

The prevalence of anaemia in rural adolescent girls – A cross-sectional study to understand the sociodemographic and dietary determinants in Dharwad District, India

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ABSTRACT

Context: Anaemia is one leading cause of morbidity among adolescent girls. Prevention, early detection, and treatment can break the intergeneration cycle of malnutrition. **Aims/Objectives:** The aim of the study was to estimate the prevalence of anaemia and assess its sociodemographic determinants and understand its association with the dietary pattern of rural adolescent girls. **Settings and Design:** A cross-sectional study was conducted among 350 adolescent girls studying in the school of Kalgatigi Taluk, Dharwad district. The school girls were interviewed using a predesigned structured questionnaire by interview method. A food frequency questionnaire was used to assess the dietary pattern. Haemoglobin levels were estimated using Sahli's method. **Statistical Analysis Used:** Data were entered in Microsoft Excel and analysed using SPSS version 19 and the Chi-square test was applied to study the significance. **Results:** Rural adolescent school girls between the age group of 13–16 years were included. The prevalence of anaemia among them was found to be 47.4% and was significantly associated with the educational status of the mother, their socioeconomic status (SES), and type of diet. Vegetarian girls had a higher prevalence of anaemia. The frequency of meat and egg consumption was significantly associated with anaemia. The prevalence of anaemia was higher in thin and severely thin girls based on WHO-BMI. **Conclusions:** Anaemia in rural adolescent girls is of high burden and public health importance with a prevalence of 47.4% and significant association with dietary habits, SES, and BMI.

Keywords: Adolescent health, adolescent nutrition, anaemia, dietary habits, food frequency questionnaire

Introduction

World Health Organization (WHO) defines adolescence as the age period between 10 and 19 years of age for both sexes.^[1,2] The word adolescence is derived from the Latin word, “adolescere”, meaning “to grow, to mature”. Adolescence is a key phase in the life cycle wherein physical, physiological, and psychological transformations begin and set a foundation for productive

healthy adulthood. Thus, nutritional demands in this phase are higher comparatively making them vulnerable to deficiencies and detrimental in the case of girls due to their higher physiological demands compared to boys.

According to the WHO database, the prevalence of anaemia worldwide is nearly 25%^[1] and the prevalence is much higher in adolescent girls. Adolescent girls are the backbone of a healthy and progressive next generation. Anaemia in adolescence can crucially affect the physical growth, cognitive ability, and reproductive health of young girls. A higher prevalence of anaemia has been linked to various conditions like essential hypertension, hypothyroidism, congestive heart failure, coronary

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artery disease, and rheumatoid arthritis. Mild to severe anaemia typically manifesting during adolescence remains undetected or underdiagnosed by physicians.

Maternal mortality is higher among these anaemic girls entering pregnancy and poorly nourished young mothers are more likely to give birth to low birth weight babies, perpetuating a cycle of nutritional problem to the next generation. Thus, worldwide attention over iron deficiency anaemia in pregnancy has shifted recently from providing nutritional supplements during pregnancy to attempting to ensure that women especially adolescent girls have adequate iron stored prior to conception.^[3]

Nutritional anaemia is not just a medical condition but a social problem rooted in demography, socioeconomic condition, agriculture, and social development.^[4] Gender-based discrimination like selective nutritional neglect, differential investment or expenditure on health care, educational opportunities, and workforce participation for girls are still common in our country. Peer influence, body image consciousness, easy accessibility of junk food, and extreme changes in food habits and life style in the recent past have affected both their nutrient intake and nutritional status.^[5]

Despite all these important considerations, rural adolescent girls who mostly fall prey for early marriages and bear the risk of teenage pregnancy did not receive adequate attention. Only few studies have been carried out in rural areas. Keeping in view, the present study has been elucidated to assess the prevalence of anaemia and its sociodemographic determinants and also understand the association between dietary pattern and anaemia among rural adolescent girls.

Subjects and Methods

A cross-sectional study was conducted among school girls from classes 8, 9, and 10th from schools in Kalgatigi taluk, Dharwad district, Karnataka. Kalgatigi taluk was divided into four zilla parishad (ZP) areas. A list of schools having all 8th, 9th, and 10th standards was obtained. Out of 29 schools listed from 4 ZPs, 2 schools were selected from each ZP by simple random sampling; 8 schools were included in the study. Permission was obtained by Deputy Director of Public Instructions, Dharwad District and respective school authorities. Written informed consent was obtained from parents of girls through school authorities. Ethical clearance for study was obtained from IEC, Karnataka Institute of Medical Sciences.

The prevalence of anaemia among rural adolescent girls in Karnataka as per DLHS-4 (District level household and facility Survey)^[24] as 60.2% and a nonresponse rate of 10% sample size worked out to be is 290. Schoolgirls who were chronically ill and those who did not cooperate for sample collection were excluded. Remaining girls present on the day of the visit to school were included. A one-on-one interview was conducted among the participants using a predesigned semistructured questionnaire

to obtain data regarding their demographic profiles, medical history, and dietary patterns. Hemoglobin concentration (Hb %) estimation was done using Sahli's Hemoglobinometer. Hb% < 12g% was considered as anemia present and > 12 g% was considered anemia absent as per WHO classification of anemia.^[1,2] The girls identified with anaemia were referred to Kalgatigi PHC for further investigation and were prescribed tablets of albendazole for deworming and iron and folic acid supplementation.

Results

The overall prevalence of anaemia among rural adolescent girls was found to be 47.4%. According to the WHO classification of anaemia, 40% were mildly anaemic, 6.5% were moderately anaemic, and 0.9% were severely anaemic. The mean Hb% was found to be 11.8 ± 1.39. No statistically significant variance was observed between Hb% of adolescent girls and their age. The mean age of the study population was 14.85 ± 2.3 years [Table 1].

The prevalence of anemia was significantly associated with Standard of Living and Socio economic stat's (SES) of rural girls. 52.3% of girls belonging to Class IV and 51.9% from class V according to BG prasad SES scale were anaemic. Anaemia was lower in adolescent girls with a high standard of living compared to adolescent girls living with medium and low standard of living which was highly significant. In total, 57.5% of vegetarians were anaemic which was much higher in comparison to nonvegetarians (35.8%). Eggetarian had a lower prevalence than vegetarians but higher than nonvegetarians [Table 1].

Among the various symptoms of anaemia, 54.8% of adolescent girls with anemia had frequent headaches and 62.2% had palpitation on routine work 67.7% of anemic girls complaint of poor appetite [Table 2].

Table 3 shows the prevalence of anaemia was significantly lower in adolescent girls who consumed meat and egg regularly compared to those who did not. No statistical relation was found between the consumption of green leafy vegetables and milk/coffee/tea with anaemia.

Table 4 shows that the prevalence of anaemia among severely thin 73.3% and 55.2% in those who were thin was statistically higher than adolescent girls with normal weight.

Discussion

Early adolescence is the age for high vulnerability to nutritional deficiencies like anaemia. The study constituted of both early and middle adolescent subjects belonging to the age group of 13–16 years and found the prevalence of anaemia among these girls were 47.4%. In total, 40% of adolescent girls were mildly anaemic, 6.5% were moderately anaemic, and 0.9% were found to be severely anaemic. These results were comparable with the study by Siddharam SM and *et al.*^[6] (45.2%) in the Hassan district

Table 1: Distribution of prevalence of anaemia among adolescent girls according to their sociodemographic profile

	Anaemia prevalence		Total	Chi-square value
	Absent	Present		
Age (in years)				
13	5 (41.7%)	7 (58.3%)	12	2.27
14	49 (47.1)	55 (52.9%)	104	P=0.3
15	84 (53.5%)	73 (46.5%)	157	Not significant
16	46 (59.7%)	31 (40.3%)	77	
Religion				
Hindu	158 (52.0%)	146 (48.0%)	304	3.9
Muslim	23 (63.9%)	13 (36.0%)	36	P=0.1
Other	3 (30%)	7 (70%)	10	Not significant
Type of family				
Nuclear	146 (52.9%)	130 (47.1%)	276	3.2
Joint	31 (57.4%)	23 (42.6%)	54	P=0.3
Extended	4 (30.8%)	9 (69.2%)	13	Not significant
Broken	3 (42.9%)	4 (57.1%)	7	
Literacy status of mothers				
Illiterate	55 (38.7%)	87 (61.3%)	142	18.4
Primary school	91 (62.3%)	55 (37.7%)	146	P<0.001
Secondary school	23 (62.2%)	14 (37.8%)	37	Highly Significant
10th and above	15 (60%)	10 (40%)	25	
Socioeconomic status				
Class II	8 (66.7%)	4 (33.3%)	12	12.2
Class III	43 (71.7%)	17 (28.3%)	60	P<0.05
Class IV	71 (47.7%)	78 (52.3%)	149	Significant
Class V	62 (48.1%)	67 (51.9%)	129	
Standard of living				
High	113 (63.1%)	66 (36.9%)	179	19.3
Medium	67 (43.8%)	86 (56.2%)	153	P<0.001
Low	4 (22.2%)	14 (47.4%)	18	Highly Significant
Type of diet				
Vegetarian	51 (42.5%)	69 (57.5%)	120	10.5
Nonvegetarian	68 (64.2%)	38 (35.8%)	106	P<0.005
Eggetarian	65 (52.4%)	59 (47.4%)	124	Highly Significant

Table 2: Distribution of adolescent girls according to presence of symptoms of anaemia and anaemia status

Symptoms	Symptom status	Anaemia status		Total	Chi-square
		Absent	Present		
a) Palpitation on doing routine work	Yes	17 (37.8%)	28 (62.2%)	45 (100%)	4.5 P<0.05
	No	167 (54.8%)	138 (45.2%)	305 (100%)	Significant
b) Breathing difficulty on doing work	Yes	13 (41.9%)	18 (58.1%)	31 (100%)	1.5 P=0.2
	No	37 (53.6%)	32 (46.4%)	319 (100%)	Not significant
c) Frequent headaches	Yes	87 (45.3%)	105 (54.7%)	192 (100%)	8.9 P<0.005
	No	97 (61.4%)	61 (38.6%)	158 (100%)	significant
d) Experience fatigue in doing work	Yes	37 (53.6%)	32 (46.4%)	143 (100%)	0.38 P=0.38
	No	147 (52.3%)	134 (47.7%)	207 (100%)	Not significant
e) Noticed worms in stools	Yes	19 (61.3%)	12 (38.7%)	31 (100%)	1.03 P=0.30
	No	165 (51.7%)	154 (48.3%)	319 (100%)	Not significant
f) Difficulty to concentrate in studies	Yes	84 (51.8%)	78 (48.1%)	162 (100%)	0.063 P=0.80
	No	100 (53.2%)	88 (46.8%)	188 (100%)	Not significant
g) Poor appetite	Yes	10 (32.3%)	21 (67.7%)	31 (100%)	5.62 P=0.017
	No	174 (54.5%)	145 (45.5%)	319 (100%)	Significant

of Karnataka. Much higher prevalence was found in studies by Subramanian M *et al*^[7] (71.7%) in Haryana, Ajay Keshav Rao Jawarkar *et al*^[8] (54.8%) in Maharashtra, Neelam S Deshpande

et al^[9] (60.1%) in Pune, and Tiwari K and Seshadri S^[10] (60.5%) in Nepal. Higher prevalence was reported by Abha Singh *et al*^[11] (64%) in Chhattisgarh, Ramesh Verma *et al*^[5] T. Kaur

Table 3: Distribution of adolescent girls according to their consumption of food items and anaemia

Food item	Frequency	Anaemia status		Total	Chi- square
		Absent	Present		
Meat/liver	≥1 times a week	56 (69.1%)	25 (30.9%)	81 (100%)	11.8, P<0.005 Significant
	<1 time a week	38 (50%)	38 (50%)	76 (100%)	
	None	90 (46.6%)	103 (53.4%)	193 (100%)	
Egg	≥1 times a week	69 (58.5%)	49 (41.5%)	118 (100%)	7.4 P<0.05 Significant
	<1 time a week	65 (57%)	49 (43%)	114 (100%)	
	None	50 (42.4%)	68 (57.6%)	118 (100%)	
Green leafy vegetables	≥1 times a week	140 (53.6%)	121 (46.4%)	261 (100%)	0.47 P=0.78 Not significant
	<1 time a week	28 (49.1%)	29 (50.9%)	57 (100%)	
	None	16 (50%)	16 (50%)	32 (100%)	
Milk/coffee/tea	≥1 times a week	94 (49.5%)	96 (50.5%)	190 (100%)	1.6 P=0.4 Not significant
	<1 time a week	10 (55.8%)	8 (44.4%)	18 (100%)	
	None	80 (56.3%)	62 (43.7%)	142 (100%)	

Table 4: Distribution of adolescent girls according to their BMI – for – age and anaemia

BMI for age	Anaemia status		Total	P
	Absent	Present		
Normal (+1 to -2)	144 (57.8%)	105 (42.2%)	249 (100%)	P<0.005 significant
Thin (-2 to -3)	26 (44.8%)	32 (55.2%)	58 (100%)	
Severe thinness (<-3)	8 (26.7%)	22 (73.3%)	30 (100%)	
Overweight (+1 to +2)	6 (75.0%)	2 (25%)	8 (100%)	
Obese (>+2)	0 (00%)	5 (100%)	5 (100%)	
Total	184	166	350 (100%)	

and Kaur M^[13] (88%) in Karnal district, and Kulkarni MV *et al.*^[14] in Nagpur (90.1%),^[14] whereas lower prevalence was found by Seema Choudhary *et al.*^[15] (30.7%), Sanjeev M Chaudhary *et al.* (35.1%),^[27] JS Poyyamozhi (38.13%),^[16] and Darakshan Ali *et al.*^[17] (35.7%). The proportion of mild, moderate, and severe anaemic girls found in the present study is in coordinance with various studies done by Ramesh Verma *et al.*^[5] in Rohtak, Ajay Keshavrao Jawarkar *et al.*^[8] in Maharashtra, and T. Kaur and Kaur M^[13] (88%) in Karnal district. This difference in variation may be due to prevailing sociocultural factors and dietary habits in the region.

Among these various demographic factors, this study found that the literacy status of the mother, the SES of the family, and the standard of living of the family were found to be significantly associated with the prevalence of anaemia. As the study was in a rural setting, the majority of adolescent girls belonged to lower socioeconomic status (Class IV (42.6%) and Class V (36.5%) according to modified BG Prasad classification). A similar distribution was found by Sulakshana S Baliga *et al.* in Belagavi, Karnataka.^[18] The present study found a statistically significant difference in the prevalence of anaemia among various socioeconomic classes. Anaemia prevalence was higher in adolescent girls belonging to Class IV (52.3%) and Class V (51.9%) [Table 1]. A similar finding was reported by Siddharam SM and *et al.*^[6] in Karnataka, Neelam S Deshpande *et al.*^[9] in Pune, and Verma KB *et al.* in Rajasthan.^[12]

The study found a higher prevalence of anaemia among Hindus (48.8%) compared to girls of Muslims (36.9%) community [Table 1]. This difference would be likely due to religious practices with respect to the dietary habits among girls; however, the difference was not statistically significant. Though this showed a slightly higher prevalence of anaemia in girls living in extended families, the difference was not statistically significant, whereas the studies done by Kulkarni MV *et al.* in Nagpur (93.7%)^[14] and JS Poyyamozhi (62.2%)^[16] in Trichy showed a higher prevalence of anaemia in girls living in joint families. Similarly, a study done by Darakshan Ali *et al.*^[17] in Kashmir also found a higher prevalence among joint (54.50%) and nuclear families (48.40%).

The prevalence of anaemia was much higher (61.3%) in adolescent girls whose mothers were illiterate. Studies done by Subramanian V *et al.* in Haryana^[7], Rawat *et al.* in Meerut^[20] and Darakshan Ali *et al.*^[17] in Kashmir reported similar findings. Studies have previously indicated the education of the mother significantly affects the nutrition of the family, especially of the girl child in the family.^[12,17,19,20] Thus, education of a girl child is an integral part of the holistic development of the family. The study also found that the prevalence of anaemia was 49.8% in adolescent girls with mothers who are home maker compared to 42.1% mother who are working. A similar finding was reported in a study done by Darakshan Ali *et al.*^[17] in Kashmir though the difference was statistically insignificant in both studies.^[17]

The nutritional status of rural adolescent girls was closely associated with micronutrient deficiency. The present study found that anaemia was significantly associated with BMI [Table 4]. The prevalence of anaemia was found higher in severely thin (73.3%) and thin (55.2%) adolescent girls. A Similar association was found in Mallika V Chavada and *et al.*^[21] studies in Ahmedabad, Neelam S. Deshpande *et al.*^[9] in Pune, and Dr Abha Singh *et al.*^[11] in Chhattisgarh.

The dietary pattern of the adolescent girls in the region was also studied and a statistically significant relationship found between vegetarians and nonvegetarians. The prevalence of anaemia

was 57.5% in vegetarians, which is higher in comparison to nonvegetarians (35.8%). Eggetarian had lower prevalence than vegetarians but higher than nonvegetarians. The adolescent girls who consumed meat and egg more frequently had less prevalence of anaemia compared to others who did not consume. Our results were in coordination with results in studies by Mallika V Chavada and *et al.*^[21] in Gujarat on adolescent girls (43.3%), Dr Abha Singh *et al.*^[11] in Chhattisgarh (61.41%), Kaur T and Kaur M in Karnal^[13] (53.18%), and JS Poyyamozi^[16] in Trichy (71.04%) showing higher prevalence of anaemia in vegetarian girls.

With respect to the frequency of consumption of various food items [Table 3], 55.1% of adolescent girls did not consume meat or fish at all. Only 0.9% of adolescent girls consumed meat/fish daily and 17.1% consumed at least once a week. In total, 28% consumed eggs once a week. Only 1.7% of adolescent girls consumed eggs daily. Green leafy vegetables were consumed daily by 15.7% of rural adolescent girls and 25.4% consumed alternate days. 33.4% said they consumed once a week but 9.1% did not consume at all. In total, 41.7% of adolescent girls consumed milk/coffee/tea with meals daily and 40.5% did not consume at all. The study found a statistically significant relation between the frequency of meat/liver and egg consumption and anaemia. The prevalence of anaemia was lower in girls who consumed meat/liver and eggs more frequently than those who did not consume. No relation was found between the consumption of green leafy vegetables and milk/coffee and tea consumption. A study by Al-Sayes F *et al.*^[28] in Saudi Arabia also found a higher prevalence of anaemia in girls who did not consume red meat.^[5] There is a need to sensitize the community to the benefits of heme iron and its sources and motivate their consumption especially if a deficiency of iron is detected. The study has the limitation of being conducted in a small geographical area with similar food diversity and cultural practices. Various studies supported that education series through videos and small group discussions have increased positive attitudes towards eating behaviour in adolescents.^[22] Organizing village health and nutrition day at schools in rural areas at least once a month can help create awareness regarding nutritionally rich locally available food and encourage their consumption. The rural school can also be encouraged to set up kitchen gardens in their courtyard. This can promote sustainable utilization of available resources and achieve dietary diversification in rural areas which will be acceptable to that region.^[23,25,26]

Symptoms of anaemia are mostly ignored among young children and adolescents. In the present study [Table 2], among the various symptoms of anaemia, 54.8% of adolescent girls had frequent headaches and 12.9% had palpitations on routine work. Breathing difficulty on routine work was found in 8%. In total, 8.9% of girls noticed worms in their stools. The study also found palpitation on routine work (62.2%), and frequent headaches (54.7%) were higher in adolescent girls with statistically significant anaemia. A study by Mallika V Chavada^[21] in Gujarat on adolescent girls found only 1.2% of girls had a history of passing worms in stool, and among them, 50% were anaemic. A study by Kaur T

and Kaur M also found a high incidence of headache, dyspnoea on exertion, anorexia, and lethargy among adolescent anaemic adolescent girls;^[13] thus, early symptoms of anaemia can be early identified by primary care physicians. This also indicates the need for strengthening school-based screening programmes like Rashtriya Bal Shurakha Karyakarm in rural areas and also adequate training of school teachers in identifying the signs and symptoms of anaemia. In rural areas, all school girls are beneficiaries of the mid-day meal programme; fortification of food items like salt (double fortified salt) and rice with iron can also improve their iron status.^[23] Hence, the anemia prevention approach should be tailored considering resource-limited settings of rural areas focusing on socioeconomic status, dietary habits and community based early detection.^[23,26]

Conclusion

The prevalence of anaemia is high in rural adolescent girls and is closely associated with the education of women, SES, dietary habits, and their BMI. Training of teachers in identifying anaemia, achieving food diversification by promoting local food, and creating awareness can help in reducing anaemia in rural areas.

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Conflicts of interest

There are no conflicts of interest.

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