

# Prevalence of Anaemia among Adolescent Girls: A One Year Cross-Sectional Study

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## ABSTRACT

**Introduction:** India has the world's highest prevalence of iron deficiency anaemia among women, with 60 to 70 percent of the adolescent girls being anaemic. Adolescence is considered as a nutritionally critical period of life. The pre-pregnancy nutritional status of young girls is important as it impacts on the course and the outcome of their pregnancy. Hence, the health of adolescent girls demands special attention

**Objectives:** To assess the prevalence and the severity of anaemia among adolescent girls in rural areas; To study the association of anaemia with respect to the age of the participants and their socio-economic status.

**Materials and Methods:** The present study was a cross-sectional study which was conducted for a period of one year from Jan 2008 – Dec 2008 at villages which were under Vantamuri PHC, a field practice area of J.N Medical College, Belgaum. A total of 840 adolescent girls (10-19 years of age) were included in the study. A pre-designed and pre-tested proforma was used to obtain the details of the socio-demographic variables. A relevant

clinical examination of the participants was done. Following this, 2ml of blood was obtained by venipuncture. The blood samples were analyzed by using an automated cell counter. The diagnosis was established as anaemia when the haemoglobin level was less than 12gm/dl.

**Results:** The prevalence of anaemia was 41.1% (with that of severe anaemia being 0.6%, that of moderate anaemia being 6.3% and that of mild anaemia being 34.6%. It was observed that the prevalence of anaemia was high in late adolescents (15-19yrs) as compared to that in the early adolescents (10-14yrs). A majority of the girls had mild anaemia. The prevalence of anaemia was considerably high among the girls who belonged to the low socio-economic status.

**Conclusion:** A high prevalence of anaemia was found among the adolescent girls, which was considerably high in the late adolescents. There was a significant association of anaemia with the socio-economic status. The prevalence of anaemia was high in girls who belonged to the low socio-economic status.

**Key Words:** Anaemia, Adolescent girls, Prevalence

## INTRODUCTION

Anaemia is the most prevalent nutritional problem worldwide and it is mainly caused due to iron deficiency. Its prevalence is highest among young children and women of childbearing age; particularly in pregnant women [1]. The prevalence of anaemia is disproportionately high in the developing countries, due to poverty, inadequate diet, worm infestations, pregnancy/lactation and poor access to the health services [2].

The world's adolescent population is facing a series of serious nutritional challenges which are not only affecting their growth and development but also their livelihood as adults. Yet, adolescents remain a largely neglected, difficult-to-measure and hard-to-reach population, in which the needs of adolescent girls in particular, are often ignored [3].

The word adolescence is derived from the Latin word, 'adolescere'; meaning "to grow, to mature" [4]. The WHO has defined adolescence as the age period between 10 to 19 years of age for both the sexes (married and unmarried). There are about 1.2 billion adolescents in the world, which is equal to 1/5th of the world's population and their numbers are increasing. Out of these, 5 million adolescents are living in developing countries. India's population has reached the 1 billion mark, out of which 21% are adolescents [5].

Adolescence more broadly refers to the phase of human development which encompasses the transition from childhood to adulthood. This period is very crucial, since these are the formative years in the life of an individual, when major physical, psychological and behavioural changes take place. The nutritional and the health needs of the adolescents are also more because of the growth spurt and the increase in physical activity in them [6].

In females, adolescence marks the beginning of the menstrual cycle or reproduction. Adolescents gain 30% of their adult weight and more than 20% of their adult height between 10-19 years, which we call as growth spurt [7].

Adolescent girls are at a high risk for anaemia and malnutrition. Inadequate nutrition during adolescence can have serious consequences throughout the reproductive years of life and beyond [4]. Very often, in India, girls get married and pregnant even before the growth period is over, thus doubling the risk for anaemia [8].

The nutritional anaemia in adolescent girls attributes to the high maternal mortality rate, the high incidence of low birth weight babies, high perinatal mortality and the consequent high fertility rates. This phase of life is also important due to the ever-increasing evidence that the control of anaemia in pregnant women can be more easily achieved if a satisfactory iron status can be ensured

during adolescence [2]. About 43% of the adolescent deaths are related to pregnancy. Pregnancy during adolescence deprives the girls from achieving their full growth according to their genetic potential [9].

## Anaemia

**Definition:** Anaemia is said to be present when the haemoglobin level in the blood is below the lower extreme of the normal range for the age and sex of the individual [10].

### Normal haemoglobin range according to age [11]:

Age group	Hb (Range in gm/dl)
Newborn (< 1 week old)	14-22
6 months old	11-14
Children (1-15 yrs)	11-15
Adults-men	14-16
Women	12-16

According to the WHO criteria, the cut off level of the haemoglobin concentration in blood for the diagnosis of anaemia is less than 11gm/dl for pregnant women and for children who are aged between 6 months and 6 years, less than 12 gm/dl for non-pregnant women and children who are aged 6-14 years old, and less than 13 gm/dl for adult males [12].

As compared to the vast amount of work which has been done in pregnant mothers and young children, there are relatively few published studies on the prevalence of anaemia among adolescent girls. The data on the prevalence of anaemia among the rural adolescents is scarce, particularly in a rural community setup. Meaningful programmes cannot be implemented without sufficient data.

Therefore, the present study was undertaken to assess the prevalence of anaemia among adolescent girls who belonged to the rural communities.

## METHODOLOGY

### Study Design

The present study was a cross-sectional study which was conducted at villages which were under Vantamuri PHC, a field practice area which was attached to J.N Medical College, Belgaum. The study period was one year and it was from January 2008 to December 2008. Vantamuri PHC is situated 22 kilometers away from Belgaum city.

This study was approved by the institutional ethics committee for human subjects research of J.N. Medical College. .

### Source of the Data

**Inclusion criteria:** Girls of the age group of 10-19 years

**Selection of the participants:** All the girls of the age group of 10-19 years, who attended the government primary and high schools in the study area, were included in the study. The participants were informed about the study and informed consent was obtained from the heads of the schools as well as the participants. A pre-designed and pre-tested proforma was used to collect the information about the participants. A brief, relevant clinical examination was also done.

**Sample size - 840:** The following formula was used to calculate the sample size:

$$n = 4 p q/d^2$$

$$\begin{aligned} p &= \text{Percentage of the study participants with anaemia} \\ &= 48.75 \\ q &= \text{Percentage of the study participants without anaemia} \\ &= (100-p) = 51.25 \\ d &= \text{Allowable error (taken as 10\% of this study)} = 4.87 \end{aligned}$$

$$\text{Hence, } n = \frac{4 \times 48.75 \times 51.25}{4.87 \times 4.87} = 420$$

Cluster sampling was done for the complete coverage of the study area.

Therefore,  $420 + 420 = 840$

### List of variables:

Age was recorded to the nearest completed years and was determined from the register of the school.

The adolescence period was classified as early and late adolescence.

### Classification of the adolescents: [13]

Early adolescence: 10-14 yrs

Late adolescence: 15-19 yrs

### Socio-economic status:

Information regarding the per capita income ( in rupees/month) was collected and the socio-economic status was classified by using the Modified B G Prasad's classification for the study period (2008-09), which was calculated by multiplying the multiplication factor (2008-09) with the Prasad's classification values of the year 1961 [14].

Socio-economic status	Prasad's classification 1961	Modified Prasad's classification in study period 2008–2009 (per capita income in Rs/ month)
I	100 and above	2166 and above.
II	50-99	1083-2165
III	30-49	650-1082
IV	15-29	325-649
V	<15	below 325

As the study period was from January 2008 to December 2008, the average consumer price index for that period (2008 - 09) was taken [15].

The modification was done with the aid of the multiplication factor (M.F), which was obtained as below:

$$\begin{aligned} \text{M.F} &= \frac{\text{Average consumer price index for the study period (2008–09)}}{100} \times 4.93 \\ &= \frac{439.33}{100} \times 4.93 = 21.658 \sim 21.66 \end{aligned}$$

### Data collection

**Collection of the blood samples:** 2ml of venous blood was drawn by venipuncture (antecubital vein) under aseptic precautions and it was collected in EDTA (Ethylenediamine tetraacetic acid) vacutainers. EDTA acts as an anticoagulant. The collected blood samples were analyzed in the Department of Pathology, KLE's

Dr.Prabhakar Kore Hospital and Medical Research Centre, which was attached to J.N.Medical college, Belgaum.

**Analysis of the blood samples:** The samples were analyzed by using an automated cell counter (Beckman Coulter AC T diff 2).

**Classification of the anaemia according to its severity:** [7]

Anaemia	Hb (Range in gm/dl)
Mild	10-11.9
Moderate	7-10
Severe	<7

**Data analysis:** Codes were prepared for the options of the proforma. The master chart was prepared by using the EXCEL2007 software (Annexure V). The SPSS software was used for the analysis of the data. Tables and graphs were prepared by using the Microsoft Windows 2007 software. Chi-square test was used for the statistical analysis. The differences were considered as significant at a p value of <0.05.

## RESULTS

The present study was a cross-sectional study which was conducted at villages which were under Vantamuri PHC. It included 840 adolescent girls who attended government schools.

The overall prevalence of anaemia was 41.1%. 345 out of 840 adolescent girls had varying severity of anaemia. Anaemia was absent in 58.9% of the girls.

Out of the 840 adolescent girls, 290 (34.6%) were mildly anaemic, 53(6.3%) were moderately anaemic and 2(0.2%) were severely anaemic.

A majority of the girls were in the age group of 10-14 years. There were no participants in the age group of 19 years.

- The range of haemoglobin among the participants was 5.3-14.9gms/dl.
- The mean haemoglobin level among the anaemic girls was  $10.9 \pm 1.04$ gms/dl.
- The mean haemoglobin level among the non-anaemic girls was  $12.80 \pm .5$ gms/dl.

The prevalence of anaemia was more in girls who were 10 years of age and in girls who were more than 14 years of age. One of the participants who was 18 years old was non-anaemic.

Out of the 840 girls, 755 (89.9%) were in the age group of 10-14 years, whereas only 85(10.1%) were in the age group of 15-19 years.

Thus, a majority of the girls were in the age group of 10-14 years.

The prevalence of anaemia among the late adolescents was 60%, whereas; it was 38.9% among the early adolescents. This was found to be statistically significant.

Thus, the prevalence of anaemia was high among the late adolescents (15-19yrs) as compared to the early adolescents (10-14yrs).

In the present study, out of the 840 adolescent girls, a majority (84.2%) belonged to the socio-economic class IV, whereas 11.5% of them belonged to class III and only 4.3% belonged to class V. None of the girls belonged to classes I and II.

The prevalence of anaemia among the girls who belonged to class III was 4.1%, whereas it was 43.1% in girls of class IV and 100% in girls of class V. This was found to be statistically significant. Thus,

the prevalence of anaemia was high among girls who belonged to the lower socio-economic groups.

## DISCUSSION

Anaemia is a major public health concern in pre-school children and pregnant women in the developing world. While many studies have examined these two at-risk groups, there is a paucity of data on anaemia among adolescents who were living in developing countries, in the complex ecologic context of poverty and malnutrition [16]. It is becoming increasingly evident that the control of anaemia in pregnant women can be more easily achieved if a satisfactory iron status can be ensured in the adolescent females prior to marriage [17].

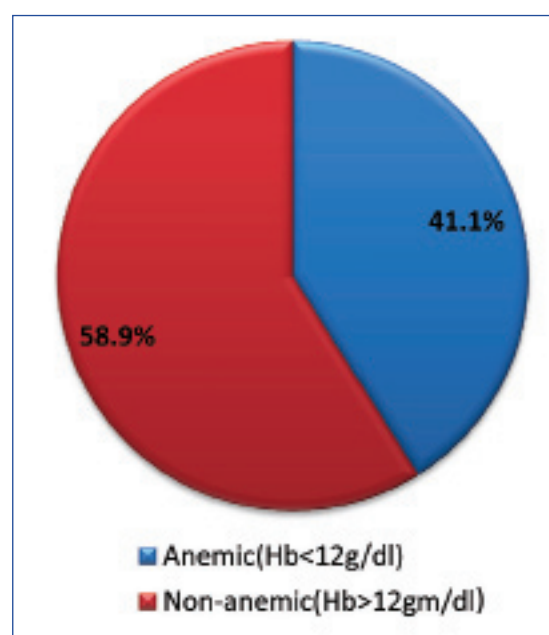
The reasons for the high incidence of anaemia among the adolescent girls are:

- Increased iron requirements because of growth
- Menstrual loss
- Discrepancy between high iron need for haemoglobin formation and low intake of iron containing foods
- Erratic eating habits, dislike for foods which are rich in iron, like green leafy vegetables
- Iron absorption inhibitors in food: phytates/tannins [6]

The following cutoff points which were suggested by the WHO were used to determine whether iron deficiency anaemia was a major problem among the general population: [6]

Prevalence	Public health problem
<5%	Not a problem
5-14.9%	Low magnitude
15-33.9%	Moderate magnitude
40% and above	High magnitude

**Prevalence of anaemia:** [Table/Fig-1]



Anemia	Study participants	
	Number	Percentage
Anemic	345	41.1
Non-anemic	495	58.9
Total	840	100

**[Table/Fig-1]:** Distribution of study participants in relation to anemia

In the present study, it was found that out of 840 girls, 345 (41.1 %) were suffering from various degrees of anaemia and that 495 (59.9 %) were non-anaemic. This indicated that it was a public health problem of high magnitude as per the WHO guidelines.

In a multi-country study on the nutritional status of adolescents, which was carried out by the International Centre for Research on Women (ICRW), anaemia was found to be the most widespread nutritional problem and its prevalence ranged from 32-55% [18].

A study which was conducted in the rural areas of Tamilnadu revealed that the prevalence of anaemia among the adolescent girls was 44.8% [19].

Another study which was conducted among the girls who belonged to the low income families in Vadodara, revealed that 67% of the adolescent girls were anaemic [20].

Studies which were conducted in rural Wardha and Lucknow to estimate the prevalence of anaemia among adolescent girls, found that the prevalence of anaemia in those areas was 59.8% and 56% respectively [21].

In a study which was conducted in rural South India, it was found that 30% of the adolescent girls were anaemic [22].

Thus, the results of various studies which have been mentioned above, demonstrated that the prevalence of anaemia in this study was high as in other parts of the country. This indicated 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 haemoglobin levels among the adolescent girls through prophylaxis treatment, dietary modification and helminth control.

#### Prevalence of anaemia according to the severity: [Table/Fig-2]

In our study, the prevalence of severe anaemia was 0.2%, that of moderate anaemia was 6.3% and that of mild anaemia was 33%.

In a study which was conducted in rural Tamilnadu, the prevalence of severe anaemia was found to be 2%, that of moderate anaemia was 6.3% and that of mild anaemia was 36.5% [19].

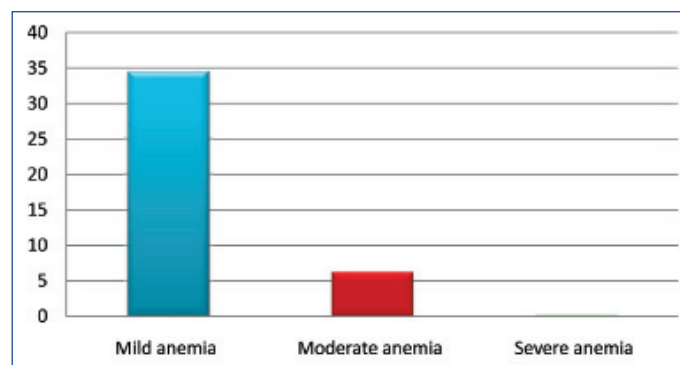
Similar results were seen in a study which was conducted in three districts of Orissa to assess the haemoglobin status of non-school going adolescent girls, in which it was revealed that 96.5% of the subjects were anaemic, of which, 45.2%, 46.9% and 4.4% were found to have mild, moderate and severe anaemia respectively [23].

Another study which was conducted in rural Wardha showed the prevalence of severe, moderate and mild anaemia to be 0.6%, 20.8% and 38.4% respectively [2].

A study which was conducted among school going girls in Ahmedabad revealed that 55.2% were mildly anaemic, 44.9% were moderately anaemic and that 0.6% were severely anaemic [24].

Sl. no	Studies conducted in India and Abroad	Prevalence of anemia
1	Rajaratnam J et al in Tamil nadu	44.8%
2	Singh J et al in Lucknow	56%
3	Bulliy G et al in Orissa	45.2%
4	Kara B in et al in Turkey	9.7%
5	T Leenstra et al in Keenya	21.1%
6	Looker A C et al in USA	11%
7	Hilary M. C et al in Peru	27.4%

[Table/Fig-2]: Comparison of prevalence of anemia in India and abroad



Degree of anemia	Study participants (n=840)	
	Number	Percentage
Mild anemia	290	34.6
Moderate anemia	53	6.3
Severe anemia	2	0.2
Total	345	41.1

[Table/Fig-3]: Distribution of study participants in relation to the severity of the anemia

Age (in years)	Study participants	
	Number	Percentage
10	129	15.31
11	96	11.4
12	232	27.6
13	151	17.9
14	147	17.5
15	31	3.6
16	52	6.2
17	1	0.1
18	1	0.1
Total	840	100

[Table/Fig-4]: Distribution of study participants according to their age

The high prevalence of mild and moderate anaemia demands due emphasis on iron and folic acid supplementation and health education on the consumption of iron rich foods, so as to bring down the total prevalence of anaemia among the adolescent girls.

#### Anaemia with respect to age: [Table/Fig-3, 5]

In the present study, anaemia was more prevalent in girls of 10 years of age and among girls who were more than 14 years of age.

A study which was conducted in rural Tamil Nadu to assess the prevalence of anaemia among adolescent girls, found that there was reduction in the mean Hb as the age increased. This decreasing trend of haemoglobin with increasing age was not seen in our study [19].

#### Anaemia with respect to the age group (early and late adolescents): [Table/Fig-5,6]

In our study, we found that anaemia was more prevalent in girls who were more than 14 years of age as compared to girls who were less than 14 years of age.

A study which was conducted in Haryana on 110 adolescent girls who belonged to low socio-economic groups, found that anaemia was more prevalent in girls who were more than 14 years of age [25].

Thus, the high prevalence of anaemia among girls who were more than 14 years of age could be related to menstrual loss.

Age (in years)	Total	Anemic		Mean Hb
	Number	Number	Percentage	
10	129	67	51.9	11.7±1.02
11	96	32	33.3	12.3±0.89
12	232	77	33.2	12.3±1.06
13	151	57	37.7	12±1.20
14	147	61	41.5	12±1.35
15	31	15	48.5	11.7±1.61
16	52	35	67.3	11.2±1.54
17	1	1	100	9.8
18	1	-	-	13.2

**[Table/Fig-5]:** Distribution of study participants according to their age and anemia

Age (in years)	Study participants	
	Number	Percentage
10-14	755	89.9
15-19	85	10.1
Total	840	100

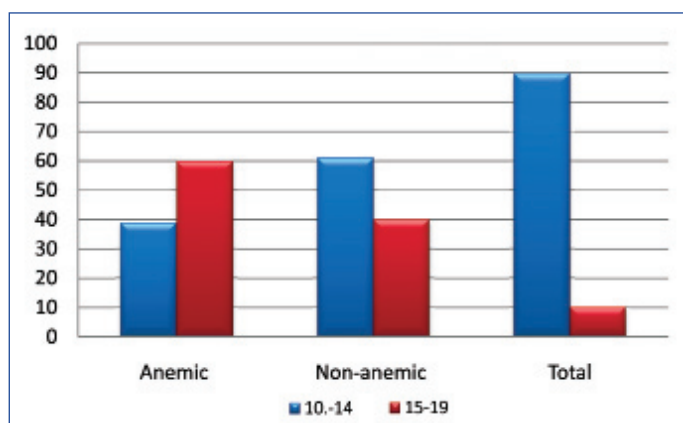
**[Table/Fig-6]:** Distribution of study participants as early and late adolescents

**Anaemia with respect to the socio-economic status:** [Table/ Fig-.7,8]

In the present study, the prevalence of anaemia was high among girls who belonged to lower socio-economic groups (43.1% in class IV and 100% in class V) as compared to the girls who belonged to higher socio-economic groups (4.1% in class III). This was statistically significant.

These findings correlated with those of the studies which were conducted among adolescent girls in Chandigarh, Nagpur, UP and Delhi, where it was revealed that anaemia was high in the lower socio-economic groups [18, 26, 27, 28].

A significant association of anaemia with the low socio-economic status suggested a need to develop strategies for intensive adult education and to improve the socio-economic status of the population through poverty alleviation programs.

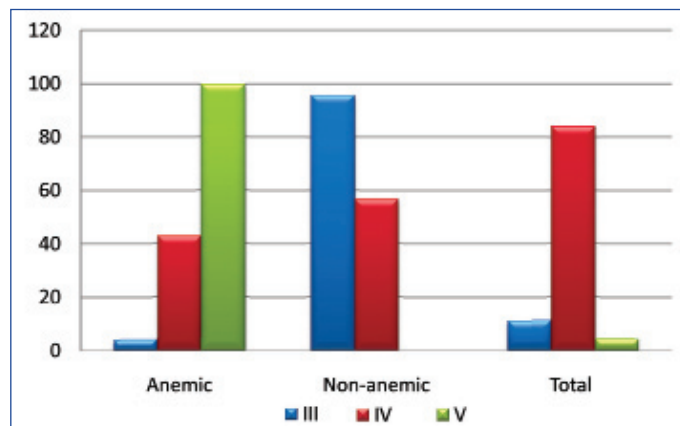


Age group (in years)	Anemic		Non-anemic		Total	
	No.	% age	No.	% age	No.	% age
10-14	294	38.9	461	61.1	755	89.9
15-19	51	60	34	40	85	10.1
Total	345	41.1	495	58.9	840	100

**[Table/Fig-7]:** Distribution of study participants in relation to anemia and age group.  $\chi^2=14.00$  DF=1 p=0.000.

Socio-economic status	Study participants	
	Number	Percentage
III	97	11.5
IV	707	84.2
V	36	4.3
Total	840	100

**[Table/Fig-7]:** Distribution of study participants according to their socio-economic status



Socio-economic Status	Anemic		Non-anemic		Total (n= 840)	
	No.	% age	No.	% age	No.	% age
III	4	4.1	93	95.9	97	11.5
IV	305	43.1	402	56.8	707	84.2
V	36	100	-	-	36	4.3

**[Table/Fig-8]:** Distribution of study participants according to socio-economic status and anemia  $\chi^2= 107.61$  DF=2 p=0.000.

## CONCLUSION

In conclusion, the present study revealed anaemia to be a major health problem among the adolescent girls in rural areas.

The prevalence of anaemia was more among girls who were more than 14 years of age.

There was a higher prevalence of mild anaemia as compared to moderate and severe anaemia.

The prevalence of anaemia was high among girls who had attained menarche.

There was a higher prevalence of anaemia among girls who belonged to the lower socio-economic groups.

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