

## Original Research Article

# Prevalence of anaemia among adolescent girls in a rural area of Central Kerala, South India

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## ABSTRACT

**Background:** Adolescence lays the foundation for future health. Anaemia among adolescent girls has become a significant public health issue. The state of Kerala has few reported studies in this regard. The current study was conducted to determine the prevalence of anaemia in adolescent girls in a rural area of central Kerala and to find out the factors associated with anaemia among them.

**Methods:** A cross sectional study was conducted among 194 adolescent girls of Tholur panchayath in Thrissur district, Kerala. The study participants were randomly selected from the adolescent registers maintained in anganwadies. A semi-structured questionnaire was administered after getting informed assent and consent from the participants and their guardians respectively. All the participants were clinically examined, anthropometric measurements were taken and 2 CC of EDTA anti-coagulated blood samples were collected to test haemoglobin.

**Results:** The prevalence of anaemia among the participants is found to be 26.3% (95% CI: 17.4-37.34). Out of the total anaemic girls, 94% were mildly anaemic (Hb between 10-11.9 g/dl) and the remaining were moderately anaemic (Hb between 7-9.9 g/dl). Anaemia was significantly higher in the age group between 10-14 years (39.5%), compared to 15-19 years (15.6%). Lower frequency of intake of green leafy vegetable and wholegrain cereals were found to have significant association with anaemia.

**Conclusions:** Anaemia remains a moderate public health hazard among the adolescent girls, with roughly every fourth girl becoming anaemic. Nutritional inadequacies were shown to be the most common cause of anaemia, which was found to be greater in the early teenage period.

## INTRODUCTION

The basis of future health aspects is laid during adolescence. Adolescence is also a time when people are most vulnerable. Anaemia in adolescent girls has become a significant public health issue, particularly in poorer nations. In India, anaemia affects 55% of adolescent females.<sup>1</sup> Despite having higher health statistics than the rest of the country, Kerala has 31.3% anaemic youngsters.<sup>2</sup> Iron requirements grow during adolescence. It's complicated by nutritional deficits, illnesses, and worm infestations. This scenario is heavily influenced by

socio-cultural elements. Anaemia in adolescence has been identified as a risk factor for chronic illness, as well as poor maternal and foetal outcomes during pregnancy. Increased maternal and foetal mortality, impaired health and development of infants and children, limited learning ability, impaired immunological functions, and diminished working and productive capacity are all consequences of this condition. Anaemia estimation in adolescent girls has a variety of concerns. It can determine the prevalence of anaemia in the adolescent age group in the community, advocate for solutions, review and improve existing services, and ultimately

improve the health of future mothers and generations. The state of Kerala has few reported studies on anaemia among adolescent girls, and none from the Thrissur district. In this context, the current study was conducted to determine the prevalence of anaemia in adolescent girls in a rural community and to find out the factors associated with anaemia among the same group.

## METHODS

A community based cross sectional study was conducted among adolescent girls (10-19 years old) who were permanent residents of Tholur Panchayath in Thrissur district of Kerala from October 2018-March 2019. Total of 194 participants were randomly selected from the adolescent girls' registers maintained by Anganwadies under the sub-centres of the primary health centre Tholur. Adolescent girls who were pregnant or not willing to participate were excluded. The selected participants were informed about the study and were mobilized to Anganwadies by ASHA workers. Data collection was scheduled on Saturdays, from Anganwadies. A semi structured questionnaire was administered by the investigators for collecting the data, which included variables on socio-demographic factors, dietary habits, iron and folic acid supplementation (IFA supplementation), menstrual history, symptoms and signs of any infections/worm infestations, symptoms and signs of anaemia. Height and weight measurements were also taken using measuring tape and calibrated weighing machine. All the study participants were clinically examined and 2 CC of EDTA anti-coagulated blood samples were collected to test hemoglobin using automated haematology cell counter. Anaemia was diagnosed when haemoglobin value was <12 g/dl in an adolescent girl.<sup>3</sup> The study was approved by institutional ethics committee, GMC Thrissur. The investigators collected informed assent and consent for participation from the adolescent girls and their parents respectively. The collected data were entered into Microsoft excel and analysed using SPSS version 20. Mean with standard deviation and percentage with confidence interval were used to summarize quantitative and qualitative variables respectively. Statistical association was assessed using student t test and Chi-square test.

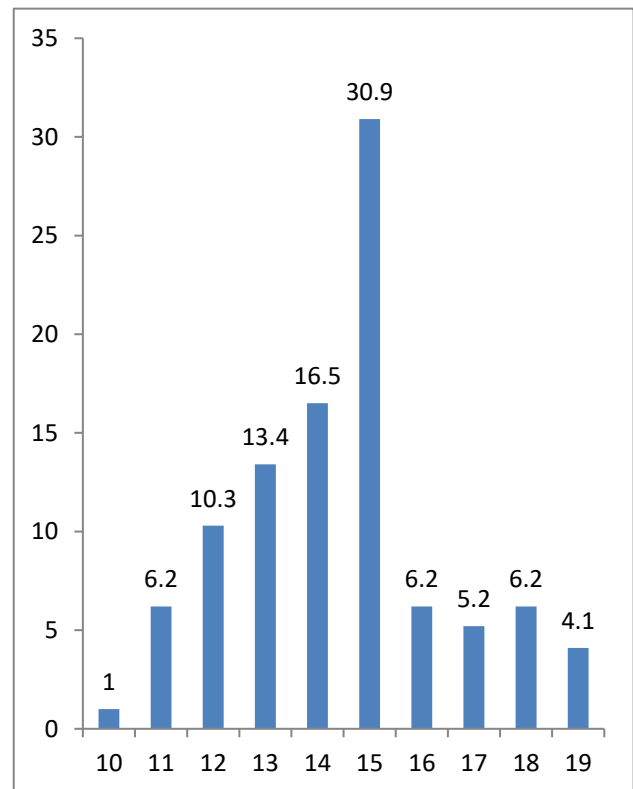
## RESULTS

### Socio-demographic details

Mean age of the study participants was  $14.47 \pm 2.03$  (SD). Majority of the participants were 15 years old (30.9%). Among the total, 62.9% belonged to Hindu religion and 62.1% were from nuclear families. The 49.4% were from below poverty line families and 19.6% of the participants had more than 5 members in their families. Baseline socio-demographic details of the study participants are given in Table 1. The distribution of the study participants according to age in completed years is given in Figure 1.

**Table 1: Socio-demographic details of the study participants, (n=194).**

Variables	Number (%)
<b>Religion</b>	
Hindu	122 (62.9)
Christian	58 (29.8)
Muslim	14 (7.2)
<b>Education</b>	
5 <sup>th</sup> -7 <sup>th</sup> standard	22 (11.5)
8 <sup>th</sup> -10 <sup>th</sup> standard	112 (57.5)
Higher secondary	45 (23)
Degree/diploma	15 (8)
<b>Socio-economic status, (n=174)</b>	
APL	88 (50.6)
BPL	86 (49.4)
<b>Type of family, (n=165)</b>	
Nuclear	102 (62.1)
Joint	47 (28.4)
Three generation	16 (9.5)
<b>Number of members in the family, (n=190)</b>	
≤5	153 (80.4)
>5	37 (19.6)



**Figure 1: Distribution of study participants according to age in completed years (%), (n=194).**

### Dietary habits

Majority of the participants were following a mixed diet (91.8%). Frequency of intake of specific food items by the participants, based on a food cycle (7 days) approximately over last 3 months is shown in Table 2.

**Table 2: Frequency of intake of food items by the participants.**

Food items	Frequency of intake			
	Daily number (%)	>3 days/week number (%)	<3 days/week number (%)	Never number (%)
Whole grains, (n=130)	30 (23)	38 (29.2)	37 (28.4)	25 (19.2)
Legumes, (n=146)	41 (28)	53 (36.3)	46 (31.5)	6 (4.1)
Green leafy vegetables, (n=150)	26 (17)	44 (29.5)	75 (50)	5 (3.4)
Red meat, (n=146)	-	5 (3.4)	113 (77.6)	28 (19)
Chicken, (n=150)	-	10 (6.6)	138 (92)	2 (1.3)
Fish, (n=152)	15 (9.8)	61 (40)	64 (42.1)	12 (7.8)
Egg, (n=154)	6 (3.8)	44 (28.6)	82 (53.2)	22 (14.2)
Citrus fruit, (n=150)	7 (4.5)	17 (11.4)	74 (49.4)	52 (34.6)
Milk, (n=142)	42 (29.5)	10 (7)	32 (22.5)	58 (41)
Tea, (n=144)	90 (62.5)	8 (5.5)	18 (12.5)	28 (19.4)

### IFA supplementation

The 128 out of 194 (65.9%) participants consumed IFA supplementation in the past 3 months by means of weekly IFA supplementation or as per medical prescription.

### Menstrual history

The 80.2% of the study participants had attained menarche. Mean age of attaining menarche was 12.5±1.1 years. 13.5% of the participants had bleeding for >5 days. Details of menstrual history of study participants is given in Table 3.

**Table 3: Details of menstrual history of the study participants.**

Menstrual history	Number (%)
<b>Frequency of cycles</b>	
Regular	122 (78.8)
Irregular	33 (21.2)
<b>Duration of bleeding (Days)</b>	
≤5	134 (86.5)
>5	21 (13.5)
<b>No. of pads /day</b>	
≤4	151 (97.4)
>4	4 (2.5)
Total	155

### Worms in the stool

The 8 out of 142 (5.6%) had history of passing worms in the stool. Frequency of de-worming by the study participants is shown in Table 4.

**Table 4: Frequency of deworming reported by study participants, (n=142).**

Frequency of deworming (Months)	Number (%)
<6	72 (50.7)
6-12	58 (40.8)
Not in last 12	12 (8.4)

### Systemic diseases and infections

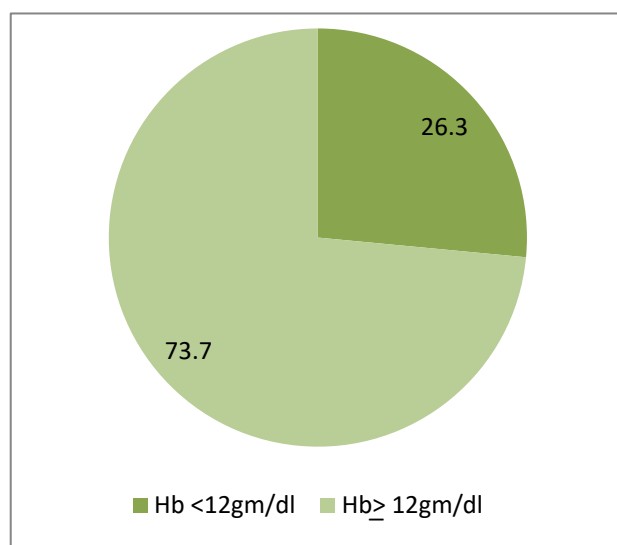
There was no history of any systemic diseases affecting kidney, liver or bone marrow reported by the study participants. None had any previous or current infections like tuberculosis, malaria or HIV.

### Clinical examination

The 47 out of 194 (24.2%) presented with one or more symptoms of anaemia. 35% had pallor on clinical examination.

### Prevalence of anaemia

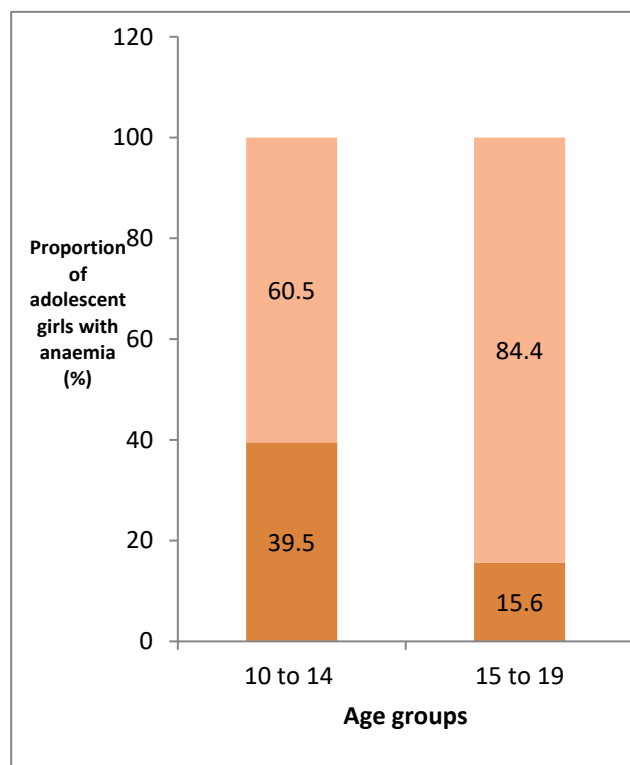
Among the total 194 study participants, 51 (26.3%) had haemoglobin value below the cut off to diagnose anaemia (<12 g/dl). Thus, prevalence of anaemia among the study subjects is calculated to be 26.3% (95% CI: 17.4 -37.34) (Figure 2). Out of the total anaemic adolescent girls, 94% mildly anaemic (Hb between 10-11.9 g/dl) remaining were moderately anaemic (Hb between 7-9.9 g/dl).

**Figure 2: Proportion of study participants according to haemoglobin cut off to define anaemia, (n=194).**

**Associations**

*Age group and anaemia*

Anaemia was more prevalent in the age group between 10-14 years (39.5%), compared to 15-19 years (15.6%) and the difference in proportion was found to be significant statistically (p value of 0.014) as shown in the Figure 3.



**Figure 3: Proportion of adolescent girls with and without anaemia across the age groups ( $X^2=6.0$ ,  $p=0.014$ ).**

*Frequency of intake of specific food items and anaemia*

Lower frequency of intake of green leafy vegetable and wholegrain cereals were found to be associated with anaemia,  $p=0.018$  and  $0.04$  respectively. Those who consumed green leafy vegetables for <3 days in a week/never had higher prevalence of anaemia compared to those who consumed it for  $\geq 3$  days in a week (32.6% vs. 10%). Similarly, those who consumed whole grain cereals for <3 days in a week/ never had higher prevalence of anaemia compared to those who consumed it for  $\geq 3$  days in a week (32.3% vs. 11.8%) as shown in the Table 5.

*Menstruation, de-worming and anaemia*

There was no significant association found between menstruation and anaemia as well as frequency of deworming and anaemia among the study participants (Table 6 and 7).

**Table 5: Association between frequency of intake of food items and anaemia.**

Food items	Anaemia		$X^2$ (p)
	Present (%)	Absent (%)	
<b>Green leafy vegetables (n=150) (Days/week)</b>			
$\geq 3$	7 (10)	63 (90)	5.6 (0.018)
<3 and never	26 (32.6)	54 (67.4)	
<b>Citrus fruits, (n=150) (Days/week)</b>			
$\geq 3$	2 (8.3)	22 (91.7)	1.036 (0.309)
<3 and never	34 (27)	92 (73)	
<b>Red meat, (n=146) (Days/week)</b>			
$\geq 3$	0	5 (100)	
<3 and never	36 (25.7)	105 (74.3)	
<b>Chicken, (n=150)</b>			
$\geq 3$	2 (20)	8 (80)	0.00 (1)
<3 and never	32 (22.9)	108 (77.1)	
<b>Fish, (n=152) (Days/week)</b>			
$\geq 3$	18 (23.7)	58 (76.3)	0.076 (0.783)
<3 and never	16 (21.1)	60 (78.9)	
<b>Egg, (n=154) (Days/week)</b>			
$\geq 3$	10 (20)	40 (80)	0.236 (0.627)
<3 and never	26 (25)	78 (75)	
<b>Legumes, (n=146) (Days/week)</b>			
$\geq 3$	20 (21.3)	74 (78.7)	0.81 (0.368)
<3 and never	16 (30.8)	36 (69.2)	
<b>Milk, (n=142) (Days/week)</b>			
$\geq 3$	12 (23.1)	40 (76.9)	0.017 (0.896)
<3 and never	22 (24.4)	68 (75.6)	
<b>Tea, (n=144) (Days/week)</b>			
$\geq 3$	22 (22.4)	76 (77.6)	0.532 (0.466)
<3 and never	14 (30.4)	32 (69.6)	
<b>Whole grains, (n=130) (Days/week)</b>			
$\geq 3$	8 (11.8)	60 (88.2)	4.0 (0.04)
<3 and never	20 (32.3)	42 (67.7)	
<b>Iron supplementation, (n=180)</b>			
Yes	33 (25.78)	95 (74.22)	1.42 (0.23)
No	18 (34.62)	34 (65.38)	

**Table 6: Association between menstruation and anaemia.**

Menstrual history	Anaemia		$X^2$ (p)
	Present (%)	Absent (%)	
<b>Menarche, (n=154)</b>			
Attained	32 (25.4)	94 (74.6)	0.09 (0.755)
Not attained	6 (21.4)	22 (78.6)	
<b>Duration of bleeding, (n=126) (Days)</b>			
$\leq 5$	20 (22.7)	68 (77.3)	0.549 (0.459)
>5	12 (31.6)	26 (68.4)	
<b>No of pads/day, (n=122)</b>			
$\leq 4$	28 (23.3)	92 (76.7)	
>4	2 (100)	0 (0)	

**Table 7: Frequency of deworming versus anaemia.**

Frequency of deworming (months)	Anaemia (%)	
	Present	Absent
<6	18 (25)	54 (75)
6-12	18 (31)	40 (69)
>12	0	12 (100)

## DISCUSSION

Anaemia is classified as a moderate public health hazard by the WHO, between the prevalence of 20-39.9%. More than 25% of adolescent females are anaemic in all Member States of the South-East Asia region, except Thailand; in some countries, the frequency is as high as 50%.<sup>4</sup>

Various studies in India have found that the frequency of anaemia among adolescent girls ranges from 56% to 90.1%.<sup>4</sup> Despite the fact that anaemia is projected to be the leading cause of lost DALYs among 10-19-year-old girls and 10-14-year-old boys in the South-East Asia Region, there is no national data collected on the condition.<sup>5</sup>

According to the district level household and facility survey (DLHS 4) in Kerala, the prevalence of anaemia among girls is 31.3%, compared to 90.4% previously recorded (DLHS 2, 2001-04).<sup>2,6</sup> According to a few recent research from Kerala published in the last decade, the prevalence of anaemia ranged from 21% to 47.7%. Rakesh et al. observed a prevalence of anaemia of 31.4 percent among adolescent girls from Kollam area in a cross-sectional survey conducted in 2015.<sup>7</sup> Another cross-sectional study conducted in 2015 by Shiva et al among adolescent girls in Kottayam found a prevalence of anaemia of 21%.<sup>8</sup> The current study reports prevalence of adolescent anaemia in Thrissur district as 26.3%, which is comparable with the previous studies. Kerala's lower prevalence of adolescent anaemia compared to national data could be related to the state's higher quality of reproductive child and adolescent health care. In a cross-sectional study conducted by Rakesh et al in 2019 to examine anaemia among school students in Ernakulam district, the incidence of anaemia among girls was found to be 47.7% which is worrying and demands for more stringent application of IFA supplementation in some pockets.<sup>9</sup>

Anemia is linked to a reduced frequency of consumption of green leafy vegetables and whole grains, according to the findings. The community's favoured, historically consumed staple meal of refined grains (polished rice, refined wheat) is a low-bioavailable source of iron and may contribute to the development of anaemia. In the current study, girls aged 10 to 14 were also shown to be more anaemic. The findings are consistent with the idea that nutritional anaemia is the leading cause of anaemia, and that increased iron requirements paired with rapid growth are contributing factors in adolescent anaemia.

Approximately 65.9% had received iron supplements in the prior three months. It shows that weekly IFA supplementation has a good coverage of adolescent girls through schools and anganwadies. Prevalence of anaemia is found to be low in those who received IFA supplementation.

Many other studies have discovered a link between anaemia and menorrhagia in late adolescence, indicating that bleeding is a major cause of anaemia.<sup>8,10-12</sup> The current study was unable to find such a link, but it did find a reduced prevalence in the late adolescent group. This could be because better anaemia control later in life could have improved the flow and duration of menstrual bleeding. The current study also could not find any association between the socio-demographic profile of the adolescent girls and anaemia, though that was established by other other researches.<sup>13</sup>

## Limitation

There is a possibility of recall bias in remembering the frequency of intake of certain food items and nutritional supplements.

## CONCLUSION

Anemia was found to be prevalent in 26.3% of adolescent girls in the study. Thus, anaemia remains a moderate public health hazard in the adolescent age range, with roughly every fourth adolescent girl becoming anaemic. This is low when compared to nationally reported values, indicating that IFA supplementation is having a positive influence on anaemia control in the district's adolescent age group. Nutritional inadequacies were shown to be the most common cause of anaemia, which was found to be much greater in the early teenage period. The findings suggest that efforts to enhance nutrition should be stepped up by boosting the availability and consumption of a nutritionally adequate, iron-rich diet. The focus of this may be on providing simple practical advice on suitable meal combinations from a variety of locally accessible foods, with an emphasis on the early adolescent age group, as well as reaching out to every single adolescent girl with IFA supplementation through weekly IFA supplementation.

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*Conflict of interest:* None declared

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

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