (PDS), should also be strengthen to increase the per capita availability of food.

Conflict of interest

The authors declare no conflict of interest.

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