

Original Research Article

Study of anemia among adolescent school girls and young adults

Anil Kumar^{1*}, Akhilesh Goyal², Niket Verma³, Ashwin Mahesh⁴

¹Department of General Medicine, Command Hospital Chandimandir, Panchkula, Haryana, India

²Consultant, Department of General Medicine, 5 Air force Hospital, Kanpur, Uttar Pradesh, India

³Department of General Medicine, Army College of Medical Sciences, Delhi Cantt., New Delhi, India

⁴MBBS Student (Final Year), Armed Forces Medical College, Pune, Maharashtra, India

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*Correspondence:

Dr. Anil Kumar,

E-mail: anilcardiologist@gmail.com

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ABSTRACT

Background: The world's adolescent population (age 10–19 years) is estimated to stand at more than 1 Billion, yet adolescents remain largely neglected, difficult-to-measure, and hard-to-reach. Population in which the needs of adolescent girls, in particular, are often ignored. Anemia during adolescence limits growth and delays the onset of menarche, which in turn may later lead to cephalopelvic disproportion. In armed forces young serving soldiers make the backbone of forces, anemia in this group affects man hour badly. So, study was planned to assess prevalence of anemia in these two groups.

Methods: A prospective study was carried out with 340 girls and 500 serving adults and prevalence of anemia was carried out with respect to different prevailing factors.

Results: The prevalence of severe, moderate and mild anemia in girls was 0.5%, 10.6% and 27.9% respectively and in serving soldiers prevalence of anemia was 1.8%, 2.8% and 3.4 % respectively.

Conclusions: In the present study, the prevalence of anemia was found to be 39% in adolescent girls and 8% in serving soldiers. Strongest predictor to anemia in adolescent girls was history of excessive menstrual bleeding and vegetarian diet. Age group, age at menarche and BMI did not affect anemia prevalence. Strongest predictor to anemia in soldiers was age.

Keywords: Adolescent girls, Anemia, Soldiers

INTRODUCTION

The world's adolescent population (age 10–19 years) is estimated to stand at more than 1 billion, yet adolescents remain largely neglected, difficult-to-measure, and hard-to-reach population in which the needs of adolescent girls, in particular, are often ignored.¹ In India adolescents constitute about 25% of the population and form an important physiological group whose nutritional needs demand special attention (Rao V, 1987).² Adolescence is a significant period of human growth and maturation, when unique changes occur and many adult

patterns are established.³ Increased nutritional needs at this juncture relate to the fact that adolescents gain up to 50% of their adult weight, more than 20% of their adult height, and 50% of their adult skeletal mass during this period.⁴ The iron needs are high in adolescent girls because of the increased requirements for expansion of blood volume associated with the adolescent growth spurt and the onset of menstruation.⁵

During the adolescent growth spurt, the risk of iron deficiency anemia reappears for both boys and girls.⁶ Adolescent girls are a particularly vulnerable group as their requirements of iron as well as its losses from the

body are high.⁷ Of the total population, adolescent girls form 22% and estimates suggests that about 25-50% girls become anemic by the time they reach menarche.^{8,9} Anemia during adolescence limits growth and delays the onset of menarche, which in turn may later lead to cephalopelvic disproportion.¹⁰ Iron deficiency is the most widespread form of malnutrition among women and children. India has the highest prevalence of iron-deficiency anemia among women, including adolescents, worldwide. Between 60 percent and 70 percent of Indian adolescent girls are anemic (Hemoglobin (Hb) < 12 g/dl).¹¹

The prevalence of anemia is disproportionately high in developing countries, due to poverty, inadequate diet, certain diseases, pregnancy/lactation and poor access to health services.¹² This phase of life is also important due to the ever-increasing evidence that control of anemia in pregnant women may be more easily achieved if satisfactory iron status can be ensured during adolescence.¹³ Few programs for anemia control have targeted adolescent girls and health care of adolescent girls all over the world has not been given priority.¹⁴ The USAID/OMNI/PCD consultation concluded that "iron supplementation resulted in significant improvement in school measurements of verbal and other measurable skills among primary school children and adolescents".¹⁵

Data on the prevalence of anemia among adolescent girls in North – east India is lacking and hence the present study is significant. It will help in identifying the quantum of this problem and planning interventions to increase Hemoglobin (Hb) level of adolescent girls through Iron Prophylaxis, dietary modification and helminth control. This will ensure better school performance at this stage of life and safe motherhood in future.

METHODS

Adolescent girls of the age group 12 – 18 yrs were included in the study from the schools located in Jorhat after taking due consent from the parents. A pre-tested and pre-designed proforma was used to collect the information on socio-demographic characteristics like age, educational status, family size, monthly family income; medical history like age at menarche, excessive menstrual bleeding in the past 3 months and dietary history. Height, weight and hemoglobin were recorded. Nutritional status was assessed by recording height and weight with the help of Telescopic measuring rod and digital weighing scale. Hemoglobin estimation was done using cyanmethaemoglobin method.

All subjects were assessed for presence of anemia using WHO criteria. A peripheral blood smear (PBS) examination was carried out in subjects with hemoglobin less than 12g/dl. Serum Iron and Total Iron Binding Capacity (TIBC) were estimated in subjects with PBS suggestive of Iron deficiency anemia to confirm Iron

deficiency. For interpretation of anemia, cut-off point for hemoglobin level taken was < 12g/dl.

To define Iron deficiency anemia the cut off points taken were Serum Iron less than 30 mcg/dl and TIBC more than 470 mcg/dl. The severity of anemia was graded as Mild (10-12g/dl), Moderate (7-10gm/dl) and Severe (<7gm/dl).

Young serving soldier age group (20 years to 40 years) presenting to medical outpatient department were taken for study after taking consent. A pre-tested and pre-designed proforma was used to collect the information on socio-demographic characteristics like age, educational status, family size, monthly family income, medical history for chronic blood loss was taken. Height, weight and hemoglobin were recorded.

Hemoglobin estimation was done using cyanmethaemoglobin method. All subjects were assessed for presence of anemia using WHO criteria. A peripheral blood smear (PBS) examination was carried out in subjects with hemoglobin less than 13g/dl. Serum Iron and Total Iron Binding Capacity (TIBC) were estimated in subjects with PBS suggestive of Iron deficiency anemia to confirm Iron deficiency.

For interpretation of anemia in serving soldiers, cut-off point for hemoglobin level taken was < 13g/dl. The severity of anemia was graded as Mild (10-12g/dl), Moderate (7-10gm/dl) and Severe (<7gm/dl). To define iron deficiency anaemia the cut off points taken were Serum Iron less than 30 mcg/dl and TIBC more than 470mcg/dl.

Data obtained was analyzed to find out the prevalence of anemia, its severity and prevalence of iron deficiency in adolescent girls. Univariate analysis was done to identify epidemiological determinants such as different age groups, age at menarche, nutritional status, food habit and excessive menstrual bleeding.

RESULTS

Table 1: Anemia in adolescent's girls.

Hemoglobin (g/dl)	No. of girls (%)
<7	2 (0.5)
7-10	36 (10.6)
10-12	95 (27.9)
>12	207 (60.9)
Total	340

Table 2: Blood iron status and Total Iron Binding Capacity (TIBC) of the subjects.

Blood parameter	N	Range mcg/dl	Mean±SD mcg/dl
Serum Iron	340	26-188	88±2
TIBC	340	272-672	429±9

Table 3: Epidemiological determinants of anemia: univariate logistic regression analysis.

Variables		Total (%) (N=340)	No. of Anemic girls (%)	OR	C.I. for OR (Lower-Upper)
Age	Early adolescence	225 (66)	55 (21.7)	1	-
	Late adolescence	115 (44)	34 (29.5)	1.29	0.78-2.15
Status of Menarche	Attained	300 (88.2)	125 (41.7)	1	-
	Not-attained	40 (11.8)	8 (20)	0.35	0.16-0.79
Body Mass Index	>85 th percentile	51 (15)	21 (41)	1	-
	5-85 th percentile	272 (80)	104 (38)	0.88	0.48-1.63
	<5 th percentile	17 (5)	8 (47)	1.27	0.42- 3.83
Dietary habits	Non-Vegetarian	202 (59.5)	55 (27.2)	1	-
	Vegetarian	138 (40.5)	78 (56.5)	3.47	2.20-5.49
History of excessive menstrual bleeding	Absent	315 (93.2)	114 (36.2)	1	-
	Present	23 (6.8)	20 (87)	11.75	3.42-40.42

There were 340 subjects in the study population of whom majority 66% (N=225) were early adolescents (13-16 years) and 44% (N=115) were late adolescents (age >16yrs) (Table 3). All of them were school going girls and belonged to families with income group above Rs 5000 per month.

88% of girls had attained menarche and 6.8% girls had history of excessive menstrual bleeding. With regards to dietary intake 59.5% girls were non-vegetarians. 5% of the study population was under nourished based on body mass index (BMI). In the present study prevalence of anemia was 39% (n=133) of which 37% (n=49) was due to iron deficiency. The prevalence of severe, moderate and mild anemia was 0.5%, 10.6% and 27.9% respectively (Table 1). Overall mean hemoglobin level was 11.2±1.61. Serum Iron level ranged from 26-188 mcg/dl and TIBC 272-672 mcg/dl (Table 2). The mean values were 88 (±2) for Serum Iron and 429±9 for TIBC. In univariate analysis (Table 3), strongest predictor to anemia was history of excessive menstrual bleeding (OR=11.75, CI=3.42-40.42) and vegetarian diet

(OR=3.47, CI=2.20-5.49). Age group, age at menarche and BMI did not show any significant association with anemia.

Table 4: Anemia in young serving soldiers.

Hemoglobin (G/DL)	No. of Pts (%)
<7	9 (1.8)
7-10	14 (2.8)
10-13	17 (3.4)
>13	460 (92)
Total	500

Table 5: Blood iron status and Total Iron Binding Capacity (TIBC) of the subjects.

Blood parameter	N	Range mcg/dl	Mean±SD mcg/dl
Serum iron	500	24-240	103±12
TIBC	500	260-650	410±8

Table 6: Epidemiological determinants of anemia: univariate logistic regression analysis.

Variables		Total (%) (n=500)	No. of Anemic Pts (%)	OR	C.I. For OR (lower-upper)
Age	20 – 30 years	380 (76)	14 (3.6)	1	-
	30 – 40 years	120 (24)	26 (21.6)	5.2553	2.6333 – 10.4879
Economic status	<7000 Rs/ month	390 (78)	12 (3.0)	1	-
	>7000 Rs/ month	110 (22)	28 (25)	10.7561	5.2503 – 22.0354
Dietary habits	Non- vegetarian	365 (73)	32 (8.7)	1	-
	Vegetarian	135 (27)	8 (5.9)	0.6555	0.2942 – 1.4602
Type of anemia	Macrocytic	40	25 (62.5)		
	Microcytic	40	11 (27.5)		
	Normocytic	40	04 (10)		

There were total of 500 patients included in study, majority of them were of age group from 20 to 30 years (380/500-76 %) and rest 24 % were in age group of 30 to 40 years. Out of 500 soldiers 390 (78%) had monthly income less than Rs 7000/per month, while 110 (22%) had monthly income of more than Rs 7000/per month. Non-vegetarians were 73% (365) and vegetarians were 27 % (135).

In present study prevalence of anemia was 8% (40/ 500) with mild, moderate and severe anemia 3.4%, 2.8 % and 1.8% respectively (Table 4). Serum Iron level ranged from 24-240 mcg/dl and TIBC 260-650 mcg/dl (Table2). The mean values were 103 + 12 for Serum Iron and 410 + 8 for TIBC. In age group of 20 to 30 years 3.6% (14/380) patients were anemic as compared to age group of 30 to 40 years where 21.6 % (26/120) were anemic. Income group of less than Rs 7000/ per month had anemia in 3 % (12/ 390) while soldiers belonging to income group of more than Rs 7000/per month had anemia in 25 % (28/110) cases. Non – vegetarians had anemia in 8.7 % (32 / 365) while vegetarians had anemia in 5.9% cases (8/135). Out of total 40 anemic soldiers 25 had megaloblastic anemia (62.5%), 11 had microcytic anemia (27.5%), rest 04 soldiers had normocytic anemia. In univariate analysis (Table 5), strongest predictor to anemia was age of soldiers, as soldiers in age group of 30 to 40 years anemia more commonly (OR 5.2553 CI 2.6333-10.4879). Again, soldiers in higher income group were of higher age and anemia was more prevalent as compared to lower income group (OR 10.7561 CI 5.2503-22.0354) (Table 6). Dietary factors did not predict prevalence of anemia (OR 0.6555 CI 0.2942 – 1.4602). Macrocytic anemia was commonest followed by iron deficiency anemia.

DISCUSSION

In 1997, WHO convened a regional consultation of experts to address malnutrition issues among adolescent girls in South-East Asia.¹⁶

Nutritional anemia in serving soldiers is a cause for national concern. A departmental study revealed that 38.9% soldiers screened had anemia with hemoglobin level below 13 gm and 19.5 % below 12 gm%.⁵ Authors found no literature on nutritional anemia in Indian soldiers and worldwide also literature is far and few. Further especially on northeastern states studies are still less.

In the present study, the prevalence of anemia was found to be 39% which was similar to that reported by Rajaratnam et al from Tamilnadu.³ These differences in the prevalence of anemia may be due to difference in the study area.

The prevalence of anemia in serving soldiers is less as compared to general population in earlier as well as this study (8% versus 39%).

In the study the prevalence of severe, moderate and mild anemia was 0.5%, 10.6% and 27.9% respectively. The prevalence of severe anemia was similar to that reported by Kaur S et al.¹²

The mean hemoglobin in the present study was 11.2±1.6gm/dl which was similar to the one reported by S. Kaur et al but higher than that reported by Mehta et al.^{12,17} (10.6±1.2gm/dl) and lower than Kotecha et al reported as 11.8 ±1.4g/dl.¹⁸ In serving personnel group, present study prevalence of anemia was 8% (40/ 500) with mild, moderate and severe anemia 3.4%, 2.8 % and 1.8% respectively.

In the present study iron deficiency was noticed in 37% of the anemic adolescents. Considering that anemia development is a consequence occurred at a later stage of iron deficiency, a prevalence of 39% anemia in these adolescent girls of which 37% was due to iron deficiency should be considered significant and calls for an action. UNICEF/WHO JCHP recommends iron supplementation for all females between 10-49 years in countries where over 30% of the population is anemic.¹⁹ High prevalence of mild and moderate anemia demands due emphasis so as to bring down total prevalence of anemia in adolescent girls. In serving soldiers prevalence of macrocytic anemia was more as compared to microcytic (Iron deficiency) anemia (62.5 versus 27.5).

In the present study, the important correlates of anemia were found to be vegetarian diet (OR 3.47, CI 2.20-5.49), excessive menstrual bleeding. However, age, status of menarche, BMI, education and socio-economic status did not contribute significantly. This further reiterates and emphasizes the need for corrective measures for anemia and iron deficiency in girls before they enter adolescence so as to compensate the additional requirements for growth and development during puberty and combat the extra losses during menstruation.

Age and BMI was not significantly related with anemia. Mehta et al and Kotecha et al also reported that age is not a significant correlate of anemia.^{17,18}

As the study subjects were school children from well to do families (monthly income of Rs 5000 and above) status of education and socio-economic status could not be included in the epidemiological variants.

This study has demonstrated that anemia among adolescent girls of North east is also high as in other parts of the country and the important correlates of anemia were found to be vegetarian diet and excessive menstrual bleeding. This indicates the importance of including adolescents in the risk group to improve their iron status and the need for planning intervention programs that would increase the hemoglobin levels among adolescent girls through prophylaxis treatment, dietary modification. It will also ensure safe motherhood.

The strongest predictor to anemia was age of soldiers, as soldiers in age group of 30 to 40 years anemia more commonly (OR 5.2553 CI 2.6333 – 10.4879). This could be because of factors like malabsorption, chronic infection or other undetected systemic illness in addition to dietary habits.

CONCLUSION

In the present study, the prevalence of anemia was found to be 39%. The important correlates of anemia were found to be vegetarian diet (OR 3.47, CI 2.20-5.49), excessive menstrual bleeding. However, age, status of menarche, BMI, education and socio-economic status did not contribute significantly. In serving personnel group, present study prevalence of anemia was 8% (40/ 500) with mild, moderate and severe anemia 3.4%, 2.8 % and 1.8% respectively. The strongest predictor to anemia was age of soldiers, as soldiers in age group of 30 to 40 years anemia more commonly (OR 5.2553 CI 2.6333 – 10.4879). This can be explained due to poor dietary intake of iron and folic acid. Same applies to the more prevalence of anemia in low income group ie poor dietary intake. Prevalence of anemia in vegetarian and nonvegetarian group did not differ significantly. Schools can be a key part of helping adolescent girls become healthy adults: Research shows that promoting female education and literacy can improve nutrition and encourage females to seek regular health care. A number of strategies are available for dietary modification based either on promoting the intake of iron or its absorption, including haem iron and vitamin C rich fruits along with the diet, or on reducing the ingestion of absorption inhibitors (such as phytates and tannins) to double the bioavailability of iron.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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